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**Agricultural Sector Policy Reforms:
Implications for
Poverty and the Environment in Malawi**

A thesis submitted in fulfilment
of the requirements for the degree

of

Doctor of Philosophy

at

The University of Waikato

by

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THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

2012

Abstract

Since independence in 1964, Malawi has implemented a number of agricultural reforms particularly in the tobacco and maize sectors. These reforms have been designed with four key objectives as follows: (a) to improve smallholder prices particularly in the tobacco sector; (b) to increase income for the poor especially in the rural areas; (c) to reduce income inequality between smallholders and estate owners; (d) to ensure food security both at national and household levels. In this thesis, econometric and optimization techniques were employed to examine and explore the extent to which these objectives have been achieved. In addition, the links between poverty and deforestation in the country were investigated.

Although some objectives have been achieved, there is underperformance in a number of areas. For instance, while there were improvements in the prices of tobacco that smallholders receive, reforms in the tobacco sector did not lead to a sustainable reduction in income inequality between small and large growers. In the maize sector, fertilizer subsidies were found to improve food security at the national level. However, at household level, maize production was heavily skewed with the south lagging behind the centre and the north. Although maize sector reforms improved income distribution for smallholders, they failed to improve the income level and poverty status of non-agricultural households in rural areas.

Finally, it was demonstrated that cultivation of maize on customary land by poor smallholders, is the primary causative agent of deforestation in Malawi, with cultivation of tobacco and pulses being the next most important causes. It is therefore recommended that Malawi should adopt improved farming techniques and technology to ensure that farmers are able to produce more output from less land. In addition, there is a need to ensure that farmers, especially the poor, cultivating plots on customary land are granted stronger property rights. This would give smallholders the incentive to consider the issue of reforestation more seriously than is the case today.

Publications from this thesis

Mkwara, B. (2011). Globalization and poverty in Africa: Case of Malawi. In D. Lutz (Ed.), *Africa and Globalization*, CUEA, Nairobi, Kenya.

Mkwara, B. & Marsh, D (2011). Effects of maize fertilizer subsidies on food security in Malawi, Department of Economics, Working Paper in Economics 14/11, November, downloadable at: <http://ideas.repec.org/p/wai/econwp/11-14.html>

Mkwara, B. (2010). The impact of tobacco marketing and pricing policy reforms on income inequality amongst growers in Malawi: What lessons can be learnt from the Australian experience? AARES 54th Annual Conference, Adelaide Convention Centre, South Australia, February 10-12, downloadable at: <http://purl.umn.edu/59103>

Mkwara, B. & Marsh D. (2009). The links between poverty and the environment in Malawi, Department of Economics, Working Paper in Economics 09/10, November, downloadable at: <ftp://mngt.waikato.ac.nz/RePEc/wai/econwp/0910.pdf>

Acknowledgements

This thesis would not have been achievable without the help of a number of individuals that in one way or another provided me with their invaluable guidance in the preparation and completion of this study. I sincerely thank my chief supervisor, Dr. Dan Marsh for his unwavering support during the entire period of my study. Special thanks must also go to my second supervisor, Dr. Anna Strutt and third supervisor, Professor Mark Holmes for their immeasurable help and comments that I received during the entire period of this work. Professor John Gibson and Professor Jacques Poot, I thank you for your time spent on some of my chapters and the methodological support that you rendered thereafter.

I owe my deepest gratitude to the New Zealand AID (Commonwealth) scholarship that enabled me and my family to live in New Zealand and study at the University of Waikato. I also thank the Department of Economics (University of Waikato), the New Zealand Agricultural and Resource Economics Society (NZARES) and the Australian Agricultural and Resource Economics Society (AARES) for financially supporting my research presentations in New Zealand and Australia.

During this study, I was mostly an absent husband and parent to my wife, Lena and children, Grace, Gift and Glad. I am humbled by their patience and understanding and for all this I say thank you. Finally, I thank God for freely giving me life, good health and ability to accomplish this huge task.

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List of acronyms

AFORD	:	Alliance for Democracy
ADMARC	:	Agricultural Development and Marketing Corporation
AGE	:	Applied General Equilibrium
AIDS	:	Acquired Immune Deficiency Syndrome
APEX	:	Agricultural Policy Experiments
APIP	:	Agricultural Productivity Investment Project
CGE	:	Computable General Equilibrium – same as AGE
CES	:	Constant Elasticity of Substitution
CET	:	Constant Elasticity of Transformation
DFID	:	Department for International Development
ESAF	:	Enhanced Structural Adjustment Facilities
EU	:	European Union
FGT	:	Foster, Greer & Thorbecke
GAMS	:	General Algebraic Modelling System
GDP	:	Gross Domestic Product
GoM	:	Government of Malawi
HDI	:	Human Development Index
HDR	:	Human Development Report
HIV	:	Human Immunodeficiency Virus
IMF	:	International Monetary Fund
LES	:	Linear Expenditure System
MCP	:	Malawi Congress Party
MDGs	:	Millennium Development Goals
MK	:	Malawi Kwacha
PPP	:	Purchasing Power Parity
PRSP	:	Poverty Reduction Strategy Paper
RBM	:	Reserve Bank of Malawi
ROW	:	Rest of the World
SAM	:	Social Accounting Matrix
SAP	:	Structural Adjustment Program
SPS	:	Starter Pack Scheme
UDF	:	United Democratic Front
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children’s Fund
USA	:	United States of America
US\$:	United States Dollar

***I can do all things through Christ who strengthens me.
(Philippians 4:13)***

CHAPTER ONE

INTRODUCTION

1.0 Background

Eradication of extreme poverty and hunger should be the most important global priority according to the 192 UN member states who, in September 2000, came up with eight millennium development goals. At that time, it was acknowledged that “poverty eradication is not only a development goal – it is a central challenge for human rights in the 21st century”, as such the international community unanimously agreed to halve extreme poverty by the year 2015 (UNDP, 2000, p. 8).

Today, close to the end of this 15-year period, many countries remain off track and may not reduce their poverty in the next few years. Poverty is still widespread and deep-rooted in sub-Saharan Africa, South Asia and Latin America. Amongst these three regions, sub-Saharan Africa continues to lag behind the rest followed by South Asia while Latin America appears to be doing much better (UNDP, 2007).

Sub-Saharan Africa’s poor record on poverty has been widely documented by international bodies such as the UN and the World Bank. For instance, the UN (2005, p. 2) stated that “sub-Saharan Africa, most dramatically, has been in a downward spiral of AIDS, resurgent malaria, falling food output per person, deteriorating shelter conditions, and environmental degradation, so that most countries in the region are on a trajectory to miss most or all of the Goals.” These sentiments were echoed in the World Bank Report of 2007 and UN Report of 2008. At the same time, the UNDP (2008, p. 25) predicted that sub-Saharan Africa was expected to “account for almost one-third of world poverty in 2015, up from one-fifth in 1990”. The prediction was largely confirmed in the UNDP Timor-Leste report of 2011. Based on the Index of progress on the MDGs

(IProg)¹, the Timor-Leste report stated that most countries in sub-Saharan Africa, “have actually regressed, with the Index having a negative value” (p. 108).

With regard to the main social indicators, again, sub-Saharan Africa lags behind other developing regions. Statistics from UNDP (2010) indicate that in sub-Saharan Africa, life expectancy at birth is at 52.7 years compared with 65.1 years in South Asia and 74.4 years in Latin America. Although the region has recorded reduction in infant mortality per 1000 live births from 144 in the 1970s to 86 in 2008, it still compares unfavourably with the decline from 130 to 56 in South Asia and from 86 to 19 in Latin America over the same period. By the end of 2009, of the estimated 33.3 million people living with HIV/AIDS, about 22.5 million were from sub-Saharan Africa with an average of 3 million deaths annually (UNAIDS, 2010b).

¹“In order to compute the IProg, only six of the eight MDG targets have been considered, due to data constraints. These are:

1. Halve, between 1990 and 2015, the proportion of people whose income is below US\$ 1 a day, in purchasing power parity (PPP) terms.
2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger. (The indicator that has been used is the prevalence of malnutrition).
3. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling. (The net enrolment rate has been used as an indicator).
4. Eliminate gender disparity in primary and secondary education, preferably by 2005 and no later than 2015.
5. Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.
6. Halve, by 2015, the proportion of people without sustainable access to drinking water and basic sanitation.

For each target, the measure of progress, IProg, is derived as follows:

IProg = +1 The country is on track to meet the target

IProg = 0 The country is making progress but not enough to meet the target

IProg = -1 The country has actually shown deterioration in relation to the indicator

To get an overall measure, IMDG, of progress on MDGs by a country, the IProgs across the six targets are summed together and divided by 7, since twice the weight is attached to the first target for poverty reduction. Therefore, the minimum value of IMDG is -1 and the maximum value is +1” (UNDP Timor-Leste, 2011, p. 108)

The above gloomy picture about sub-Saharan Africa does not exclude Malawi. With an average of 65 percent of the population living below the international poverty line of US\$1 per person per day, Malawi stands out as one of the poorest countries even amongst those of sub-Saharan Africa. The Human Development Index (HDI) for Malawi at 0.385 in 2010 ranked the country at 153 out of the 169 countries for which this index was compiled (UNDP, 2010).

Based on the above ranking, the country is worse off than it was in 1995 when the HDI was at 0.444 (UNDP, 1997). With per capita income of US\$290 in 2008/09, Malawi ranks ninth from the bottom of the World Bank listings based on that measure (World Bank, 2009). Social indicators for Malawi are likewise poor within the category of low-income sub-Saharan African countries. Life expectancy at birth in 2010 was 54.6 years, the adult literacy rate was 74 percent, and an estimated 12% of the population was infected with HIV/AIDS (UNAIDS, 2010a; UNDP, 2010).

Nearly 90 percent of Malawi's 13 million people live in rural areas, and more than 80 percent of these are smallholder farmers owning land in the range of 0.2 to 1 hectare (GoM, 2008c). When compared with other African countries, Malawi's population density currently at 139 persons per square kilometre and the population growth rate of 2.7 percent per annum² are conspicuously on the higher side. The country's high population growth and density put pressure on land for agriculture and on the conservation of forest land. It is this close link between rural agriculture, poverty and environmental degradation in Malawi that forms the basis of this thesis.

² According to the UNDP(2010), the average population density and growth for sub-Saharan Africa are estimated at 60 persons per square kilometre and 2.4 percent per annum, respectively.

1.1 Motivation and contributions of this thesis

Despite the overwhelming evidence of wide-spread poverty in Malawi as highlighted above, not much has been done to explore, analyze or evaluate the situation. Up until the end of the 1980s, the government's official view was that there was no poverty in Malawi, as such anybody talking or writing about it was regarded as being unpatriotic³. It is therefore not surprising that most local researchers did not start working on this topic until the 1990s (e.g., Kaluwa *et al.*, 1992; Mkandawire, 1999; Mtawali, 1993). However, these studies focused mainly on the links between the structural adjustment programmes and poverty and were thus limited to a period stretching between 1980 and the early 1990s.

The above limitation has been partly addressed by a number of recent studies such as Lofgren *et al.* (2001), Sen & Chinkunda (2002), Harrigan (2003, 2008), Dorward (2006) and Chirwa, Kydd, & Dorward (2006). However, some gaps still exist. For instance, except for the optimization technique employed by Lofgren *et al.* (2001), most recent studies employ explanatory methods in their analyses. The downside of explanatory approaches is that they are unable to assign computable explanations to variables such as poverty and its complex interrelationships with various factors in the economy.

In addition, most of the above studies have mainly analyzed poverty at national level. But it is widely appreciated in the literature that even at a country level, poverty is not spread evenly across regions (Shimeles & Thoenen, 2005). In sub-Saharan Africa, for instance, "rural areas account for three in every four people living on less than US\$1 a day" (UNDP, 2008, p. 26). In the case of Malawi, "about 25 percent of the population in urban areas is living in poverty, compared to 56 percent of the rural population. That is, a person in a rural area is more than twice as likely to be poor" (GoM, 2005c, p. 139). As such, it is highly possible to

³ Kamuzu Banda, Malawi's first president, used to openly claim that there was no poverty in the country as long as people at least had something to eat and wear and lived in houses that did not leak.

overlook pockets of poverty, particularly in rural areas if the analysis is done at national level.

Another general drawback of most recent studies is that they have largely concentrated on discreet measures of income in analyzing poverty incidences in the country⁴. Consequently, income distributional effects of various policies on different income groups have generally been overlooked. It is these limitations in the previous studies that motivate this thesis.

This thesis makes three key contributions to the literature on agricultural policy reforms, poverty and the environment. First, it descriptively paints a clear picture of what agriculture and poverty mean in the Malawian context. This is important because currently there is a growing tendency in the literature to regard sub-Saharan African as a homogeneous entity when it comes to analysis of problems that the region faces. While it is true that countries in sub-Saharan Africa have a lot in common, still there are major spatial, socio-economic and political variations amongst them. The description of Malawi's agriculture and poverty helps set up the platform of analysis for the country's socio-economic challenges and the way it has attempted to solve them.

Second, this thesis offers a comprehensive empirical analysis of the agricultural reform-poverty nexus in Malawi. For instance, it employs econometric and optimization tests such as the empirical fluctuation process, Poe test, K-S test, spatial analysis and a CGE model to examine and explore the effects of agricultural reforms in the tobacco and maize sectors on prices, food insecurity, income distribution, inequality and poverty for households. These analyses holistically provide a much more detailed investigation compared to previous studies.

⁴ Discrete measures of income, such as the head count measures, fail to capture the sensitivity to the distribution of income or consumption levels amongst the poor and therefore are unable to divulge more information regarding the severity of poverty.

Third, this thesis stands out as one of the first studies to look at poverty and deforestation as twin problems that require formulation of double-edged policies capable of addressing them simultaneously. Previous studies in Malawi have had a tendency of looking at poverty and deforestation as separate issues. The downside of this has been the formulation of policies with conflicting effects particularly on the rural poor. For instance, trade liberalization policies which were mainly designed with an aim of promoting trade and increasing household income are on record as having led to deforestation in a number of countries including Malawi. Looking at poverty and deforestation as intertwined issues puts Malawi on a new page as far as agricultural policy formulation is concerned.

1.2 Malawi – An outline of key facts

Malawi is a landlocked country with a total land area of approximately 118,500 square kilometres and is about 1,500 kilometres from its nearest sea ports of Beira and Nacala in Mozambique. Figure 1.1 below shows the map of Malawi and its neighbouring countries.

Figure 1.1: Map of Malawi and its neighbouring countries



Source: Google (2011)

Historically, very little was known to the outside world about this part of Africa until 1859 when Dr. David Livingstone from Scotland visited the land. He was the first European to reach the lake that stretches from the north to the south of the country which he named Lake Nyasa. When he went back to England, Livingstone told his countrymen about the place, especially the Shire Highlands, as a right place “for some description of colonization by Europeans. The first step taken in this direction was the advent of missionaries...After the missionaries came the traders, the most notable of these being the African Lakes Corporation...” (Sharpe, 1910, p. 338). Later, Sir Harry Johnston visited the country in 1889 and 1890 before he was appointed its First Commissioner in 1891. In that year, the country was declared a British Protectorate and was named Nyasaland, after its lake.

Sir Harry Johnston described his experience in establishing British administration in Nyasaland as follows:

In short, throughout all this country there was absolutely no security for life and property amongst the natives, and not over-much for the Europeans except in districts like Blantyre and West Nyasa, where the missionaries had acquired a strong hold over a section of the population...there was no proper postal service, there was no customs-houses, no roads suitable for wheeled traffic, very little labour in the coffee plantations; the forests of the land were being steadily destroyed year by year by bush fires, and the navigation of the upper Shire was entirely at the mercy of evil-minded slave-traders (Johnston, 1895, p. 196).

However, what attracted Europeans was firstly, the country's fertile soils and plentiful water supply and secondly, its hard working but cheap labour. According to The British Central African Gazette (1896, p. 146), the southern Nyasaland was described as having "thousands of acres of virgin soil on the skirts of the fine forests, with an abundant water supply, and at average altitudes of 4,000 feet above the sea." This was echoed and partly extended by Johnston (1895, p. 206), who pointed out that "the great attraction of this country lies in its beautiful scenery, in its magnificent blue lakes, its tumultuous cascades and cataracts, its grand mountains, its golden plains and dark green forests." Talking about labour, Sharpe (1910, p. 339) noted that "Nyasaland natives cannot by any means be described as lazy; on the contrary, they are generally anxious to obtain work..."

During the 73 years of the British rule, irrespective of some reports of oppressive colonial behaviour, Malawi benefitted in various ways, especially in the areas of agriculture, including the introduction of new crop varieties such as Virginia tobacco and the establishment of the agricultural research stations. These developments, especially towards the end of the British rule, were summarized by Sir Geoffrey Colby as follows:

...we can claim that the period 1948 to 1955 was one of steady development. The need to increase production and at the same time to safeguard the land for the future were our main problems. The programme was assisted by the expansion of experiments of agricultural education, and by the protection of national resources, including the conservation of some three-quarter million acres of land, by providing stable marketing facilities, and the encouragement of the native farmers (Colby, 1956, p. 279).

When Malawi attained independence in 1964, its hope for economic growth and development largely rested on the natural resources that Britain had constantly cited and partly developed namely fertile soils, plentiful water supply and abundant unskilled labour. These resources, particularly fertile agricultural soils and abundant unskilled labour were immediately put to extensive use by promoting agricultural production and the export of unskilled labour to the mineral rich southern Africa, particularly South Africa.

1.2.1 Economic significance of unskilled labour exports in Malawi

The gold and platinum rich South Africa started to import labour for mining soon after it signed a labour agreement with the Malawi Government in 1966⁵. By 1973, there were about 119,141 Malawian miners in South Africa, a number which had increased from 39,000 miners in 1966. However, it appears that the Malawi government became disillusioned with the idea of using cheap labour exports as a means of economic development barely two years after signing the labour agreement.

According to Englund (2002) towards the end of the 1960s, the Malawi Government started to pay more attention towards intensifying agricultural estates in the country. This planned expansion led to an increase in the expected demand for local labour. However, with an ever increasing outflow of labour to South Africa, it was likely going to be very difficult to convince men to work in

⁵ Initially, Nyasaland "natives were in the habit of finding their own way south" (Sharpe, 1910, p. 342).

the comparatively low paying agricultural sector. President Banda might have come across what Sir Alfred Sharpe wrote stating that there was “fear that men who have worked in the south and earned wages of £2, £3, and even up to £5 a month would be unlikely to return to work on plantations within the Protectorate” (Sharpe, 1910, p. 342). By the early 1970s, it became more evident⁶ that Malawi was increasingly looking for an opportunity to control the number of men emigrating to South Africa and this happened in April 1974 when, according to Chirwa (1996, p. 623):

... 74 Malawian migrant labourers returning from work in South Africa died in a plane crash in Francistown, Botswana. Immediately, Dr Hastings Kamuzu Banda, the then [Life] President of Malawi banned all labour recruiting activities in his country. Miners on holiday were not allowed to go back to their jobs and those under contract with the Witwatersrand Native Labour Association (WNLA), known as *Wenela* were to be repatriated – a decision that cost the South African mining industry some R7 million during the next two years.

On the other hand, South Africa had a great interest in the Malawian miners arguably for their discipline and hard working spirit. In addition, the availability of Malawian and other southern African miners provided the South African Government with an ethnically divided labour force which was easy to control. This was particularly important given that at that time there was a growing sense of resistance and sometimes militancy amongst the black South African labour force due to the oppressive Apartheid regime. It is widely believed that it was largely due to the need for Malawian labour that the South African Government provided large financial and technical support to enable Malawi construct its new

⁶ President Banda was often recorded on the state owned radio displaying his dissatisfaction with his people leaving the country to work in the mines in South Africa. Instead, he insisted that Malawi’s wealth was in its fertile soils hence he encouraged his people to stay and farm on their own land (Chirwa, 1996).

capital city in Lilongwe in 1974/75⁷. It is this financial and technical support that provided the South African Government with leverage to negotiate for the return to status quo as per 1966 labour agreement.

President Banda's decree banning all recruitment activities for the South African mines was rescinded and recruitment resumed in 1978. However, the numbers hardly came close to the pre-1974 levels. Actually, between 1974 and 1987, the population of Malawian miners in South Africa fluctuated between 13,000 and 18,000. This forced the South African Government to start re-strategizing. Towards the end of the 1980s, South Africa adopted new policies which mainly aimed at replacing foreign miners with local workers. "In 1988, the South African mining industry itself stopped recruiting Malawians" (Englund, 2002, p. 138) and by 1991 all Malawian workers in South Africa had been repatriated.

There are no reliable statistics on how much the Malawi economy benefitted through remittances generated from the exportation of unskilled labour to South Africa. At household level, families that had their men working in South Africa were generally better off than those that did not. This was evidenced by ownership of some household assets such as radio-grams and good clothing. However, the Malawi Government put more emphasis on the social evils of migrating:

It was frequently alleged that since migrating husbands often left their wives pregnant and/or with small babies without much care, it would be better for them to stay at home...Moreover, when men left their wives 'unattended to' the women were tempted to engage in extramarital sexual relations, thereby leading to more 'fatherless' children and/or loss of dignity on their part. Some claimed that a lot of young unmarried women who had difficulties finding 'good

⁷ The financial support for the construction of Malawi's new capital city, Lilongwe dates back to 1968 when Malawi turned to South Africa for support after Britain rejected the plan on the basis that it was too expensive and unnecessary at that time for a country that had just attained its independence. As such, "help was eventually solicited from South Africa to the extent of an initial loan of 8 million Rand in 1968. A master plan was also commissioned from a firm of architects in Johannesburg" (Potts, 1985, pp. 188-189).

husbands', mainly because so many men were away in the mines, often moved to towns and became prostitutes" (Chirwa, 1996, p. 633).

The fact that the president and other senior officials opposed migration to the mines does much to explain the scarcity of information on the economic benefits that emanated from the system. Instead, the economic performance of the country, as described in the following sub-section, has largely been attributed to agriculture.

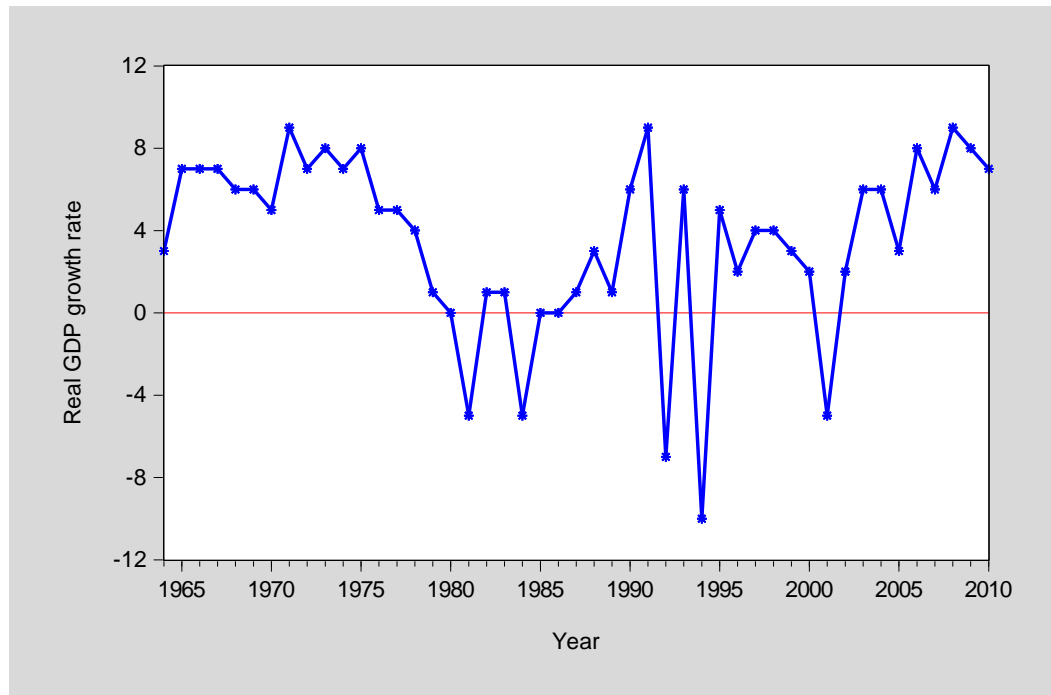
1.2.2 Economic significance of agriculture in Malawi

For decades, agriculture has accounted for an average of 40 percent of Malawi's GDP and 90 percent of its total exports. The industry mainly revolves around two crops, namely maize and tobacco. Maize is the major food crop cultivated by 98 percent of the rural population (National Statistics Office, 2010). Currently, the crop covers nearly 65 percent of the country's arable land while tobacco, the major cash crop – accounting for more than 70 percent of agricultural exports – takes up a further 15 percent. All other crops, such as tea, sugar, cotton, cassava, millet, pumpkins, beans, nuts, sorghum and rice are catered for by the remaining 20 percent of the arable land.

For the first fifteen years of independence, Malawi's economic performance was good with an average GDP growth rate of 6.7 percent per annum (see Figure 1.2 below). Almost all key economic indicators registered comfortable growth rates. During the same period, especially in the 1970s, the economy in general and the agricultural sector in particular experienced the fastest growth in GDP and exports in Sub-Saharan Africa (Pryor & Chipeta, 1990). However, this rapid growth did not lead to much poverty reduction especially among the rural poor because it largely accrued to estate owners at the expense of smallholders. For instance, the growing of lucrative exportable burley tobacco was restricted to the well-to-do estate owners while smallholder peasants, making up to over 80 percent of the population, grew food crops, particularly maize and some cash

crops for which they were paid very low prices (Harrigan, 2003; Kydd & Christiansen, 1982).

Figure 1.2: Malawi's real GDP growth rate (1964-2010)



Source: World Bank (2011b)

Malawi's real GDP growth rate started to fall in the late 1970s due to several factors including the disruption of trade routes through civil-war-torn Mozambique⁸, falling commodity prices, a decline in terms of trade, oil shocks, and a rise in the interest rates on the international financial markets. The economy also displayed inefficiencies in the production sector as a result of price controls, and in the smallholder agricultural sub-sector due to a pricing structure that favoured the large-scale state sub-sector. In addition, there were

⁸ The war in Mozambique affected Malawi in two major ways. First, it disrupted Malawi's closest and most direct route to the sea via the ports of Nacala and Beira. "Transport costs thus rose by US\$50 million – close to 20 percent of the value of exports and 3 percent of the GDP by 1984" (Chirwa, 1996, p. 628). Second, by 1989 Malawi had to host and support nearly 780,000 refugees from the war-torn Mozambique. According to Babu & Hassan (1995, p. 234), the direct impact of this was "on the land availability for cultivation of agricultural crops...Given the already existing population pressure in Malawi, the new land cleared for agricultural purposes is usually the forest land in the refuge inhabited districts."

inefficiencies in most parastatals due to unsystematic and wasteful investments, which resulted in poor financial performance (Chipeta, 1999; GoM, 2003b).

In view of the aforementioned structural inefficiencies, the government started to undertake various reforms particularly in the agriculture sector. As was the case with most poor African countries, Malawi's economic reforms were initially packaged within the structural adjustment programmes (SAPs) which were enforced and monitored by the IMF and World Bank. The first phase of the SAPs took place between 1981 and 1987 during which period Malawi received three structural adjustment loans from the World Bank. At that time, the primary aim was to enforce reductions in government expenditure and bring about a balanced budget.

The structural adjustment programmes of the 1980s were criticised by many poor countries and some international bodies. For instance, the United Nations Children's Fund (UNICEF) pointed out that these internationally administered stabilization programmes led to high levels of malnutrition, disease and death particularly amongst children in third world countries. It was therefore recommended that poor countries should put more emphasis on issues relating to their poverty and economic growth rather than the balance of payments (Cornia *et al.*, 1987). These and other similar concerns culminated into what can be termed as the second phase of the SAPS.

During the second phase, which, in the case of Malawi, extended from 1988 to 1994, a more flexible arrangement was pursued by the donor community in which the state and market forces were encouraged to interplay. However, just as was the case in the first phase, loans offered to Malawi were mainly directed towards "the agricultural sector and can be characterised by what Lipton (1987) has referred to as 'pricism and state minimalism' of the Washington Consensus. [This time around] the aim was to remove the incentive bias against smallholders" (Harrigan, 2003, p. 849).

To remove biases against smallholders, Malawi was urged to promote competition in the agricultural production industry and ensure that smallholder farmers received good input and producer prices. For instance, in 1994, the Agricultural Produce (Marketing) Regulation Act was revoked and the ban on private exports of agricultural produce was lifted. In 1995, pricing for smallholder crops was liberalized. On the input side, the marketing of fertilizer and hybrid seed started being liberalized in 1993 culminating in amendment of the Fertilizer Farm Feeds and Remedies Act to allow for private sector importation and distribution. Furthermore, the Seed Act was amended to open up private sector participation in seed marketing. Price subsidies for fertilizer and hybrid seeds were abolished in 1995 (Kherallah et al., 2001).

The third phase of the SAPS can be dated back to calls by a number of international bodies including UNICEF for the involvement of local policy makers in the development of socially responsible economic adjustment policies. In particular, the World Bank (1990) started to campaign for making structural adjustment work for the poor especially in Africa through involvement of local experts. Involving local experts in policy reformulation processes was regarded as one way of increasing ownership amongst policy makers (Alwang & Mario, 2008).

Since the mid 1990s, Malawi's reform programmes have experienced a paradigm shift with active participation of local experts while the donor community has largely been providing moral and financial support. This has led to the birth of a number of programmes and projects that have been locally designed. Table 1.1 below shows some of the agriculture-sector-focused documents developed in Malawi between 1994 and 2006 whose expertise was largely locally sourced.

Table 1.1: Agriculture-sector-focused policy documents for Malawi

Policy	Year
Poverty Alleviation Program (PAP)	1995
The Agricultural and Livestock Development Strategy and Action Plan	1995
The National Health Plan of Malawi	1996
Sustainable Livelihoods and Food Security Programme (SLFSP)	1997
Malawi Agriculture and Irrigation Sector Investment Programme	1997
Malawi Vision 2020	1998
The Malawi Agricultural Sector Investment Programme	2001
The Malawi Poverty Reduction Strategy (MPRS)	2002
The Growth Strategy for Malawi	2003
The Malawi Economic Growth Strategy (MEGS)	2004
The Malawi Growth and Development Strategy (MGDS)	2005

Source: GoM (various)

Starting from 1995, about eleven major and numerous minor policy documents were developed in Malawi. Nearly all of them are designed to achieve similar goals and objectives, i.e., agriculture sector development and poverty alleviation. In particular, agricultural policy reforms in Malawi have been designed with four key objectives:

- (a) To improve smallholder prices particularly in the tobacco sector.
- (b) To increase income for the poor especially in the rural areas.
- (c) To reduce income inequality between smallholders and estate owners.
- (d) To ensure food security both at national and household levels.

The main question that the rest of this thesis addresses is: ‘to what extent have these agricultural reforms achieved their intended objectives?’ This main question is broken down into specific questions starting from chapter three to six.

1.3 Chapter outline of the thesis

The rest of the thesis is organized as follows. Chapter two focuses on theories and measurements of poverty. More importantly, it looks at the way poverty is officially measured in Malawi by differentiating the general poverty line from the

food poverty line. An Appendix to this chapter explains key poverty reduction approaches that the country has undertaken since independence in 1964.

Three key questions are raised in chapter three as follows: (a) Have the tobacco policy reforms led to an improvement in the absolute prices that smallholders get? (b) How well off do tobacco prices that smallholders receive compare with what the rich estate owners get? (c) What is the impact of these reforms on income inequality between small and large tobacco growers? The empirical fluctuation tests, Poe test, K-S test and income inequality tests are conducted in order to address these three questions. Prior to the empirical analysis, a review of the tobacco crop production, marketing and pricing policies is conducted. The chapter ends with a discussion on other related issues including diversification away from tobacco and promotion of fair trading.

In chapter four various statistical and econometrics analyses are carried out in order to examine the effects of maize fertilizer subsidies on national and household food security. Of much interest is the spatial analysis which tests for spatial correlation between the subsidies and maize production in the country. Chapter five employs a country specific CGE model to explore the impact of reforms in the maize sectors on household income distribution and poverty. It further uses the Foster, Greer & Thorbecke (FGT) method to decompose poverty for various socioeconomic groups.

Chapter six starts by looking at classifications of forests and the reasons why the poor are closely associated with forests. Later, a regression analysis of changes in crop land use on changes in forest cover is conducted. It ends with a discussion on property rights and the rule of law as some of the basic tenets that are necessary to contain deforestation and encourage reforestation in Malawi. Chapter seven concludes and provides recommendations based on the previous discussions and main findings from chapter two through to chapter six.

CHAPTER TWO

POVERTY: A REVIEW OF THEORY AND EVIDENCE IN MALAWI

2.0 Introduction

Much as “poverty is old news” (Massey, 1996, p. 396), its meaning and measurement in modern economics can be traced as far back as 1776 when Adam Smith appreciated the worth of man. He argued that “every man is rich or poor according to the degree in which he can afford to enjoy the necessaries, conveniences, and amusements of human life” (Smith, 1776/1910, p. 26). Since then, the way poverty is defined, measured and theorized has gradually evolved.

Towards the end of the twentieth century many researchers started questioning the fact that lack of income was regarded as the principal measure of poverty. This was matched by a general shift in poverty reduction policies from economic growth to human capital development with provision of basic education being regarded as one of the cornerstones. Today, poverty indicators such as income, literacy rate and access to safe water and health facilities tend to be given an equal weighting. While all these indicators are important, research (e.g. Narayan, 1999) has shown that their level of importance tend to vary from one country to another.

This chapter’s main objective is to explain theories and measurements of poverty as they have evolved over time. It also explains how poverty is officially understood and measured in Malawi. An Appendix to this chapter (Appendix 1) looks at key poverty reduction approaches that the country has undertaken since independence in 1964.

2.1 Theories of poverty

A number of theories of poverty have evolved over a long period of time and have been classified in various ways in the academic literature. These theories can be grouped into two main categories, namely the conservative and liberal (or progressive) approaches. The conservative approach roots the cause of poverty in individual deficiencies while the liberal theories lay the causes of poverty on a broader social spectrum. In this section, a discussion is conducted on three main theories of poverty that have greatly impacted on the way poverty is currently understood, namely the Social Darwinian, the culture of poverty and the structural theory. The first two are conservative while the last one is liberal in approach.

2.2.1 The Social Darwinian theory of poverty

This is a classic example of the conservative theories of poverty that cling to a longstanding disposition in which the individual deficiencies are blamed as the main cause of poverty. In the distant past, it was a religious doctrine to equate wealth with the favour of God (Weber, 2001) and think that the poor, blind, crippled or deformed people were in that state as a punishment from God for either their or their parents' sins. The Holy Bible records a similar viewpoint being upheld during the time of our Lord, Jesus Christ:

As he passed by, he saw a man blind from his birth. And his disciples asked him, "Rabbi, who sinned, this man or his parents, that he was born blind?" Jesus answered, "It was not that this man sinned, or his parents, but for the works of God might be made manifest in him" (John, 9:1-3).

More recent views encapsulated in the Social Darwinian theory contend that the poor are poor because they do not work hard; they act irresponsibly with their money and other assets including their lives and generally they have dysfunctional and disorderly family backgrounds. The poor have no ambition,

lack inner call for work, and are fatalistic and uneducated. Rainwater (1970, p. 16) notes that the poor are “afflicted with the mark of Cain. They are meant to suffer, indeed must suffer, because of their moral failings. They live in a deserved hell on earth.”

In the US, the Social Darwinian proponents such as Herrnstein & Murray (1994) argue that the poor are genetically blueprinted to be at the bottom of the social hierarchy because they have low IQ and low mental capacity and therefore they are biologically destined to be poor. They therefore condemn the welfare system that is aimed at helping the poor as an absolute wastage of resources. With particular reference to poor women, they argue that “going on welfare really is a dumb idea, and that is why women who are low in cognitive ability end up there...when they have a baby to care for and no husband to help” (Herrnstein & Murray, 1994, p. 201). Earlier, similar sentiments were expressed regarding efforts to support the poor who were regarded as a ‘moral hazard’ by Gwartney & McCaleb (1985, p. 15) who argued that “the problem of poverty continues to fester not because we are failing to do enough, but because we are doing too much that is counterproductive.” The solution to poverty therefore is to “ensure that the penalty of poverty was great enough that none would choose it.”

While this theory largely emanates from sociology and is not fully embraced by many economists, some of the neo-classical economics assumptions reinforce the individualistic sources of poverty. At the heart of this paradigm regarding the study of the conditions leading to poverty is that individuals are utility maximizers and will therefore make choices and pursue economic opportunities that are directed at maximizing their well being. However, according to Bauer (1981, p. 10), “people differ in economic aptitudes...particularly they differ in their ability to perceive and utilize economic opportunities.” It therefore follows that the poor are like that because they fail to take advantage of the available economic opportunities. Given that wealth derives from productivity and its reward for effort, Clark (2002, p. 417) accordingly argues that the poor are in that state “due to the absence of productivity and the inability or unwillingness to

work and wait.” From the foregoing, it can be deduced that the utility maximizing theory implicitly assumes that an individual’s welfare is determined by their characteristics and hence accuses the poor of being lazy, short-term maximizers and choosers of low-payoff returns.

Economists that toe this line of thinking have usually come up with poverty reduction policies that regard the poor not as passive recipients of assistance but as active participants in the fight against poverty. The key initiative underlying these policies is primarily to push the poor into work, which in Malawi, for instance, was spearheaded by ‘self-help’ projects which were very popular in the 1970s and 1980s. Recently, the government introduced ‘food-for-work’ programmes whereby the impoverished and food insecure people are asked to work in return for food. Work includes constructing and maintaining earth roads, bridges and primary school blocks within their locality in return for a certain amount of maize. The more one works the more kilograms of maize one gets. However, whether this approach has helped reduce poverty is still debatable.

2.2.2 The culture of poverty theory

Unlike the Social Darwinian theory which looks at individual deficiencies, the culture of poverty theory focuses at the group or community poverty. Developed by Lewis (1959), this theory suggests that poverty is created and transmitted from one generation to another through beliefs, values and skills that are socially generated but individually held. It is therefore argued that the culture of poverty is developed and perpetuated because the poor feel ignored or bypassed by the larger well-off society.

People that are entangled in the culture of poverty tend to disengage or maintain some social distance from the larger society and have a high mistrust of the dominant institutions of the society. They tend to live in poor houses which are usually overcrowded with no organizational structure beyond the space of family (Thompson, 1974). They belong to an inward looking slum economy

characterized by use of second hand goods. Their families are extendedly linked to a bilateral kinship system (Billingsley, 1968), with unstable marriages and polygamy; and therefore while the rich get richer, the poor have more children (Lebergott, 1976). As is the case with the Social Darwinian theory, here, individuals harbour strong feelings of marginality, fatalism, helplessness, dependence and inferiority against existing institutions (Lewis, 1998; Moynaham, 1965).

Similar to the culture of poverty theory is the situational theory of poverty in which the latter views the poor as displaying aberrant behaviour that deviates from the culture of the well-off. For instance, while the well-off go to school, get educated and eventually lead a successful life, the poor drop out of school and become criminals. However, the situational theory does not assume pre-existence of a subculture that charts the course of poverty for an individual. Instead, it assumes that the poor's behaviour is a reaction in the different direction from the values upheld by the well-off society.

Those who view poverty through the lens of the culture of poverty theory or situational theory of poverty have usually encouraged application of policies that will disentangle the youth away from the recreation of the detrimental culture. For instance, Zigler & Styfco (1996) have noted that educational programs, especially those focusing on the youth, have been successful at providing an alternative socialization for the next generation to reduce poverty.

2.2.3 The structural theory of poverty

The structural theory of poverty was born mainly as an attack on the Social Darwinian theory. This theory is premised on the understanding that poverty is perpetuated by the economic systems which are usually structured in such a way that the poor fall behind regardless of their competences. The structure of the global capitalism, for example, is frequently faulted as being responsible for the rise of inequality and large scale poverty all over the world.

By 1848 this line of thinking, that the structure of global capitalism was the main cause of poverty and inequality, was strongly propagated by Karl Marx who blamed capitalists for extracting ‘surplus value’ and profit by making workers work longer hours than they should without extra compensation. Marx argued that the capitalists were keeping the wages low through a ‘reserve army’⁹ if the wages threatened to rise. It was therefore only by overthrowing the ruling class that the proletariat would be liberated from misery, oppression, slavery, degradation and exploitation (Taymans, 1951). Marx believed that one day capitalism would be overthrown by socialism and/or communism. However, he did not clearly elaborate whether poverty would be eradicated in the socialist and/or communist future and so far experience has not vindicated his thinking.

In the twentieth century, probably the most notable criticism of the global capitalism as being at the epicentre of poverty and inequality has come from Townsend (1970). He argued that:

...the poverty of deprived *nations* is comprehensible only if we attribute it substantially to the existence of a system of international social stratification, a hierarchy of societies with vastly different resources in which the wealth of some is linked historically and contemporaneously to the poverty of others. This system operated crudely in the era of colonial domination, and continues to operate today, though more subtly, through systems of trade, education, political relations, military alliances, and industrial corporations (Townsend, 1970, p. 42).

⁹ An industrial reserve army was meant to refer to a collection of the poor that could be used and later abandoned by the capitalists. “Marx divides this industrial reserve army into three types: latent, floating, and stagnant. First, the latent portion of the industrial reserve army results from agricultural mechanization which produces a surplus rural population constantly on the point of passing over into an urban or manufacturing proletariat, and on the look-out for circumstances favourable to this transformation...Second, the floating reserve are workers sometimes attracted to modern industry, sometimes repelled, especially children and older people in Marx’s day, but now largely recent immigrants who otherwise subsist on welfare payments. Third, the stagnant labour reserve is a part of the active labour army which has extremely irregular employment. Hired at minimum wages...the conditions of life for this group sink below the norm for the rest of the working class” (Peet, 1975, p. 567).

This criticism was echoed and extended in France by Rene Lenoir who in 1974 used the term ‘social exclusion’ (Silver, 1994) to refer to people that were excluded from employment-based social security system. Lenoir’s excluded included a wide variety of people: not only the poor, but also handicapped, suicidal and aged people, abused children and substance abusers. The term gained popularity in France during the 1980s as an expression of a new form of poverty that was associated with technological change and economic restructuring which led to rapid unemployment, slums and family disruptions. The phenomenon attracted more research and in 1996, Bill Jordan came up with *a theory of poverty and social exclusion*. He postulated that any theory that aims at explaining the relationship between individual needs and social exclusion is supposed to analyze the economics of human collectivities.

Individuals are most vulnerable when they have fewest personal capacities and material resources, and especially when they face the hazards of childhood, old age, sickness, disability and handicap. But none of these deficits and risks necessarily threatens their survival so long as they enjoy the protections afforded by membership of an inclusive group, that co-operates productively and redistributes its product (Jordan, 1996, p. 5).

Since then, a number of surveys and publications on poverty and social exclusion have ensued (e.g., Bradshaw *et al.*, 1998; Gordon *et al.*, 2000; Levitas, 1998). The general consensus from this kind of literature can be summarized by the Townsend (2002, p. 3) statement where he argues that, “...wealth and poverty are becoming increasingly polarized...Any resolution of this problem depends on connecting three concepts – *poverty, social exclusion, and social polarization...*”

2.2 Measurements of poverty

The most common objective definition of poverty was first established in 1963 by the Federal Government of the United States of America as a statistical measure that looked at the annual income needed for a family to survive (Darby,

1996). At that time, a poverty line was created “by Mollie Orshansky at the U.S. Department of Agriculture based on three times her estimate of what a family would have to spend for an adequate but far from lavish diet” Bradshaw (2006, p. 4). This was immediately adopted by the World Bank to measure global poverty.

One major reason for the World Bank’s adoption of the measurement was that income poverty was a widely understood concept and largely appreciated as the most important contributor to overall deprivation globally. Since income is the major conduit through which goods and services are accessed to meet people’s basic needs, lack of it implies poverty in terms of basic needs. At that time, two strands of income poverty measures were established, namely absolute and relative poverty¹⁰ (Todaro & Smith, 2005). Absolute poverty generally calculates the number of people who are unable to acquire a certain set of resources in order to maintain a minimum standard of living. On the other hand, relative poverty is mainly concerned with how well off an individual is with respect to others in the same society.

The distinction between absolute and relative poverty was principally meant to suggest that it was possible to have trends in income levels and income distributions take entirely different directions. This implies that even if the poor were to move up the income ladder, it was possible for them to remain far behind their richer counterparts. However, starting from the 1970s, the World Bank started to pay more attention to the absolute poverty as its focus turned to the third world countries where the masses were in chronic poverty. The World

¹⁰ In some cases the income poverty is looked at from three main angles, namely the headcount index, the poverty gap index and the severity of poverty index. In the case of the headcount index, the focus is on the proportion of people that live below the poverty line compared to the entire population. However, this index does not provide enough information about how poor the poor are. It also fails to capture income distribution amongst different groups of people living below the poverty line. The poverty gap index looks at the scale or degree of poverty. “It is obtained by multiplying the poverty headcount index by the ratio of the difference between the poverty line and the average income of the population living under the poverty line expressed as a fraction of the poverty line” (Shimeles & Thoenen, 2005, p. 4). The headcount index and the poverty gap index together make what is known as the absolute income poverty measure. The severity of poverty, which is also known as the relative income poverty measure, mainly looks at the income distributional effects amongst the different groups of the poor.

Bank's US\$1 per person per day was therefore established as an application of the absolute income poverty measurement. This measure, according to Ravallion (2002), was devised in an effort to measure global poverty by the standards of what it means to be poor in poor countries. From its conception up to the early 1990s, the US\$1 per person per day was measured in nominal exchange rate terms (Nye, 2002) but nowadays, it reflects what is known as the purchasing power parity (PPP)¹¹.

Although the World Bank's income approach to poverty measurement is deemed to be simple, easy to remember and applies to all countries, it has been faulted for various reasons. Firstly, it has been argued that income may not adequately represent basic necessities such as food, shelter and clothing. Secondly, Deaton (2000) questions the current use of PPP exchange rates as being less useful than desired. In this regard, he argues that there are growing discrepancies between the World Bank's household surveys and those obtained from national accounts. He further points out that the PPP exchange rate in its current form is problematic because it gives the price of all commodities in the world market under the assumption that all goods are traded freely without tariffs, barriers and transportation costs. Finally, Reddy & Pogge (2002) argue that the poverty line was chosen arbitrarily and does not correspond to any clear and meaningful underlying conception of poverty.

The Nobel Prize winning economist Amartya Sen questioned the richness of the income approach in measuring poverty in his book: *Poverty and famines : An essay on entitlement and deprivation* published in 1981. He contended that income gives only a partial picture of the many ways human lives could be affected. Regarding relative poverty, Sen (1985) argued that poverty was not just a matter of being relatively poorer than others in the society, but of not having some basic opportunities of material wellbeing – the failure to have certain minimum *capabilities*. Sen did not entirely forsake the importance of income as a

¹¹ PPP bases the poverty line as the equivalent of what a person could buy with US\$1 in their society.

determinant of poverty or wealth. He pointed out that “lack of income can be a principal reason for a person’s capability deprivation” (Sen, 1999, p. 87). His major argument was that income deficiency is just one of the many factors that influence capability deprivation. This led to the birth of the capability approach to measuring poverty.

Generally, it has been argued that Sen’s capability approach has been central in reorienting the concepts of economic and social development towards human development. Initially, the view was that social development such as education was a means to economic development. Instead, the capability approach views social development as an end in itself rather than a means to economic development (Streeten, 1994).

Later, from Sen’s capabilities approach, the Human Development Index (HDI) approach was developed. Initiated by the UNDP in 1990, it is intended to ameliorate the income poverty approach by creating people-centred indicators to measure the depth of deprivation across countries. The UNDP (1997, p. 15) defines poverty as a situation in which “opportunities and choices most basic to human development are denied – to lead a long, healthy, creative life and to enjoy a descent standard of living, freedom, dignity, self respect and the respect of others.”

According to Todaro & Smith (2005, p. 59):

The HDI attempts to rank all countries on a scale of 0 (lowest human development) to 1 (highest human development based on three goals: *longevity* as measured at life expectancy at birth, *knowledge* as measured by a weighted average of adult literacy (two thirds) and mean years of schooling (one third), and *standard of living* as measured by real per capita income adjusted for the differing purchasing power parity of each country’s currency to reflect cost of living and the assumption of diminishing marginal utility of income.

The HDI is viewed as a good supplement to income poverty measurement and current Human Development Reports apply both, the human poverty and the income poverty. Some advantages of the HDI approach can be cited. It is user-friendly in its presentation and simple in its methodology. The use of non-monetary indicators makes it less sensitive to wide fluctuations in the market that usually cause problems when using income-based measures.

However, HDI approach fails to account for the number of people that are below a certain threshold. Irrespective of its limitation, the approach has had a considerable impact on the way poverty is currently viewed as compared to the 1970s and 1980s. Today, the world looks at poverty by taking into account both the social as well as economic aspects and poverty reduction policies are being devised largely alongside this current line of thinking.

Probably a more debatable aspect of the HDI is its widely adopted assumption that poverty indicators carry same weightings across countries. As a result, in 1998 the World Bank launched a global research mainly to determine how the poor themselves understand and define poverty. It was revealed that although the understanding of poverty indicators is generally similar across nations, relative importance of each of these indicators tends to vary from one country to another. For instance, in some countries such as Ukraine and Vietnam, poverty was lack of food and clean water, in Guatemala it was defined as lack of housing and food while in Pakistan lack of income and employment were given the highest weighting (Narayan, 1999). The foregoing also underscores the complexity of poverty measurements in space. This being the case, caution needs be taken when calibrating and interpreting poverty. In the following section, the focus is on one of the major and commonly used approaches in estimating the poverty line in a country.

2.3 Calibration of the poverty line

Theoretically, the calibrations of poverty lines are largely based on the utility function approach. “Following this approach, the poverty line can be interpreted as a point on the consumer’s expenditure function, giving the minimum cost to a household of attaining a given level of utility at the prevailing prices and for a given household characteristics” (Ravallion, 1998, p. 3).

The foregoing implies that by assuming a household of c characteristics consuming x quantities of goods, both c and x being vectorial, then a utility function representing the household’s preferred bundle of consumption can be given as $u(x, c)$. If a price vector is given as p , then the household’s minimum expenditure function, evaluated at actual utility level, becomes $e(p, c, u)$ and therefore the poverty line v can be written as:

$$v = e(p, c, u) \tag{2.1}$$

The poverty line as defined by equation (2.1) above is usually divided into two forms, namely the food poverty line and the general poverty line. In the case of the food poverty line, officials identify the amount of money per annum required to purchase a certain amount of food that provides a minimum recommended daily calories. In Malawi, the identification process involves baseline surveys in which people are asked to indicate how they usually get their food and income. To achieve this at national level, “geographical areas are grouped into livelihood zones (areas where people have similar options for obtaining food or income)” (Rethman, 2006, p. 2). A number of products are included in the food basket including maize, rice, legumes, cassava, pumpkins, sorghum, nuts, wheat, goats, cows and chicken. Of all these food products, maize consumption is given the highest weighting of close to three-quarters of the required daily calories in determining Malawi’s food poverty line. According to the World Health Organization, an average person is required to have an intake of 2,400 calories per day.

The general poverty line takes into account the food poverty line plus expenditures on non-food items. The non-food expenditures are determined by observing the non-food purchases of households whose expenditures on food items are very close to the poverty line (National Statistics Office, 2009b). During the 2004-2005 Integrated Household Survey, the National Statistics Office included a number of non-food items such as, wrist/wall watch, housing, bed/beddings, table, chair, hoe, iron, axe, sickle, sewing machine, clothes, oxcart, bicycle, cell phone and radio.

The relationship of food and non-food expenditures in determining a general poverty line is based on two fundamental assumptions. First, households tend to prioritize survival food needs. Beyond this, as total expenditure (income) increases, basic non-food needs are considered first followed by basic food needs. Second, once survival need are met, both food and non-food goods are regarded as normal. Algebraically, if a is the amount of money spent on basic food needs, b is expenditure on non-food needs and I is total expenditure, then the poverty line as shown in equation (2.1) above can be rewritten as:

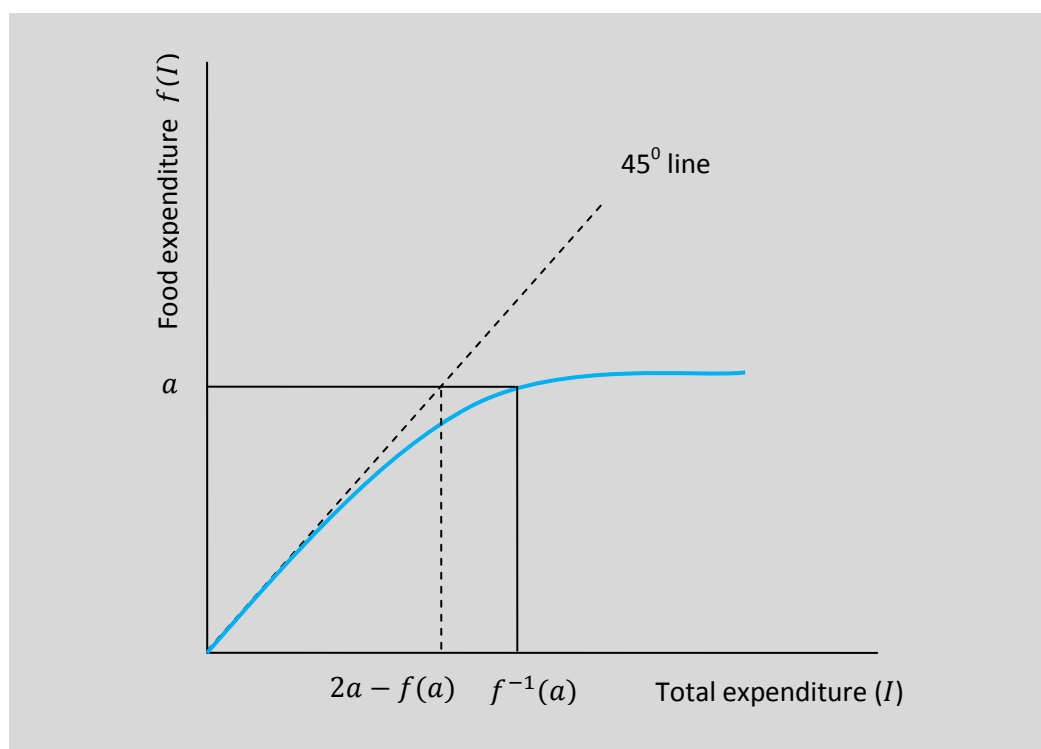
$$v = a + b \tag{2.2}$$

For a household whose total expenditure is barely enough to meet the food poverty line, the algebraic representation can be given as $I = a$. This implies that, for this household, any extra expenditure on non-food items would be regarded as a minimum payment for non-food consumption. This payment on non-food goods (b) can therefore be expressed as $a - f(a)$. This translates into a lower poverty line based on equation (2.2) as follows:

$$v = 2a - f(a) \leq f^{-1}(a) \quad (\text{see Ravallion, 1998}) \tag{2.3}$$

This relationship is geometrically represented by Figure 2.1 below.

Figure 2.1: Relationship between food and general poverty line



Adopted from Ravallion (1998)

Food expenditures and total expenditures are indicated on the vertical axis and horizontal axis, respectively. The food poverty line is represented by a where $0 < f'(I) < 1$. The general poverty line is indicated by $f^{-1}(a)$ while $2a - f(a)$ is the household's non food expenditure. It follows that $f^{-1}(a) \geq a$; in words, the general poverty line can be equal to, but is often higher than, the food poverty line.

Although the above approach to measuring poverty provides an insight regarding absolute poverty in the country, it has a number of limitations. First, the process of determining the poverty line is “conveyed to experts who have to measure these basic needs” (Goedhart *et al.*, 1976, p. 506). The problem with this is that experts are not immune from subjectivity. This means views of different experts are likely to differ as summarized by Atkinson (1987, p. 751) in reference to the poverty line determined by Bowley in 1925:

He referred to his poverty line as “arbitrary, but intelligible”... recognizing that others might disagree, as illustrated by the famous occasion in 1920 when he was being cross-examined by Ernest Bevin, the well-known union leader...during the inquiry into dock workers’ pay. Bowley had given evidence for the employers as to what constituted a minimum basket of goods. Bevin in turn had gone out and bought the recommended diet and came into court with a plate bearing a few scraps of bacon, fish, and bread. In a devastating piece of cross-examination, he asked Bowley whether he thought that this was sufficient breakfast for a man who had to carry heavy bags of grain all day.

Several decades later, the ‘Bowley-Bevin’ argument remains unresolved and Ravallion (1998, p. 6) terms it the referencing problem. He sums his argument by stating that “the question is left begging as to what the poverty line should be in poverty space...which anchors the monetary poverty line...” In conclusion he points out that, “It is tempting to say that this choice is arbitrary, and to hope that it is innocuous”.

Apart from the referencing problem, there is the issue of variations in households’ characteristics with regard to age, gender, size and culture which have an impact on consumer demand behaviour. For instance, giving maize a higher weighting, as is the case in Malawi, can and usually have a negative effect on households whose staple food crops fall outside the maize bracket. These may include households that rely on crops such as sorghum (in the Lower Shire), rice (for some districts along the lake shore) and cassava (for some districts in the northern region).

In addition, just as household characteristics vary across space, so do commodity prices. For instance, in Malawi, many non-food commodities tend to be cheaper relative to food commodities in urban than in rural areas. “This will probably mean that the demand for food and (hence) food energy intake will be lower in urban than in rural areas at any given real income. But this does not, of course, mean that urban households are poorer at a given expenditure level” (Ravallion, 2003, p. 9). Irrespective of its weaknesses as discussed above, the utility-based

poverty line calibration is widely used in various countries (including Malawi) partly because of its advantages that are associated with the income poverty approach as indicated in section 2.2 above.

In this thesis, the poverty line is employed in chapter five to decompose income poverty for different socioeconomic groups. In chapter three, the income poverty is analysed along the lines of income inequalities between two tobacco growing socioeconomic groups, namely smallholders and estate owners. Finally, food insecurity, another form of poverty, is analysed in chapter four.

2.4 Measurement of poverty in Malawi

In Malawi, the National Statistics Office is responsible for the official measurement of poverty. The Office periodically conducts national surveys on living standards and income approach “is often taken as a primary, singular measure” to estimate the poverty line and poverty rates for the country (National Statistics Office & World Bank, 2005, p. 24). The current poverty lines, calculated in collaboration with the World Bank staff team, are primarily based on the Integrated Household¹² Survey of 2004-2005 (National Statistics Office, 2005)¹³.

¹² According to National Statistics Office (2009b, p. 11), the term household “is defined as a person or a group of persons, related or unrelated, who live together in the same dwelling unit or separate dwelling units, but make common provisions for food and regularly take their food from the same pot or share the same grain store (*nkhokwe*), or who pool their income for the purpose of purchasing food.” The average household size in Malawi is currently between five and six members although there are regional disparities with north having relatively more members in a household than the centre and the south. From the foregoing, it can be appreciated that ‘household’ is a complex and not very easy term to define. For instance, there is no clear-cut period for which someone is supposed to live in a particular dwelling unit or share their food and money before they can be regarded a member of that household. Also, with very high dependency ratio in the country, the term household becomes more blurred because some households, particularly in the rural areas usually dependent on financial support from their relatives usually living in the urban centres.

¹³ Appendix 1 provides a more detailed picture of the way Malawi has viewed poverty over the past four and half decades and the strategies that have so far been used to fight poverty.

In line with the above methodology, the current reference poverty lines for Malawi are as follows. The general poverty line stands at “MK16,165” (US\$142.86) per year while the food poverty line is at “MK10,029” (US\$88.63) per year (National Statistics Office, 2005, p. 138). All households that are below the general poverty line are referred to as ‘poor’ while households that live below the food poverty line are regarded as ‘ultra poor’. Malawi’s general poverty line as indicated above translates to MK44.26 (US\$0.39) per person per day which is much less than the internationally recognized poverty line of US\$1 per person per day (Bradshaw, 2006). This implies that, by international standards, Malawi’s poverty situation is far worse than is recognized locally. Table 2.1 below indicates the status of poverty based on Integrated Household Survey (IHS2) of 2004-2005 and Welfare Monitoring Surveys (WMS) of 2005 up to 2009.

Table 2.1: Proportion of poor and ultra-poor main indicators 2004 to 2009

Poverty status	IHS2 2004	WMS 2005	WMS 2006	WMS 2007	WMS 2008	WMS 2009
Proportion poor						
Malawi	52	50	45	40	40	39
Urban	25	24	25	11	13	14
Rural	..	53	47	44	44	43
Rural Northern region	56	51	46	46	35	31
Rural Central region	47	46	40	36	40	41
Rural Southern region	64	60	55	51	51	51
Proportion ultra-poor						
Malawi	22	21	17	15	15	15
Urban	8	8	6	2	3	3
Rural	..	23	19	17	17	17
Rural Northern region	26	21	17	18	11	9
Rural Central region	16	16	12	11	12	13
Rural Southern region	32	30	25	22	24	23

Source: National Statistics Office (2009b, p. 85)

From Table 2.1, it is clear that poverty in Malawi varies from one region to another. The southern region has the highest number of both poor and ultra poor people followed by the north and then finally the centre. Further discussion on the distribution of poverty in Malawi is conducted in chapter four and six. In the following section, a brief look at income inequality is considered.

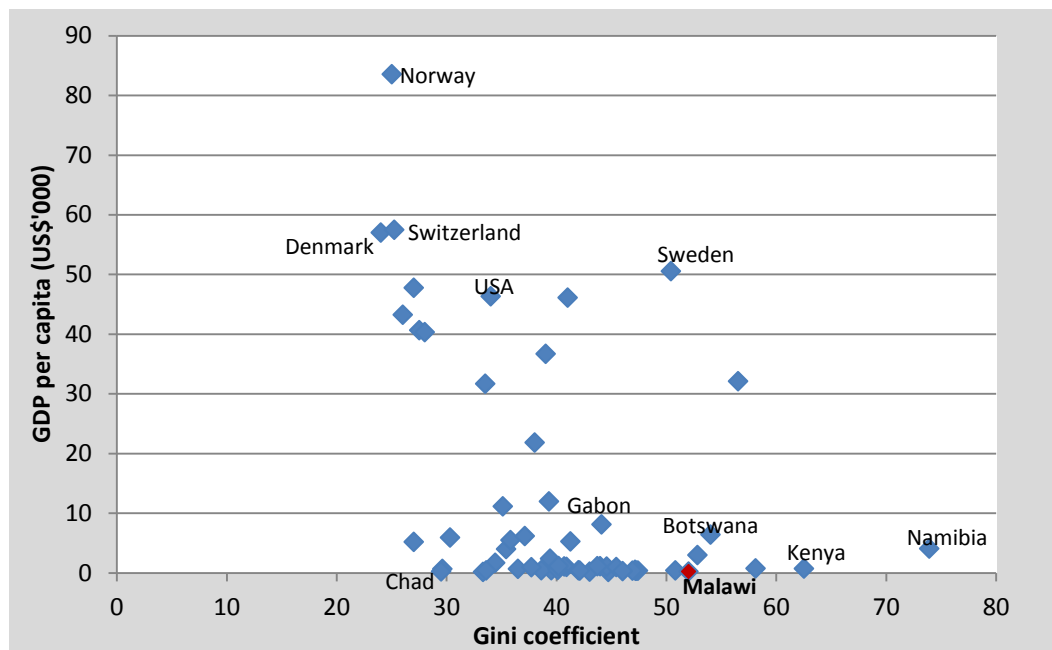
2.5 Income inequality

Although the link between poverty and inequality is not straightforward, there is a growing consensus that both of them are essential to people's life experiences (Jarvis & Gardner, 2009). On the one hand, "the persistence of inequality at high levels makes poverty reduction difficult" (Heshmati, 2004, p. 2) and on the other, "poverty reduction could help to reduce inequality" (Le, 2008, p. 1). The policy implication of this is that there is a need to address poverty and inequality as two sides of a coin.

Income inequality can be defined as the degree of discrepancy between high income and low income households. This is a very important aspect particularly with regard to fairness of a particular society. Therefore, narrowing the income gap between the poor and the rich is often viewed as one way of promoting fairness in society. However, determining or comprehending reductions in the levels of income inequality is usually a complex and daunting task. Anderson *et al.* (2012, p. 49) point out that "understanding whether the gap between rich and poor country wellbeing is narrowing is really about whether rich and poor groups can be identified in the overall size distribution of the characteristic of interest, and how those respective subgroup size distributions are changing." Despite the challenges, several techniques have been developed to measure the levels of income inequality in a community or country; one of them is the Gini coefficient¹⁴. Figure 2.2 indicates Gini coefficients of countries across the globe.

¹⁴ Details about Gini coefficient are in Chapter three, section 3.5

Figure 2.2: International comparison of income inequality by GDP per capita



Source: UNU-WIDER (2008)

The data used in Figure 2.2 above come from different years – most of which pertain to years between 2000 and 2005. The downside of having data from various years is that international comparisons are difficult to interpret effectively. Irrespective of this limitation, Figure 2.2 above clearly suggests that Malawi is one of the countries with high levels of income inequality by international standards. With the Gini ratio at 0.45, income inequality was lower in the 1960s (Mkandawire, 1999). It steadily increased to 0.57 between 1980 and the late 1990s (GOM, 2003c). However, it slightly improved to 0.52 starting from the early 2000s as indicated in Figure 2.2 above.

Figure 2.2 further reveals that, in general, countries in sub-Saharan Africa have the highest levels of income inequality. Since “income distribution influences the rate at which economic growth translates into poverty reduction”, this implies that compared with the rest of the world, many countries in sub-Saharan Africa might need more growth in order “to achieve an equivalent poverty reduction outcome” (UNDP, 2008, p.25).

In chapter three (section 3.5), other methods used to compute income inequality are discussed followed by an estimation of income inequality between tobacco growers in Malawi.

2.6 Chapter summary

The main objective of this chapter was to review the main theories and methods of measuring of poverty as they have evolved over time. Three main theories of poverty have been discussed, namely the Social Darwinian, the culture of poverty and the structural theory. It has been illustrated that the first two theories put the blame on either an individual or on society. On the other hand the structural theory blames the existence of poverty and inequality on the structure of global capitalism.

A number of poverty measurements have been discussed in this chapter including the income approach, the capability approach and the Human Development Index. One outstanding point that has emerged from the discussion of these measurements is that poverty is a very complex phenomenon. Therefore, its measurement and interpretation need to be done with a lot of care. This point was underscored by the 1998 World Bank study which revealed that although the domain of poverty indicators is largely the same, different countries have different views about poverty.

Despite the existence of various methods of computing poverty, this chapter has zeroed in on the calibration of the poverty line using the utility function approach. Under this approach, the poverty line can be interpreted as a point on the consumer's expenditure function, giving the minimum cost to a household of attaining a given level of utility at the prevailing prices and for a given household characteristics. The relationship of food and non-food expenditures in determining a general poverty line has been extensively discussed. One reason for focusing on this methodology is that in the case of Malawi, officially, poverty is still largely measured based on income approach. Lastly, it has been illustrated

that poverty in Malawi is unevenly distributed within its three regions. The southern region has the highest number of both poor and ultra poor people followed by the north and then finally the centre. Further decomposition of poverty for different socioeconomic groups is pursued later in the thesis.

CHAPTER THREE

THE IMPACT OF TOBACCO POLICY REFORMS ON PRICES AND INCOME INEQUALITY IN MALAWI

3.0 Introduction

Since 1981 Malawi has implemented a series of Enhanced Structural Adjustment Facilities (ESAF) supported by the IMF and World Bank, particularly in the agricultural sector. Most of these agricultural policy reforms have been carried out in the tobacco industry for two main reasons. Firstly, tobacco is the main cash crop with no major close substitutes so policy makers felt that positive reforms in this industry would have far-reaching economic benefits. Secondly, prior to the reforms, the tobacco industry had growing, marketing and pricing policies that strongly discriminated against smallholders. Reviewing such restrictive policies was therefore regarded as the best way to ensure that smallholders became active participants and beneficiaries of the socio-economic growth and development of the country.

The reforms were designed with three main objectives, namely to allow market forces to drive allocation in crop production, promote competition and ensure that smallholder farmers get good producer (tobacco) prices. The last two objectives were regarded as central because it was observed, particularly by the donor community, that nearly fifteen years after independence the majority of smallholders remained poor and that the income gap between the rich estate owners and the poor smallholder farmers had greatly increased. Competition and favourable producer prices were therefore viewed as an effective route to reducing absolute and relative poverty, especially amongst smallholder tobacco growers.

While Malawi's agricultural policy reforms in general, and the tobacco policy reforms in particular, have triggered great attention amongst researchers, the impact of these reforms on producer prices and income inequality has not been adequately examined. By extension, this means that the welfare effects of the tobacco policy reforms on smallholders are still not well informed. The main objective of this chapter is to examine whether the policy reforms in the tobacco industry have indeed helped to improve the prices that smallholder farmers get. In addition, it tests the impact of these reforms on income inequality between smallholders and estate owners. To achieve this, three key questions are raised as follows: (1) Have the tobacco policy reforms led to an improvement in the absolute prices that smallholders get? (2) How do the prices that smallholders receive compare with what the estate owners get? (3) What is the impact of these reforms on income inequality between smallholder and estate tobacco growers?

To address the first question, an analysis of structural changes is conducted. The analysis is achieved by employing two tests, namely the cumulative sum-based (CUSUM) and moving estimates-based (ME) empirical fluctuation process (efp). Later, the Poe (convolutions) test and the Kolmogorov-Smirnov (KS) test are performed in order to tackle the second question. Finally, the Gini index and the general entropy measures are used to test for income inequality between the above indicated socioeconomic groups involved in growing of tobacco. Prior to these tests, a review of the tobacco crop production, marketing and pricing policies is carried out. In the final analysis, a discussion on other related issues including economic diversification away from tobacco and promotion of fair trading is included. This is done with the aim of shedding more light on other relevant issues that may require attention if improvement of the smallholders' welfare is to be achieved.

3.1 Economic significance of tobacco production in Malawi

Tobacco stands out as Malawi's major foreign exchange earner, followed by tea and sugar. Tobacco alone accounts for more than 70 percent of agricultural exports while tea makes up 7.5 percent and sugar 7.4 percent. Nearly 15 percent of GDP and 25 percent of Malawi's total tax base emanate from tobacco exports and nearly 20 percent of Malawian households derive most of their income from the tobacco sector (National Statistics Office, 2009b, 2010; Reserve Bank of Malawi, 2008).

The history of tobacco production in Malawi stretches back to 1889 when David Buchanan, a white farmer, planted the first Virginia (flue-cured) tobacco crop in the Shire highlands (Mwasikakata, 2003). By 1920, the number of white farmers engaged in tobacco production had increased substantially, such that some started to trek to the central region of the country in search of more land to grow the crop. Over time, other types of tobacco were introduced and by the end of the 1920s three main types were cultivated, namely burley, flue-cured and oriental. Currently, four main types of tobacco are grown which include the aforementioned three plus Malawi Western. The Malawi Western tobacco is subdivided into three categories: sun/air-cured, Southern Division Dark-fired and Northern Division Dark-fired.

Initially, the tradable tobacco crop was exclusively grown by the white settlers. However, towards the end of the 1940s some Africans were allowed to cultivate a limited amount of the crop on their trust land as long as it was not burley or flue-cured tobacco. The restriction on the cultivation of burley and flue-cured tobacco took a new twist after independence in 1964. This time around, for the first time, some members of the African elite, mostly those with strong political ties with the Malawi Government, were allowed to own estates and grow burley and flue-cured tobacco. However, flue-cured tobacco is generally very capital-intensive, a thing which has over time created an automatic barrier against the majority of growers. This may explain why the Special Crop Act of 1972 did not include

flue-cured tobacco but rather prevented smallholders from growing burley tobacco. Smallholder farmers were only allowed to grow the two unpopular and less lucrative types – oriental and Malawi Western.

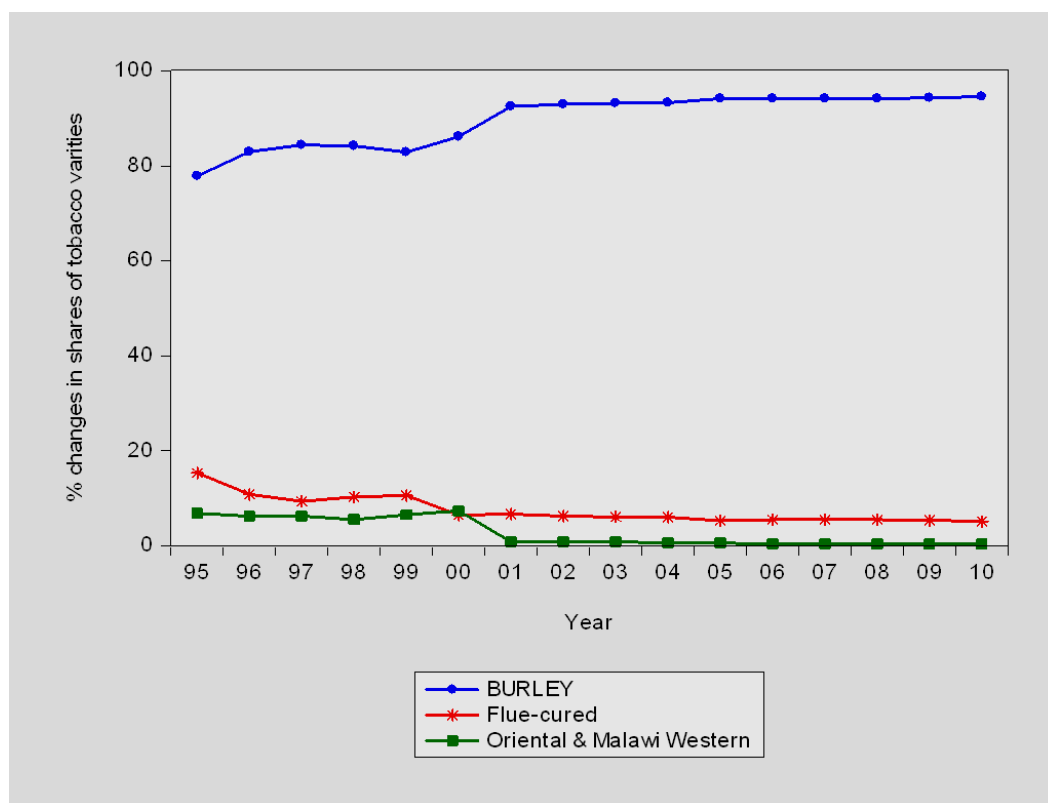
The segregation between those who grew burley tobacco and those who did not was clearly replicated in the chasm between the rich and the poor. While estate owners enjoyed increasing wealth, the majority of smallholders slipped into more poverty. By the beginning of the 1980s it became apparent, especially through the eyes of the donor community, that Malawi's elite-centred growth model was having a grave negative effect on poverty reduction especially amongst smallholder farmers. This prompted the IMF and World Bank to put pressure on the Malawi Government to liberalize tobacco cropping. At first, many government officials, who in most cases happened to be estate owners, were strongly opposed to the idea of liberalization. They cited poor quality and excess supply of the crop as some of the potential weaknesses. However, towards the end of the 1980s the government reluctantly succumbed to pressure from the donor community and in 1990, the Special Crops Act was amended to allow smallholders to grow burley tobacco for the first time (Kaluwa *et al.*, 1992).

The amendment of the Special Crops Act had two main welfare implications. Firstly, the number of smallholder tobacco growers increased tremendously. About 7,600 smallholder farmers entered the tobacco industry immediately after they were allowed to produce burley tobacco in 1990. By 1994 there were nearly 50,000 smallholder tobacco farmers and the number swelled to about 200,000 in 1996. Currently, it is estimated that the number has reached a plateau oscillating between 315,000 and 330,000. The '15,000' difference relates to the erratic entry and exit into the industry in response to the international price changes of the crop¹⁵.

¹⁵ In the case of estate owners, the numbers range between 5,000 and 8,000. This implies that currently, the smallholders constitute between 90 percent and 95 percent of the total number of tobacco growers in Malawi.

The increase in the number of tobacco growers was paralleled by an increase in burley tobacco production. With the liberalization of the tobacco growing industry, many smallholder farmers chose to cut back on their traditional types of tobacco and switched to burley as this type fetches high prices (second to flue-cured), is not capital intensive and is very easy to cure. As such, there was a substantial increase in the cultivation of burley tobacco as a share of total national production from 77.84 percent in 1995 to 94.6 percent in 2010. Figure 3.1 below shows changes in the shares of tobacco varieties cultivated in Malawi between 1995 and 2010.

Figure 3.1: Changes in shares of tobacco varieties (1995-2010)



Source: Tobacco Control Commission (2011)

The second major effect of the amendment of the Special Crops Act has been the increase in demand for child labour in the tobacco estates. Before the repeal of the Act, estate owners mainly relied on smallholders as a source of cheap labour. However, the tobacco production liberalization prompted most tenants to withdraw their services from the estates where they were generally being

underpaid. They instead decided to concentrate on growing their own burley crop where they had hope of a better financial reward.

The huge loss of labour in the estate sector prompted many estate owners to start filling the labour vacuum with under-aged tenants. According to Otanez *et al.* (2006, p. 255), it is estimated that nearly “78,000 children” are employed in the tobacco estates and that 55 percent of them are aged between 7 and 9 years. These children are robbed of their education, they usually work under inhuman conditions and are usually underpaid. Most parents that release their children to work as tenants are desperately poor and hope that their children can be used as a source of income generation. In some cases, it is the former tenants that send their children to work in estates partly as a replacement mechanism and also as a way of augmenting their income. Unfortunately, the child-labour tenancy system is more likely to breed other cycles of helplessly impoverished generations as reported by Semu-Banda (2008):

It is too late for children like 15-year-old Martha Kalima who dropped out of school at 12 years old to work in the tobacco fields. Pregnant at 14, she continued working in the fields until she gave birth. The father was the 16-year-old son of another tenant farmer. “There is nothing like maternity leave for tobacco workers,” Kalima said. “No one is entitled to sick leave nor is there transport to hospital. I gave birth at home because it was too late for me to get to hospital.” Martha is back in the tobacco fields carrying the baby on her back (p. 4).

Malawi is a signatory to the 1989 United Nations Convention on Child Rights. Earlier, the country also ratified the 1973 and 1979 International Labour Organization conventions which set a working age floor of 18 and outlawed child labour, respectively. As such, the government is obliged to ensure that the rights of children are enshrined and so far, Malawi, assisted by the United Nations, has been trying to fight this problem of child labour. However, this task can be difficult where nearly 30 percent and 65 percent of the population is respectively illiterate and poor and where some, if not many, of the abusers (such as estate

owners) happen to be the same people that are supposed to be the ‘child-rights’ protectors, i.e. government officials.

3.2 Crop marketing policy changes in the tobacco industry

According to Mathews & Wilshaw (1992), the first tobacco export, weighing about 40 pounds was auctioned in London in 1893. However, it is reported that the crop failed to obtain a good price due to its poor quality. As more white settlers joined the tobacco production industry, its exportable quantity and quality improved substantially. For instance, in 1909, “the total value of [tobacco] exports was £90,000” (Sharpe, 1910, p. 341). By 1924, Smith (1924, p. 17) reported that “the tobacco crop, which in recent years has averaged five to six million pounds of dried leaf, and this year is estimated at nine million pounds, is the highest output of any of his Majesty’s dominions.” In response to increase in the number of growers, the National Tobacco Board (NTB) was formed in 1926 with the principle objective of coordinating overseas marketing of the crop and later management of the domestic production became NTB’s auxiliary objective.

However, starting from 1929, tobacco exports were hampered by increasing transport costs amidst plummeting world prices which translated into huge losses for the estate owners. To help farmers reduce transport costs, the British Government recommended that local auction floors be introduced and this led to the establishment of the Limbe auction floors in 1938. At that time NTB was entrusted with the intermediary role of purchasing the graded and packaged tobacco leaf from some estate owners, especially those that had transport problems, and selling it at the auction floors. However, the majority of estate owners traded directly with the auction floors.

Later in the 1950s, NTB started to deal with Africans that had been allowed to grow some tobacco and changed its name to African Tobacco Board (ATB) in 1952. A few years later, ATB started to include on its list other farm produce

such as cotton and groundnuts and this led to a change of its name to Farmers Marketing Board (FMB) in 1962.

The role of FMB in trading with estate owners was further weakened after independence as nearly all the white farmers and the newly introduced African burley growers sold their tobacco directly at the auction floors. This compelled FMB to concentrate its intermediary role on smallholder farmers who were growing either oriental and Malawi Western tobacco or other crops such as cotton, groundnuts and rice.

In 1971 the Agricultural Development and Marketing Corporation (ADMARC) was established by Act of parliament and took over the role of FMB. Up until the early 1990s, ADMARC was in charge of marketing nearly all smallholder crops. The parastatal was also responsible for the procurement and supply of farm inputs to smallholder farmers. All the tobacco varieties¹⁶ ADMARC purchased from smallholders were sold at the auction floors except for oriental, which was sold abroad under a special treaty (Mkandawire, 1999).

After the tobacco production liberalization, it was noted that ADMARC alone was very unlikely to adequately serve the growing pool of smallholders. This came on the heels of mounting pressure from the donor community to ensure that smallholders were given freedom to choose between selling their crop directly at the auction floors or via ADMARC. In view of this, by early 1991, smallholder farmers that grew burley tobacco were asked to form clubs. It was envisaged that club members would organize resources together and hire transport to the auction floors.

Malawi's smallholder tobacco clubs could also be instrumental in fulfilling other functions of agricultural producer organizations (POs). For instance, POs can help in ensuring that members have a voice "in decision-making processes in

¹⁶ The term 'all the varieties' mainly refers to the three categories of the Malawi Western tobacco, namely sun/air-cured, Southern Division Dark-fired and Northern Division Dark-fired.

which asset allocations are determined, as well as policies that affect the context in which they produce, market, transform, and export their products” Collion & Rondot (1998, p. 2). However, by 1994, it was observed that most clubs were weak and a large number of burley growers did not join them¹⁷. As such, policy makers and, more importantly, the donor community recommended that in addition to ADMARC there was a need for other intermediaries to be engaged in the tobacco marketing chain. This led to the revoking of the Agricultural Produce (Marketing) Regulation Act and the introduction of the intermediate tobacco buyer (IB) program in 1994.

Under the IB system, which became operational in 1995, intermediaries bought tobacco from smallholder farmers and sold it at the auction floors using their registered names. The system attracted a wide range of players including civil servants, estate owners and other traders. Jaffee (2003) points out that the motivations for obtaining IB licenses were as varied as the players themselves ranging from profit maximization to bypassing of delivery quota restrictions and credit defaults. While it was initially envisaged that the IB program would attract players that had prior knowledge in growing and handling tobacco, by the year 1997, the majority of the 4,000 IBs had no such experience. The system was later marred by accusations of credit defaults, theft and declining quality of burley tobacco arising from ineffective grading (Kadzandira *et al.*, 2004) so the government terminated the program in the year 2001.

Currently, smallholder burley growers trade their crop via the Tobacco Association of Malawi (TAMA) satellite depots situated throughout the country. The system works in such a way that smallholder farmers (as a club) take their crop to any of the 88 satellite depots depending on proximity. TAMA arranges transport on behalf of the farmers to the auction floors where club representatives monitor the trading. However, this system is not free from challenges and

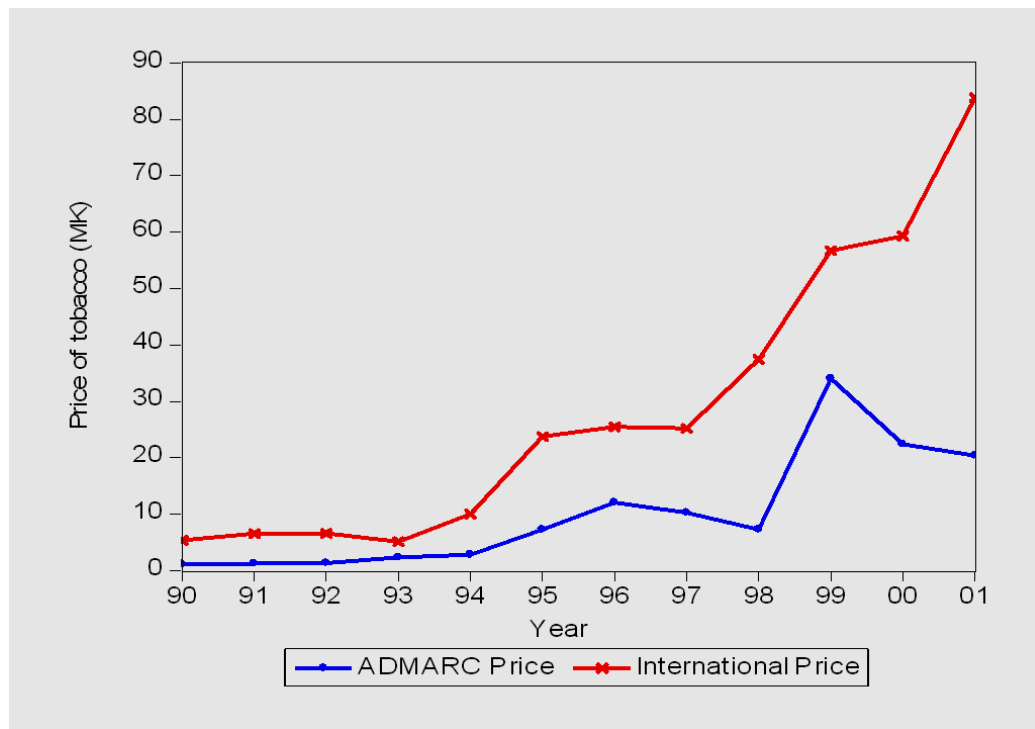
¹⁷ Jaffee (2003) reports that by 2001 the Tobacco Control Commission had a registration figure of 23,363 burley clubs most of which had an average of fifteen members per club. However, club membership became almost mandatory after 2002 and today nearly 95 percent of smallholders belong to a club.

bottlenecks. For instance, there have been many instances where tobacco “is damaged or goes missing at the depots or in transit to the auctions, yet no one is held accountable for this and the farmers affected end the season without any earnings and perhaps with a defaulted loan” (Jaffee, 2003, p. 41).

3.3 The tobacco pricing policies

It is reported that the pre-reform tobacco pricing policies did not favour smallholder farmers and largely failed to reduce their poverty (Harrigan, 2003). Firstly, the tobacco growing restriction policy which was started by the colonialists and continued by the dictatorial one-party Malawi Government limited smallholders to oriental and Malawi Western tobacco which were sold at low prices dictated by the state. Unlike the estate tobacco growers who have been selling their crop directly to the international buyers at the auction floors prices since 1938, the smallholder sales were largely channelled through NTB, ATB, FMB and, till recently, ADMARC and IBs. By buying tobacco from smallholders at very low prices and selling at the usually high international prices, the parastatals were implicitly taxing the poor smallholders. Figure 3.2 below shows the average tobacco prices paid by ADMARC vis-à-vis the international prices between 1990 and 2001.

Figure 3.2: ADMARC versus international prices of tobacco in Malawi Kwacha (1990-2001)



Source: Reserve Bank of Malawi (2008); NSO (2008)

It can clearly be observed from Figure 3.2 above that generally prices offered by ADMARC substantially fell short of the international tobacco prices. Over the indicated 12 year period, ADMARC prices stood at an average of 33 percent of the international prices. In half of the indicated time period ADMARC prices were actually less than 30 percent of the international prices with the lowest standing at 19 percent. A similar picture was painted by the United Nations and Malawi Government in 1993 when they both pointed out that in the 1980s crop prices paid by ADMARC oscillated between 20 and 30 percent of the international prices. However, other scholars have defended the role played by the parastatal especially towards smallholders. For instance, Harrigan (1988) argues that a portion of ADMARC's profit was utilized to finance development in the smallholder sector in form of employment, smallholder credit facilities and a network of markets, especially in the rural areas. ADMARC is also said to have been at the forefront in safeguarding domestic prices for producer goods and inputs.

Furthermore, it has been argued by others such as Mkandawire (1999) that much as ADMARC prices appeared to be exploitative, the whole approach to trading with smallholders was better than it is today. For instance, it was ADMARC's tradition to guarantee minimum crop purchasing prices before the commencement of the planting season which would either be confirmed or increased during the selling season. It has further been contended that although in theory, price fixing is said to distort market operations, in reality, with this approach farmers were able to predict their after-sale income and hence plan accordingly. In addition, farmers were getting cash on delivery right at the ADMARC depot and this could help them make use of their payment immediately and, in most cases, effectively (Chilowa, 1998).

In contrast, nowadays although the system at the auction floors guarantees payment within 24 hours, most smallholders receive their income from tobacco sales two or three months down the road. This is because many of them have no personal bank accounts and therefore they rely on group (or club) accounts which usually take a long time to sort out as to who gets how much, especially when clubs have so many members. Now, prices at the auction floors are paid in U.S. dollars but the majority of smallholders receive their money in local currency.

The local currency tends to appreciate against the U.S. dollar during the tobacco selling period and usually weakens after that. Unfortunately, with the above cited delays the majority of smallholders receive their payment at the time when the local currency is weak. Paradoxically, this is the time they are supposed to buy their farm inputs such as fertilizer and pesticides and since these inputs are imported their prices are usually adjusted upwards during this time as the local currency depreciates. This leaves most smallholders worse off and less competitive than their counterparts, the estate owners.

Despite the stated advantages, many economists and researchers such as Kaluwa et al. (1992) still argued that monopsony and crop price fixing policies would be

more hurtful to poor farmers than if they were allowed to operate in a liberalized and free market system. This led to the liberalization of smallholder crop prices in 1995. On the input side, the marketing of fertilizer and hybrid seed was liberalized in 1993 culminating in the amending of the Fertilizer Farm Feeds and Remedies Act to allow for private sector importation and distribution. Furthermore, the Seed Act was amended to open up for the private sector participation in seed marketing and the price subsidies for fertilizer and hybrid seeds were abolished in 1995 (GoM, 2006c; Mkandawire, 1999).

Most of the above amendments were seen by policy makers as the best way to make prices for smallholders more competitive – a phenomenon that would translate into poverty reduction. Jaleta & Gardebroek (2007) employ a bidding model to explain the phenomenon. They postulated that in a situation where buyers and sellers were allowed to negotiate their prices, buyers would strive to quote a lower price while sellers would do the opposite. The final price (P_f) that both parties would agree upon would therefore be between the buyer's asking price (P_b) and the seller's offered price (P_s), i.e.:

$$P_f = \theta_s P_s + (1 - \theta_s) P_b \quad (3.1)$$

where $\theta_s \in [0, 1]$ is the relative bargaining power of the seller. From this model, it follows that during ADMARC's monopsony, the seller, who happened to be the smallholder farmer had no bargaining power implying that θ_s was zero as such the final price was essentially the buyer's asking price. By increasing the number of tobacco buyers the government expected to widen the sellers' choices (making $\theta_s > 0$) which would eventually increase their bargaining power.

It is reported that the post 1994 sales partly reflected government's expectation of the prices that smallholder farmers would get after introducing competition. According to Jaffee (2003) and Mkandawire (1999) smallholder burley farmers that traded with intermediate buyers received better prices than before. However, it is not clear whether these price improvements were significant, sustainable and

evenly distributed amongst smallholders¹⁸, especially when some of the reasons that led to termination of the IB system included poor quality tobacco, theft and price exploitation. It is partly due to this lack of clarity that this study was conducted. It is also very doubtful that the improvements in the prices that smallholders got had anything to do with their bargaining power. Traditionally, the majority of smallholders have had very weak bargaining power mainly due to low education levels, asymmetric information regarding international prices and the poor quality of the tobacco crop that they produce.

On the issue of poor quality, investigations by the author in 2011 found that the problem is still widespread particularly amongst smallholder tobacco growers. On the market, poor quality tobacco fetches very low prices as indicated in Figure 3.3 below. In this particular example, the poor quality leaf was sold at US\$0.35 per kilogram while the high quality leaf fetched a much better price of US\$3.70 per kilogram.

¹⁸ These issues are discussed further in section 3.3.3, particularly Table 3.1.

Figure 3.3: Quality differences in tobacco leaves



Poor quality tobacco



High quality tobacco

Source: Author (July, 2011)

3.4 Methodology for assessing the impact of tobacco pricing policies

In this section price data will be analysed to assess whether the tobacco pricing policies have led to improvements in absolute and relative prices that smallholders get. This will involve testing for structural changes in time series data. In order to detect these changes, two main approaches are often used, namely the generalized fluctuation tests (Kuan & Hornik, 1995) and F statistics-based tests (Hansen, 1992). The generalized fluctuation tests mainly comprise the cumulative sum (CUSUM) and the moving estimates (ME) tests. In the case of the F statistics-based tests, the main components are the Chow test and F test (Chow, 1960).

The main difference between the generalized fluctuation tests and the F statistics-based tests is that the latter are mainly applicable when testing for a single change in the series while the former are normally used when testing for various patterns of structural changes. In this section, the generalized fluctuation tests are employed to test for any changes in prices of tobacco that smallholders get. The applications of the Poe and KS tests as well as the tests for inequalities are explained later in the chapter. However, this section begins with calculations of the transaction and logistics costs.

3.4.1 Transaction and logistics costs and calculation of the final price

The final prices are computed as the difference between international prices announced at the auction's fall of the hammer and the transaction and logistics costs. In Malawi, tobacco farmers incur various transaction and logistics costs that impact negatively on their final price. The situation is worse for smallholders than estate owners. For the majority of smallholders, transaction and logistics costs start with TAMA which gets a commission for membership, handling and arranging transport.

It is alleged that the transport that TAMA arranges is usually unfavourable to farmers and there are suspicions that profits from such deals are shared between the transport providers and TAMA. For instance, Jaffe (2003) reports that in 2002 members of the National Smallholder Farmers' Association of Malawi (NASFAM) were paying MK350 (about US\$5) per bale¹⁹ while their counterparts under TAMA were paying MK600 (about US\$8) per bale. Much as transport costs have over time adjusted upwards in nominal terms, findings by the researcher in July 2011 suggested that these charges have remained relatively the same when converted into the US dollar²⁰. This implies that on average smallholders that transport their tobacco via TAMA are more than one-and-half times worse off than their counterparts that do not. Unfortunately, those that are outside TAMA are less than 5 percent of the entire population of smallholder tobacco growers.

Apart from the transport cost, which translates to about US\$0.08 per kilogram, smallholders are required to pay institutional taxes which currently stand at an average of 2.48 percent²¹ of their total earnings. In addition they are required to pay Auction Holdings Limited (AHL) a logistics fee of 3.95 percent and a loan stop-order handling fee of 3 percent of their total revenue. On the other hand, estate owners²² tend to pay only the AHL logistic fee of 3.95 percent and TCC fee of 0.13 percent of their gross revenue. Their average transport costs estimated

¹⁹ A bale of tobacco weighs between 75 and 100 kilograms and transport cost of US\$5 per bale is more realistic than US\$8 per bale.

²⁰ In July 2012, the researcher went to Malawi to collect secondary data on the prices of tobacco. These data were collected from the Tobacco Control Commission (TCC) in Blantyre, Malawi. The researcher also visited auction floors in Blantyre, Lilongwe and Mzuzu to find out more about the average cost of transporting tobacco from farm gates to the auction floors.

²¹ These taxes are broken down as follows: 1 percent goes to Agricultural Research and Extension Trust (ARET), 0.85 percent goes to associations, 0.5 percent goes to TAMA and 0.13 percent goes to TCC.

²² Estate owners usually do not belong to clubs. They are also not supported by TAMA or ARET. These farmers seldom require loans from the bank to run their estates and in the case of loans all transactions are conducted at the bank without involving the auction floors.

at US\$0.05 per kilogram²³ are also more reasonable when compared with what the above highlighted smallholders incur.

Since the above costs are deducted at the auction's fall of the hammer, the total transaction and logistics costs incurred by tobacco growers of group j in time t ($\sum TLC_{jt}$) can therefore be estimated by weighting their sum against the export prices, P^E as follows:

$$[\sum TLC_{jt}] P_t^E \tag{3.2}$$

Between 1990 and 2001, smallholders' final prices were equivalent to ADMARC prices and therefore $\sum TLC_{jt} = 0$ because at that time ADMARC (and later the intermediate buyers) bought the crop straight from the farmers. However, during the same time for estate owners, $\sum TLC_{jt} > 0$. From 2002, final prices, P_{jt} for both smallholders and estate owners are given as follows:

$$P_{jt} = P_t^E - [\sum TLC_{jt}] P_t^E = P_t^E (1 - \sum TLC_{jt}) \tag{3.3}$$

3.4.2 Have smallholder tobacco prices improved?

In this sub-section the intention is to establish whether the absolute prices received by smallholders have registered statistically significant improvements as a result of the tobacco production and marketing reforms that started in 1990. To do this, an analysis for structural changes is conducted. This is achieved by employing the CUSUM-based²⁴ and moving estimates-based (ME) empirical

²³ The US\$0.05 per kilogram estimate is the price that according to Jaffe (2003), farmers outside TAMA were paying to transport their tobacco and is reflective of the reality on the ground.

²⁴ The idea of cumulative sums (CUSUM) process dates back to the work of Brown, Durbin, & Evans (1975). The process aims at determining the cumulative sums of recursive residuals as follows:

fluctuation process (efp) tests. These tests are carried out by firstly determining an error correction model (ECM) for the tobacco price function as follows:

$$\Delta p_t = \gamma_1 + \gamma_2 \varepsilon_{t-1} + \gamma_3 \Delta p_{t-1} + \mu_t \quad (3.4)$$

$$\varepsilon_t = p_t - \beta_1 - \beta_2 p_{t-1} \quad (3.5)$$

where, p_t is price of tobacco in period t ; while Δp_t , which is later referred to as ‘diff.Smprice’, denotes changes in tobacco price received by smallholders. γ_i and β_i are coefficients while ε_t is cointegration residual and μ_t is classical ordinary least squares (OLS) residual.

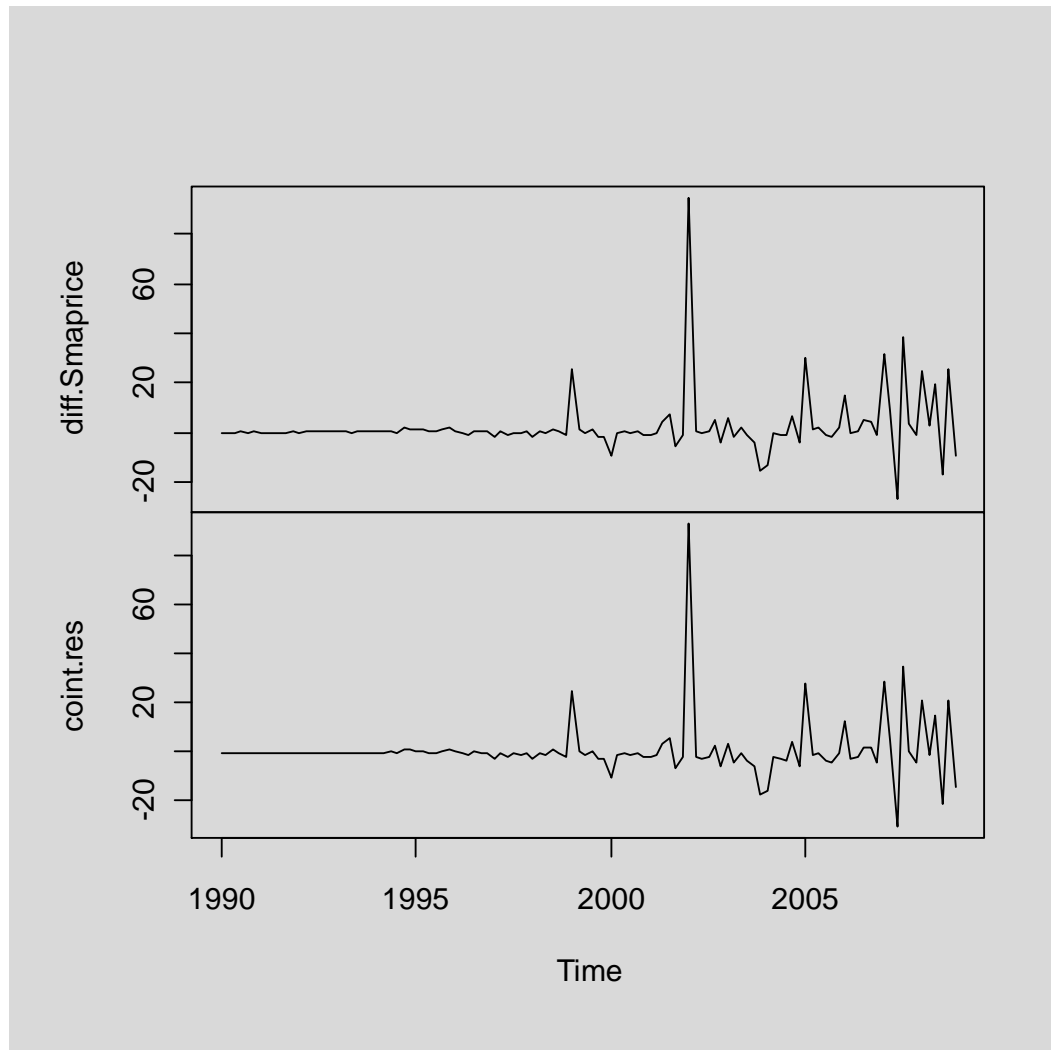
Secondly, from equation (3.5), cointegration analysis is conducted whose cointegration residuals, $\hat{\varepsilon}_t$ (later referred to as ‘coint.res’), plus changes in the lagged Δp_t (later referred to as ‘diff.Smprice1’) are used as regressors in equation (3.4). Figure 3.4 below indicates the transformed data (1990 – 2008; April to September of each year) used to estimate equation (3.4). The original data was sourced from the Tobacco Control Commission in Blantyre, Malawi.

$S_n(t) = \frac{1}{\sigma\sqrt{\eta}} \sum_{i=k+1}^{k+(t\eta)} \tilde{\mu}$ ($0 \leq t \leq 1$), “where, $\eta = n - k$ is the number of recursive residuals and $(t\eta)$ is the integer part of $t\eta$ ” (Zeileis *et al.*, 2009, p. 4). However, the OLS-CUSUM type efp, as employed in this study, is given as:

$$S_n(t) = \frac{1}{\sigma\sqrt{n}} \sum_{i=1}^{nt} \tilde{\mu} \quad (0 \leq t \leq 1)$$

The other important structural change tests include the moving sums of residuals (MOSUM), the Chow test and the F test (see, Zeileis *et al.*, 2009).

Figure 3.4: Transformed data: First difference and cointegration residuals



Sample size = 114

Based on the above transformed data, the cumulative sums of standardized residuals (CUSUM) and estimates-based approaches are employed to test for structural changes in the above described model. The null hypothesis is premised on the assumption that there are no structural changes hence:

$$H_0: \gamma_i = \gamma_0 \quad (3.6)$$

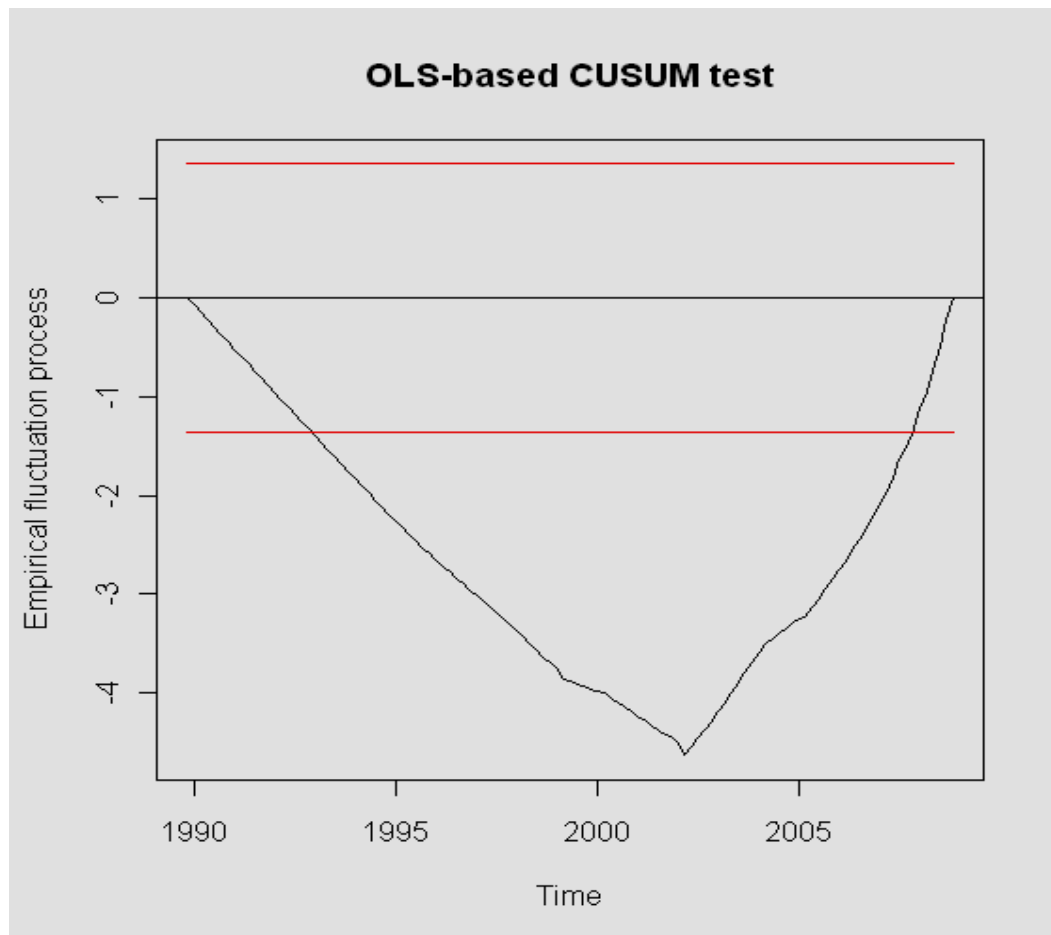
$$H_1: \gamma_i \neq \gamma_0 \quad (3.7)$$

According to Zeileis, Leisch, Hornik, & Kleiber (2009, p. 3), the efp test is principally designed:

to fit a model to the given data and derive an empirical process, that captures the fluctuation either in residuals or in estimates. For these empirical processes the limiting processes are known, so that boundaries can be computed, whose crossing probability under the null hypothesis is α . If the empirical process path crosses these boundaries, the fluctuation is probably large and hence the null hypothesis should be rejected.

In the case of this study, the derived empirical process is designed to capture changes in both residuals and estimates at 5 percent significance level. The OLS-based CUSUM test results are as indicated in Figure 3.5 below.

Figure 3.5: Results of the OLS-based CUSUM test



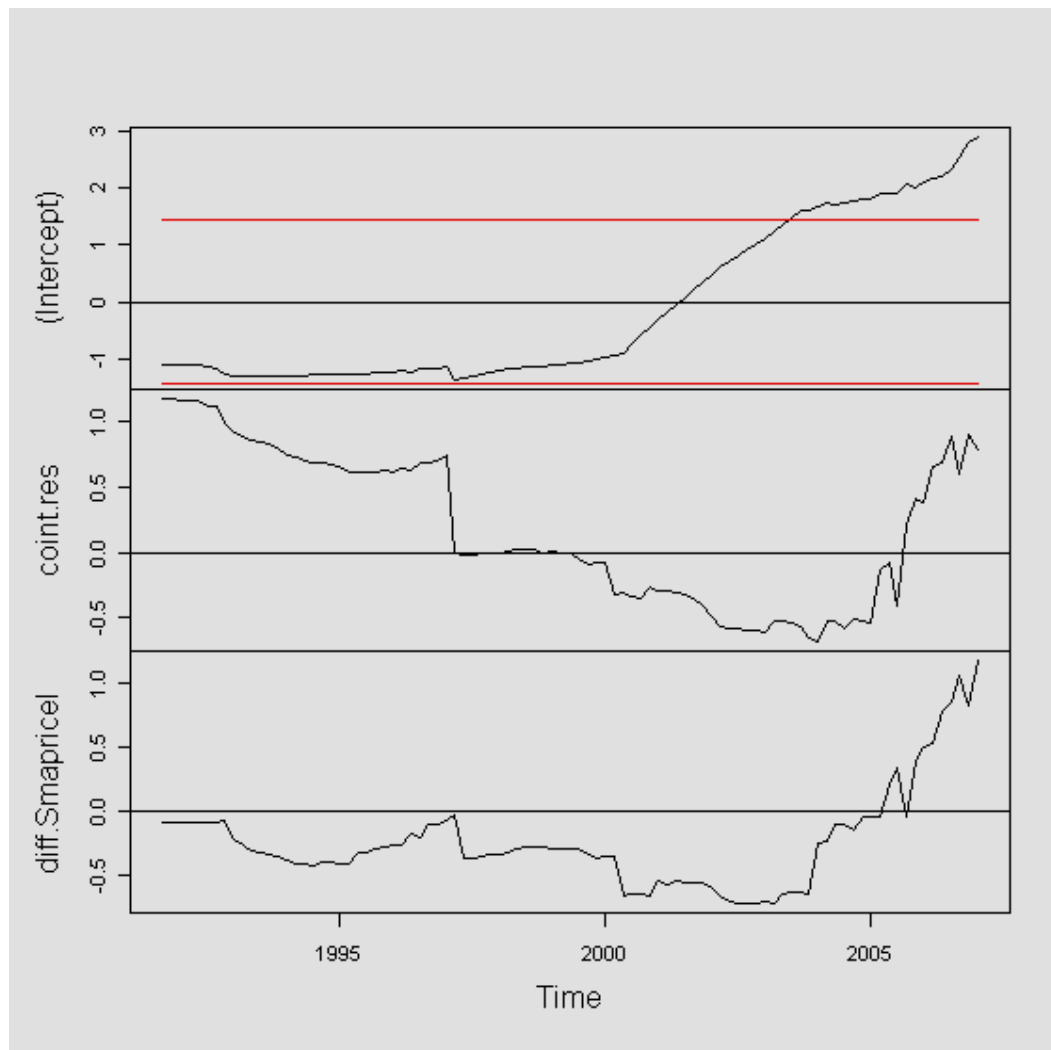
Sample size = 114

Results indicate that the efp crosses the lower boundary firstly, in the year 1994 and secondly, in the year 2006. This implies that the fluctuations are unusually large and hence the null hypothesis is rejected at 5 percent significance level²⁵. Since the residuals in this study's model are largely explained by differences between current and previous prices, a further interpretation of results from the CUSUM-based test may be appropriate. In terms of absolute prices, results indicate a general slide in price changes for the majority of smallholders starting from the year 1990. The downward trajectory reaches the bottom and starts to continuously increase starting from 2002.

Next, the study looks at the moving estimate-based (ME) test of structural changes. The test is basically similar to the CUSUM-based one except for the fact that instead of explaining fluctuation processes based on residuals, estimates of the excluded regression coefficients represented by the constant are used. Its ability to provide more information regarding the kind of the structural change in the model gives it an advantage over the CUSUM-based approach. Figure 3.6 below indicates results of the ME test.

²⁵ The structural change test (sctest) provides the following results: $S_0 = 4.6347$, $p\text{-value} = 2.2e-16$, which lead to a similar conclusion.

Figure 3.6: Results from the moving estimate (ME) test



Sample size = 114

The above indicated ME test has three components which are related to regression coefficient estimates of the intercept, error term and the explanatory variable. The major shift in movements of the intercept takes place after 1999 while in the case of 'smallpricel' and 'coint.res', the major shifts take place after 2002. Results indicate that, starting from 2002, the shift in the intercept is statistically significant at 5 percent level. On the other hand, shifts in 'smallpricel' and 'coint.res' are not statistically significant at 5 percent level. One important point emerging from these tests is that results from the ME-based test are similar to the ones obtained from the CUSUM-based test. Both tests indicate that

there has been a significant change in absolute prices of tobacco that smallholders get.

However, changes in absolute prices that smallholders receive do not necessarily divulge a complete picture with regard to how such price improvements (or decreases) compare with what their counterparts (estate owners) get. In order to gain this insight, the study carries out two econometrics tests, namely the Poe (convolutions) test and the Kolmogorov-Smirnov (KS) test. The Poe test is conducted to establish whether there are significant differences between the distributions of the prices received by smallholders (smaprice) and estate owners (estprice). The KS test augments the Poe test by examining whether the means of these two price distributions are significantly different. These tests are addressed in the following sub-section.

3.4.3 Smallholder tobacco prices versus what estate owners get

To conduct the Poe test, it is assumed that the two sets of price distributions are randomly and independently selected. According to Poe, Giraud, & Loomis (2002, pp. 3-4), “the distribution of the difference of these two distributions is given by the subtractive variant of the convolution formula:

$$f_v(v) = \int_{-\infty}^{\infty} f_x(v+y)f_y(y)dy \quad (3.8)$$

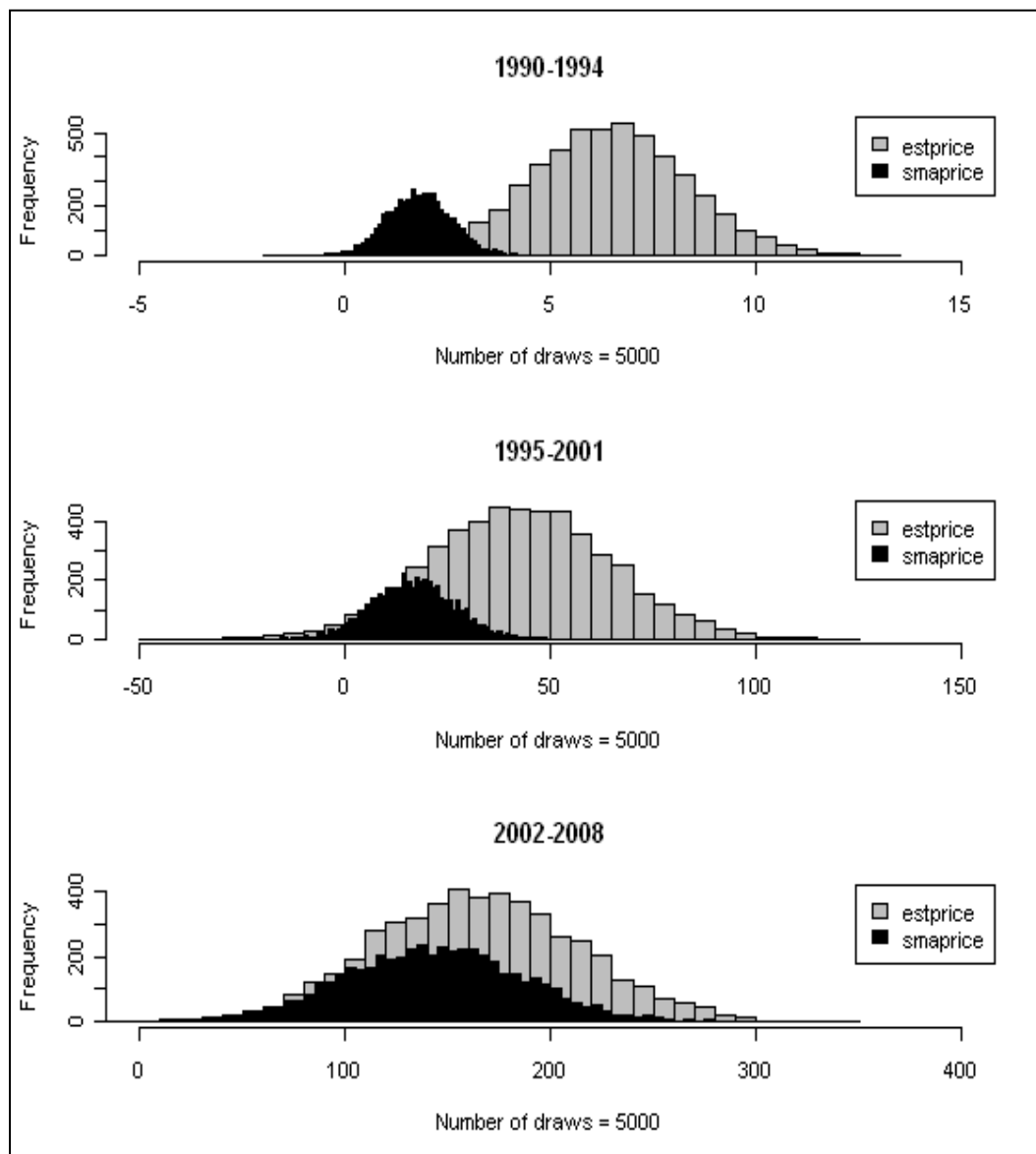
The associated cumulative distribution function at a specific value V' is:

$$f_v(V') = \int_{-\infty}^{V'} \int_{-\infty}^{\infty} f_x(v+y)f_y(y)dydv'' \quad (3.9)$$

where, $f_x(x)$ and $f_y(y)$ are probability density functions of independent random variables X and Y while v is the probability of the event V . The “union of all the possible combinations of x and y result in a difference of v ” (Poe et al., 1994, p. 907).

In this study, five thousand draws generated through a non-parametric bootstrapping process were randomly selected using the convolution technique which “calculates the probability of each possible outcome, considering all possible combinations of the two independent distributions. The probability of outcome is simply the sum of the products of each possible combination” (Poe et al., 2002, p. 4). Results, estimated at 5 percent level of significance, are as indicated in Figure 3.7 and Table 3.1 below.

Figure 3.7: Poe et al. convolutions test results



From Figure 3.7, it can be observed that during the period of monopsony (1990-1994), the bar graphs hardly overlap. The situation improves between 1995 and 2001 when competition was introduced through the IB programme. The two bar graphs completely overlap during the post IB era which started in 2002. This suggests that the distribution of prices between smallholders and estate owners was clearly different in the first phase (1990-1994) of the reform programme. These differences narrowed during the second phase (1995-2001) and today (since 2002) differences in the price distributions between the two groups can be said to be statistically insignificant. This picture is also reflected in the differences between the mean prices of the two groups as indicated in Table 3.1 below. Between 1990 and 1994, the estate mean price was nearly 3.5 times more than that of smallholders. This difference narrowed down to about 2.5 times between 1995 and 2001 and currently, it is about 1.1 times.

Table 3.1: Poe et al. convolution and Kolmogorov-Smirnov (KS) test results

	Mean price	Quartiles					KS Test	
		0%	25%	50%	75%	100%		
estprice (1990-1994)	6.45	-1.54	5.15	6.45	7.69	13.17	} D P-value	0.9304 0.013
smaprice (1990-1994)	1.82	-0.69	1.28	1.82	2.33	4.6		
estprice (1995-2001)	43.33	-48.48	28.46	43.4	57.7	120.6	} D P-value	0.6372 0.058
smaprice (1995-2001)	17.11	-14.76	10.33	17.15	23.58	52.55		
estprice (2002-2008)	164.82	-49.98	130.02	164.99	198.44	345.62	} D P-value	0.187 0.783
smaprice (2002-2008)	144.23	2.08	113.97	144.38	173.07	302.29		

Table 3.1 indicates that overtime (1990-2008) the mean price difference between smallholders and estate owners has gradually declined. For instance, between 1990 and 1994, the average price for large tobacco growers was 3.5 times more than what smallholders received. The gap narrowed down to 2.5 times after competition was introduced (1995-2001). It further went down to 1.1 times from 2002. The quartiles suggest that reductions in average price in the first two phases of the reform process were largely propelled by smallholders in the upper quartiles. On the other hand, in the last phase (2002-2008), price improvements

for smallholders in the lower quartile were instrumental in narrowing the gap between large and small tobacco growers.

Such changes as revealed by the quartiles may be attributed to the alleged exploitations by the state owned monopsony (ADMARC) followed by the IB system. At that time, it was alleged that the poorest smallholders sold their tobacco at very low prices. Larger improvements in prices received by smallholders in the lower quartiles experienced in the post ADMARC and IB era probably testify to the alleged exploitations.

In addition to the above tests, the study looks at the KS test to establish whether the mean prices between the two groups of tobacco growers are significantly different. This is important because differences (or similarities) in estimated distributions do not necessarily denote differences (or similarities) in the means derived from these distributions. “For instance, it is possible that two significantly different distributions can cross and have identical means” (Poe et al., 1994, p. 912) and by extension, significantly similar distributions may have different means.

The KS test is a non-parametric and distribution-free technique of comparing differences or similarities in distributions²⁶. In this chapter, employment of the KS test is closely linked to the Poe test discussed above. With a large sample of draws (5,000), the price distributions mimic the Gaussian (normal) function (see Figure 3.7). This being the case, if these price distributions are similar their means will also be similar. According to Alexander & Jaforullah (2005, p. 13), the KS test “computes the maximum vertical deviation (D statistic) between the empirical distribution functions of a pair of samples along with a p-value appropriate for testing the null hypothesis” – in the case of this study– that the means of the two bell-curved price distribution functions are the same. Low p-

²⁶ In appendix 2 a mean equality test is employed to test for the difference in the mean prices. This hinges on normality assumptions. Contrary to the criticism by Poe et al.(1994) that the normal-based approach leads to biased estimates of the differences, results compare favourably with those of the non-parametric approaches.

values together with high D statistics would signify differences in the means of the two distribution functions.

Table 3.1 above indicates that between 1990 and 1994, the mean prices between smallholders and estate farmers were different at 1 percent level of significance. In other words, the mean price differences were very large. Between 1995 and 2001, the differences were only significant at 10 percent level implying that the differences had largely narrowed down. The high p-value and low D statistic computed between 2002 and 2008 indicate that currently there are no statistically significant differences between the mean prices of the two groups of farmers.

From the above three tests, it can be concluded that the tobacco policy reforms that started in 1990 have not only helped to improve the absolute prices that smallholders receive but they have also narrowed the mean and distributional price gaps between the rich estate owners and smallholders. All tests consistently point to the fact that major positive changes in the tobacco price structure have occurred after the ADMARC and IB system era which started in 2002. However, improvements in absolute and relative tobacco prices (in nominal terms) for smallholders do not necessarily provide enough information with regard to real income distributional differences between the estate owners and smallholders. This is the issue that is dealt with in the following section.

3.5 Tobacco reforms and household income inequality

As indicated earlier, policy makers envisioned that by allowing smallholders to participate in cultivation of burley tobacco, there would be an increase in income for rural agricultural smallholders mainly through increased production. Rising incomes for rural smallholders were believed to culminate in reduction of income inequality between smallholders and large landowners. In this section, the main objective is to examine the extent to which these reforms have helped reduce income inequality amongst tobacco growing households in Malawi.

A number of indexes are used to measure income inequality but the most frequently used is the Gini coefficient. Its popularity stems from its simplicity in both computation and interpretation as indicated below.

$$\text{The Gini coefficient, } G = \frac{1}{k} \left(k + 1 - 2 \left(\frac{\sum_{i=1}^k (k+1-i)y_i}{\sum_{i=1}^k y_i} \right) \right) \quad (3.10)$$

where, $i = 1 \dots k$ is the position of the i^{th} household in the distribution and y_i is the level of income of the i^{th} household. However, “the problem with the Gini coefficient is that the marginal social rate of substitution between income accruing to individual i and income accruing to individual $i - 1$ is simply $\frac{i}{i-1}$, and is thus independent of the actual income difference between them” (Dasgupta *et al.*, 1973, pp. 186-187). This implies that two different income distributions can have the same Gini coefficient. In addition, the Gini index is very hard to decompose or even add across groups. This implies that the sum of Gini coefficients for subgroups is different from the total Gini coefficient of the population.

It is due to the above limitations of the Gini index that some researchers have proposed other methodologies. The most popular alternatives to the Gini coefficient are the generalized entropy measures, which are computed as follows.

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)} \left[\frac{1}{K} \sum_{i=1}^K \left(\frac{y_i}{\bar{y}} \right)^\alpha - 1 \right] \quad (3.11)$$

where, \bar{y} is the average income, y_i is as defined above and α is the weight of the distances between incomes in a distribution. The measures of the GE range from zero (representing equal distribution) to ∞ (signifying higher levels of inequality). Traditionally, α takes the values of 0, 1 and 2.

When $\alpha = 0$, the entropy measure becomes a Theil’s L (mean log deviation) index. Here, the index is more sensitive to variations affecting the lower tail of

the income distribution (Maasoumi, 1986; World Bank Institute, 2005). When $\alpha=1$, the entropy measure is referred to as the Theil's T index, which is more sensitive to changes in the upper tail of the distribution. With $\alpha=2$, the measure is "half the square of the coefficient of variation" (Newton, 1999, p. 8). The main advantage of the generalized entropy measures, as proven by Foster (1984, p. 106), is that they are "symmetric and homogeneous of degree zero in all incomes."

In this study, both methods, the Gini coefficient and generalized entropy measures, are employed to test for income inequality between two main income groups in the tobacco sector, namely smallholders and estate owners. The original data for the calculation of Gini and generalized entropy indices was collected from the tobacco Control Commission in Blantyre, Malawi as summarised in Table 3.2 below.

Table 3.2: Revenue per capita for tobacco growers in Malawi (US\$)

	1990-1994		1995-2001		2002-2008	
	Smallholders	Estates	Smallholders	Estates	Smallholders	Estates
Minimum	119	19,792	410	15,600	170	13,000
Maximum	986	45,476	1205	38,750	327	31,250
Mean	402	34,651	702	24,824	246	22,657

Source: Tobacco Control Commission (2011)

The income inequality tests were conducted on five thousand draws which were generated by a non-parametric bootstrapping process and randomly selected using the convolution technique as discussed earlier. Results are as shown in Table 3.3 below.

Table 3.3: Results for income inequality between smallholder and estate tobacco growers

Period	Inequality measures			
	GE(0)	GE(1)	GE(2)	Gini
1990 - 1994	0.63	0.43	0.40	0.49
1995 - 2001	0.20	0.18	0.17	0.33
2002 - 2008	0.49	0.38	0.36	0.46

Results as indicated in Table 3.3 above suggest that the income inequality between smallholder and estate tobacco growers is high. It was highest between 1990 and 1994 when ADMARC was the main buyer of tobacco from smallholders. With competition (1995-2001) the income inequality dropped tremendously as suggested by all the inequality measures above. However, between 2002 and 2008, the inequality increased again although not reaching the extent it was between 1990 and 1994. Interestingly, this (2002-2008) is the period when, on average, price differences between small and large tobacco growers became statistically insignificant as discussed in the previous section. The findings confirm what was highlighted in chapter two (section 2.2) about the possibility of having trends in income (price) levels and income distributions taking different directions. This suggests that even if smallholders were to move up the income ladder, it was possible for them to remain behind their richer (estate) counterparts.

3.6 Economic diversification beyond tobacco

As stated earlier, Malawi is heavily reliant on tobacco for its foreign exchange earnings. The country has had negligible success in diversifying its exports away from tobacco during the past forty five years. For instance, the share of tobacco in total domestic exports was planned to fall below 50 percent starting from 1981. Instead, it rose from 47.4 percent during 1980-83 to 64 percent in 1988 and to 70 percent by 1998 (Mkandawire, 1999). This trend can be very risky particularly considering the fact that currently the anti-smoking campaigns has intensified

especially in the developed countries which might lead to reduction in world demand for the crop.

Since 1991, the World Bank, which is Malawi's key lender, has steadily and actively participated in international campaigns to reduce demand for tobacco products. The Bank's policy of 1991, updated in 1999, clearly stipulates that it will not finance the tobacco sector through either direct lending or investment in the tobacco production, processing or marketing (World Bank, 1997). However, exceptions to this policy have so far been made to two countries, namely Malawi and Zimbabwe whose foreign reserves heavily depend on tobacco.

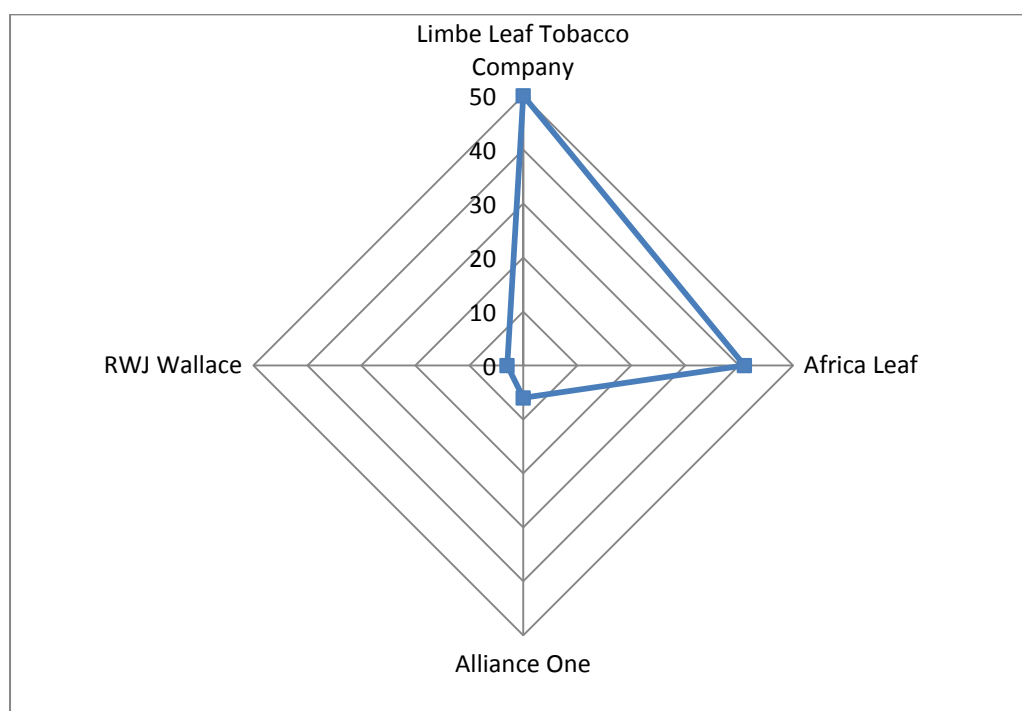
Owing to these exceptions, in 1993, the World Bank facilitated the establishment of the Malawi Rural Finance Company (MRFC) which was designed to provide credit and other services to smallholder burley club members. Studies have shown that tobacco growers that benefited from the MRFC credit facilities had in most cases performed better than their counterparts who did not. However, it is hard to assume that the World Bank policy exception may be extended for a very long time; actually the opposite is likely to be the case. The current warning lights point to the fact that relying on tobacco as the only tool for economic growth and poverty reduction may not be a sustainable approach in the long run. Therefore, there is a need to diversify to other crops such as cotton, pulses, cassava, and bananas.

While diversification away from tobacco is a pertinent policy option, it must be pointed out that this may not take place in the near future. As highlighted above, strides to reduce Malawi's dependence on tobacco have actually taken the opposite direction. It can therefore be argued that the country is likely to depend on tobacco for many years to come as such, in the short term, it is important to examine some of the issues that impinge on what would guarantee better tobacco proceeds for smallholders. One of them is the way tobacco is traded at the auction floors as discussed in the following section.

3.7 Promotion of fair trading

Under the Control of Tobacco Floors Act, tobacco in Malawi is supposed to be sold strictly at the auction floors. There is only one licensed seller: Auction Holdings Limited (AHL) which sells tobacco on behalf of farmers at the three auction floors of Limbe, Lilongwe and Mzuzu. On the other hand, there are four companies that are licensed to purchase tobacco at the auction floors, namely Limbe Leaf Tobacco Company (LLTC), Africa Leaf (AL), Alliance One (AO)²⁷ and RWJ Wallace (see Figure 3.8 below).

Figure 3.8: Tobacco buyers at Malawi's auction floors



Source: Tobacco Control Commission (2011)

As suggested by the radar above, the buying powers are heavily skewed in favour of LLTC which dominantly buys about 50 percent of tobacco followed by AL which buys about 41 percent while the remaining two buyers purchase less than 10 percent of the total crop traded. This has led to the creation of a cartel in

²⁷ Alliance One was born out of a merger between Stancom Tobacco Company and Dimon Tobacco Company in 1995.

which prices and quantities are dictated by the two dominant buyers. An investigation by the Anti-Corruption Bureau in 1995 revealed that:

The buying companies come to the Auction Floors knowing how much each company is supposed to buy. The buyers ensure that each buyer is maintaining his percentage by employing statisticians... The statisticians keep on consulting and sharing information with fellow clerks of other buying companies in the counting of bales throughout the sale. They consult in order to know how much each company has bought so far. The clerks constantly feed the information to their respective buyers through a small piece of paper called “counter” so that they do not exceed their buying percentages of that day. Because of this system, the buyers do not compete against each other since they are assured of buying their required percentage whatever the case may be (GoM, 1995, p. 8).

The above quoted buying behaviour violates the purchasing regulations as stipulated in the Control of Tobacco Floors Act in which buyers are not supposed to connive on the prices and quantities of tobacco they are buying. This malpractice has partly contributed to the poor auction prices that farmers get. There is therefore a need on the part of government to ensure that trading is conducted in a fair and transparent manner following the rules. Government can also encourage other tobacco buyers to enter the market to foster competition²⁸.

Related to the issue of unfair buying practices is the issue of high logistics fees at the auction floors (see section 3.3.1). If compared with Zimbabwe, Malawi farmers incur much higher costs in trading their crop at the auction floors. For instance, while AHL charges 3.95 percent of a farmer’s gross revenue, in Zimbabwe a farmer pays 2.4 percent of gross revenue as logistics charges. In addition, AHL charges stop-order fee of 3 percent of the total loan which is too high compared to only 0.14 percent that farmers in similar situations pay in Zimbabwe. Therefore, there is a need for government to lobby for a reduction in logistics charges in order for tobacco production to have a greater and more meaningful welfare impact on smallholders.

²⁸ For instance, in Zimbabwe there are 16 buyers; this is four times more than that in Malawi.

It is also possible that tobacco trading could be made fairer to smallholders if, for example, AHL would be allowed to take over management of the satellite depots currently being run by TAMA. This would be similar to having satellite auction floors spread throughout the country. Jaffe (2003) observes that some stakeholders tried to implore the Malawi Government to replace TAMA with AHL. However, TAMA was strongly opposed to the idea and lobbied unceasingly to retain its role of storing and transporting the crop. Unfortunately, the main stakeholders – smallholders – had no say on the issue which led to the continuation of the status quo.

The advantages of having AHL manage satellite auction floors would be two fold. Firstly, this would cut on the high transport costs that farmers incur when transporting their leaf to any of the three auction floors. Secondly, framers can save on the losses and damages that take place en-route to the auction floors which unfortunately are hardly accounted for and the poor farmers bear the whole burden. Through these satellite depots, AHL may also consider paying farmers an upfront down-payment. This would be advantageous in the sense that it would lead to saving on some of the losses that farmers incur due to delayed payments as discussed above (section 3.3).

3.8 Chapter summary

A number of agricultural policy reforms have been pursued in Malawi since 1981. However, major policy reforms have been undertaken in the tobacco industry apparently due to its socio-economic importance and hence the welfare benefits that were expected to be derived from the reforms. The main objectives of this chapter were: (a) to test whether there have been any improvements in absolute and relative prices that smallholder tobacco growers receive. (b) to examine the extent to which these reforms have helped reduce the income inequality between small and large tobacco growers. Results indicate that over time such reforms have indeed led to some improvements in both absolute and relative tobacco prices that smallholder farmers receive.

However, improvements in the net producer prices have not translated into sustainable reductions in income inequality between smallholders and estate owners. The income gap between small and large tobacco growers decreased with the introduction of completion (1995-2001). However, over the last years (2002-2008), it has once again increased although currently it is lower than it was between 1990 and 1994.

It has also been illustrated in the chapter that tobacco growers, especially smallholders, face a number of bottlenecks with regard to trading their crop. Some of these bottlenecks include high transaction costs, auction fees and collusion on the part of the buyers. In this regard, the government may intervene to ensure that fair trading is promoted at the auction floors. For instance, by ensuring that tobacco is traded competitively at the auction floors, farmers are likely to get better international prices than would be the case if buyers collude. Government can also lobby for reduction in the logistics cesses that farmers meet at the auction floors.

Over-reliance on tobacco is another issue that the Malawi Government needs to consider. Currently, tobacco exports are greatly threatened by an expected decline in demand particularly from the developed world. Diversifying to other crops may be a better option if economic growth and the improvement of smallholders' welfare are to be upheld in the long term.

CHAPTER FOUR

EFFECTS OF MAIZE FERTILIZER SUBSIDIES ON FOOD SECURITY IN MALAWI

4.0 Introduction

The maize sector provided the second target for Malawi's agricultural policy reforms. Policy interventions in this sector which were mainly in the form of fertilizer and seed subsidies, started during the 1960s' government campaign for turning maize into the national food crop. At that time the main objective was to ensure food security at both national and household levels. In the 1990s, improvement in rural household income distribution and poverty reduction were added to the original objective of the subsidies. This chapter deals with the first objective, i.e., food security. The other objective, i.e., raising incomes is considered in the following chapter.

The key question that will be addressed is: what has been the effect of maize fertilizer subsidies on national and, more importantly, household food security? Various statistical and econometric tests are employed to address this question. For instance, spatial analysis is employed to examine the existence of spatial correlation between fertilizer subsidy and maize production. In addition, the Epanechnikov Kernel density and Tuckey's notched box-and whisker plots are used to compare regional per capita maize distributions. These analyses are preceded by a description of the historical background, performance and reforms in the maize sector. At the end of the chapter, a discussion leading to a number of recommendations is included.

4.1 Historical background of maize production in Malawi

Maize, whose origins are traced to central Mexico nearly seven thousand years ago, was introduced to southern Africa by Portuguese sailors and tradesmen (McCann, 2001a). Although the exact date of arrival is not known, by the early 1800s various native groups in southern Nyasaland²⁹ grew maize. However, cultivation was limited to very small quantities because at that time the staple food crops were sorghum, millet, rice, potatoes, groundnuts, pumpkins and cassava of which the first two were most important. According to Vaughan (1982, p. 354), people of the Shire highlands, especially the Nyanja, grew maize by exploiting riversides. “River-sand was placed on top of the waterlogged *dambo* mud and maize planted in it, allowing the roots to take what moisture the plant required from the clay below, without becoming saturated.”

Good trade ties that existed between people of the Shire highlands and those of the central highlands of the country led to adoption of the crop by the latter. By the mid-1850s, except for the northern part of the country, maize was well known in what, from 1891, came to be known as the southern and central regions of Nyasaland. In one of his letters, Livingstone (1862, p. 255) indicated that the natives: “cultivate the soil pretty extensively, and grow large quantities of sweet potatoes, as well as rice, maize...but in the north manioc was the staple product...”

Cultivation of maize took a new turn in the early 1900s with the arrival of Lomwe migrants from Mozambique which led to a shortage of agricultural land in the Shire highlands. “It was in this period that this section of the peasantry began growing increasing amounts of maize at the expense of the older staples, millet and sorghum” (Vaughan, 1982, p. 359). Maize was prioritized mainly because of its higher productivity per unit of land compared to the other crops. By the end of the 1960s, maize was cultivated nearly throughout the country as a staple crop. Since then, its importance and consequently land allocated to its

²⁹ Nyasaland was Malawi’s former name, particularly between 1891 and 1964, when the country was a British protectorate.

cultivation has steadily increased. Currently, the crop is cultivated by 98 percent of rural farming households (GoM, 2005) covering nearly 65 percent of the country's arable land (see chapter 1, section 1.3.2).

In today's Malawi, people say, "*chimanga ndi moyo*" – which literally means: "maize is life"³⁰ (Smale *et al.*, 1995, p. 352). In the rural areas, the crop symbolizes wealth for those who have it and poverty for those who do not. "As long as a house is without a *maize* granary it is not recognized as a separate household. It belongs to the household from whose granary its occupants are fed" (Englund, 1999, p. 144). It also acts as a political barometer against which the success or failure of a political party in power is measured. Finally, the crop is an economic yardstick on which the national consumer price index (cpi) and therefore inflation is largely determined.

4.2 Maize sector performance and policy reforms

Although replacing millet and sorghum with maize meant that people would have more food from less land, maize cultivation had its own limitations. Unlike the traditional crops, maize proved to be labour intensive and was not very resistant to drought. These limitations, particularly the latter, have over time contributed to periodic poor maize harvests in Malawi. The first maize crop failure was reported by Livingstone (1863) when he said:

I took a journey with some of our own people down the Shire a short time before I left Mikarango, to try if anything was to be bought in the way of seed or corn, but I could get nothing:..at present the complaint is famine...The whole country is in a state of utter ruin and destitution, and the drought still continues (pp. 275-276).

³⁰ Interestingly, this is exactly the way people characterized maize (*zea mays*) in the land of its origin. According to McCann (2001a, p. 248), "the Aztec and Mayan civilizations had long called the descendants of that plant "maize," literally "that which sustains life," and claimed that the crop was flesh and blood itself."

It appears that the drought of 1863 was so severe that even the traditional crops (millet and sorghum) failed. At that time, it is reported that for the following planting season, chiefs collected seeds from their subjects that had surplus maize from previous harvests and distributed it to those that had nothing. No other droughts or maize failures were reported until nearly two decades after the country became a British protectorate in 1891. According to Ng'ong'ola (1986), in 1912 and 1922, Nyasaland experienced rain failures that led to poor maize harvests. In both cases, the British government helped to normalize the situation through free maize seed distribution.

However, Malawi's crop failure that has so far attracted most oral and written attention is the one that occurred in 1949. The problem started in 1948 when swarms of locusts destroyed many crops. This was followed by drought. According to Vaughan (1985):

“The situation had started as a small joke, but it turned into a bad joke, and a serious issue”. The main features of the famine were firstly the extreme mobility of the population (especially men) in search of food to buy, earn, beg or gather; and secondly, the progressive breakdown of whatever community support and family solidarity had existed earlier (p. 185). By January 1950 people began to show signs of severe malnutrition...feeding camps were set up to deal with the worst cases of malnutrition...The really bad cases were taken to the Blantyre mission hospital for further “food treatment” (pp. 193-194).

Although the exact number is not known, many people died of hunger between 1949 and 1950, particularly in the southern region. The government intervened with several measures. Selling of maize was rationed to a tune of 5 shillings per family head. Those that had no cash were asked to work for food by gathering large stones that were used to construct roads, bridges and in some cases rail way lines. It was only the sick and old which were occasionally provided with free food. In 1950, the government distributed free maize seed to farmers throughout the country. This was followed by a famine tax of 2 shillings 6 pence per adult

male. In 1951, the National Resource Ordinance of 1946³¹ was strengthened “which made ridge cultivation and erosion bunding compulsory, set planting and uprooting dates and even required the cultivation of cassava as an insurance against maize shortages” (Thomas, 1975, p. 36). Those who did not comply were either fined or imprisoned.

Many people viewed the imposition of the famine tax and the National Resource Ordinance that came with “the fines and arrests of people who infringed the laws as being direct punishments for having caused the government so much trouble with the famine” (Vaughan, 1985, p. 195). As a result, there was a widespread discontentment amongst the natives which, in 1959, sparked political unrests that culminated into independence in 1964³². After independence, the Malawi government repealed the National Resource Ordinance making the control of soil erosion a voluntary act. At that time, the president would cautiously say that it was the soil and not the government that would punish the bad farmer. On the other hand, the government strongly advocated for maize to be cultivated by all smallholder farmers in the country. This appeal was particularly meant for the people of the northern region most of whom were still growing cassava as their staple crop.

The government campaign for turning maize into a national food crop was supported by policy interventions such as fertilizer and seed subsidies. These subsidies were channelled through the state owned Agricultural and Marketing Corporation (ADMARC), which by then was the sole seller and buyer of agricultural inputs and harvests, respectively. Losses that ADMARC incurred on its subsidized maize trading were recuperated through profits made from exportable tobacco and other cash crops that it purchased from smallholders at

³¹ The Natural Resources Ordinance of 1946 was decreed mainly with the aim of controlling soil erosion that was the major problem particularly in the Shire highlands. The problem emanated from poor farming methods and wanton cutting down of trees (Mulwafu, 2002).

³² It is worth noting that the drive for independence in Malawi included other factors such as the John Chilembwe uprising in 1915, the campaign by the Nyasaland African Congress party from the 1940s and discontentment about the federation of Rhodesia and Nyasaland in the 1950s.

below export parity producer prices. Currently, the subsidies are administered directly by the Ministry of Agriculture and Food Security through various regional and district outlets where coupons are distributed to beneficiaries in all administrative areas in the country (see Appendix 3).

Over a period of twenty years after independence in 1964, maize production and hence national food security was a success story for Malawi. During that period, the country became a net exporter of maize to countries such as Zambia and Tanzania. However, the food security policy was fragile as it hinged on an overall agricultural strategy that favoured the estate sector. The smallholder sector, the core producer of maize, was largely regarded as a provider of food to the nation and low cost labour to the estate sector, which, at that time, was the sole producer of the lucrative burley tobacco and tea. Consequently, by the end of the 1970s “whilst the estate sector grew at over 17 percent per annum, smallholder growth was less than 3 percent” (Harrigan, 2008, p. 241).

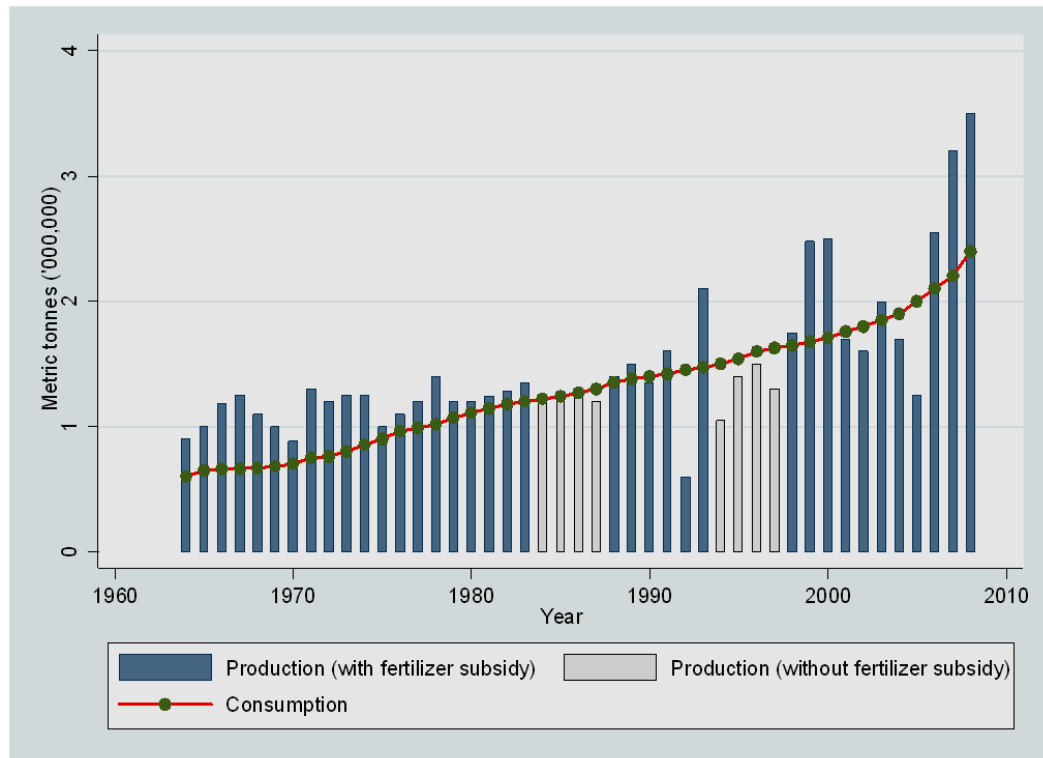
The smallholder maize sector started to falter from the early 1980s mainly due to inconsistent fertilizer subsidies as explained in the following section. Since then, Malawi has registered erratic trends in smallholder maize production and food security. The situation has drawn interest from a number of researchers. For instance, Dorward (2006), Chirwa *et al.*(2006) and Harrigan (2008) have carried out insightful explanatory work regarding performance of the agriculture sector, poverty and food security in Malawi. However, studies based on empirical analysis to examine the impacts of maize fertilizer subsidies on food security are surprisingly scarce. It is this shortfall that motivates this chapter. The following question is addressed. What has been the effect of maize fertilizer subsidy on national and, more importantly, household food security?

4.3 Maize fertilizer subsidy and national food security in Malawi

The first phase of Malawi’s fertilizer subsidies occurred between 1964 and 1983. During that time, smallholder fertilizer had a price ceiling of about 25 percent

below commercial price of the day (Mkandawire, 1999). However, subsidies on fertilizer were phased out in 1983 under the structural adjustment policies that started in 1981. After removing these subsidies, the country's maize output fell by nearly 10 percent in 1984 as indicated in Figure 4.1 below.

Figure 4.1: Maize production and consumption in Malawi (1964-2008)



Source: Ministry of Agriculture and Food Security (various issues)

From 1984 to 1987, there was stagnation in maize production, a situation that compared unfavourably against an increasing national consumption trend. By 1987, Malawi was forced to import 140,000 metric tonnes of maize (Stambuli, 2002). Poor performance of the smallholder maize sector compelled the Malawi government to resume fertilizer subsidies in 1988 but this was opposed by the donor community. Donors felt that subsidies on smallholder fertilizer were one of the major factors that led to high public deficits, which Malawi was required to address. The feud that followed between Malawi and the donors over the issue of the subsidies partly led to foreign aid withdrawal in 1992 and precipitated change of government in 1994. However, during the time the subsidies were reintroduced

(1988-1993), the country registered food surpluses except for 1990 and 1992 due to drought which was particularly severe in 1992.

At the end of 1993, price subsidies for fertilizer and hybrid seeds were abolished once again. The marketing of fertilizer and hybrid seed was liberalized and the Fertilizer Farm Feeds and Remedies Act was amended to allow for private sector importation and distribution (GoM, 2003b; Mkandawire, 1999). The years that followed were characterized by severe food shortages as most farmers were unable to purchase fertilizer for their maize production.

By 1997, the Malawi government started to negotiate with the donor community for support to resuscitate smallholder productivity and ensure food security in the country. Towards the end of 1997, an agricultural investment project was approved which marked the introduction of what can be termed as the second phase of fertilizer subsidy programmes, which started in 1998. In that year, the starter pack scheme (SPS) was devised and funded jointly by the Malawi government, the Department for International Development (DFID), the European Union (EU), and the World Bank to a tune of US\$25.6 million.

The SPS was primarily designed as a short term rescue plan. At the start of the programme, about 2.8 million starter packs were distributed to smallholders country-wide. The free input packs included fertilizer (about 10 kilograms of urea or NPK) and seeds (about 2.5 kilograms of maize and legumes) for 0.1 hectare per smallholder household. For two consecutive years after the introduction of the SPS, Malawi recorded unprecedented high maize yields of about 2.48 million metric tonnes and 2.50 million metric tonnes in 1999 and 2000, respectively (GoM, 2001b).

However, by the end of the year 2000, the Malawi government and the donor community were again at loggerheads over continued funding and poverty effects of the SPS. Some donors faulted Malawi's intention of turning the SPS into a long term rescue plan, contrary to its initial objective. They viewed the SPS as a

waste of donor aid with a potential of stifling private sector input delivery, promoting corruption and locking Malawi into a maize poverty trap. The above disputes made the World Bank discontinue and the EU curtail their financial assistance towards the scheme.

With one committed donor, DFID, Malawi was forced to scale down the SPS to a targeted input programme (TIP). Under the TIP, the number of beneficiaries was reduced from an average of 2.8 million households between 1998 and 2000 to 1.5 million households in 2001 and 1 million households in 2002. Total funding was also reduced from US\$25.2 million in 1999 to only US\$7.2 million in 2001. Unfortunately, the TIP coincided with a drought that affected the country from 2001 to 2002 which led to another food crisis in which many people became destitute and lost their lives. During that time, maize output dropped to an average of 1.5 million metric tonnes against an expected demand of about 1.9 million metric tonnes.

DFID increased its financial support from US\$9.9 million in 2002 to US\$10.9 million in 2003 and, for this reason, the TIP was renamed Extended TIP (ETIP). Combined with Malawi's contribution, ETIP total funding in 2003 stood at US\$12.1 million. This led to an increase in the number of beneficiaries to 2 million households. In that year, maize output went up to 2 million metric tonnes. In 2004, ETIP total funding declined to about US\$9 million which catered for a reduced number of 1.7 million smallholder families. The drop in the number of beneficiaries was matched by a drop in maize yield to 1.7 million metric tonnes. In 2005, the harvest went down further to about 1.25 million metric tonnes partly due to another drought that affected a number of districts in the country.

From 2005/06 growing season, the ETIP was once again renamed 'smallholder fertilizer subsidy'. This marked the beginning of what can be referred to as the third and current phase of fertilizer subsidies in Malawi. This phase is similar to the first one except for the fact that today's price ceiling is much higher than

before³³. In addition, just as was the case during the first phase, the current subsidy programme is primarily financed locally through domestic borrowing.

In the 2007/08 fiscal year, the government allocated US\$112 million for the program up from an average allocation of US\$52 million for the two previous fiscal years. During the 2008/09 growing season, the government procured 242,000 metric tonnes of fertilizer at US\$1,600 per metric tonne³⁴. Both the quantity and price were, by far, more than what was budgeted for in the 2008/09 fiscal year. Initially, the government had allocated US\$136 million for the procurement of 170,000 metric tonnes of fertilizer at the estimated price of US\$800 per metric tonne (GoM, 2005b, 2006b, 2007b, 2008b).

Later, it was noted that the government overestimated the 2008/09 demand by 83,000 metric tonnes so for the 2009/10 fiscal year it allocated US\$127 million to procure 160,000 metric tonnes assuming the price stood at US\$800 per metric tonne (GoM, 2009b). Table 4.1 provides a summary of the key features of the fertilizer subsidy programme as discussed above.

³³ For instance, in 2006/07, the price ceiling was at 72 percent while it was at 79 percent, 95 percent and 88 percent in 2007/08, 2008/09 and 2009/10, respectively (GoM, 2008a, 2009a, 2010, 2011).

³⁴ The Malawi government spent up to US\$387.2 million on fertilizer subsidy in the 2008/09 growing season.

Table 4.1: Some key features of the fertilizer subsidy programme (1998/99-2009/10)

	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Total cost of fertilizer subsidy (US\$ million)	25.6	25.2	7.6	7.2	9.9	12.1	9	50	53	112	387.2	127
Total cost of fertilizer subsidy (US\$ million)*	53.6	50.5	12.0	12.4	17.0	18.6	11.2	50.0	43.9	82.9	224.7	105.2
Total subsidized fertilizer (mt thousand)	-	-	-	-	-	-	-	130	150	170	242	160
Coupon value (US\$/50 kg bag)	-	-	-	-	-	-	-	15	18	23	56	27
Coupon value (US\$/50 kg bag)*	-	-	-	-	-	-	-	15	15	17	33	22
Percentage subsidy per 50 kg bag	-	-	-	-	-	-	-	64	72	79	95	88
Households receiving fertilizer subsidy (million)	2.8	2.4	1.5	1	1.5	2	1.7	2.2	2.2	2.4	2.6	2.6
Maize production at national level (mt million)	1.75	2.48	2.5	1.7	1.6	1.99	1.7	1.25	2.55	3.2	3.5	3.5

* indicates prices measured in 2005 US\$, deflated by urea monthly price index

Source: Ministry of Agriculture and Food Security (various issues)

The foregoing clearly indicates that currently the government is spending far more on the subsidies than used to be the case during the era of the SPS, TIP and ETIP. Paradoxically, these changes in total expenditure on the subsidies do not appear to be proportional to changes in maize yields let alone beneficiaries. For instance, at the peak of the SPS in 1998-1999, an average injection of US\$25.3 million achieved about 2.5 million metric tonnes of maize. On the other hand, in the 2007/08 growing season the government spent US\$112 million to achieve 3.2 million metric tonnes of maize and US\$387.2 million was spent to realize 3.5 million metric tonnes of maize in the 2008/09 growing season.

The import price of fertilizer may be a key factor³⁵, in explaining disparities between changes in maize production and changes in total expenditure on fertilizer subsidies. However, there might be other factors behind the difference in changes of the two variables. For instance, the scenario may suggest that either maize marginal productivity is increasingly diminishing or there is gross public mismanagement of the subsidy as argued earlier by the donor community or both. Furthermore, this suggests that maize production is a function of many factors other than the fertilizer subsidy. Some of these factors are discussed in the following section.

Although the current fertilizer subsidy programme has been associated with bumper crop harvests, the sustainability of the programme is questionable. For instance, in 2008, high import costs of fertilizer which coincided with a surge in oil prices depleted Malawi's foreign reserves (forex) to an average of about 1.2 months against the minimum requirement of 3 months of import cover (Reserve Bank of Malawi, 2008). The situation was worsened by poor prices of tobacco in 2009 and delayed budgetary support from donors so that by October 2009, Malawi was unable to import fuel. For eight weeks (until the end of November), the transport sector was severely affected leading to a shortfall of nearly all imports and rising prices of most commodities. The situation only eased after

³⁵ Between 1998 and 2002, the cost of a metric tonne of fertilizer in Malawi was about US\$770 (Sanchez, 2002). By 2007, the cost was US\$800, however it jumped to US\$1,600 per metric tonne in 2008 (GoM, 2009b).

donors started to release funds for budgetary support. However, the problem resurfaced in the mid 2010 when foreign reserves were depleted once again primarily due to high importation costs of fertilizer coupled with poor tobacco sales and aid withdrawal by the donor community.

It is against these bottlenecks that some experts have expressed fears that the policy intervention may not be sustainable in the long run (see, Harrigan, 2008, p. 243). It has also been argued that fertilizer subsidies as currently operated may perpetuate a dependency syndrome among smallholder farmers. This would make them more vulnerable to shocks should the policy be abolished as it happened in the mid-1980s and mid-1990s. Should that be the case, maize production and food security in the country could seriously be threatened.

Since the reintroduction of the fertilizer subsidies, the country has enjoyed bumper maize harvests. For the first time in about three decades, out of its 3.2 million metric tonnes of maize harvest in 2007, Malawi was able to export about 0.4 million metric tonnes to Zimbabwe and 0.08 million metric tonnes to Swaziland and Lesotho (World Bank, 2011a). In general, the above analysis suggests that, at national level, high maize production and hence food security is positively linked to fertilizer subsidies. Based on Figure 4.1, the study finds that there is a statistically significant correlation coefficient of 0.389 (with P-value= 0.008) between fertilizer subsidies and national maize output. However, correlation is not a good indicator of causality. Therefore, in sub-section 4.3.2, the study conducts an econometric test to examine the extent to which fertilizer subsidies explain national maize output in Malawi. Before that, there is a brief discussion regarding the impact of political influence on the distribution of fertilizer subsidies in Malawi.

4.3.1 The role of politics in spatial distribution of fertilizer subsidies in Malawi

Fertilizer subsidies are administered directly by the Ministry of Agriculture and Food Security through various regional and district outlets where coupons are distributed to beneficiaries in all administrative areas in the country. In the rural areas, administrative areas are overseen by traditional authorities (TAs) and senior chiefs while in the urban areas, administration areas fall under the authority of councillors and mayors. When it comes to distribution of coupons, which takes place primarily in the rural areas, officials from the Ministry of Agriculture and Food Security, ensure that they involve TAs and senior chiefs.

However, there is evidence pointing to the fact that distribution of the subsidized fertilizer in Malawi is spatially selective based on political influence and affiliation. For instance, in 2008 the then Minister of National Defence, Bob Khamisa, confessed to the media that government ministers were given 2000 coupons each to dispense in their districts. Since the majority of the ministers come from the president's home and the surrounding districts, this meant that smallholders in these areas benefitted more compared to other areas.

Holden & Lunduka (2010, p. 16) summarized the politically motivated rent seeking behaviours associated with Malawi's subsidized fertilizer in a number of bullets, some of which are as follows.

- A top political party member being caught with coupons that he had obtained from a minister in the government.
- A paramount chief being caught selling coupons and therefore put in prison until the president himself reacted quickly to get him released.
- Use of the subsidy system in relation to the parliamentary elections to buy votes.
- Partly distributing coupons to and through the chiefs to get their support and have them organize the identification of beneficiaries with use of village level committees...

Ricker-Gilbert *et al.*(2011, p. 40) employ a ‘Double-Hurdle’ model of fertilizer demand in Malawi with an objective of examining how fertilizer subsidies affect farmer demand for commercial fertilizer. Among other things, their “findings indicate that the level of social and political connections affects how much subsidized fertilizer households receive.” Of course, Malawi’s case is not an isolated one. Elsewhere, Banful (2010) found out that political influence affected the way the 2008 subsidized fertilizer was distributed in Ghana. Earlier, Robinson (2002, p. 854) revealed that smallholders that were chosen for the irrigation scheme in Zimbabwe “had some affiliation with those in political power.” Finally, in South Korea, the Park regime of 1961 to 1979, which was dominated by people from Kyongsang, “imposed regionally biased policies through the recruitment of elites and the allocation of public resources to secure political support from Kyongsang” (Park, 2003, p. 814).

Cox & McCubbins (1986, p. 379) argue that “politicians will adopt strategies in which they invest little (if at all) in opposition groups, somewhat more in swing groups, and more still in their support groups.” Although “political colour of governments influences the distribution of access to scarce goods...” (Westert & Groenewegen, 1999, p. 237), public finance theories postulate that political influences lead to inefficient resource allocation (Oates, 1999). Therefore, the key question is: taking into account the impact of political incentives, how effective are these subsidies on the Malawi’s maize production? To answer this question, ordinary least squares (OLS) and spatial regression analyses are conducted in the following sub-section.

4.3.2 Methodology: OLS and spatial regression analyses

In the following sections analysis on relationship between maize yield and fertilizer subsidy will be conducted. To do this OLS and spatial regression techniques are employed. The model in this study is based on data from the 2008/09 Annual National Census of Agriculture conducted by the Ministry of Agriculture and Food Security covering all (246) administrative areas in the

country. The log linear production function to estimate how fertilizer subsidies and other factors affect maize production is expressed as follows:

$$\ln Y_i = \ln \alpha_0 + \sum \ln \alpha_j X_{ji} + \varepsilon_i \quad (4.1)$$

where, Y_i is administrative area i^{th} maize output in metric tonnes. α_0 is a constant while α_j is an estimated coefficient of parameters and ε_i is the error term. X_{ji} is a vector of explanatory variables, namely topography, temperature, fertilizer subsidy, rainfall, access to credit, use of machinery and lagged maize price in administrative area i . Under topography, the consideration is on the percentage of farmers that grew maize in plains in each administrative area during the 2008/09 agricultural season. In Malawi, maize tends to do well in plains most of which have fertile loamy soils suitable for maize production. Therefore, its coefficient is expected to be positive.

Temperature is another important factor for maize production that is considered in a number of studies. According to Taba & Twumasi-Afriyie (2010, p. 2), “maize can grow in a temperature range of 5–45 °C, but generally does best at 25–35 °C. Extreme high temperatures, especially combined with low humidity, may reduce pollen viability and cause poor seed set.” Until recently, Malawi’s average temperatures have been oscillating between 15 and 35 °C. However, of late, in a number of areas, Malawi has been experiencing a steady increase in temperatures above 35 degrees Celsius, a phenomenon that has been attributed to global warming. It is feared that sustainable increases in average temperatures might have a negative impact on maize production in the country. In view of this, its coefficient is expected to be negative.

At the heart of this study is the importance of fertilizer subsidies in maize production. The focus is on the amount of the subsidized fertilizer that was distributed in each administrative area in the 2008/09 growing season. It is hypothesized that administrative areas that received more subsidised fertilizer would register higher maize production than the ones that received less. A positive coefficient is therefore expected. Similarly, the amount of rainfall

received in each administrative area and previous season's maize price are also expected to have a positive impact on each area's maize production³⁶. Administrative areas where farmers had greater access to credit and machinery such as ploughs and tractors are expected to achieve higher maize yields than areas where farmers had less or nil; therefore positive coefficients are expected for these variables. A summary of these variables is provided in Table 4.2 below.

Table 4.2: A summary of the model variables (2008/09)

Variable name	Maize	Subsidy	Rainfall	Temperature	Topography	Price_1	Credit	Machinery
Definition	Maize yield per administrative area in kilograms	Amount of subsidized fertilizer per administrative area in metric tonnes	Rainfall in millimetres	Temperature in degrees Celsius	Households growing maize on plains (%)	Previous season maize price in Malawi Kwacha	Number of maize farmers receiving credit	Number of maize farmers using machinery
Minimum	4116	185	713	23	10	42	1	1
Maximum	23380	1060	1465	37	26	95	12	21
Mean	14205	694	1075	28	16	71	2	4

Traditionally, a classical ordinary least squares (OLS) regression analysis could be employed to estimate the above model. However, there is a growing literature pointing to the fact that location can be a major factor in explaining crop production (Cliff & Ord, 1970). According to the first law of geography³⁷ (Tobler, 1979), distant (contiguous) locations can have different (similar) topographies and experience different (similar) weather patterns that may impact differently (similarly) on crop production. It is in this regard that this study incorporates a diagnosis for spatial dependence in its model. The other reason for testing for spatial association is that in this study cross-sectional data is used which may

³⁶ Rainfall and temperature statistics were supplied by the Department of Climate Change and Meteorological Services in Blantyre, Malawi while maize prices were sourced from the National Statics Office (2010).

³⁷ The first law of geography states that contiguous locations tend to be more similar to each other than distant locations.

subject its model to spatial autocorrelation (Anselin & Rey, 1991). Should that be the case then the estimates may either be inefficient or biased.

Spatial association is typically analyzed by a global Moran's I correlation coefficient as follows:

$$I = \frac{n}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij} (x_i - \mu)(x_j - \mu)}{\sum_i (x_i - \mu)^2} \quad (4.2)$$

where, x ($i, j = 1, \dots, n$) stands for all observations with their mean given as μ and w_{ij} is an element of the spatial weight matrix, W that identifies neighbouring spatial units.

There are two main kinds of spatial association, namely spatial error and spatial lag. In the case of spatial error autocorrelation, it is the error terms across regions that are correlated. With spatial error autocorrelation, equation (4.1)'s error term becomes:

$$\varepsilon = \lambda W \varepsilon + \mu \text{ with } \mu \sim N(0, \sigma^2 I) \quad (4.3)$$

where λ is the spatial autoregressive parameter and ε is a vector of error terms while the rest of the variables are as defined before. Equation (4.3) violates the assumption of uncorrelated error terms governing the OLS regression which in turn makes the estimates inefficient. The solution is to take into account the spatial autocorrelation of the error term in equation (4.1) as follows:

$$\ln Y_i = \ln \alpha_0 + \sum \ln \alpha_j X_{ji} + \lambda W \varepsilon + \mu = \ln \alpha_0 + \sum \ln \alpha_j X_{ji} + (I - \lambda W)^{-1} \mu \quad (4.4)$$

On the other hand, the spatial lag hypothesizes that it is possible for a dependent variable in one spatial location to be influenced by independent variables from neighbouring spatial locations. If that happens, then both assumptions of uncorrelated error terms and independent observations are violated making the

estimates biased and inefficient. In this case, the way forward is to include a spatially lagged dependent variable in equation (4.1) as follows:

$$\ln Y_i = \ln \alpha_0 + \sum \ln \alpha_j X_{ji} + \rho W \ln Y_i + \mu = (I - \rho W)^{-1} [\ln \alpha_0 + \sum \ln \alpha_j X_{ji}] + (I - \rho W)^{-1} \mu \quad (4.5)$$

where ρ stands for the spatial autoregressive coefficient of the dependent variable that has been spatially lagged.

In line with equations (4.2), (4.4) and (4.5), three tests are used to measure spatial autocorrelation in OLS regression models, namely Moran's I, Lagrange Multiplier (Error) and Lagrange Multiplier (Lagged). While the Moran's I "provides reliable results for alternative forms of ignored spatial dependence", the Lagrange Multiplier tests "supply precise information about the kind of spatial dependence" (Niebuhr, 2001, p. 10). Table 4.3 below indicates results of the spatial autocorrelation tests.

Table 4.3: Diagnostics for spatial dependence on OLS model

Test	MI/DF	Value	Probability
Moran's I (error)	0.609	15.494	0.000
Lagrange Multiplier (lag)	1	6.603	0.010
Robust LM (lag)	1	0.369	0.544
Lagrange Multiplier (error)	1	199.454	0.000
Robust LM (error)	1	193.219	0.000
Lagrange Multiplier (SARMA)	2	199.822	0.000

Highly significant positive values for Moran's I suggest that there is a strong positive spatial autocorrelation as far as maize production is concerned. The Lagrange Multiplier (lag) tests yield significant positive values suggesting strong spatial autocorrelation between independent variables. Similarly, the Lagrange

Multiplier (error) tests yield significant positive values suggesting strong spatial autocorrelation of residuals. This implies that spatial autocorrelation with respect to maize production in Malawi is explained by both spatial lag and error. In view of this, classical OLS, spatial lag and spatial error regression analyses are conducted with the results being presented in Table 4.4 below.

Table 4.4: Classical OLS and spatial error regression results

Dependant variable: Log(Maize yield/administrative area)						
Number of observations: 246						
Variable	OLS		Spatial lag		Spatial error	
	Coefficient	t-Statistic	Coefficient	z-value	Coefficient	z-value
Constant	0.043	0.329	0.163	1.203	0.075	1.325
Log(Subsidy)	0.178	2.529***	0.179	2.622***	0.194	3.060***
Log(Rainfall)	0.390	2.428***	0.371	2.378**	0.413	2.821***
Log(Temperature)	0.282	1.234	0.373	1.657*	-0.008	-0.034
Log(Topography)	0.730	5.392***	0.736	5.599***	0.273	1.579
Log(Price_1)	0.136	1.130	0.099	0.844	0.564	5.024***
Log(Credit)	0.005	0.162	0.011	0.333	0.023	1.236
Log(Machinery)	0.049	1.694*	0.050	1.784*	-0.006	-1.347
W_Maize (Rho)	-----	-----	0.034	2.670***	-----	-----
Lambda (λ)	-----	-----	-----	-----	0.945	52.738***
R-squared	0.76		0.77		0.91	

The ***, ** & * indicate statistical significance at 1%, 5% & 10% level, respectively.

REGRESSION DIAGNOSTICS

Test	DF	Value	Probability
Jarque-Bera	2	5.322	0.070
Breusch-Pagan test	7	87.608	0.000
Koenker-Bassett test	7	70.980	0.000
White	35	136.642	0.000

The overall performance of the models can be described as very good. The values of R-squared indicate that the variables in OLS, spatial lag and spatial error respectively explain 76 percent, 77 percent and 91 percent of maize production per administrative area. The Jarque-Bera test indicates normality in distribution of the error term. The Breusch-Pagan test, Koenker-Bassett test and White test indicate existence of heteroskedasticity. This is not surprising given that the spatial dependence, as indicated in Table 4.3 above, is likely to affect the error variance.

OLS results indicate that the effects of topography, subsidised fertilizer and rainfall on maize production are statistically significant at 1 percent level while use of machinery is statistically significant at 10 percent level. Removal of spatial lag slightly improves results evidenced by an increase in R-squared from 76 percent to 77 percent. Subsidised fertilizer, topography and use of machinery remain statistically significant at 1 percent (for the subsidised fertilizer and topography) and 10 percent (for use of machinery), respectively. However, the statistical significance of rainfall drops to 5 percent level. Furthermore, temperature which was not statistically significant under OLS is now significant at 10 percent level, albeit with an unexpected sign.

Removal of spatial error also improves results as indicated by an increase in R-squared to 91 percent. Both subsidised fertilizer and rainfall remain statistically significant at 1 percent level while topography is no longer statistically significant. Lagged price of maize which is not statistically significant under OLS and spatial lag, is now significant at 1 percent level. The rest of the variables are statistically insignificant. As pointed out earlier, regression analyses were designed mainly to examine the relationship between fertilizer subsidies and maize production in Malawi. Based on the above three tests, it can be concluded that, indeed, fertilizer subsidies have a positive impact on maize production in the country. In each model, a 1 percent increase in the amount of subsidised fertilizer leads to 0.2 percent increase in maize production per administrative area.

Although the above regression analyses provide important information with regard to the impact of fertilizer subsidies on maize production in the country, it does not reveal the distribution of the relationship at administrative area level. This is particularly important because, as indicated earlier, political influence and affiliation have an impact on the spatial distribution of the subsidies. This issue is considered next.

4.3.3 Local spatial association between fertilizer subsidies and maize production in Malawi

First, this study uses box maps to reveal quartile distributions of fertilizer subsidy and maize production in Malawi. Second, local Moran's I BiLISA cluster map is employed to examine areal-level spatial autocorrelation between the two variables. Based on the formula of Anselin (1995, p. 98), local Moran's I BiLISA statistic can be represented by the following equation:

$$I_i = z_{ai} \sum_{j=1, j \neq i}^N w_{ij} z_{bj} \quad (4.6)$$

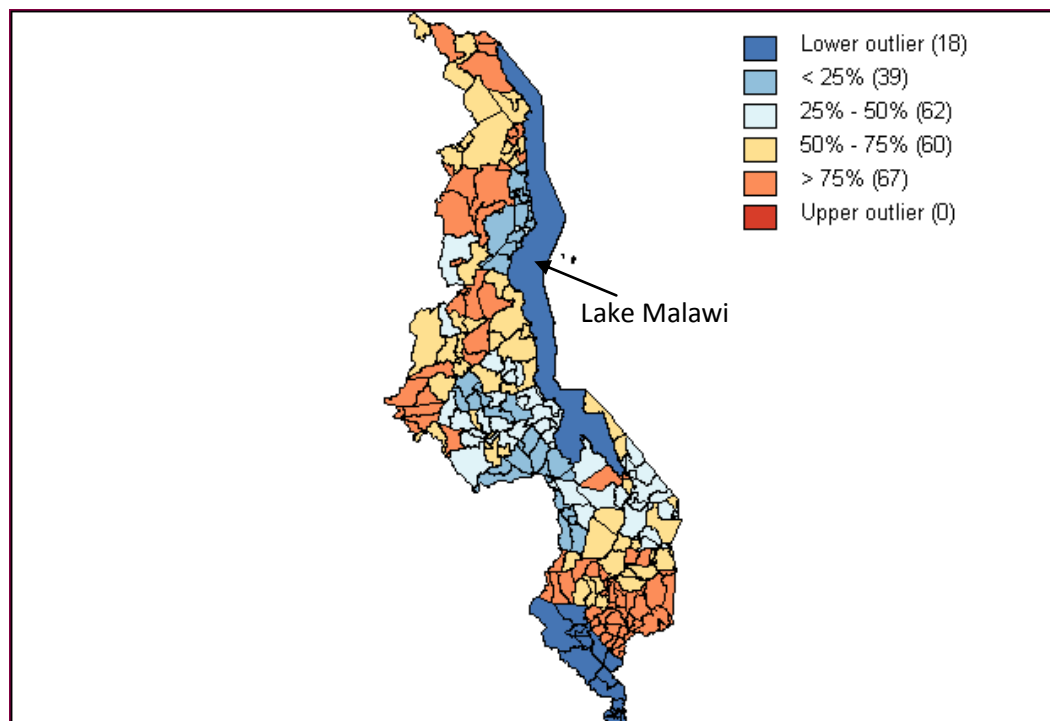
where, a and b are the two variables under consideration for the two spatial neighbours, i and j while z_a and z_b are the respective standerdized scores of variables a and b . "The spatial weight matrix w_{ij} is a binary contiguity matrix that defines the spatial structure for the locations that are included in the calculations of the local Moran's I" (Sunderlin *et al.*, 2008, p. 4). The weight can be written as:

$$w_{ij} = \frac{C_{ij}}{\sum_{j=1}^N C_{ij}} \text{ with } C_{ij} = 1 \text{ if } i \text{ and } j \text{ are contiguous, otherwise, } C_{ij} = 0. \quad (4.7)$$

GeoDa, the software used to compute spatial autocorrelation, identifies two main contiguity matrices, namely rook contiguity and queen contiguity. A contiguity matrix, C_{ij} is an array designed to indicate which spatial locations share a common boundary. A value of one at spatial location (i, j) is indicated if the two

spatial units are contiguous as indicated in equation (4.7) above. While rook contiguity ignores neighbours at the edge, queen contiguity takes into account all the surrounding neighbours. The study employs first-order queen contiguity which means it takes into account all districts in the country with at least a single shared boundary point. Figure 4.2 and 4.3 indicate box maps; and Figure 4.4 shows BiLISA cluster map which reveal quartile distributions and spatial autocorrelation of subsidised fertilizer and maize production, respectively.

Figure 4.2: Box map of subsidised fertilizer per administrative area in Malawi (2008/09)

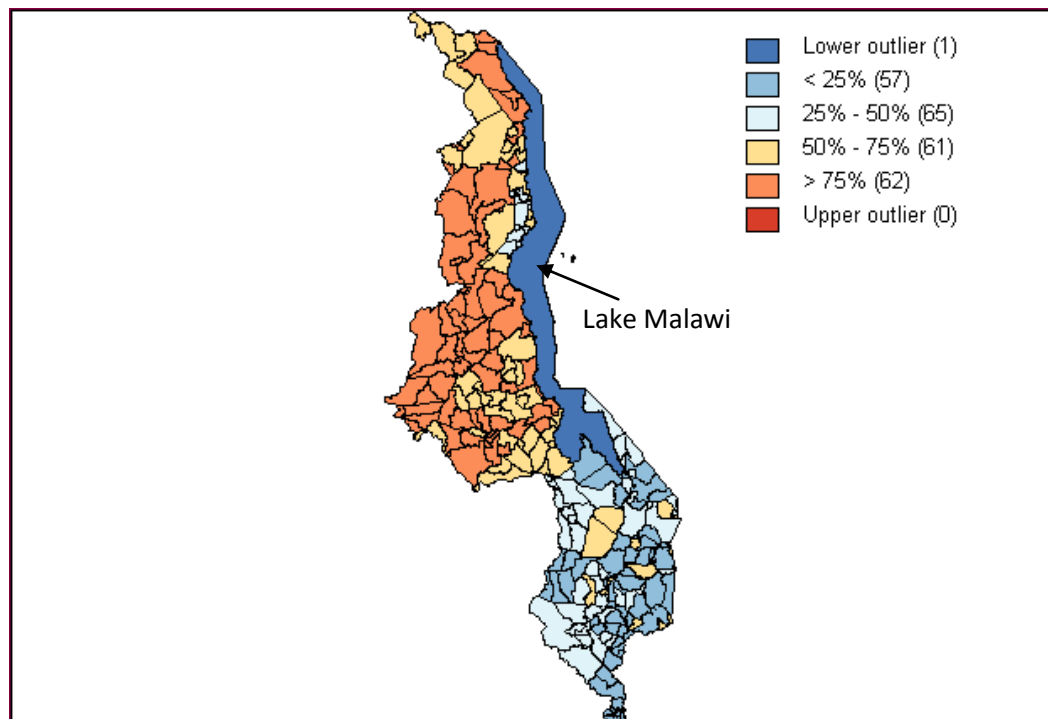


Data for the Box map is in metric tonnes of subsidised fertilizer distributed per administrative area

Figure 4.2 indicates the distribution of subsidised fertilizer for the 2008/09 growing season in the 246 administrative areas across the country. The national mean for recipients stood at 694 metric tonnes per administrative area (see Table 4.2 above). At national level, 189 administrative areas (77 percent) received subsidised fertilizer above the national mean. Notably, the majority of beneficiaries that received subsidised fertilizer above the national mean were from the south (68 out of 110 administrative areas = 62 percent). This was

followed by the north (30 out of 51 administrative areas = 59 percent). On the other hand, only 34 out of 85 administrative areas (40 percent) in the centre received subsidised fertilizer above the national mean.

Figure 4.3: Box map of maize production per administrative area in Malawi (2008/09)



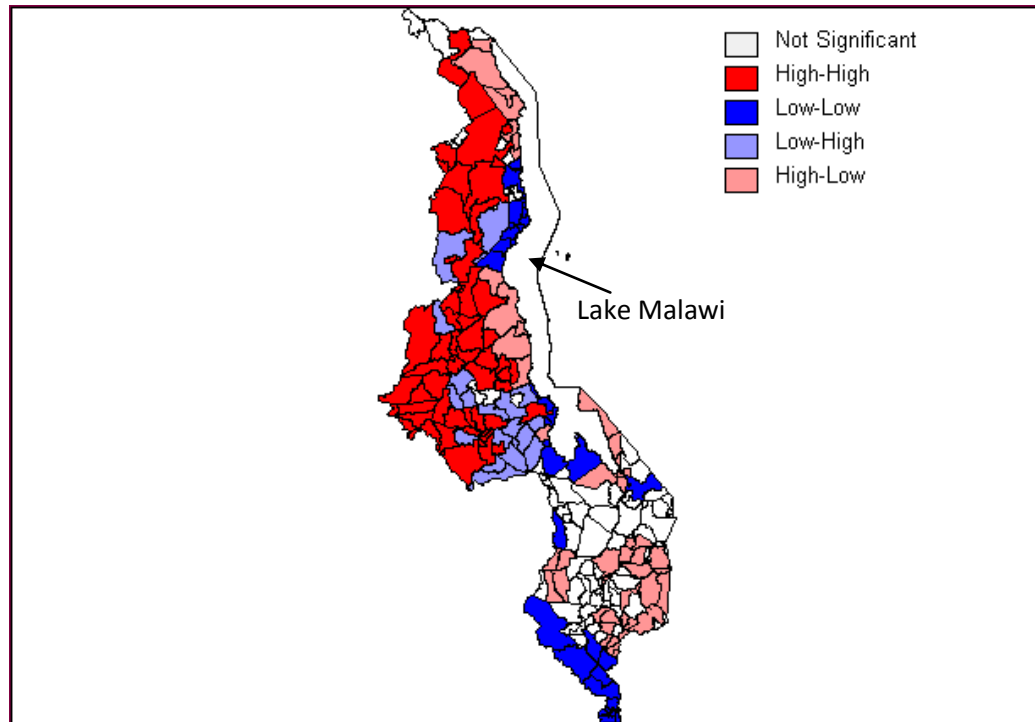
Data for the Box map is in metric tonnes of maize production per administration area

Figure 4.3 indicates maize production per administrative area during the same growing season with a national mean of 14.2 metric tonnes per administrative area. In the centre, the majority of administrative areas (76 out of 85 = 89 percent) recorded maize production per administrative area above the national mean³⁸. This was seconded by the north where 32 out of 51 administrative areas (63 percent) had maize production per administrative area above the national mean. The south came last with only 22 out of 110 administrative areas (20 percent) registering maize production per administrative area above the national mean. Figure 4.3 further reveals that the first law of geography of spatial dependence holds. Contiguous locations largely display similar patterns as far as maize

³⁸ High maize production in the central region can be attributed to favourable weather conditions (adequate rainfall) and fertile soils.

production is concerned. This is in line with our findings (Moran's I) in Table 4.3 above.

Figure 4.4: BiLISA map showing correlation between maize production and distribution of subsidised fertilizer in Malawi (2008/09)



With regard to spatial autocorrelation between distribution of subsidised fertilizer and maize production, Figure 4.4 shows that the relationship is mixed across the country. In the centre, all administrative areas which received subsidised fertilizer above the national mean recorded maize production per administrative area above the national mean. In these areas, the bivariate local Moran's I (BiLISA) is 'High-High' implying that the association between subsidised fertilizer and maize production is significantly different from zero and positive.

BiLISA is 'Low-High' in some other administrative areas in the centre suggesting a significantly negative relationship between the two variables. In these areas, on the one hand, subsidized fertilizer received was less than the national mean while on the other average maize production was above the national mean. A few areas, particularly along the lake shore in the central region

show a 'Low-Low' Moran's I suggesting that they received subsidised fertilizer below the national mean and had maize production per administrative area also below the national mean. The pattern in the centre is largely repeated in the north with many areas indicating 'High-High' Moran's I.

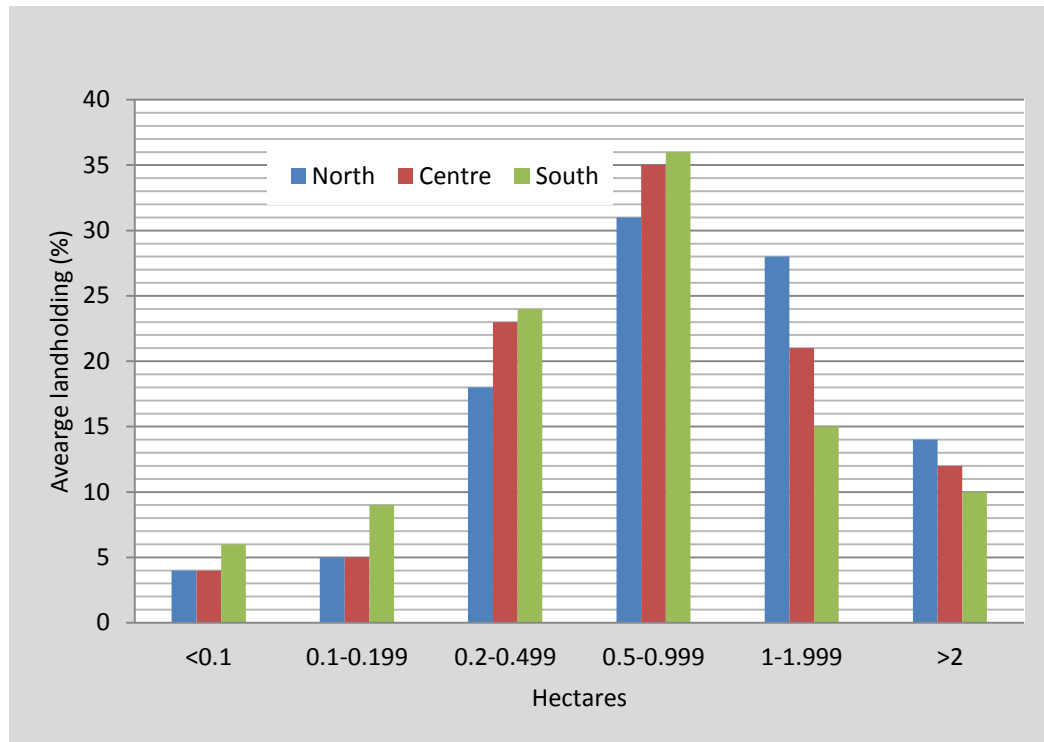
However, in the south, the opposite is true. Many areas are either insignificant or have a 'High-Low' BiLISA indicating a statistically significant negative relationship. These areas received subsidised fertilizer above the national mean but registered maize production per administrative area below the national mean. There are also a number of areas, particularly in the Shire valley where the BiLISA is 'Low-Low' which can be interpreted as above.

One major point that stands out from Figures 4.3 and 4.4 is that for the 2008/09 growing season, maize production per administrative area was not uniformly distributed in Malawi. Maize production per administrative area was highest in the centre followed by the north while in the south, maize production per administrative area was generally below the national mean. In the following section, the analysis dwells on regional household per capita maize production using longitudinal data from 1964 to 2008 in order to determine if the above results are reflective of long term trends in the country.

4.3.4 Household per capita maize production in Malawi: 1964-2008

Here, the following question is raised. Are the spatial variations of maize production in 2008/09 reflective of the trends in the country or not? To address this question the study compares household per capita maize production in the three regions of the country. Available data indicate that the average landholding is evenly distributed throughout the country as indicated in Figure 4.5 below.

Figure 4.5: The distribution of mean landholding size in Malawi (2006/07)



Source: National Statistics Office (2008a, p. 14)

In all the three regions, the majority of households own land between 0.5 and 1.0 hectare, a situation which has “mostly remained unchanged during the past ten years” (National Statistics Office, 2008a, p. xi). As pointed out earlier, the majority of smallholders use their land for maize cultivation. This implies that comparing per capita household maize production at regional level would yield statistically unbiased results.

Firstly, a test for normality is conducted to guide the study as to whether parametric tests can be used. Results, as indicated in Appendix 4, suggest that maize production at regional level is not normally distributed. In view of this, the Epanechnikov Kernel density³⁹ is employed in order to compare household per capita maize production in the three regions of the country. This test is premised

³⁹ According to Silverman (1986), the Epanechnikov Kernel density is the most effective method with regard to reducing the error when estimating the actual density.

on the assumption that data for each of the regional maize output (1964-2008) is nonparametric and has a probability density function f , i.e.:

$$P(a < X < b) = \int_a^b f(x)dx \quad \text{for all } a < b \quad (4.8)$$

Silverman (1986, p. 12), argues that if “ $f(x) = \lim_{h \rightarrow 0} \frac{1}{2h} P(x - h < X < x + h)$ ” then a kernel density estimator \hat{f} can be developed as follows:

$$\hat{f}(x) = \frac{1}{nh} \sum_{i=1}^n K\left(\frac{x-X_i}{h}\right) \quad (4.9)$$

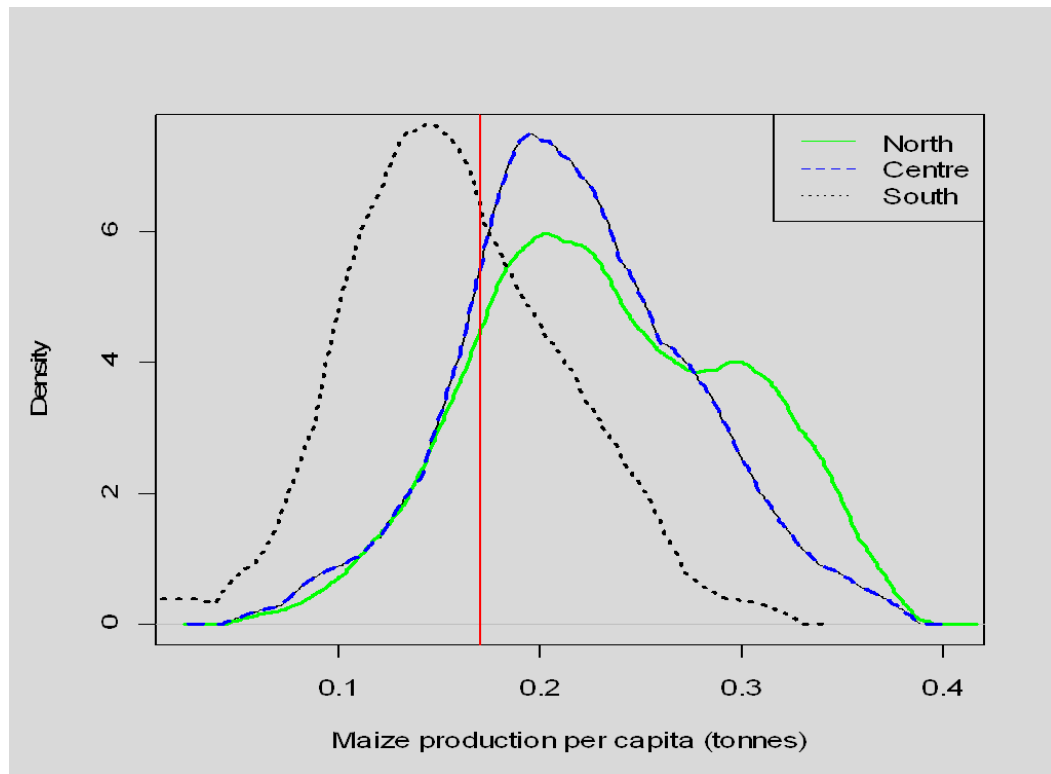
where, h is any given small number (band width), n is the number of X_i ⁴⁰ that fall in the range $(x - h, x + h)$, x is the point where the density is estimated and K is the weight (Kernel) function whereby:

$$\int_{-\infty}^{\infty} K(x)dx = 1 \quad (4.10)$$

Figure 4.6 below is a graph of the Epanechnikov Kernel density estimates indicating the regional household maize production per capita. A vertical line reflecting minimum national per capita maize requirement of 0.17 metric tonnes is added to the graph. According to government studies, an average household of about five to six members requires a minimum of 0.17 metric tonnes of maize per head annually (Australian Centre for International Agricultural Research, 2010; Mkandawire, 1999).

⁴⁰ X_i is also known as the centre of the interval and the band width is equal to 2.344.

Figure 4.6: Epanechnikov Kernel density estimate of regional per capita maize production in Malawi (1964-2008)



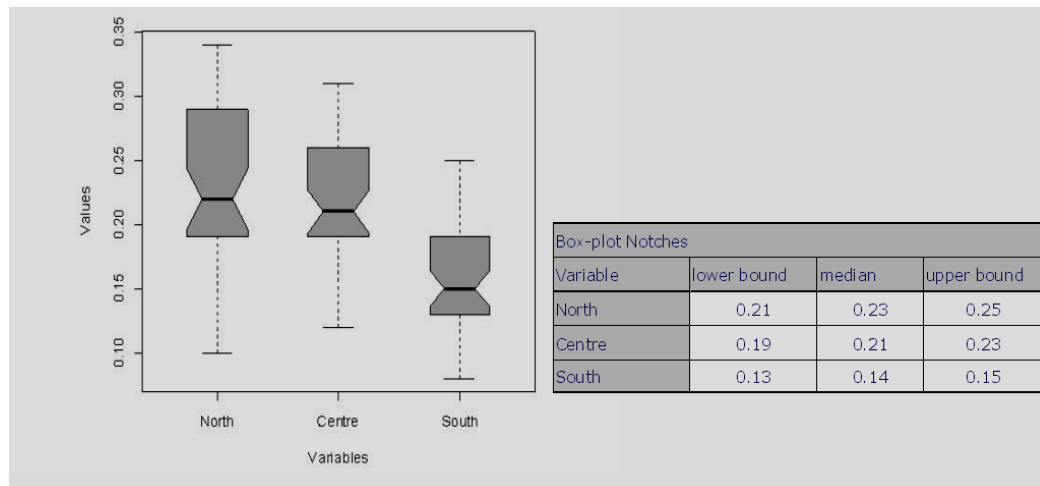
Data source: Ministry of Agriculture and Food Security (various issues)

The distributions indicate that each of the three regions has a number of households that fall on both sides of the national threshold. However, these numbers differ from one region to another. For the northern and central regions the modal distributions of per capita maize production fall on the right side of the national threshold. In the case of the southern region, the modal distribution is to the left of the national threshold.

In order to examine whether differences in regional maize production are statistically significant, the study employs the concept of notched box-and-whisker plot as developed by Haemar (1948), extended by Spear (1952) and popularized by Tuckey (1977). Each plot displays a five-number summary which includes “the minimum and maximum range values, the upper and lower quartiles, and the median” (Potter *et al.*, 2006, p. 98) as indicated in Figure 4.7 below. According to McGill, Tuckey, & Larsen (1978, p. 14), “the notches

surrounding the medians provide a measure of the significance of differences between the values. Specifically, if the notches about two medians do not overlap...the medians are significantly different at a 95 percent confidence level.”

Figure 4.7: Side-by-side notched box-and-whisker plots of regional per capita maize production in Malawi (1964-2008)



The notches for household maize production in the south and the north overlap, implying that differences in their production medians are not statistically significant at 95 percent confidence interval. However, differences between household maize production in these two regions and the south are statistically significant with the latter being comparatively lower.

Figures 4.6 and 4.7 suggest that irrespective of similarities in average landholding, unlike the centre and the north, the majority of households in the south produce below the national minimum requirement and hence are likely to be more food insecure. These findings are similar to the ones obtained under local spatial analysis in section 4.3 which imply that spatial variations of maize production in 2008/09 are reflective of the national trends.

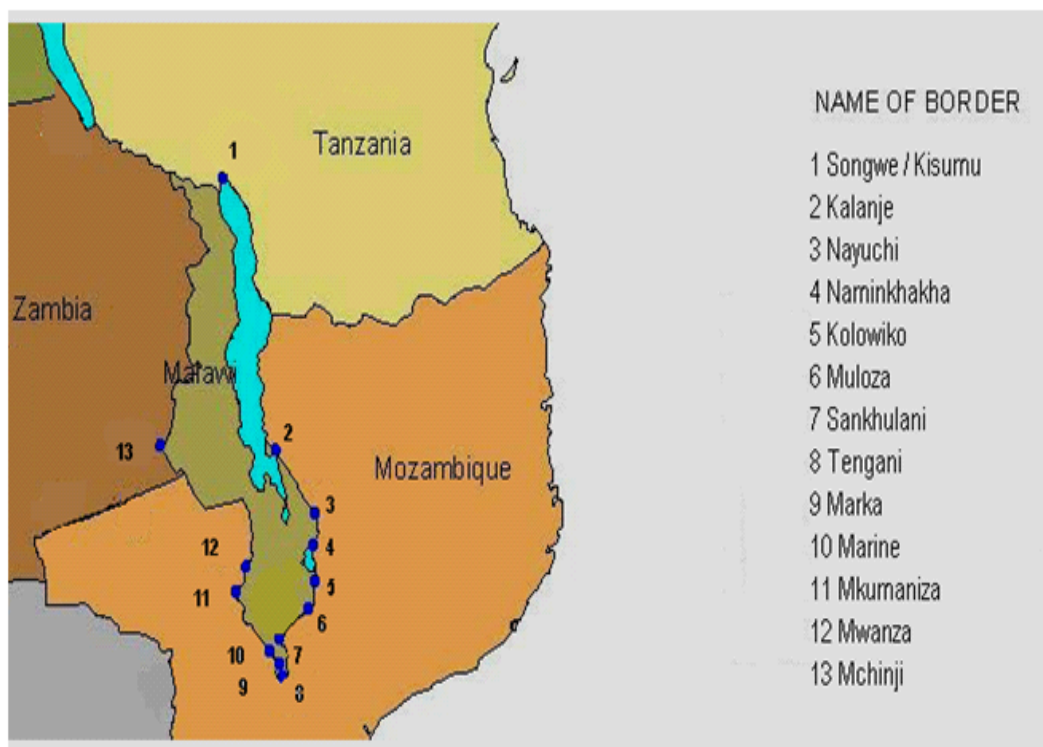
The foregoing implies that for the majority of households in the southern region, maize purchases are essential if their household food requirements are to be met. One would expect that the central region would be the main supplier of maize in

the southern region markets. However, studies have indicated that, as far as maize is concerned, there is very poor trade between the south and the rest of the country. The south mainly relies on informal cross-border trade with northern Mozambique for its maize supplies. According to Harrigan (2008, p. 247), “in the trade years 2001/2002 and 2002/2003 between a third and a half of southern Malawi’s maize imports were informal and in 2002/2003 alone it is estimated that MT 223, 000 was informally imported from Mozambique.” Maize from Mozambique is usually much cheaper and its intra-year prices are more stable than maize from central and northern Malawi. This is because northern Mozambique employs extensive methods of maize cultivation and hardly uses fertilizer due to low population density and very fertile soils, respectively⁴¹.

Apart from price differences, cross-border trade in maize between southern Malawi and northern Mozambique is also influenced by cultural ties and proximity. Northern Mozambique shares boundaries with nearly all districts in the southern region and many people share traceable tribal roots which are usually reinforced by marriages across the two borders. With virtually no restrictions on border crossings between the two states, proximity makes informal maize importation from Mozambique easier and cheaper than getting it from the other regions which are comparatively further away. Figure 4.8 below indicates informal cross-border trading points between Malawi and its neighbouring countries.

⁴¹ Northern Mozambique’s sparse population density and fertile soils are partly due to the sixteen year old civil war (1977-1992) that killed and displaced many people and left vast land areas uncultivated.

Figure 4.8: Informal international maize trade: Cross border monitoring sites (2007)



Source: USAID & WFP (2010)

The map shows that of all 13 informal cross border points that Malawi has with its neighbouring countries, 11 are between southern Malawi and Mozambique. Studies have shown that buying and selling of maize dominates these cross border trade (USAID & WFP, 2010).

4.4 Malawi's alternative strategies to meet national food requirements

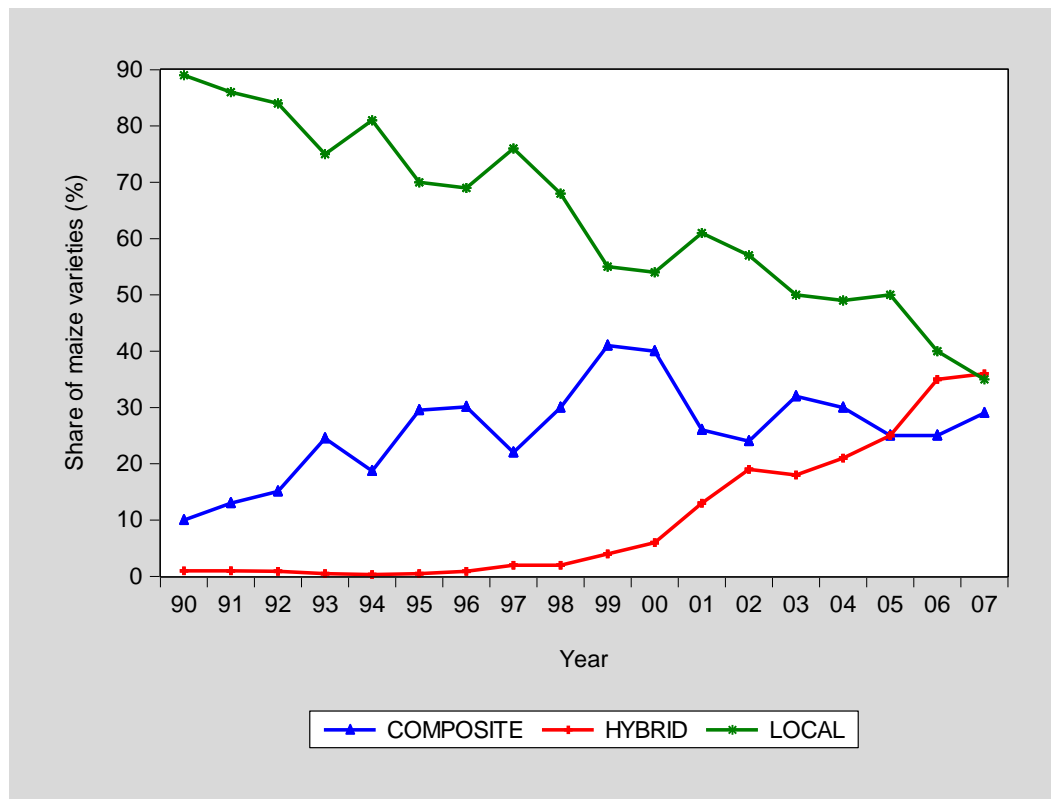
Apart from fertilizer subsidies, Malawi has over time tried to alleviate food shortage through various strategies such as maize imports, food aid and adoption of hybrid maize. While maize imports and food aid have been adopted only during critical times, adoption of hybrid maize has been the most wide spread and sustainable alternative.

Hybrid maize was said to have two main advantages over local varieties, namely, it was fast maturing and more productive. It was estimated that with the introduction of hybrid varieties, maize yields would increase from an average of 0.8 metric tonnes to at least 1.5 metric tonnes per hectare for an average smallholder farmer. For those that would practice proper farm husbandry, the potential yields for hybrid maize has been estimated at 10 metric tonnes per hectare (USAID, 2007)⁴².

However, the introduction of different hybrid maize varieties has had its own challenges. For instance, between 1994 and 2005, eighty-seven (87) varieties of maize were produced at Chitedze research station (JAICAF, 2008). The availability of too many seed brands on the market often confuses farmers most of whom are illiterate. This problem is compounded by the fact that private seed companies usually use different advertising tactics some of which are unethical such as unduly praising one variety and bedevilling another. In addition, hybrid seed prices are usually too high for most poor farmers. This has been a big challenge because unlike local varieties where planting seeds are taken from previous harvests, hybrid maize requires fresh seeds from the shop each and every planting season. These factors have partly led to poor adoption of modern maize varieties as indicated in Figure 4.9 below.

⁴² Although achievement of yields closer to 10 tonnes per hectare will be difficult given the complexity of factors involved with farming, particularly at smallholder level, this underscores the importance of adoption of new techniques in farming.

Figure 4.9: Share of maize varieties planted by smallholders in Malawi (1990-2007)



Source: Ministry of Agriculture and Food Security (various years)

Figure 4.9 above reveals that the introduction of hybrid varieties was met with a lot of inertia with the majority of smallholders cultivating at least 75 percent of the local (flint) varieties between 1990 and 1997. Amongst smallholders themselves, a study conducted by Langyintuo (2005) indicated that those that fell in the bottom 40 percent of the income groups were the ones that least adopted the modern varieties. Major changes started to occur after 1997 with the introduction of the Agricultural Productivity Investment Project and the starter pack scheme in which many poor smallholders started to receive free hybrid maize seed. This underscores the point that seed price has an impact on the adoption of new varieties by poor smallholders.

However, there are other factors that make many smallholders stick to local varieties despite their low yielding capacities. It is usually argued that, compared with hybrid varieties, local varieties have better storage quality, are more resistant

to pests such as fungi, taste better, are easier to process and provide higher process yields (JAICAF, 2008). It is due to these factors that composite maize varieties were introduced. The composite varieties are basically a blend of the local and hybrid varieties which makes them more attractive to many local farmers than hybrid varieties.

4.5 Discussion and recommendations

Maize production in Malawi from 1964 has oscillated between periods of high and low production. At national level, food security is correlated with fertilizer subsidies. However, household food security is skewed with the south lagging behind the centre and the north. Long lasting solutions are therefore required to improve smallholder agricultural productivity and household food security in Malawi. The study draws attention to four key issues as follows.

First, maize cultivation has undergone very limited technological advancements. Apart from the use of fertilizer (usually available through government subsidies) and adoption of some new varieties, the crop has always been predominantly cultivated by the poor smallholders mainly for household consumption. As was the case in the 19th Century, cultivation of the crop remains a hoe-based labour intensive activity which is entirely dependent on rainfall.

Absolute reliance on rain-fed maize cropping is very surprising considering the fact that Malawi is endowed with adequate river and lake water supplies that can be irrigated. For sustainable maize production, one would expect that the issue of irrigation would have been a priority especially given the drought spells that have blighted the country over the past two decades. The only time the issue of maize irrigation appeared to have been seriously discussed was in 2003 when the then Ministry of Agriculture and Irrigation came up with a strategic plan (2003-2008) where it was pointed out that:

Malawi requires US\$80 million (about MK6.4 billion) to revive the agricultural sector through irrigating 120, 000 hectares of land to increase maize yield by 600, 000 tonnes with double cropping over the next three years. Government of Malawi plans are that the MK6.4 billion should be used for buying 300, 000 treadle pumps, building 400 kilometres of canals and buying 2,000 motorized pumps (RATES, 2003, p. 30).

The above quoted plan to revive the maize sector through irrigation never came to pass and, so far, no explanation has been given for its failure. Today, the country's maize production is still entirely dependent on rain – a thing that has over time made Malawi fail to achieve long lasting maize production and food security. There is a need to implement wide scale irrigation schemes for maize and other crop if sustainable crop production is to be harnessed.

Second, although encouraging all poor smallholders to cultivate maize seems to be a good policy option particularly with regard to food security, promoting specialization might be better. With proper incentives such as commercialization of the sector, the estate sector, especially in the centre, appears to be capable of producing enough maize to feed the entire country. This would not only promote local investment and create jobs but it would also save a lot of foreign exchange that the government spends on fertilizer subsidies.

Even if focusing on the estate sector might not be a good option for the government, universal fertilizer subsidies (for all smallholders) is a very inefficient way of using scarce government funds. Some places are not conducive for maize production so providing them with the subsidies tends to have limited results. There is a need to focus on areas (or regions) that have comparative advantages in maize production, such as the ones that indicate 'High-High' and 'Low-High' bivariate associations. Areas where maize cultivation is hampered should be utilized for other economic activities. For instance, the government can encourage smallholders to cultivate other exportable cash crops that do well in places where maize fails. People in these areas can also be encouraged to invest away from agriculture into small-to medium scale businesses. To achieve this,

government can devise deliberate policies to promote micro-finance programmes that can extend soft loans to smallholders. Such activities would increase people's incomes and hence their food buying power.

Given that intra-year maize prices tend to increase especially in areas where maize production is limited, the government can address some of the following bottlenecks. (1) The high cost of transport is reported to be the major cause of high and differential maize price in the country mainly due to poor road networks. Improving regional linkages can therefore reduce transport costs and enhance trade within and between regions in the country at affordable prices. (2) Stable maize prices can also be achieved by constructing maize depots (food banks), particularly in areas where production is constrained. These would be similar to depots that were developed by the then state-owned ADMARC from the early 1970s to the mid-1990s. This time around, the government may encourage local farmers' clubs to run the maize depots. This would be much less costly than if they were let out to profit oriented private enterprises which are usually expensive.

Third, policy interventions in the maize sector have tended to be reactive rather than proactive with no "clearly articulated food security strategy" (Harrigan, 2008, p. 241). For instance, free distribution of maize seed, maize export controls and introduction of some new maize varieties have usually been preceded by disasters such as drought and pestilences. Lack of clearly articulated long term agricultural policy frameworks might be one of the major factors that have contributed to dismal performance of the maize sector in Malawi. This issue culminates into the following final and related point of consideration.

Although there is a positive correlation between maize production and fertilizer subsidies in Malawi, there is a need to ensure that the subsidy programme is guided by a clearly formulated strategy that indicates an exit period. Unfortunately, today, the programme is more of a political than economic phenomenon where ruling parties use it either as a campaign tool to get more

votes to remain in power or as a reward for political allegiance. This being the case, exiting (or promising to exit) from the programme would be politically suicidal. On the other hand, past experience from the subsidies of 1964-1983 indicates that long term fertilizer subsidies only perpetuates dependency and never prepares smallholder farmers for sustainability in maize crop cultivation. By putting political interest aside, Malawi is capable of devising a proper strategy that provides fertilizer subsidies for a given period of time (e.g., 10 years). During this time, the government must ensure that farmers are prepared to go commercial.

4.6 Chapter summary

The main objective of this paper was to examine the effects of maize fertilizer subsidies on national and household food security. It has been indicated that maize production in Malawi, from 1964 to 2008, has oscillated between periods of high and low production. At national level, high maize production and hence food security are positively linked to fertilizer subsidies.

At household level, food security is heavily skewed with the south lagging behind the centre and the north. The Moran's I results, supported by the Kernel density estimates, indicate that there is spatial autocorrelation between maize production and location. The central region stands out to be the main country's food basket as far as maize production is concerned. In the same region, there is high correlation between subsidised fertilizer and maize production per administrative area suggesting that targeting the region with fertilizer subsidies would be more beneficial than a politically motivated country wide distribution of the subsidies.

In places where maize fails to do well, encouraging smallholders to diversify into other crops or small-scale businesses may help them increase their income and hence food buying power. This may also save government revenue through reduced subsidies that are currently extended to the majority of smallholders in areas where maize production is hampered.

CHAPTER FIVE

THE IMPACT OF MAIZE POLICY REFORMS ON INCOME DISTRIBUTION AND POVERTY IN MALAWI

5.0 Introduction

Apart from food security, reforms in the maize sector have been designed with the aim of improving income distribution and reducing poverty, particularly in the rural areas. For instance, when the maize fertilizer subsidy programme was reintroduced in 1998, it was regarded as a rural income growth strategy. It was envisaged that the subsidies would spur surplus maize production that would engender profits amongst both rural smallholder farmers and non-agricultural households. The programme was therefore only viewed as a ‘starter’ in that as soon as smallholders started to generate profits from maize sales, they would no longer require free or subsidized fertilizer as they could now afford to purchase the inputs at commercial rates (Van Donge *et al.*, 2001). Similarly, rural non-agricultural households were expected to generate profits through trade, especially in maize.

The main objective of this chapter is to explore the extent to which reforms in the maize sector affect household income distribution and poverty. The main focus is on smallholders and non-agricultural households in the rural areas, since statistics indicate that these two socioeconomic groups have the highest poverty levels (National Statistics Office, 2009b). The study proceeds by employing a CGE model in the context of the Walrasian equilibrium and the circular flow of income.

The choice of a CGE model is necessitated primarily by the fact that there are many markets and players involved in explaining, firstly, how fertilizer subsidy is distributed and, secondly, how household income poverty is affected. According to Hertel *et al.* (2007, p. 294), one major advantage of CGE models is that “they impose consistency on one’s view of the world, e.g., that all exports are imported

by another country...This consistency can often generate empirical insights that might otherwise be overlooked in complex policy analysis”. However the authors concede that these models are not free from limitations. “An important limitation of CGE models is that very few of them are tested as a whole against historical experience (p. 295). With particular reference to this chapter, the CGE model employed is unable to decompose household poverty mainly because data on intra-group distributions of income are unavailable. To circumvent this limitation, the Foster, Greer and Thorbecke (FGT) method of poverty decomposition is used (see section 5.7).

5.1 Foundations of the CGE model: The circular flow of income and the Walrasian equilibrium

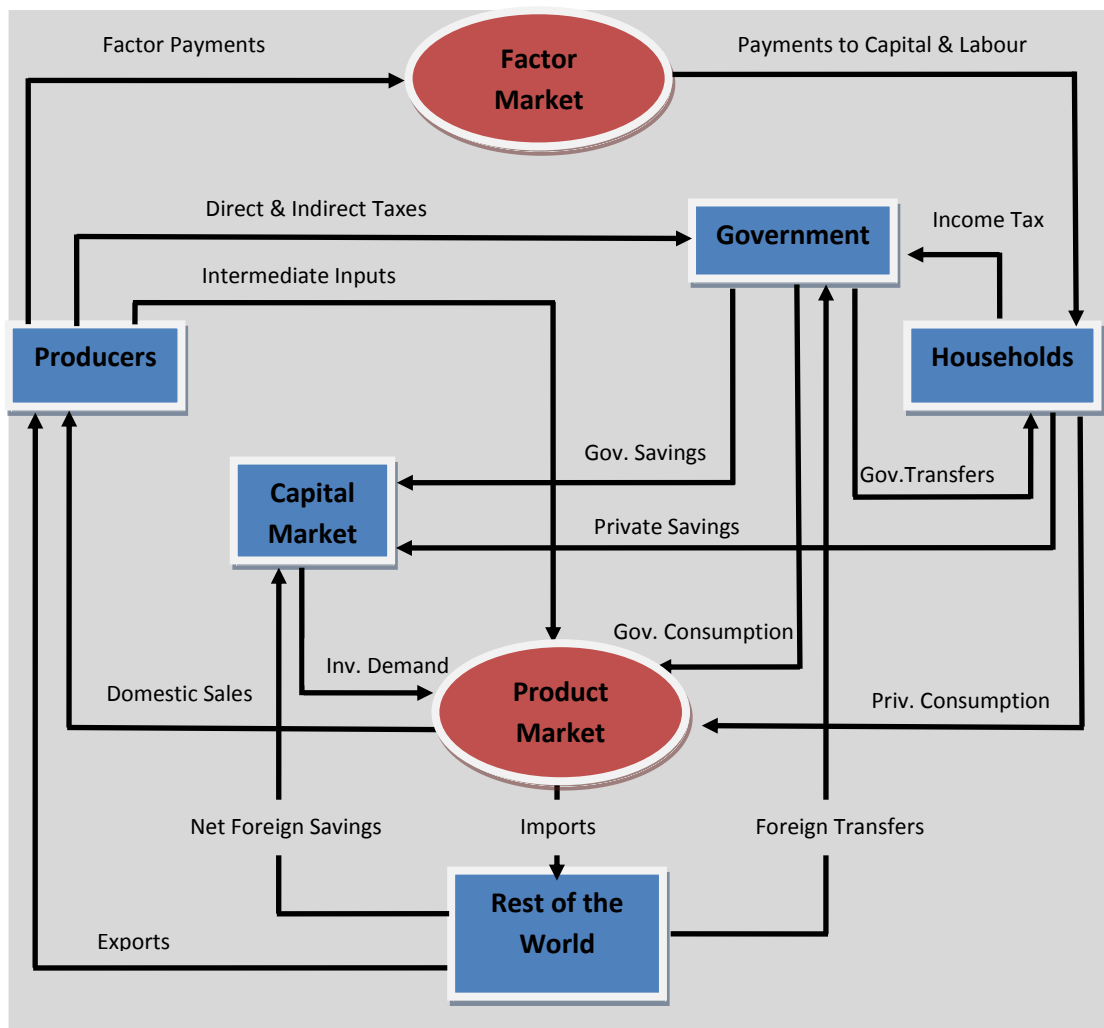
Over the last several decades, CGE modelling has emerged as a widely accepted method for conducting empirical economic analyses because of its ability to integrate economic theory with real-world data. The development of the framework for the CGE models started in the late 1930s when researchers started looking for economic models that could be used for empirical work in which an interplay of different sectors in an economy would be analyzed simultaneously. The research began with Leontief (1936) who developed the static input-output model which was largely designed to examine the economy-wide inter-industry linkages in the United States of America during the great depression of the 1930s. However, the input-output approach employed fixed coefficients that did not allow production technologies to change in response to different policies.

To circumvent the limitations of the input-output approach, researchers such as Hicks (1939), started working towards the development of a general equilibrium theory. In this regard, much of the work, especially by Arrow & Debreu (1954), Arrow & Hurwicz (1958) and Negishi (1960), focused on trying to find out if at all there existed unique static market equilibrium in perfectly competitive markets. A breakthrough came when, for the first time, Johansen (1960) developed an applied general equilibrium model (AGE) that moved away from

the fixed coefficients assumption to production functions that allow substitution among inputs and technical change. Since then, a wide range of complex models has been developed to investigate different policies, ranging from taxes to trade and the environment.

In general, the circular flow of income forms the essential theoretical starting point for a CGE model by providing a summary of how the entire economy works. It basically highlights the inflow of revenue and the interdependence of the economic agents in the whole system as shown in Figure 5.1 below.

Figure 5.1: The circular flow of income



Source: Author

The primary economic agents in the circular flow of income are households and producers (firms). Households are the owners of the factors of production, namely land, labour and capital. Households rent out the factors of production to firms which use them to produce goods and services that are in turn consumed by households (Wing, 2004). The other actors are government and the rest of the world, whose roles are explained in the subsequent paragraphs.

Producers sell their products in the domestic as well as the international markets. They use the income earned from their sales to buy intermediate inputs, pay factors of production and pay direct and indirect taxes. The domestic demand in the product markets comprises consumption from the private and public sectors, private and public investment demands, and demand for intermediate inputs while the domestic supply is either domestically produced or originates from the rest of the world. In the factor markets, households receive incomes from producers which are in the form of rent, wages and interest. They also receive transfer payments from government. In return, households use these incomes to pay taxes, consume and save.

Government gets its revenue from three main sources: (a) transfers which come from the rest of the world; (b) direct taxes collected from households, firms and factors; and (c) indirect taxes which include import, export and sales taxes. All taxes are assumed to be imposed on the basis of fixed *ad valorem* rates. The revenue collected by government is used for public consumption, household transfers and savings. In the capital market, the total purchase of investment goods is funded through domestic and foreign savings.

The underlying assumption of the foregoing is that all economic sectors must be in a steady state and that all economic activities must be clearly accounted for, and this can be viewed from three angles. First, based on the condition of *market clearance*, every commodity that is produced must be consumed either domestically or exported to foreign consumers. Second, prices of these

commodities reflect all costs of production, subject to which firms are assumed to maximize profits. However, in equilibrium, revenues from sales are equal to expenditures on factors of production and raw materials; as such firms are assumed to make *zero profits*. Third, the assumptions that households fully employ their factor endowments and that they spend all their income on commodity purchases, reveal the accounting principle known as *income balance*.

The above mentioned “three conditions of *market clearance*, *zero profit* and *income balance*” are the defining blocks of the Walrasian general equilibrium and “are employed by CGE models to solve simultaneously for the set of prices and the allocation of goods and factors that support general equilibrium” (Wing, 2004, p. 5).

5.2 Data sources: The social accounting matrix (SAM)

The operation of a CGE model is based on an initial balanced income and expenditure data set which may be contained in a social accounting matrix (SAM). Generally, a SAM is a snapshot of an economy-wide dataset that indicates how resources flow through the entire economic system in a given period (Shoven & Whalley, 1984). The framework for these data comes from traditional input-output analyses. The input-output table represents the value of transactions that occur in an economy in a given period. In particular, the table indicates how producers use the factors of production, together with intermediate inputs, in order to produce a certain amount of output for intermediate and final consumption by other firms and final consumers such as households, government and consumers from the foreign markets.

Table 5.1 below shows the Thurlow *et al.*(2008) Macro SAM⁴³ for the model applied in this study. Further information on this SAM is given in section 5.3 below. It indicates the income and expenditure accounts of all the players in the system in which each of the thirteen rows and columns stands for a separate account. Each column cell indicates the expenditure made to the account of its row. Most cells in the Macro SAM represent an array of data, which can be disaggregated to the desired detail in the Micro SAM.

⁴³ A Macro SAM is the input-output table that shows the national accounts values such as activities/commodities, factors and institutions. On the other hand, a Micro SAM shows the disaggregation of the national accounts values into specific data values that facilitate interactions between them.

Table 5.1: Malawi Macro SAM 2004/05 (MK' million)

	Activities	Commodities	Labour	Capital	Land	Enterprises	Households	Government	Direct tax	Import tax	Surtax	Savings/Invest	ROW	Total income
Activities		316,506												316,506
Commodities	134,991						192,869	34,990				29,880	55,596	448,325
Labour	101,960													101,960
Capital	52,629													52,629
Land	26,926													26,926
Enterprises				37,435				33,355					14,341	85,131
Households			101,960	15,194	26,926	63,873		2,217						210,170
Government						5,573			18,284	19,904	5,802		26,763	76,326
Direct tax						12,260	6,023							18,284
Import tax		19,904												19,904
Surtax		5,802												5,802
Savings/Invest							11,278	5,764					12,838	29,880
ROW		106,113				3,425								109,538
Total expenditure	316,506	448,325	101,960	52,629	26,926	85,131	210,170	76,326	18,284	19,904	5,802	29,880	109,538	

Source: Thurlow *et al.*(2008)

Notes: Activities are expenditures and revenues that are respectively incurred and generated during the production process. Commodities show expenditures on domestic marketed production, imports of products and taxes as well as total demand for marketed commodities. Labour, capital and land – collectively known as factors of production – represent factor income in form of labour wages and receipt of rents on land and capital; and factor expenditure comprising rents on capital and land to enterprises and wages to households. Enterprises are the owners of capital and land from which they earn profits. They may also receive transfers from government and the rest of the world (ROW). In return they pay taxes to government, share out profits to households and ROW and plough back some of the profits. Households represent total income generated by households and the way it is distributed for various uses such as consumption, taxes and savings. The term government stands for all revenues and expenditures by government. Import tax is the tax on imported commodities while surtax (also known as value added tax) is a form of consumption tax, i.e., tax on spending on goods and services. Savings/investment represents total investment demand and expenditure in the economy. The rest of the world (ROW) represents foreign payments to exported commodities and foreign transfers as well as receipts on imports and interests (Chulu & Wobst, 2001).

Reading along the second row namely, ‘commodities’, the income for the production sector emanates from the sale of final output to other private and public industries (MK134,991 million), households (MK192,869 million), government (MK34,990 million), investors (MK29,880 million) and the rest of the world (MK55,596 million). In turn, firms distribute their income as indicated along the ‘commodities’ column. The income is used to buy intermediate and capital inputs from domestic producers (MK316,506 million), pay taxes to government (MK19,904 million as import tax and MK5,802 million as surtax) and pay for imports MK106,113 million). The rest of the rows and columns can be interpreted in a similar manner. The SAM and the circular flow of income are similar in principal, as such the players in the SAM interact just as explained in the circular flow of income above.

Since a SAM is a static tabular presentation of accounting identities, it is important to compare it with the economic indicators from other years to gauge its representativeness. This is particularly important in the case of Malawi because of the frequent policy changes the government has been undertaking. The 2004/05 Macro SAM of Malawi (Table 5.1 above) is therefore compared with the earlier and later years’ economic performance covering the macro aspect (see Table 5.2 below).

Table 5.2: Percentage GDP shares of selected macroeconomic indicators (1999-2010)

Percentage GDP share	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Total domestic absorption	115	110.3	109.1	117.2	115.2	112.5	122.9	121.6	112.7	112.1	112.9	112.8	114.5
Exports	27.5	25.2	27.7	23.1	24.4	24.9	26.9	27.1	26.9	28.6	28.5	28.3	26.6
Imports	42.5	35.4	36.8	40.3	39.6	37.4	60.8	59.4	49.2	50.2	51.3	52.1	46.3
Gross national savings	14.4	13.6	13.9	10.1	8.8	8.1	11	11.4	15	13	12	12	11.9
Foreign savings	9.6	3.9	3	12.7	11.3	9.6	12.4	8.8	9.4	7.2	7.3	7.2	8.5
Grants and foreign transfers	6.1	9.2	4.7	4.2	9.3	10.9	17.4	19.4	18.1	18.3	18.1	17.5	12.8
Government investment	10.1	10.1	10.4	7.4	6.7	6.1	7.2	6.9	6.2	6.2	6.1	6.2	7.5
Private investment	2.3	2.3	2.4	1.7	1.5	1.4	1.7	1.6	1.4	1.4	1.4	1.4	1.7

Sources: National Statistics Office (2008b, 2009a), Reserve Bank of Malawi (2010)

Data from Table 5.1 show that in 2004/05, the domestic absorption, which is the sum of private and public consumption plus investment, surpasses gross domestic product (GDP) by 24.4 percent. The gross national saving as a share of GDP is at 14.4 percent of which 6.2 percent is foreign savings. Notably, foreign savings (the current account deficit) is smaller than the domestic absorption due to grants and foreign transfers, which account for 12.9 percent of GDP.

The calculations from the SAM (Table 5.1) compare favourably with data in Table 5.2 above. From 1999 to 2010, on average, trade deficit (exports minus imports) as a share of GDP, stands at 19.7 percent. This magnitude is not far from the percentage value by which the domestic absorption exceeds GDP in Table 5.1. Similarly, gross national savings, in Table 5.2, stands at an average of 11.9 percent of GDP with foreign savings contributing 8.5 percent of the same. The current account deficit is likewise smaller than the average trade deficit owing to high grants and foreign transfers averaging 12.8 percent. Although not explicitly indicated in Table 5.1, according to Table 5.2, government investment, at an average of 7.5 percent of GDP, by far outweighs private investment which is at an average of 1.7 percent of GDP.

The above snapshot indicates that the current macro-economic environment of Malawi is not significantly different from the way it has been from 1999. Even from the micro-economic view-point, statistics show that there have been no major economic changes in the country. For instance, just as was the case in the 1990s, agriculture still accounts for an average of 40 percent of GDP and 90 percent of the total exports. In 2010, agriculture, which employs 90 percent of the population, accounted for more than 43 percent of GDP. Prior to that, agriculture accounted for 41 percent, 40 percent and 39 percent of GDP in 2005, 2004 and 2003, respectively (National Statistics Office, 2008a, 2010) .

From the foregoing, it can therefore be concluded that the 2004/05 SAM reflects a fair and realistic long-term picture of the Malawi economy as such a model built based on this may be viewed as broadly representative of the current economic environment of the country.

5.3 Model structure

This study of the impact of maize policy reforms on household income distribution is modelled using a country specific CGE model⁴⁴. The model structure is primarily based on the work of Lofgren (2001). It pays particular attention to the specification of demand and supply functions derived from the assumption of utility and profit maximizing consumers and firms, respectively. It also assumes perfect competition and imposes market clearing conditions. The model is static, implying that it is designed to simulate and measure the effect of exogenous shocks on the socioeconomic scheme in a manner that resembles controlled experiments. The full model documentation is presented in Appendix 5. Lofgren's model was built around the 1998 Social Accounting Matrix whose data originated from Malawi's 1998 Integrated Household Survey and complementary trade and macro statistics.

Thurlow *et al.* (2008) updated the 1998 SAM with data from the 2004/05 Second Integrated Household Survey. It is this updated SAM that is employed in this study. It has thirty six production sectors, seventeen of which are agricultural. The remaining nineteen sectors are categorized into industry and services. The SAM distinguishes households and labour into seven and three categories, respectively. In the case of land, four categories are included. Table 5.3 below indicates a complete disaggregation of the SAM's factors of production, institutions and activities into their respective elements.

⁴⁴ In the case of the impact of maize policy reforms on household poverty, the study employs a different methodology which is independent of the CGE model.

Table 5.3: Disaggregation of factors, institutions and activities

SET	ELEMENTS
Labour (3)	<ul style="list-style-type: none">• Elementary• Skilled• Unskilled
Other factors (6)	<ul style="list-style-type: none">• Land (small-scale rural farm land, medium-scale rural farm land, large-scale rural farm land and urban farm land)• Capital (agricultural and non-agricultural)
Households (7)	<ul style="list-style-type: none">• Rural (agricultural small scale, agricultural medium scale, agricultural large scale and non-agricultural)• Metro (Lilongwe and Blantyre: non-agricultural)• Urban (agricultural and non-agricultural)
Other institutions (3)	<ul style="list-style-type: none">• Enterprises• Government• Rest of the world
Agricultural activities (17)	<ul style="list-style-type: none">• Crops (maize, rice, other cereals, roots, pulses, groundnuts, vegetables, fruits, tobacco, cotton, sugar, tea, and other crops)• Non-crop (poultry and eggs, other livestock, fishing and forestry)
Non-agricultural activities (19)	<ul style="list-style-type: none">• Industry (mining, food processing, beverages and tobacco, textile and clothing, wood and furniture, chemicals and rubber, machinery and other manufacturing and construction)• Services (electricity and water, agricultural trade and transport, non-agricultural trade and transport, traded services, communications, banking and business services, real estate, community services, government administration, health and education)

Source: Thurlow *et al.*(2008)

Lofgren's model is constructed in a manner that sets most parameters endogenously to ensure that the model's base solution reproduces the SAM values. For instance, it is assumed that the return to capital is distributed in constant shares between the formal sector and households. Production taxes are calculated as ratios of tax payments to values of domestic production while other

tax rates are calculated as shares of total income. Distribution of labour income to households is computed with constant shares and after-tax income to firms is also distributed in constant shares among distributed profits to households, expatriated profits and savings. Investment demand is thought to be proportional to total investment. Finally, government expenditures and remittances from the rest of the world are held constant in real terms. The remaining parameters; a set of elasticities, are exogenously determined.

Primary agents in various sectors are assumed to be driven by the desire to maximize their objective functions by taking into account certain constraints they are faced with. Lofgren's model displays production activities by the firms in a two-level specification. Value added and intermediate inputs are the highest level of inputs that are combined in fixed proportions (Leontief function) in order to produce sectoral output. Value added inputs are generated by combining the primary factors of production, namely labour and capital in a constant elasticity of substitution (CES) function.

Producers can choose to sell their output locally or internationally, guided by the constant elasticity of transformation (CET) function. Difference in quality is a distinguishing factor between local and foreign traded goods. As profit maximizers, producers will endeavour to sell where the goods can fetch higher prices.

Being a small economy, Malawi is regarded as a price taker in the export and import markets. Export and import volumes respond to changes in the relative world prices. Therefore, changes in world growth affect exports and imports through their impacts on the foreign prices. Following Armington (1969), imports and domestic products are assumed to be imperfect substitutes and domestic supply is assumed to be a CES aggregate of imports and domestic sales (production minus exports). Exports are therefore derived from a demand function from the rest of the world while external demand is a function of the ratio of domestic prices to the world prices.

With regard to household demand, the model employs a Stone-Geary linear expenditure system (LES), supposedly reflecting the households' maximization of utility functions subject to their budget constraints. The inclusion of subsistence consumption in the LES demand system is very important, particularly with regard to most Malawian households where own-household consumption constitutes a large share of the daily food requirements. However, this does not undermine the model's primary assumption that household consumption is mainly financed by factor payments as indicated earlier in section 5.1.

In order to balance the accounts in the model, a number of closure rules are established. Closure rules involve determining the micro- and, primarily, macro-economic assumptions underlying the model. On the micro-economic side, the main interest is on the factor and product market equilibriums. Closure rules on macro-economic assumptions largely focus on the saving-investment balance, the government budget and the current account balance (Bautista & Thomas, 2000).

It is assumed that the stock of capital in each sector is fixed and labour is treated as a mobile factor across sectors. In addition, it is assumed that total labour is available in surplus at a fixed wage⁴⁵. This being the case, employment is simply equal to labour demand (Sadoulet & de Janvry, 1995). In the product markets, variable prices allow for clearing of the markets.

As stated earlier, Malawi has no influence on the world market so international prices of imported and exported commodities are treated as exogenous to the model. To reflect the current situation in Malawi, the nominal exchange rate is exogenous and the current account balance is endogenously determined. In order to get the saving-investment balance, the study goes for a savings-driven closure whereby marginal propensities to save (in the economy) are exogenously determined. This enables investment in the model to vary.

⁴⁵ The fixed wage is interpreted as being fixed in terms of the numeraire. Since in this model, consumer price index is taken to be the numeraire, the wage is assumed fixed in terms of its purchasing power.

Finally, fiscal deficit is computed as the difference between government revenues and its expenditures. Government revenue emanates from incomes from factors, institutional transfers and taxes. In turn, government spends its revenue on consumption and transfers. In algebraic terms, fiscal deficit (government savings), GS is given as follows:

$$GS = GR - GE \quad (5.1)$$

where, GR is government revenue while GE stands for government expenditure.

$$GE = \sum P_c^p \cdot G_c^p + \sum tr_i + X\Delta \cdot tr_{row} \quad (5.2)$$

where, P_c^p is composite commodity price, G_c^p is government consumption demand, tr_i is government transfers to domestic institutions, tr_{row} is government transfers to the rest of the world and $X\Delta$ is the exchange rate.

Notably, in Lofgren's model (equation 5.2), farm subsidies are not explicitly spelt out within the 'domestic transfers' component. Incorporation of farm subsidies into the model is therefore one of the contributions of the current study. Following the footsteps of Kilkenny (1993), government expenditure is therefore expressed as follows:

$$GE = \sum P_c^p \cdot G_c^p + (\sum SUB_j \cdot Q_j^d + tr_i) + X\Delta \cdot tr_{row} \quad (5.3)$$

where, SUB_j are farm subsidies transferred to institution, j (in this case household, j) and Q_j^d is total domestic production from industry j . The rest of the variables are as defined above.

Since 2004/05, fertilizer subsidy funds have largely been domestically sourced (see Chapter four, section 4.3). The government has two options to generate more revenue domestically, namely by increasing tax and/or domestic borrowing from the financial market. Since there have been no major tax adjustments over the

past five years (GoM, 2008a, 2009a, 2010), in this study fertilizer subsidy funds are assumed to be generated through domestic borrowing. The foregoing suggests that increases in farm subsidies worsen the fiscal deficit.

Based on the work of Sadoulet & de Janvry (1995), subsidies are factored into the production system via the consumer price, P_j as follows:

$$P_j = \{[P_d(Q_j^d - E) + X\Delta(P_m)(M)]/(Q_j^d - E + M)\}/(1 + SUB_j) \quad (5.4)$$

where, P_d is a price adjuster, P_m is price of imports, while M and E are imports and exports, respectively. The exchange rate and price of imports, both exogenously determined, are fixed at 1.

From equation (5.4), farm subsidies are expected to reduce the consumer price and therefore increase the value added price through reduction in expenditure on intermediate inputs. An increase in value added price induces factor employment in agriculture. Increased factor employment in the agriculture industry is expected to lead to an increase in the overall agricultural production function. This implies that “if the subsidy is removed, factors will either relocate to sectors stimulated by the change in the spending pattern, or, if no sectors are stimulated – lie idle (unemployed)” (Kilkenny, 1993, p. 971).

5.5 Income distribution analysis

In this section the effects of fertilizer subsidies on household income distribution are explored. The history and operation of the maize fertilizer subsidies has already received a lot of attention in the previous chapter.

The analysis unfolds by looking at changes in the distribution of household income if maize fertilizer subsidies of 25 percent, 50 percent and 95 percent are provided. The level of 25 percent has been considered to reflect the lowest rate of subsidies on prices of fertilizer so far recorded (Mkandawire, 1999). On the other

hand, 95 percent is the highest level of the subsidy on record (GoM, 2009a). These give the lower and upper bounds explored, with 50 percent arbitrarily selected as the median.

Discussion of the simulated results proceeds as follows. First, an overview of the macroeconomic impacts of the subsidies is provided. This is followed by an analysis of the driving forces (reasons) for the macroeconomic results. The analysis is closely linked to sectoral performance in the economy. Second and central to this chapter, effects of the subsidies on household income distribution are explored.

Under the macroeconomic impacts of changes in the rates of the fertilizer subsidies, the following indicators are discussed namely, real gross domestic product (GDP) absorption, private and public consumption, investment and trade deficit as indicated in Table 5.4 below.

Table 5.4: Macro results of simulations (% change)

	Base value (MK' million)	Fertilizer subsidy rates		
		25%	50%	95%
Real GDP	207,222	0.05	0.10	0.19
Absorption	257,739	-0.01	-0.02	-0.06
Household consumption	192,869	0.67	1.35	2.59
Government consumption	34,990	0.13	0.25	0.48
Investment	29,880	-2.57	-5.17	-9.96
Trade deficit	50,517	0.40	0.81	1.55

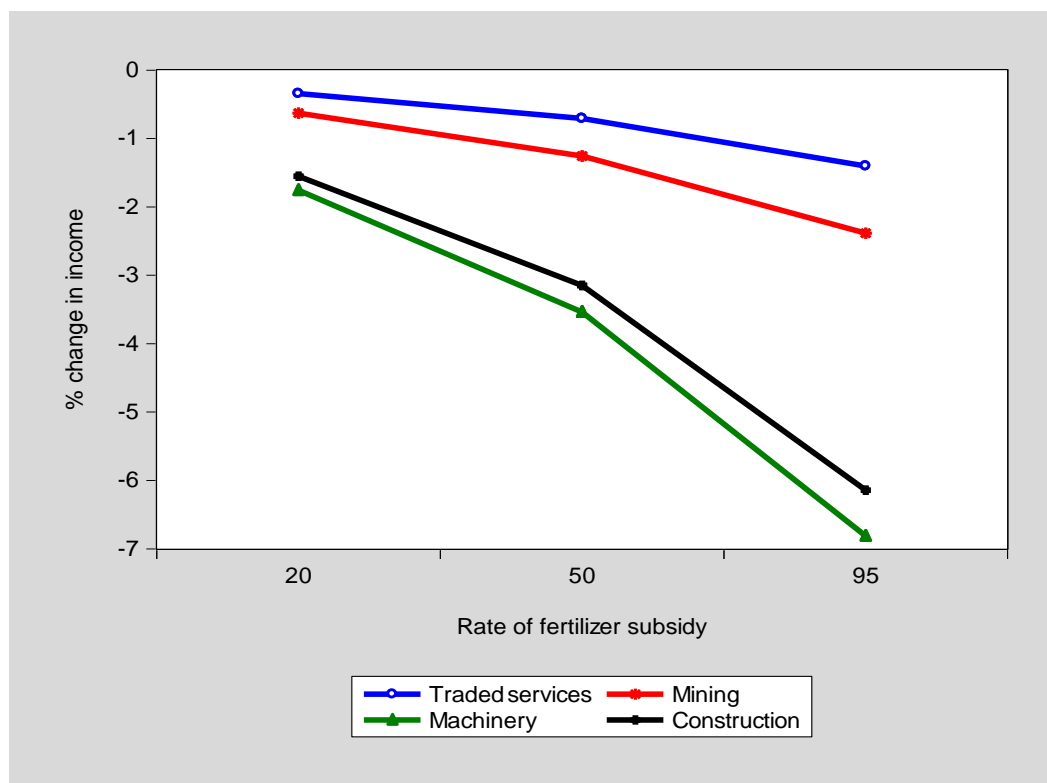
Results in Table 5.4 above indicate that high subsidy rates lead to reductions in investment demand and worsen the trade deficit. Investment demand contracts by 2.57 percent, 5.17 percent and 9.96 percent against the subsidy rates of 25 percent, 50 percent and 95 percent, respectively. On the other hand, the trade deficit increases by 0.4 percent, 0.81 percent and 1.55 percent against the subsidy rates of 25 percent, 50 percent and 95 percent, respectively.

Results in Table 5.4 above further reveal that high subsidy rates lead to contractions in the domestic absorption arising primarily from contractions in investment spending. However, private and domestic consumption register some improvements which culminate into increases in real GDP. The improvements in real GDP are however thwarted by large trade deficits. In the following paragraphs, the driving forces behind the above results, particularly investment demand and trade deficit, are discussed.

All fertilizer inputs that Malawi uses are imported and for nearly two decades the import price of fertilizer has been persistently increasing (Fandika *et al.*, 2007). Paradoxically, starting from 2005, there has been a general increase in the subsidy rates (see chapter four, section 4.2). As subsidy rates increase, returns from sales of the imported fertilizer decrease. Therefore, in order to continue financing the subsidies, the government increases its domestic borrowing.

In the short to medium term, large domestic public sector borrowing crowds out private investment. In addition, the government's role in buying and distribution of the subsidized fertilizer displaces some private traders (Banful, 2010). In the end, sectors, such as traded services, which are supposed to be involved in the fertilizer trade, end up with little or no business at all. The crowding out and displacement of the private sector leads to contractions in income for some major non-agricultural sectors as indicated in Figure 5.2 below.

Figure 5.2: Contractions in selected sectors in Malawi (% change)



From Figure 5.2 above, machinery and construction sectors are the worst affected. At 25 percent subsidy rate, income for machinery contracts by 1.76 percent. It further contracts by 3.54 percent and 6.81 percent when the subsidy rate is 50 percent and 95 percent, respectively. In the case of the construction sector, income goes down by 1.55 percent, 3.15 percent and 6.14 percent when the subsidy rate is 25 percent, 50 percent and 95 percent, respectively. Contractions also take place in the tea, sugar and cotton sector as indicated in Appendix 6. These contractions occur mainly as a result of smallholders transferring their labour from the sector into the maize sector.

The above discussed income contractions in a number of sectors are some of the major driving forces of the reductions in investment demand. Furthermore, a number of the aforementioned sectors such as tea, sugar, cotton and mining contribute a significant amount of Malawi's total exports. Therefore, contractions in these sectors lead to reductions in exports and hence worsen the trade deficit.

At the micro level, increases in the rates of fertilizer subsidies lead to increases in income for all agricultural households both in the rural as well as urban areas. However, subsidies dampen incomes for rural and urban non-agricultural households and have no effect on incomes for metro households as indicated in Table 5.5 below.

Table 5.5: Micro results of simulations (% change of household income)

	Base value (MK' million)	Fertilizer subsidy rates		
		25%	50%	95%
Rural: Agricultural small scale	20,165	0.80	1.60	3.07
Rural: Agricultural medium scale	56,825	0.78	1.56	2.99
Rural: Agricultural large scale	17,144	0.71	1.05	2.04
Rural: Non-agricultural	20,150	-0.01	-0.01	-0.03
Metro: Lilongwe & Blantyre (non-agr)	56,913	0.00	0.00	0.00
Urban: Non-agricultural	3,389	0.51	0.43	0.21
Urban: Agricultural	35,583	0.68	1.37	2.63

On their part, rural agricultural small-scale households experience the largest increase in income. To a large extent, this indicates a positive relationship between the rate of fertilizer subsidy and income distribution for rural agricultural smallholders. However, these income changes are small. For instance, a 95 percent fertilizer subsidy leads to only 3.07 percent increase in income (from MK20,165 million to MK20,784 million) for smallholders.

The limited increases in household income underscore two key points about agriculture in Malawi as discussed in Chapter four. Firstly, maize is largely cultivated for household consumption and secondly, for the majority of smallholders, there is very limited diversification away from maize cultivation. Over-reliance on maize production makes smallholders fail to effectively tap from rises in income generated from other crops such as fruits, rice, pulses, roots and tobacco as indicated in Appendix 6.

Metro (Lilongwe and Blantyre) households' incomes do not change and this is partly due to contractions in the mainly 'metro/urban-based' sectors, namely construction, traded services and machinery. These sectors are a source of employment to many metro dwellers. Therefore, when these sectors falter, metro dwellers' incomes are negatively affected stemming from reductions in hiring and in some cases job losses. However, the supposedly reductions in metro households' incomes are offset by income gains that emanate from employment in the public sector. This argument is clarified in the following paragraph.

Urban non-agricultural households mainly comprise civil servants, small scale business entrepreneurs as well as urban sector employees. Increases in government consumption partly explain the nominal increases in their incomes. Arguably, increased government consumption translates to job creation for many households in this income group. However, their incomes increase at a decreasing rate partly due to contractions in incomes for the urban-based sectors, which also form a significant part of urban dwellers' employment opportunities.

Incomes for rural non-agricultural households emanate either from farm and off-farm labour that they offer or small-scale businesses that they engage in. At the rural level, offering of farm labour, particularly in the tea, sugar and tobacco estates can be said to be the chief source of income for these households. Contractions in these industries (mainly tea and sugar) have a direct impact on their employability. Given that in this study wages are assumed to be exogenously determined, it is mainly the loss of labour opportunities (ganyu) that leads to reduction in rural non-agricultural households' income.

In the case of small-scale businesses, reductions in income for rural non-agricultural households, particularly for those that are involved in maize trade, emanate from the following two sources. First, as suggested in equation 5.4 fertilizer subsidies lead to reductions in the consumer price of the crop which culminates into reductions in income for traders. Second, subsidy driven high maize supply (production) signifies market saturation, which means traders end

up with maize that they cannot sell, which again leads to reductions in income for traders. Unfortunately, maize price reductions and market saturations can and tend to occur simultaneously in areas which experience high maize yields. A similar explanation applies in the cases of other crops such as rice, roots and groundnuts.

5.7 Poverty analysis

There is still some debate on the extent to which conventional CGE models are able to robustly decompose household poverty (Decaluwe *et al.*, 1999). In order for a CGE model to reasonably decompose poverty, information regarding income distributions within socioeconomic groups is essential. Unfortunately, SAM-based approaches implicitly assume that intra-group variances of income distributions are zero. However, it is true that even in socioeconomic groups generally endowed with high income levels there still exist some households whose average income levels fall below a given poverty line.

Despite some limitations of the CGE models in decomposing household poverty, several researchers have attempted to use the SAM-based approach to estimate poverty. For instance, Thorbecke & Jung (1996) constructed a multiplier decomposition method by systematically interlinking socioeconomic groups with production activities. They argued that “certain production activities contribute more to the growth of household groups' incomes than others” (p. 285). They also explained the structural mechanism in which changes in sectoral output affect poverty alleviation. Key to this mechanism was the adoption of the Foster, Greer & Thorbecke (1984) (FGT) method of poverty decomposition. The way the FGT approach works is explained later.

In order to circumvent the aforementioned limitation of the SAM-based approaches, De Janvry *et al.* (1991) employs Pareto and lognormal distribution functions to portray each socioeconomic group's income distribution. But as argued by Decaluwe *et al.* (1999, p. 29), “the authors do not justify why these functional forms are more appropriate than more flexible forms.”

As an alternative to the approach by De Janvry *et al.* (1991), Decaluwe *et al.* (1999, p. 29) propose a more flexible functional form in which “the intra-group distributions are specified so as to conform to the different socioeconomic characteristics of the groups.” They further assume a poverty line “based on a unique and constant basket of needs commodities.” However, for this method to work, it requires knowledge of the minimum and maximum incomes of each household group. In addition, parameters that determine the shape and skewness of the distribution need to be known. In the case of this study, these variables and parameters are unavailable and therefore a different approach, independent of the CGE model, is employed as explained hereunder.

Here, the decomposition of poverty was conducted in two steps. The first step involved generating one thousand draws for the average income of each household group through a non-parametric bootstrapping process as postulated by Poe *et al.* (2002). This technique has been adequately described in Chapter three (section 3.3.3). On the upside, a sample generated using the Poe test is known to be free from observational biases.

Secondly, as with Thorbecke & Jung (1996), the Foster, Greer & Thorbecke (1984) (FGT) method was employed to decompose poverty. The FGT is an attractive technique because it does not only measure the head count ratio but also calculates how deeply and severely poverty affects each socioeconomic group. The FGT can be expressed as follows:

$$P_{\alpha} = \frac{1}{\sum_{j=1}^N w_j} \sum_{j=1}^m w_j \left(\frac{z-y_j}{z} \right)^{\alpha} \quad (5.5)$$

where, α is a parameter that measures the degree of poverty aversion, z is the poverty line, y_j is the household income and N is the total number of draws in each socioeconomic group. There is a sampling weight for the j^{th} household represented by w_j while m stands for the total number of the poor in the income group. When $\alpha= 0$, FGT becomes the headcount index measuring the proportion

of the poor in the population. The headcount index is popular because it is easy to compute and comprehend. However, it fails to give adequate information regarding how poor the poor are.

The weakness of the headcount index is overcome when $\alpha=1$. In this case, the measure becomes the poverty gap index looking at the extent to which households fall below the poverty line. The poverty gap is more useful when comparing poverty situations between different socioeconomic groups or countries. Finally, in the case of $\alpha=2$, FGT is interpreted along the lines of severity of poverty. Here the poverty gaps are squared relative to poverty line. Results of the decomposition of poverty are indicated in the following Tables 5.6-5.8.

Table 5.6: Poverty incidence variations (% changes)

	Base	Fertilizer subsidy rates		
	Value	25%	50%	95%
Rural: Agricultural small scale	0.28	-1.46	-3.28	-3.99
Rural: Agricultural medium scale	0.04	-0.88	-4.39	-7.87
Rural: Agricultural large scale	0.03	0.00	0.00	0.00
Rural: Non-agricultural	0.28	0.00	0.00	0.36
Metro: Lilongwe & Blantyre (non-agr)	0.04	0.00	0.00	0.00
Urban: Non-agricultural	0.12	-0.21	-0.21	-0.19
Urban: Agricultural	0.10	-0.54	-0.54	-3.24

Results in Table 5.6 suggest that changes in the rates of fertilizer subsidies are inversely related to changes in the poverty incidence for rural smallholders, medium landowners, urban agricultural and urban non-agricultural households. At lower rates of the subsidies (below 50 percent), smallholders are the major beneficiaries with regard to reductions in the incidence of poverty. However, at higher rates of the subsidies (above 50 percent), medium landowners experience greater reductions in headcount poverty.

Despite some increases in household income for rural large landowners, changes in subsidy rates hardly affect the incidence of poverty in that socioeconomic group. The same applies to households in the main cities of Blantyre and Lilongwe. In the case of rural non-agricultural households, up to 50 percent of subsidy rates have no impact on the incidence of poverty in that household group. However, very high rates of the subsidy (95 percent) increase their poverty incidence by only 0.36 percent.

When it comes to the poverty gap index, there are notable similarities and differences with the poverty incidence variations as indicated in Table 5.7 below.

Table 5.7: Poverty depth variations (% changes)

	Base Value	Fertilizer subsidy rates		
		25%	50%	95%
Rural: Agricultural small scale	0.1	-1.37	-2.71	-5.1
Rural: Agricultural medium scale	0.01	-1.52	-2.97	-5.5
Rural: Agricultural large scale	0.01	-0.29	-0.68	-1.26
Rural: Non-agricultural	0.1	0.01	0.01	0.05
Metro: Lilongwe & Blantyre (non-agr)	0.01	0.00	0.00	0.00
Urban: Non-agricultural	0.04	-0.13	-0.25	-0.48
Urban: Agricultural	0.04	-1.34	-2.71	-5.16

As with poverty incidence, the following households experience reductions in the extent to which households fall below the poverty line, namely rural smallholders, rural medium scale households, urban agricultural and non-agricultural households. On a different note, there are poverty depth reductions within the rural large scale household group, which is not the case when it comes to poverty incidence. Rural non-agricultural households experience increases in poverty depth, albeit nominally. However, for the metro households there are no changes as far as poverty depth is concerned. Some further analysis is carried out with respect to the severity of poverty as indicated in Table 5.8 below.

Table 5.8: Poverty severity variations (% changes)

	Base Value	Fertilizer subsidy rates		
		25%	50%	95%
Rural: Agricultural small scale	0.05	-1.46	-2.9	-5.46
Rural: Agricultural medium scale	0.01	-1.39	-2.77	-5.13
Rural: Agricultural large scale	0.01	-0.38	-0.75	-1.5
Rural: Non-agricultural	0.05	0.02	0.02	0.06
Metro: Lilongwe & Blantyre (non-agr)	0.01	0.00	0.00	0.00
Urban: Non-agricultural	0.02	-0.15	-0.25	-0.45
Urban: Agricultural	0.02	-1.36	-2.66	-4.99

Results from the severity of poverty indicate similar trends as is the case with the poverty depth. At 50 percent and 95 percent subsidy rates, rural medium scale and urban agricultural households experience lower reductions in the severity of poverty than in the case of poverty gap. However, for the rural smallholders, the opposite is true. Rural non-agricultural households' severity of poverty worsens compared to the other two poverty indices.

As stated earlier, policy makers envisioned maize fertilizer subsidies as a tool for reduction in poverty particularly in the rural areas. The main targets were the rural smallholders and rural non-agricultural households. Comparative analysis from Table 5.6 to Table 5.8 suggests that while subsidies may have some notable gains with regard to rural smallholders, the rural non-agricultural households end up being losers. It is also revealed that income benefits accrue to some households, namely the rural medium scale, more than the intended beneficiaries. This may suggest a weakness in the way the subsidies are administered as discussed in Chapter four (section 4.3.1). For instance, some of the beneficiaries, although poor, are not poor enough to receive the subsidies.

5.8 Chapter summary

The main objective of this chapter was to assess the impact of reforms in the maize sectors on income distribution and poverty. Based on CGE modelling, three simulations focusing on increases in the subsidies on price of fertilizer were considered. Modelling results suggest that the subsidies lead to small increases in income of all agricultural households. Rural non-agricultural households experience reductions in their incomes while changes in the rates of subsidies have no income effects on metro households. Although urban non-agricultural households experience increases in income, such changes occur at a decreasing rate.

It has also been illustrated that the subsidies help to reduce income poverty for the rural and urban agricultural as well as urban non-agricultural households. For these households (except for rural large scale households), all poverty indices, namely the headcount, gap and severity register reductions. This means improvements occur not only in the proportion but also in the extent to which households fall below the poverty line. However, for the rural non-agricultural households, their poverty situation worsens while no changes occur in the case of metro households.

Since the subsidies have mainly been implemented with the aim of improving income distribution and reducing poverty for the rural poor, it can be argued that their effects are mixed. On the one hand, rural smallholders can be said to have benefited from the subsidy programmes. On the other hand, rural non-agricultural households turn out to be the losers. Their income losses are mainly associated with non-lucrative trade in agricultural produce and reductions in farm and off-farm labour. Government policies that could be designed to address these bottlenecks may prove beneficial to the rural non-agricultural households. For instance, although price floors on agricultural produce may distort the market, they may help improve the welfare of the rural small scale traders.

CHAPTER SIX

THE LINKS BETWEEN POVERTY AND THE ENVIRONMENT IN MALAWI

6.0 Introduction

Poverty is widely held to be an important cause of environmental degradation. For instance, slash-and-burn subsistence agriculture is imposing a toll on forest resources in many poor countries (Carmonaa *et al.*, 2010; Shearman *et al.*, 2009; Sirén, 2007). Nevertheless, very little has been done to provide much insight regarding the extent to which cultivation of particular crops contributes to deforestation. This deficiency has led to bottlenecks when it comes to designing policies that can effectively tackle both poverty and deforestation. It is with this in mind that this chapter is developed mainly to examine how crop cultivation affects deforestation in Malawi.

The chapter starts by looking at classifications of forests and the reasons why the poor are closely associated with forests. The investigation regarding the relationship between poverty and forests is done by applying the von Thunen model. Later, a regression analysis of changes in crop land use on changes in forest cover is conducted. The chapter ends with a discussion on property rights and the rule of law as some of the basic tenets that are necessary to contain deforestation and encourage reforestation.

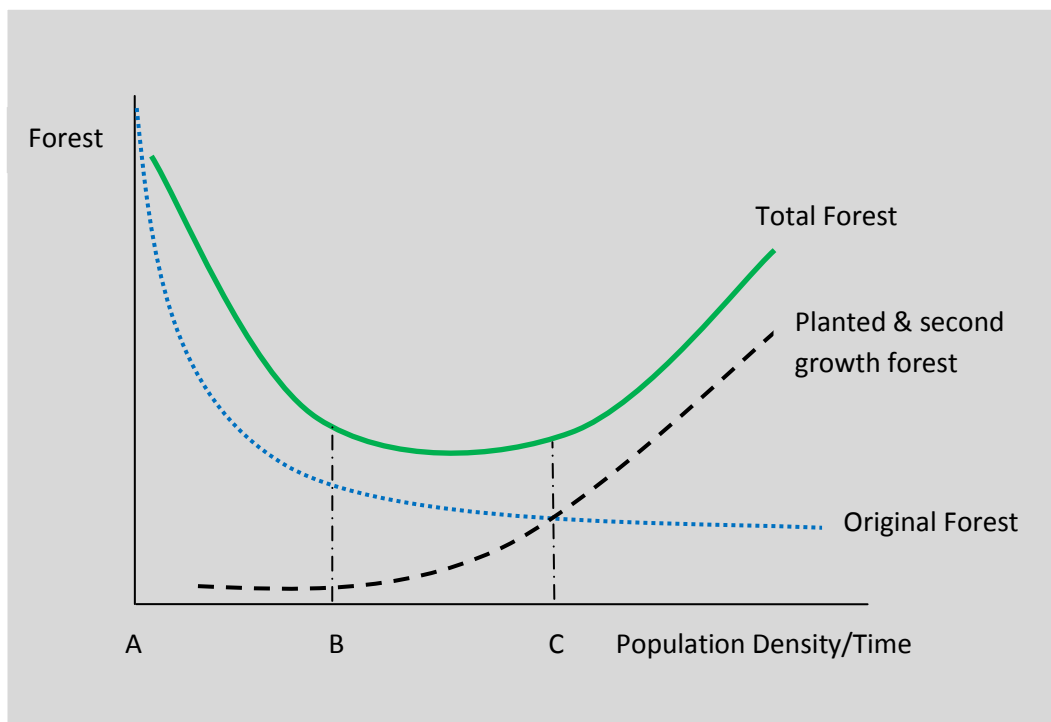
6.1 Aspects of poverty-deforestation relationship

The causes of deforestation have traditionally been viewed from two perspectives, i.e., demographic and economic. The demographic pressures on forest lands were popularized by the classic Malthusian theory, which contended that an increase in population density would lead to deforestation (Walker, 2004). It was therefore

assumed that unless population growth was contained, the world forests were destined for an eventual disappearance.

From the economic perspective, two strands emerged. The first one put the blame for deforestation on the extraction of commercial timber and other wood products as experienced in Asia and South America. The second strand had much to do with agriculture where clearing of forest land for commercial farming was regarded as the most common cause of deforestation and this stemmed mainly from the von Thunen theory (Angelsen, 2007). Both the demographic and the economic approaches can be said to be pessimistic in that they did not take into account potential for planted and second growth forest to replace original forest. From Figure 6.1 below, it can be said that their understanding of deforestation was limited to points between A and B.

Figure 6.1: Stages of deforestation



Adopted from: (Harris, 2006)

However, over time evidence started to accumulate that the world was not necessarily doomed to deforestation. In the developed world, for instance, most lands that had been cleared started to show the resurgence of natural and planted trees and this phenomenon led to the birth of the forest transition theories (Mather, 1992). Although the forest transition theories uphold the demographic and economic causes of deforestation, they are seen to be optimistic in their approach. They postulate that with respect to time, forest lands tend to go through four stages. The first one is where the land is covered with indigenous (original) forest with low or no deforestation at all. From Figure 6.1 above, this would be represented by areas close to point A. The second stage involves rapid and high deforestation between points A and B. The third stage indicates deceleration in deforestation evidenced by stabilization in forest cover (between points B and C). The final stage (to the right of point C) is where reforestation and natural resurgence take place and there is an increase in total forest.

From the above three theories, four classifications of forest land can be cited, namely the residual standing forest, the mature natural forest, the previously extracted but replenished forest and the forest that is in the region of agriculture (Hyde *et al.*, 1996). However there are remarkable differences between forest lands that can be observed in the developed and the poor countries. In the developed countries, most of which can be said to be to the right of point C in Figure 6.1, all the four classifications are generally observable.

On the other hand, in most poor countries such as Malawi, the classification of forest land can largely be broken into two: (1) the residual standing forest and (2) the forest land that is in the region of extensive agriculture. Forest lands that fall in category (1) are mostly government protected areas such as national parks and game reserves. The remaining forest land, category (2), is largely treated as common property owned by the general community.

The differences in observable forest classifications between the rich and poor countries are matched by the large differences in attitude and concerns towards deforestation. In many developed countries, one can be reasonably confident that the remaining original forest will be protected. This is due to strong institutions that have spearheaded education, property rights and awareness of the rule of law in these countries. In this part of the world, concerns about deforestation are expressed partly because the developed world views deforestation from poor tropical areas (e.g., from the Amazon basin) as having global negative externalities such as climate change (UNDP, 2007). Others are concerned with the issue of deforestation because of their passion to maintain and protect forest biodiversity and other ecosystem benefits (Harris, 2006). On the other hand, in poor countries, lack of, or weak property rights and regulations in the category (2) forest land has led to extensive extraction of forest resources and deforestation.

In poor countries, deforestation tends to have short and long term effects on the people's welfare ranging from soil erosion, flooding, siltation and reduction in agricultural production. Unfortunately, it appears that in most cases, the poor, for instance, in Malawi, do not realize and in some cases are unwilling to acknowledge that they are largely responsible for the deforestation problem. They instead ignore the problem, blame others or simply consider the adverse effects, such as soil erosion and flooding as the works of God that are entirely out of their control (Tobin & Knausenberger, 1998).

Even amongst the poor countries themselves, causes of deforestation and their effects are also divergent. For instance in Latin America and Asia, deforestation is mainly due to logging and commercial agriculture and this is regarded as having impacts on global warming. In sub-Saharan Africa, deforestation is mostly associated with rural slash-and-burn subsistence agriculture and this has effects on poverty. Unfortunately, the relationship between poverty and deforestation has not been apparent in the aforementioned theories of deforestation as such for a long time poverty and deforestation have been researched upon as separate issues that required separate policy interventions.

The downside of looking at poverty and deforestation as separate issues is that a number of studies have tended to culminate into policies which have had conflicting effects on the rural poor. For instance, the trade liberalization policies, which were mainly designed to foster trade and reduce income poverty, are on record to have led to deforestation in a number of developing countries (Lopez, 2000). Today the two issues are increasingly regarded as twin problems that require formulation of double-edged policies that are capable of addressing them both simultaneously.

A number of studies have revealed that poverty can be both the source and result of deforestation (Perz, 2003; Sunderlin *et al.*, 2008). At the centre of this 'chicken-and-egg' vicious circle is the general view that on the one hand, poverty leads to ecological degradation by causing the poor to depend on forest reserves for survival particularly with respect to firewood, farming, wildlife, water and fisheries. On the other hand, ecological degradation aggravates poverty, since the poor rely on the environment for their continued existence (Bojo, 1999; Cleaver & Schreiber, 1994).

With regard to agriculture, it is widely argued that in most poor countries, particularly in sub-Saharan Africa, the rural poor rely on low-productivity, subsistence agriculture for their living. This being the case, with no or very limited technological improvement, agricultural production can be enhanced only by converting forests into agricultural land (Coxhead & Jayasuriya, 2004; Fisher & Hirsch, 2007; Lufumpa, 2005). According to UNDP (2007), between 1990 and 2005, 3 percent of the global forests were lost owing to conversion of forests into farmland in poor countries at the estimated rate of about 13 million hectares per annum.

To a great extent, the issue of deforestation continues to be closely associated with poverty because a number of research findings indicate that many poor people live in or near forested areas. For instance, recently the patterns of association between poverty and forests were examined by Sunderlin *et al.* (2008)

through their case studies on Malawi, Mozambique, Uganda, Indonesia, Brazil, Honduras and Vietnam. By applying the bivariate-spatial-autocorrelation approach via the Moran's I statistic⁴⁶ they found that there was a strong link between the location of the rural poor and forests. Similar findings have been registered by Zhou & Veeck (1999) for China; World Bank (World Bank, 2006) and Shah & Guru (2004) for India; and Chomitz et al. (2007) for Nicaragua. While these studies provide very good information relating to where the poor are most likely to locate, they do not explain why the poor are closely associated with forests.

Furthermore, although a great deal of anecdotal evidence points towards a close relationship between poverty and deforestation through agriculture, country specific time series data on deforestation, especially in poor countries, is still a huge problem. In addition, many studies do not clearly specify which crops are responsible for how much deforestation. This has led to difficulties in designing and reviewing the effects of policies that are aimed at addressing the poverty-deforestation concerns. The main aim of this chapter therefore is to examine how cultivation of some crops can act as the causative agent of deforestation. The chapter starts by looking at the question regarding why the poor are usually located in or near forested areas by applying the von Thunen (1826) model.

6.2 Poverty and forests: Application of the von Thunen model

At the core of the von Thunen model is the argument that land is assigned to the use which yields the highest rent and that the rents of various land uses are determined by location. Today the von Thunen model has received much broader explanation and application in the literature. For instance, McCann (2001b) succinctly applies the model to explain the spatial structure of the urban economy, i.e., how people and firms are distributed within the urban economy. On his part, Angelsen (2007) uses the model in conjunction with the forest transition theories to analyse the tropical deforestation and reforestation. Here, the model is used to

⁴⁶ Derivation of Moran's I statistic is adequately covered in chapter four, section 4.3.2.

explain why the poor are usually located in or near forested areas with particular reference to Malawi. The analysis in this model closely follows the academic footprints of McCann (2001b).

The construction of the von Thunen model is based on the assumption that there is a fixed supply of homogeneous land that is managed by an omnipotent planner and can only be used for agriculture and forestry. This land is allocated according to its most profitable use. To cultivate the land, it is assumed that a farmer pays rent⁴⁷, r per hectare, h . The agricultural output, q per hectare is assumed to be traded at a central market point at a given price, p . Apart from land, it is assumed that the agricultural production is also facilitated by two non-land production factor inputs, namely labour, l and capital, k , which are remunerated with w and i , respectively. It is also assumed that the agricultural goods incur a constant transport cost, c per kilometre whenever they are moved from their point of production to the central market point over a distance which is denoted by d . Based on these assumptions, the farmer's profit can be computed as follows:

$$\pi(d) = pq - wl - ik - rh - qcd \quad (6.1)$$

From equation (3.1) the profit per unit of output can therefore be derived as follows:

$$\frac{\pi(d)}{q} = (p - cd) - w\frac{l}{q} - i\frac{k}{q} - r\frac{h}{q} \quad (6.2)$$

The profit per unit of output from equation (6.2) can be interpreted as the difference between price of goods and their costs of transport, less production factor overheads per unit output. In order to calculate the maximum rent that a farmer could pay per unit of land area, profit per unit of output is set to be equal to zero, i.e., $\frac{\pi(d)}{q} = 0$. This transforms equation (6.2) into:

⁴⁷ Based on the assumptions of Ricardo (1821) land payments are treated as residual, which implies that "rental payments to land are distributed only after all other non-land factors and transport costs have been paid" (McCann, 2001b, p. 97).

$$(p - cd)q - wl - ik - rh = 0 \quad (6.3)$$

Equation (6.3) can be rearranged to make r the subject of the formula as follows:

$$r = \frac{(p - cd)q - wl - ik}{h} \quad (6.4)$$

The rent-distance relationship can therefore be calculated by differentiating equation (6.4) with respect to distance, d as follows:

$$\frac{\partial r}{\partial d} = -\frac{q}{h} \left(c + \frac{\partial c}{\partial d} d \right) \quad (6.5)$$

Given that transport cost, c is assumed to be constant, equation (6.5) can be simplified as follows:

$$\frac{\partial r}{\partial d} = -\frac{q}{h} c = -\frac{c}{h/q} \quad (6.6)$$

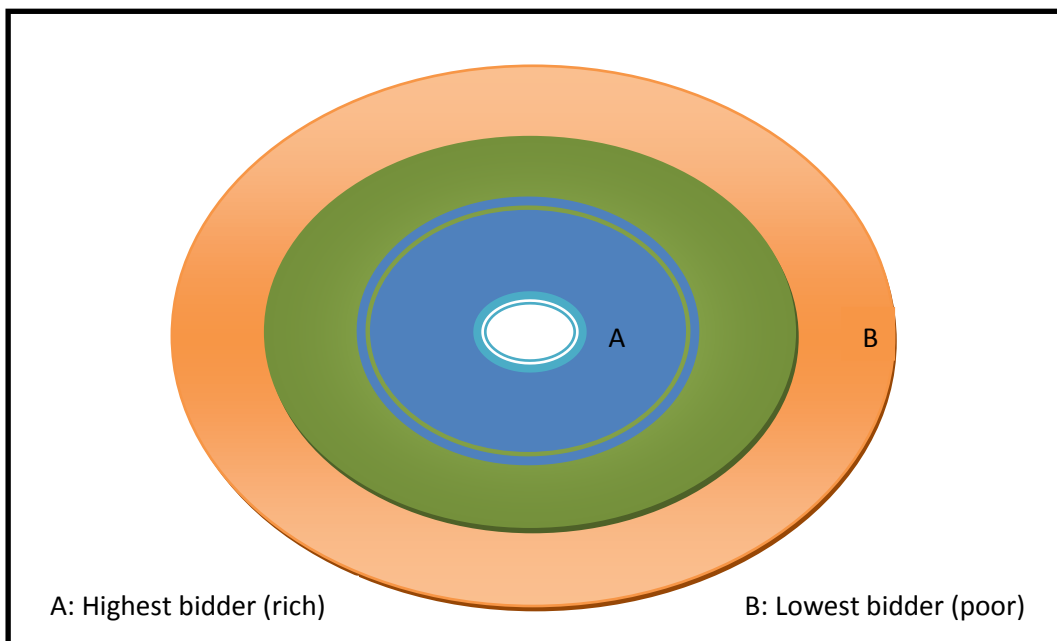
Equation (6.6) stipulates that any increases in transport costs resulting from increases in distance are essentially compensated for by reducing the rent owed to the total land that is used to produce a unit of output. In other words, the price of land falls as the distance from the central market point increases.

So far it has been implicitly assumed that there is only one farmer producing one type of product. However, to see why different groups of people or firms locate at different places, the model is extended to include two farmers producing two competitive agricultural products, q and x from pieces of agricultural land of identical sizes. It is also assumed that the two farmers are faced with identical transport, land and non-land factor costs but different market prices, $p_q \neq p_x$.

If $p_x > p_q$ then the farmer producing product x will be more competitive. Given that payments to land are treated as a residual, the producer of x will consequently bid higher land rent than the producer of q and therefore by

implication the producer of x will occupy land closest to the central market point. This trend would continue as more farmers and products are introduced into the model and the result will be several concentric zones with the most competitive bidder locating closest to the central market (McCann, 2001b) as shown in Figure 6.2 below.

Figure 6.2: Agricultural production concentric rings



Source: Author

From the foregoing, it clearly follows that the less competitive farmers or households will be continuously pushed further away from the central market point into the outskirts (forested areas) where the cost of land is lowest. If the cost of renting forests is zero (Angelsen, 2007) then by implication, it must be the poor households that would locate in or near such places.

6.3 Malawi's land competition in the von Thunen Model

In Malawi, land is distinguished into three main categories, namely leased, customary and public land. Such categorisations can be traced as far back as 1891 when Britain declared Malawi, then Nyasaland, its protectorate. At that time, the

white settlers obtained land through establishment of treaties with local chiefs for large-scale estate agriculture which were usually negotiated at a nominal price. The first acquired estates were mostly located in the Shire highlands in the south of the country and were mainly used for coffee production. However, with the collapse of world coffee prices in the early 1900s, estate owners switched their interest to tea and tobacco (Mkandawire, 1999).

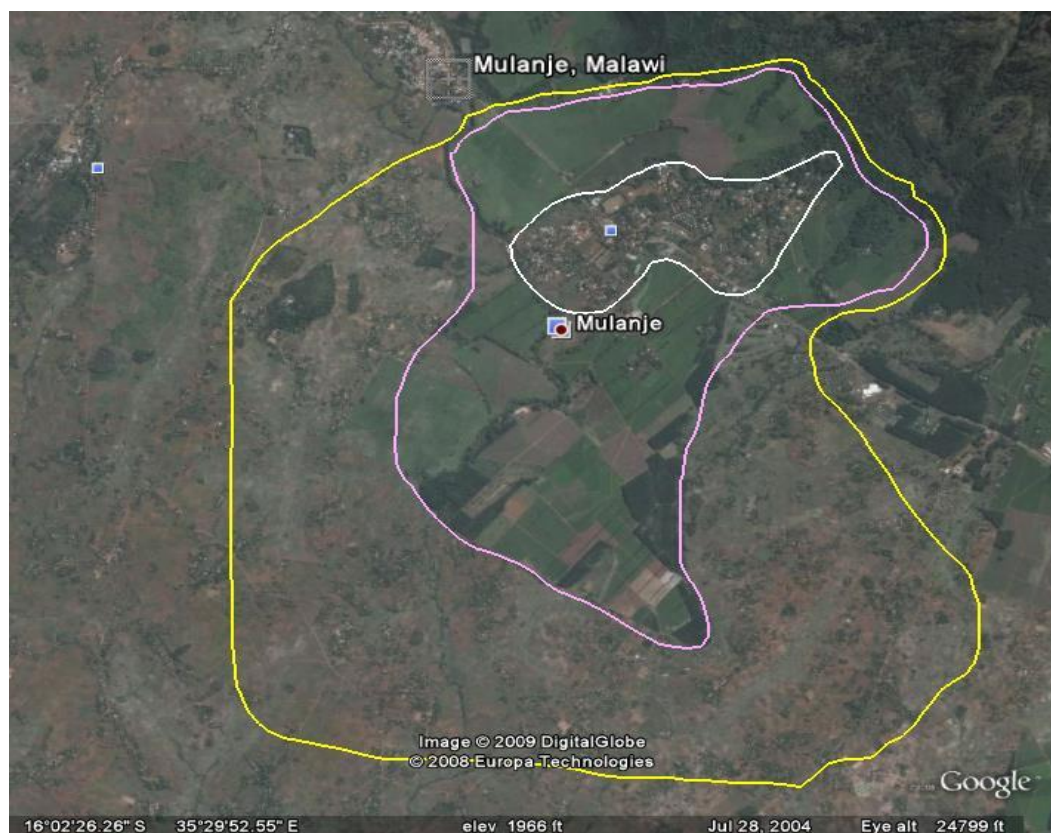
During the entire period of colonial rule, much of Malawi's best agricultural land was set aside for the white-owned tobacco and tea estates. In most cases, these estates were strategically developed close to the market points while in some cases trading centres eventually sprouted close to these estates. The poor black Africans were, by and large, forced to settle in the customary land, which was under the jurisdiction of traditional chiefs. This development led to shortage of customary land and ignited clashes over land between European estate owners and African smallholders. To solve the conflicts, a tenancy accord was designed whereby African smallholders were required to supply labour in return for a small piece of land within or close to the European-owned estates (Mkandawire, 1999).

When Malawi became independent in 1964, it inherited the then existing land policies. The only change was that the public land was officially transferred from the colonial masters into state ownership. By the end of 1969, some of the state-owned land and a better part of the customary land were leased to Africans, mostly government ministers, for the establishment of the tobacco estates especially in the central region. This worsened the problem of land scarcity, however, no one dared to complain or resist publicly because such an act would not be condoned under the iron-fist rule of the first President of Malawi.

Leasing of the arable land to the politically connected and financially powerful elites continued until 1994 when the first multi-party, democratically elected government was ushered in. However, this did not necessarily affect the distribution of land amongst different groups in the country. Currently, through

‘money votes’, the best agricultural land is largely owned by the well-off households while the poor squat in the remote areas usually far away from the strategic market centres. This scenario is largely the same across the country but is more pronounced in the south followed by the centre where most commercial farming of tea and tobacco takes place. Land distribution in Malawi can therefore be summarized as shown in Figure 6.3 below which samples land distribution in central Mulanje District as depicted by Google Earth in 2009.

Figure 6.3: Land value and market access in Mulanje, Malawi



Source: Google Earth (2009)

As it can be seen from the picture above, the central point of Mulanje district, in a white inner circle, is surrounded by commercial tea estates shown by a purple circle. Outside the tea estates, especially in the southern and western parts of the estates, reside smallholders who largely eke out their lives by providing manual labour in the estates. Land further outside the yellow line is occupied by similarly poor or even poorer households.

The scenario in the picture above strongly reflects the von Thunen model with regard to the fact that price determines which groups of people or firms occupy which particular piece of land. Land closest to the market centre is owned by the rich (highest bidders) while the poor occupy land further away, usually in the remote areas. However, unlike as expected from the von Thunen model, the picture in Figure 6.3 indicates that in Mulanje poverty is not strongly correlated with forest. Much of the land occupied by the poor is largely bare with patches of shrubs that can hardly be described as forest⁴⁸. This is true for Malawi in general. While in some parts of the country, particularly in the northern region, the poor are more likely to live close to forests (Sunderlin et al., 2008), most poor people, especially from the south and centre, occupy remote deforested land.

The above situation can be summed up by the Malthusian theories as follows: the higher the population density, the less the forest (Adger et al., 2001). In other words, bare remote areas symbolize disappearing forests due to increasing rural poor population. In Malawi, rapid population growth is a huge socio-economic problem. Culturally, “children confer status on their parents and ... provide both a form of risk insurance in an uncertain environment and an investment in old-age security”(Cohen, 2000, p. 846).

Currently, Malawi’s population growth rate is 2.7 percent per annum and population density stands at 139 persons per square kilometre. These statistics are conspicuously amongst the highest by sub-Saharan Africa standards whose average population growth rate and density are 2.4 percent per annum and about 30 persons per square kilometre, respectively (UNDP, 2010; World Bank, 2011c). Mulanje, like the rest of the southern region, and some other parts of the central region of the country have very high population densities as shown in Table 6.1 below.

⁴⁸ The most widely-accepted definition of ‘forest’ is that of FAO (2005), which considers a forest to be any piece of land with greater than 10 percent cover of trees over 5 metres high.

Table 6.1: Population distribution and density in Malawi (1977-2008)

	Total population			
	1977	1987	1998	2008
Malawi	5,548,000	7,989,000	9,934,000	13,067,000
Northern region	649,000	912,000	1,234,000	1,699,000
Central region	2,144,000	3,111,000	4,066,000	5,491,000
Southern region	2,755,000	3,966,000	4,634,000	5,877,000
	Population density			
Malawi	57	85	105	139
Northern region	24	34	46	63
Central region	60	87	114	154
Southern region	87	125	146	185

Source: National Statistics Office (2008b)

As pointed out above, high population density is closely associated with deforestation. Table 6.2 below shows the decline in Malawi's forest cover from 1990 to 2010.

Table 6.2: Forest area statistics for Malawi 1990-2010 ('000 hectares)

Year	1990	2000	2005	2010
Total land area	9,408	9,408	9,408	9,408
Forest and other wooded land	3,896	3,567	3,402	3,237
Primary	1,727	1,330	1,132	934
Modified natural	2,037	2,057	2,067	1,938
Productive plantation	132	180	204	365

Source: (FAO, 2012)

From Table 6.2, between 1990 and 2010, Malawi lost about 16.9 percent (659,000 ha) of its forest and other wooded land. The greatest loss was experienced in the primary forest area in which 45.9 percent (793,000 ha) were lost. Although the modified natural forest area registered some slight increase between 1990 and 2005, over the following years up to 2010, the sector experienced a decline in its forest cover. The total loss in forest and other woodland cover between 1990 and 2010 was offset by steady increases in

productive plantation. The sector's forest cover improved by 176.5 percent (233,000 ha) between 1990 and 2010. High deforestation rates in primary forest areas – usually unprotected forests next to customary land – suggest that most of the deforestation that takes place in the country is as a result of conversion of forest land into other activities.

According to Sunderlin et al., (2008), Fisher (2004) and Tobin & Knausenberger (1998), in Malawi the deforestation rate is highest in the southern region of the country due to conversion of the forest land into subsistence agriculture particularly by the poor households most of whom are landless. This suggests that, if it were not for high population growth and density, most of the poor in Malawi would be living in or near forested areas.

6.4 Agricultural production and deforestation

A number of studies have been conducted on the causes of deforestation in Malawi. French (1986) attributed the problem of forest clearing to population pressure which was said to be forcing people to clear forest land for agriculture and fuel wood. The study was basically descriptive focusing on reviewing and interpreting the fuel wood prices and reforestation data estimates from the Department of Energy Studies Unit in the Ministry of Forestry and Natural Resources. He concluded that the problem of deforestation in Malawi was unstoppable and recommended that it was “necessary to abandon further talk of reversing deforestation” (p. 537).

However, contrary to French's recommendation, Hyde & Seve (1993) designed an econometric model to examine the attitude of smallholder farmers towards reforestation. On the demand side of the model were prices of wood products, income elasticity, the population growth rate, the growth rate of income per capita, and the rate of technical change as the main explanatory variables. The supply side was explained by the price elasticity of supply which comprised the stock of standing indigenous and planted forests. Their model projected that at

some price, annual demand for and supply of forests would be equal and this would entail sustainability in the forest cover. Their simulation results indicated that the forestry sector in Malawi was extraordinarily resilient such that slight increases in wood prices would spark large increases in reforestation. They therefore predicted that while conversion of forests into agriculture was likely to continue, deforestation would cease to be an issue within a decade due to reforestation.

Another major study on deforestation was carried out by Place & Otsuka (2001) by employing aerial photos in conjunction with field studies conducted in 57 communities across the country. Their econometric results did not support the prediction of Hyde & Seve (1993) regarding the sustainability of forest cover as they found very little evidence of sustainable tree planting in Malawi. However, just like Hyde & Seve (1993), they found that conversion of forests into agriculture was the major cause of deforestation. In the same year, Minde *et al.*(2001) investigated the causes of deforestation in Malawi through a household survey conducted in three study areas one from each region.

The survey was supported by a regression analysis based mainly on macroeconomic data which included producer prices, real wages, population and the presence of refugees from Mozambique. Price of agricultural inputs was also acknowledged as an important factor in explaining deforestation. Just like the other highlighted studies, Minde *et al.*(2001) concluded that conversion of forest land into agriculture was the main cause of deforestation. Most recent studies that reflect the conversion of forest land into agriculture as the major source of deforestation in Malawi include that of Walker & Peters (2007) and Mwase *et al.*(2007) in which the former employed the remote sensing technique focusing on Zomba and Kasungu Districts while the latter used a field survey in six sites from the Shire highlands.

Studies on the causes of deforestation as reviewed above can therefore be summarized by the following equation:

$$Def = f(p_i, q_i, A, w, pop_j, y, f) \quad (6.7)$$

where *Def* is deforestation, p_i denotes producer prices in agricultural industry i , q_i is agricultural input prices in industry i , A is technical change, w stands for real wages, pop_j is population growth and density in region j , y is income per capita, and f is price of fuel wood. The explanatory variables in equation (6.7) are by no means exhaustive; however, they capture most of the important variables that standard econometric models tend to incorporate. The first four variables deal with factors that are associated with the expansion of agricultural land while the remaining variables look at non-agricultural factors. Therefore equation (6.7) can be re-written as:

$$Def = f(Agr, Nagr) \quad (6.8)$$

where ***Agr*** stands for agricultural factors and ***Nagr*** stands for non-agricultural factors, with the former set of factors being the central cause.

From the findings of the above discussed studies, it is apparent that deforestation in Malawi is mainly explained by agricultural factors. This being the case, it can be stipulated that the deforestation function mimics the demand for agricultural land expansion function hence deforestation is expressed as:

$$Def \approx f(p_i, A, q_i, w) = f(Agr) \quad (6.9)$$

The downside of equation (6.9) is that deforestation is explained indirectly via the factors that determine the demand for agricultural land expansion. For instance, it is usually assumed that the increase in prices of cash crops, such as tobacco and pulses, would lead to smallholder farmers converting more forest lands to grow the said cash crops. However, this might not always be the case because in most

cases the poor that are engaged in growing cash crops tend to be those that are in the upper income quartile usually with “slightly more land on average” (Tobin & Knausenberger, 1998, p. 411) as such they may not necessarily need to deforest for agricultural expansion. On the other hand, those in the lower quartile usually with limited land tend to focus on subsistence agriculture and may deforest just for their sustainability. The other weakness of equation (6.9) is that it is very difficult to link specific crop production to deforestation. For instance, although Minde et al.(2001) found out that extra land for agriculture was acquired from forests, they were unable to specifically link individual crops, particularly maize and tobacco, to the acquisition of new land.

The above bottlenecks motivate this study. It is hypothesized that although in Malawi conversion of forest land into agriculture is the major cause of deforestation, it is not the cultivation of all crops that is responsible for deforestation; and even if this was the case, their contributions would not be the same. Unlike the studies reviewed above, this study uses changes in annual forest cover as a surrogate for deforestation, which is assumed to be explained by changes in crop land areas as explained below.

6.5 Methodology

It is assumed that the size of forest cover directly depends on agricultural land use; therefore, the model is specified as follows:

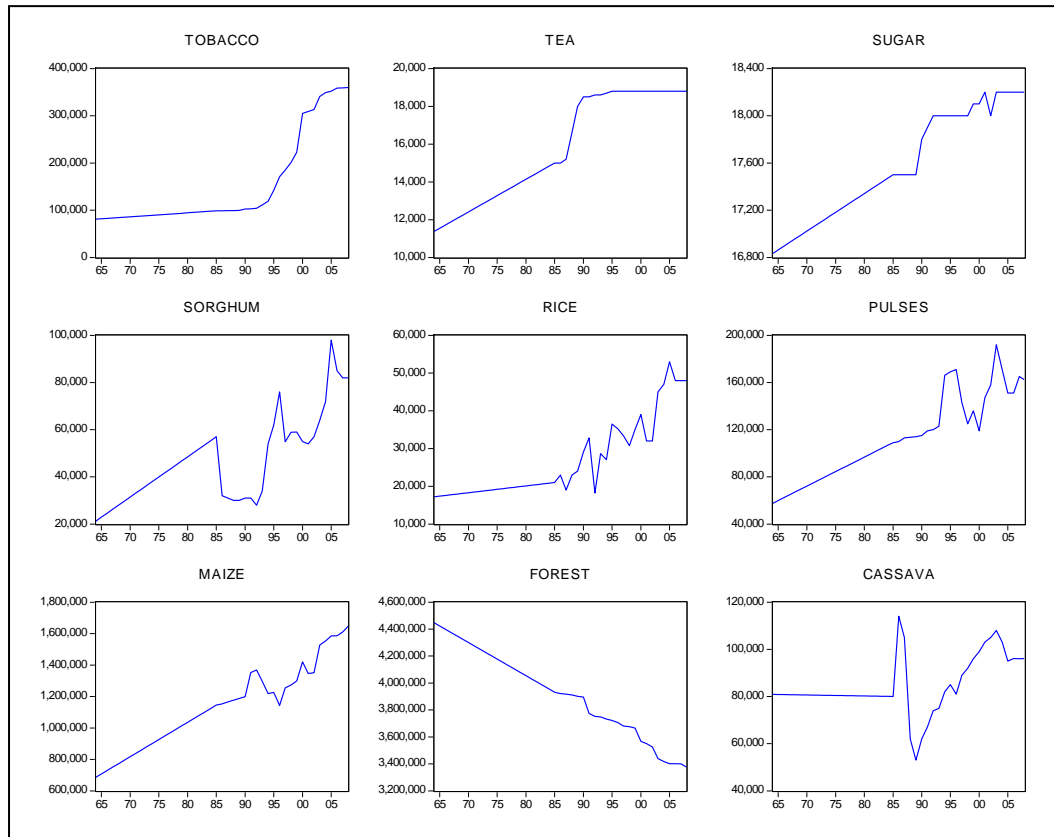
$$F = f(\mathbf{X}) \tag{6.10}$$

where, F is forest cover and \mathbf{X} is a vector of crop land areas for maize, tobacco, cassava, pulses, millet, sorghum, rice, sugar, tea and wheat. The choice of crops has been influenced by two main reasons, namely their socio-economic importance and data availability. With regard to importance, Malawi’s agriculture mainly revolves around two crops, namely maize and tobacco (see chapter one, section 1.3.2). Another important phenomenon about farming in Malawi is the

issue of inter-cropping. In most cases, legumes and other vegetables such as pumpkins are inter-cropped with maize as such they may not independently account for any land use. Considering dynamics, it is further assumed that there might be general inertia effects insofar as the current rate of deforestation might be affected by the rate in the previous period irrespective of the influences exerted by the other explanatory variables. This being the case, equation (6.10) contains a lagged dependent variable ($forest_1$) as an explanatory variable making the model autoregressive (Robinson, 1978).

Figure 6.4 below shows that changes in crop land areas are generally non-linear. For instance, cassava production experienced a steep reduction in land use between 1987 and 1990 due to mealy bugs that swiftly decimated the crop especially in the northern region of the country. During that time, other crops such as maize were substituted for cassava. The substitution was reflected in increase in land use for maize during the same period. However, land used for cassava started to register a steady increase after the pestilence.

Figure 6.4: Agricultural and forest land changes in Malawi 1964-2008 (ha)



Data source: National Statistics Yearbook (various), FAO (2005) and World Bank (2008)

Drought patterns that have frequently hit Malawi since 1990, largely explain the erratic land use for most crops such as sorghum, rice, maize and pulses. However, land use for cash crops such as tobacco and tea appear to be relatively steadier than is the case with subsistence farming, implying that there are factors other than rainfall that explain land use for cash crops. These factors may include changes in the international prices of these crops. In general, with respect to time, land uses for most crops seem to be increasing much faster than changes in time as such deforestation is expressed as an exponential function as follows:

$$F = AX^{\beta_i}e^{\mu} \quad (6.11)$$

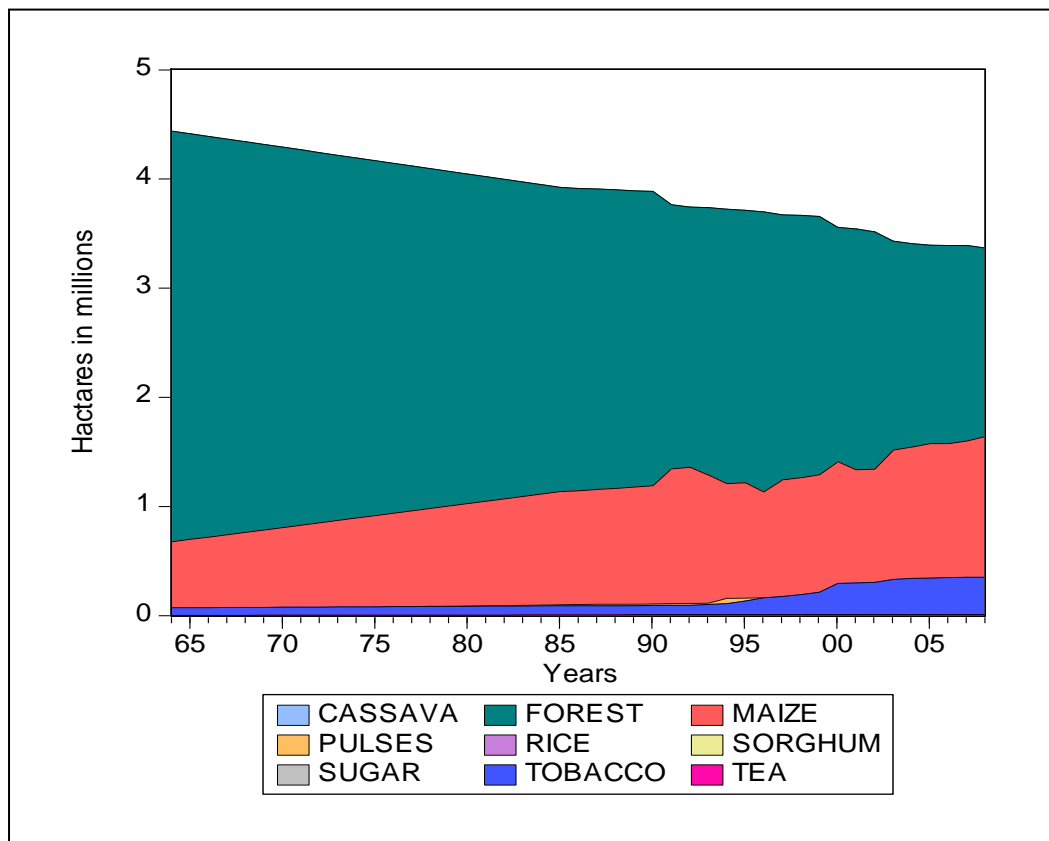
Taking the natural log of equation (6.11) and considering deforestation as change in annual forest cover, the following equation is realized:

$$Def = \Delta \ln F = \ln A + \beta_i \Delta \ln X + \mu \quad (6.12)$$

where A is a constant, β_i stand for the respective coefficients of the explanatory variables, μ is the error term and Δ signifies change.

Generally, the β_i , which can be interpreted as elasticities⁴⁹, are expected to be negative for most changes in crop land areas. In particular, changes in land areas for maize and tobacco are likely to have negative effects on the changes in forest cover. This hypothesis is supported by Figure 6.5 below.

Figure 6.5: Relationship between forest cover and crop land use



⁴⁹ These elasticities indicate the responsiveness of forest cover to changes in land use for a particular crop.

As suggested by the graph above, land used for maize cultivation has steadily increased since 1964. Arguably, with limited technological advancements, the additional land allocated to cultivation of maize is achieved through conversion of forests into agricultural land (Lufumpa, 2005). Similar trends have occurred in the cultivation of tobacco, albeit in smaller scales compared to maize. However, for some crops such as sorghum, cassava and pulses the β_i may have either positive or negative signs due to two reasons. Firstly, smallholder farmers may use part of the already cultivated land and fallows to grow these other crops. Secondly, even if growing these crops would require converting forest land into agriculture, they are grown on relatively small scale such that their impact on forest change may be negligible.

In Malawi, tea is almost entirely cultivated by the wealthy estate farmers while sugar is grown by a corporate organization (Illovo Sugar Corporation) and in both cases high technology is employed. While the main focus of this study is on deforestation arising from agriculture as practiced by the poor farmers, including tea and sugar into the model partly helps to test the hypothesis of whether wealth driven agriculture has an effect on deforestation.

Rice, which acts as both cash and subsistent crop, is mainly grown in the wetlands (*dambos*) and it may not have an immediate and direct impact on deforestation. However, its cultivation acts as a competitive substitute for maize crop that is cultivated in the *dambos* particularly during the dry seasons. The expansion of land for rice may therefore displace *dambo* maize crop. This would imply that farmers may decide to convert some forest land to grow more of the *rain-fed* maize crop as a replacement mechanism.

6.6 Sources of data and regression analysis

Data on the crop land areas were compiled from the National Statistics yearbook (various issues) and the FAO (2005, 2012) both of which are on-line. Time series data on forest cover in Malawi are not readily available. So far, there are only

three estimates on forest cover for the years 1990, 2000 and 2005 as provided by the World Bank (2008b). However, according to Mwase et al., (2007), in 1964, land was demarcated into state-owned (public), leased and customary land and at that time nearly half of the customary land was forest cover. Based on these statistics, the rest of the data (1964-2008) were estimated using the cubic spline interpolation utility as developed by Kahaner *et al.*(1988). This interpolation is performed by fitting a piecewise function of the following form:

$$P(y) = \begin{cases} p_1(y) & \text{if } y_1 \leq y \leq y_2 \\ p_2(y) & \text{if } y_2 \leq y \leq y_3 \\ \vdots & \\ p_{n-1}(y) & \text{if } y_{n-1} \leq y \leq y_n \end{cases} \quad (6.13)$$

where, p_i ($i = 1, 2, \dots, n - 1$) is a third degree polynomial which can be defined as follows:

$$p_i(y) = \alpha_i(y - y_i)^3 + \beta_i(y - y_i)^2 + \delta_i(y - y_i) + d_i \quad (6.14)$$

where, α , β and δ are coefficients; d is a constant; y represents the numerical data and the rest are as defined previously.

6.6.1 Unit root tests

Before carrying out the regression analysis, the study first carries out unit root tests to determine whether the variables in this model are stationary or not. The problem of non-stationary variables is that they tend to lead to unauthentic regression results. For instance, the results might indicate a statistically significant link between variables while, in reality, this is a mere reflection of simultaneous association. We therefore employ the Augmented Dickey Fuller (ADF) tests to investigate for the presence of unit root. Generally, the ADF model is formulated as:

$$\Delta y_t = \alpha + \rho y_{t-1} + \sum \delta_j \Delta y_{t-j} + \varepsilon_t \quad (6.13)$$

where α is a constant, ρ and δ are coefficients, j is the lag order of the autoregressive process and ε is the error term. The test is conducted under the null hypothesis $\rho = 0$, i.e., that the variable, y_t has a unit root. Table 6.3 below shows results of the OLS unit root tests.

Table 6.3: Results of the unit root tests

Variables	Augmented Dickey-Fuller test statistic	
DLOG(FOREST)		-6.722747
DLOG(SUGAR)		-7.947027
DLOG(SORGHUM)		-5.759771
DLOG(PULSES)		-5.578369
DLOG(RICE)		-6.155757
DLOG(CASSAVA)		-7.159079
DLOG(TEA)		-4.404410
DLOG(TOBACCO)		-3.921366
DLOG(MAIZE)		-6.908853
Test critical values (MacKinnon, 1996):	1% level	-3.600987
	5% level	-2.935001
	10% level	-2.605836

When compared with the ‘MacKinnon (1996)’ critical values, the results indicate that all the variables are stationary therefore, a regression analysis is carried out whereby the model is specified in its level. However, if a number of variables had proven to be non-stationary then the route of co-integration analysis would have been taken.

6.6.2 The OLS regression results

Traditionally, a conventional ordinary least square (OLS) regression technique could be employed to estimate the above model. However, given that the model is autoregressive, contemporaneous correlation between the error term and the lagged dependent variable is suspected. In this case, standard errors would be biased.

In view of the foregoing, in addition to the conventional OLS, the model is calibrated using a Newey-West estimator that produces heteroskedasticity and autocorrelation consistent (HAC) standard errors (Newey & West, 1987). These standard errors are reportedly more robust than the ones obtained from the classical OLS technique. Although the Newey-West approach leads to changes in the coefficient standard errors of an equation, their point estimates do not change. Results are as indicated in Table 6.4 below with HAC-adjusted standard errors, t-statistic and probability appearing in parentheses.

Table 6.4: OLS regression results

Dependent Variable: DLOG (FOREST)

Sample (adjusted): 1966 2008

Included observations: 43 after adjustments

HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.000)

Variable	Coefficient	Std. Error	t-Statistic	Probability
DLOG (MAIZE)	-0.154	0.018 (0.031)	-8.466 (-5.001)	0.000 (0.000)
DLOG (TOBACCO)	-0.036	0.010 (0.011)	-3.512 (-3.131)	0.001 (0.004)
DLOG (CASSAVA)	-0.003	0.009 (0.007)	-0.347 (-0.456)	0.731 (0.651)
DLOG (PULSES)	-0.024	0.008 (0.005)	-2.954 (-4.730)	0.006 (0.000)
DLOG (RICE)	-0.002	0.005 (0.004)	-0.482 (-0.598)	0.633 (0.554)
DLOG (SORGHUM)	-0.007	0.005 (0.003)	-1.364 (-1.989)	0.182 (0.055)
DLOG (SUGAR)	0.197	0.184 (0.156)	1.069 (1.262)	0.293 (0.216)
DLOG (TEA)	0.003	0.053 (0.046)	0.055 (0.065)	0.956 (0.949)
DLOG (FOREST_1)	0.195	0.111 (0.103)	1.760 (1.892)	0.088 (0.067)
C	-0.0004	0.001 (0.002)	-0.271 (-0.252)	0.788 (0.802)

R-squared	0.75
Adjusted R-squared	0.69
F-statistic	11.35
Durbin-Watson stat	2.26

The overall performance of the model can be described as good. The adjusted R-squared indicates that the variables in this model explain 69 percent of deforestation in Malawi. The F-statistic at 11.4 suggests that the model fits quite well. Finally, the D-W statistic, which tests for the presence of first order serial correlation, indicates that the error terms are not serially correlated. This implies that the estimates of the standard errors are correct therefore any statistical inferences made for the coefficients can be said to be valid and reliable.

Results indicate that the effects of changes in land use for maize, tobacco and pulses are statistically significant at 1 percent level. In particular, a 1 percent increase in land for maize, tobacco and pulses will respectively lead to 0.15 percent, 0.04 percent and 0.02 percent decline in forest cover. Forest_1 is statistically significant at 10 percent level. This confirms the hypothesis that there might be general inertia effects to the extent that the current rate of deforestation is affected by the rate in the previous period. Although sorghum is statistically insignificant under the classical OLS technique, it is statistically significant at 10 percent level under the Newey-West approach. In particular, a 1 percent increase in land for sorghum leads to 0.01 percent decline in forest cover. The rest of the crop land changes have no effect on deforestation and are therefore not discussed except for tea and sugar.

Regression results have two important implications. Firstly, they confirm the findings of most previous studies that agricultural land expansion explains much of the deforestation that occurs in Malawi. As envisaged by Minde et al.(2001), results in this study have established that indeed cultivation of maize and tobacco is responsible for much of the deforestation in country with the former being the primary causative agent. Secondly, it has been illustrated that cultivation of pulses is also responsible for deforestation in the country. This is important because traditionally studies on agriculture-led deforestation have largely revolved around two main suspects, namely maize and tobacco. However, findings in this study may act as an eye opener to the fact that other crops that

have usually been overlooked have the potential to harm the environment through deforestation.

The estimated coefficients of tea and sugar are both statistically insignificant implying that there is no correlation between these two crops and deforestation. In other words, by employing technologically intensive agricultural methods, producers of tea and sugar have been able to increase yields without necessarily increasing the crop land area. The contrast regarding effects on deforestation of maize (dominated by poor smallholders) and tea and sugar (dominated by rich estate owners) connotes the following.

First, it is not necessarily particular crops but rather the poverty behind the cultivation of these crops that has a major impact on deforestation. As indicated earlier, poor farmers tend to rely on low-productivity subsistence farming. So with limited technological advancements, agricultural production can only be increased by converting forests into agricultural land. Therefore, smallholder farmers need to be encouraged and supported to use modern technology in their farming activities. The fertilizer subsidy programme can be cited as an example (see, Bandyopadhyaya *et al.*, 2011).

Second, there is the issue of how the crop is cultivated. Smallholder farmers do not just need the fertilizer subsidy (for example) to improve their agricultural productivity. They also need to adopt improved farming methods which may involve things like crop rotation, irrigation, weeding and pest control. As indicated earlier in chapter four (section 4.4), according to USAID (2007), with proper husbandry and improved maize varieties, Malawi has the potential to increase its current average yield of about 1,500 kilograms per hectare towards the potential yield of 10,000 kilograms per hectare. This could lead to not only improvement in food production but also reduction in deforestation. In the following section, other ways that can be employed in order to help reduce pressure on forest land are briefly discussed.

6.7 Further discussion on deforestation: Enhancement of property rights and the rule of law

As suggested in Table 6.2 above, deforestation in Malawi takes place mostly in the primary forests. These forests are usually close to customary land and have minimal or no access restrictions. Primary forests are therefore prone to conversion into agricultural land by farmers that are short of land. The depletion of primary forests is also exacerbated by the need for firewood by households living near the forests and, in some cases, wanton cutting of trees and bush-fires. This being the case, it is imperative to ensure that people living close to forest lands particularly smallholders are involved in reforestation (Hyde & Seve, 1993). However, one key question worth addressing is: how can policy makers encourage the rural poor to get involved in reforestation? Answers to this question mainly revolve around property rights and the rule of law. Studies have shown that strength of property rights and enhancements of the rule law tend to be strong explanatory variables in regressions that are drawn to explain deforestation (Deacon, 1994; Pichon, 1997; Southgate *et al.*, 1991).

It is generally argued that the way in which people make use of ecological resources is largely explained by the property rights that preside over those resources. “In economics, *property rights* refers to a bundle of entitlements, privileges, and limitations defining the owner’s rights to use a resource.” An efficient structure of property rights encompasses “universality..., exclusivity..., transferability... *and* enforceability”⁵⁰ (Tietenberg, 1998, p. 37).

In section 6.1, it has been shown that in most poor countries forested areas can be categorized mainly into two, namely government protected residual forest and common property forest with the latter being heavily exposed to extensive

⁵⁰ According to Tietenberg (1998, p. 37), universality implies that “all resources are privately owned and all entitlements are completely specified.” Exclusivity means that “all benefits and costs accrued as a result of owning and using the resources should accrue to the owner, and only to the owner, either directly or indirectly by sale to others.” Transferability implies that “all property rights should be transferable from one owner to another in a voluntary exchange.” Finally, enforceability entails that “property rights should be secure from involuntary seizure or encroachment by others.”

subsistence farming. The downside of open access to forest land is that people tend to act short-sightedly with little or no regard to the negative externalities of their actions on a third party. In addition, they hardly take responsibility to manage let alone replenish the used resources (Gordon, 1954; Schaefer, 1957). It is therefore important to ensure that farmers, especially the poor, cultivating plots on customary land are granted permanent ownership. This would give smallholders the incentive to consider the issue of reforestation more seriously than is the case today. There is a general consensus amongst researchers and policy makers that secure land tenure encourages farmers to make investments in their land, such as planting or maintaining trees (Place & Otsuka, 2001; Tiffen, 1996).

However, private property ownership would be largely meaningless if there is poor or lack of enforcement of property rights. Many poor countries are characterised by poor law enforcement mainly due to lack of human and financial resources. In many other cases, corruption and general breakdown of the rule of law have often encouraged the politically powerful elites to arbitrarily confiscate the poor's endowments such as landholdings and products. Such cruelty tends to discourage poor farmers from investing in any meaningful agricultural productivities including standing forests (Mendelsohn, 1994). The establishment of strong institutions in areas of law and education are therefore very important not only to protect the poor but also to ensure that they act responsibly with regard to deforestation and reforestation.

6.8 Chapter summary

This study was carried out with an aim of developing a better understating of the extent to which cultivation of particular crops contributes to deforestation in Malawi. This understanding is crucial in helping policy makers to come up with policies that can strike a balance between poverty and deforestation. Cultivation of maize, dominated by poor smallholders, is found to be the primary causative

agent of deforestation in Malawi while tobacco and pulses stand at second and third positions, respectively.

It is recommended that smallholder farmers should adopt improved farming techniques and technology in order for them to produce more output from less land areas. In addition, there is a need to ensure that farmers, especially the poor, cultivating plots on customary land are granted permanent ownership. This would give smallholders the incentive to consider the issue of reforestation more seriously than is the case today.

CHAPTER SEVEN

CONCLUSIONS

Malawi's agriculture is dominated by maize and tobacco which together cater for about 80 percent of the cultivated land. Since independence in 1964, the government of Malawi has implemented a number of agricultural policy reforms particularly in these two sectors. These reforms have been implemented mainly to drive agricultural sector development and reduce poverty especially in the rural areas. In particular, agricultural policy reforms in Malawi have been designed with four key objectives:

- (a) To improve smallholder prices particularly in the tobacco sector.
- (b) To increase income for the poor especially in the rural areas.
- (c) To reduce income inequality between smallholders and estate owners.
- (d) To ensure food security both at national and household levels.

The main question addressed in this thesis is: 'to what extent have these agricultural reforms achieved their intended objectives?' In addition, the links between poverty and deforestation in Malawi have been examined.

Although wide-spread poverty has been an issue in Malawi for a long time, it has not been the subject of as much research as would be expected. One reason for this lack of research into poverty is that until the end of the 1980s, the government's official view was that there was no poverty in Malawi. Therefore, talking or writing about poverty in the country was regarded as unpatriotic. Some researchers who dared to write about it ended up being imprisoned. As a result, the majority of local researchers started working on the subject in the mid 1990s after the wind of democracy blew across the country. Early studies dwelt largely on the effects of the structural adjustments programmes, limiting themselves to a period stretching from 1981 to the early 1990s. This means that effects of the agricultural reforms that were introduced between 1964 and 1980 and after the early 1990s were not adequately addressed.

The above limitation has partly been addressed by a number of relatively recent studies such as Lofgren (2001), Harrigan (2003, 2008) and Doward & Chirwa (2006). Most of these studies have looked at the period stretching from the 1980s to the mid 2000s. However, some gaps still exist. For instance, apart from Lofgren, empirical analysis is largely missing in most of the studies. The key contribution of this thesis is therefore manifested through incorporation of the largely ignored period (1964-1980) and by employing empirical analyses. By synthesizing various econometric and optimization techniques, this thesis has been able to take into account the multifaceted nature of poverty and the complex interrelationships of different players in the economy. Linking poverty with deforestation is another unique example that sets this thesis apart from the rest.

As indicated above, four key objectives have been identified with Malawi's reforms in the maize and tobacco sectors. In the case of tobacco, policy makers felt that positive reforms in the tobacco sector would have far-reaching income benefits given that tobacco is the chief cash crop in the country. In addition, between 1964 and 1989, smallholders were not allowed to grow the lucrative burley and flue-cured tobacco. Reviewing such restrictive policies was therefore deemed as the best way to ensure that smallholders actively partake and benefit from the socio-economic growth of the country. Starting from 1990, smallholders were allowed to grow burley tobacco. This was followed by promotion of competition and ensuring that smallholders got favourable prices on the market. In this study, it is illustrated that over time such reforms have indeed led to some improvements in both absolute and relative domestic prices that smallholders get.

However, improvements in the net producer prices have not translated into sustainable reductions in income inequality between smallholders and estate owners. The income gap between small and large tobacco growers decreased with the introduction of competition (1995-2001). However, over the last few years (2002-2008), it has once again increased, albeit less than it was between 1990 and 1994.

It is also noted that smallholders face high transaction and logistics costs which have a negative effect on their net pay. Reduction of such costs is therefore recommended. One way to reduce the transaction and logistics costs is to allow/encourage Auction Holdings Limited (AHL), the only licensed seller of tobacco, to develop satellite auction floors in various parts of the country. This could greatly reduce the storage and transportation costs that smallholders are currently facing.

Finally, the anti-smoking campaign is being intensified particularly in the developed world. These trends should be regarded as warning shots that Malawi needs to seriously take into consideration. Malawi has had negligible success in diversifying its exports away from tobacco during the past forty five years. For instance, the share of tobacco in total domestic exports was planned to fall below 50 percent starting from 1981. Instead, it rose from 47.4 percent during 1980-83 to 64 percent in 1988 and to 70 percent by 1998 (Mkandawire, 1999). Today, tobacco remains the chief foreign exchange earner for Malawi accounting for more than 70 percent of agricultural exports. Relying on tobacco as the only tool for Malawi's economic growth and poverty reduction may not be sustainable in the long run. Therefore, there is a need to diversify to other crops such as cotton, pulses, cassava, and bananas.

In the case of the maize sector, the primary concern has been food security both at national as well as household level. In the 1990s, improvement in the distribution of household income and poverty reduction, particularly at rural household level, were added to the original objective of food security. In general, policy interventions in the maize sector have largely revolved around fertilizer subsidies.

In chapter four, the impact of maize fertilizer subsidies on the country's food security is analysed. A relatively strong correlation between fertilizer subsidies and food security is identified at national level. However, this correlation fails to hold at household level especially in the southern region of the country. Although

over the last decade it has been the major beneficiary of fertilizer subsidies, the southern region has had the highest number of households that are food insecure. Unfortunately, food insecurity in the region occurs even at times when the country produces maize above the national requirement.

In 2010, for instance, at national level, Malawi recorded maize surplus of 1.2 million metric tonnes. But at the same time, many households in the southern region experienced acute food shortages. The situation was so bad that it even attracted the attention of the international community. For instance, the British Secretary of State for International Development, Andrew Mitchell, in his letter to President Bingu wa Mutharika, wrote:

Malawi's economy has grown well in recent years, and good progress has been made on maize production and against some of the MDGs. But...I was disappointed with the Government's slow and limited response to the hunger faced by many families in Southern Malawi...This weak response undermines the Government's very positive record in improving food security at the national level (Nyasa Times, 2011, May 19).

Mitchell's argument highlights a very important point that there is a need for Malawi to prioritize food security at household level. This is because with household food security, it is easy to achieve national food security and not necessarily the other way round.

As discussed in section 4.5, poor infrastructural development is one major reason for skewed household food distribution in the country. The high cost of transport is reported to be the major cause of high and differential maize prices in the country due to poor road network. Therefore, one way to improve food security at household level is to ensure that the road network is well developed in the country. This can easily facilitate interregional trade especially between the southern region on the one hand and the central and northern regions on the other. Stable maize prices can also be achieved by constructing maize depots particularly in areas where production is constrained. These would be similar to

depots that were developed by the then state-owned ADMARC from the early 1970s to the mid 1990s. However, this time around, the government may encourage local farmers' clubs to run the maize depots. This could be much less costly than if they were left in the hands of profit oriented private enterprises.

Although encouraging all poor smallholders to cultivate maize seems to be a good policy option particularly with regard to household food security, promoting specialization might be better. With proper incentives such as commercialization, the estate sector, especially in the centre, appears to be capable of producing enough maize to feed the entire country. Commercialization could promote local investment, create jobs and save a lot of foreign exchange that the government spends on fertilizer subsidies.

Even if focusing on the estate sector might not be a good option for the government, near-universal fertilizer subsidies (for all smallholders) is a very inefficient way of using scarce government funds. Some places are not conducive for maize production so providing them with the subsidies tends to have limited results. There is a need to focus on areas (or regions) that have comparative advantages in maize production. Areas where maize cultivation is hampered should be utilized for other economic activities. For instance, the government can encourage smallholders to cultivate other exportable cash crops that do well in places where maize fails. People in these areas can also be encouraged to invest away from agriculture into small-to medium scale businesses.

In chapter five, the extent to which fertilizer subsidies have helped to increase household income and reduce income poverty was explored. Simulation results suggest that the subsidies lead to small increases in income of all agricultural households. Rural non-agricultural households experience reductions in their incomes while there are no income effects on metro households. For instance, at the subsidy rate of 95 percent, income increases by 3.07 percent for rural agricultural small scale households, 2.99 percent for rural agricultural medium households, 2.04 percent for rural agricultural large scale households and shows a

small reduction of -0.03 for rural non-agricultural households. Income for households in Lilongwe and Blantyre (Metro) does not change. In the case of urban non-agricultural and urban agricultural households, their income increases by 0.21 percent and 2.63 percent, respectively against a subsidy rate of 95 percent. Although urban non-agricultural households experience increases in income, such changes occur at a decreasing rate.

It is further illustrated that the subsidies help to reduce income poverty for the rural and urban agricultural as well as urban non-agricultural households. For these households (except for rural large scale households), all poverty indices, namely the headcount, gap and severity measurements register reductions. This means improvements occur not only in the proportion but also in the extent to which households fall below the poverty line. However, for the rural non-agricultural households, their poverty situation worsens while no changes occur in the case of metro households.

From the foregoing it can be concluded that maize fertilizer subsidies may help “alleviate one key symptom of poverty, namely food insecurity” (Harrigan, 2008, p. 248) but it might not necessarily reduce income poverty particularly for rural non-agricultural households. Rural smallholders may not necessarily generate enough profit to spur rural income growth let alone stop depending on the subsidies as intended by policy makers when the subsidies were reintroduced in the late 1990s. Making smallholders perpetually dependent on fertilizer subsidies is not a good policy option. Malawi needs to devise proper strategies that would create an exit window for the subsidies.

Finally, the link between poverty and the environment via agriculture has been examined in this thesis. As noted in chapter three and four, there has been a general increase in crop production especially for maize and tobacco. With limited technological advancements, Malawi’s agricultural production has largely been increased by converting forests into agricultural land. This study was therefore carried out with the aim of developing a better understating of the

extent to which cultivation of particular crops contributes to deforestation. Cultivation of maize is found to be the primary causative agent of deforestation in Malawi while tobacco and pulses stand at second and third positions, respectively.

One important thing that emerges from these findings is that it is not necessarily particular crops but rather the poverty behind the cultivation of these crops that is responsible for deforestation. This implies that cultivation of many if not all crops in Malawi has the potential of causing deforestation as long as the poor cultivate them on a large scale with limited technological advancements. This argument is justified by the fact that although tea and sugar have over time recorded increases in production, their land allocations have hardly changed. Tea and sugar, which are not cultivated by smallholders, are adequately supported by technological advancements and sustainable farming methods.

It can therefore be concluded that poor farmers need more than fertilizer subsidies to improve their agricultural productivity. They also need long term sustainable strategies. For instance, there is a need for farmers to adopt improved farming methods such as crop rotation, irrigation, timely weeding and pest control. According to USAID (2007) with proper husbandry and improved maize varieties, Malawi has the potential to increase its current average yield of about 1,200 kilograms per hectare towards the potential yield of 10,000 kilograms per hectare. This could lead to twin gains of food security and reduction in deforestation.

Lastly, it has been illustrated that in Malawi, deforestation is highest in primary forests. This is where land property rights are largely non-existent and forest lands are largely communal. The weakness of open access to forest land is that people may not take responsibility to manage or replenish the used resources. The government of Malawi needs to ensure that farmers, especially the poor, cultivating plots on customary land are granted stronger property rights. This would give smallholders the incentive to reduce deforestation and increase reforestation.

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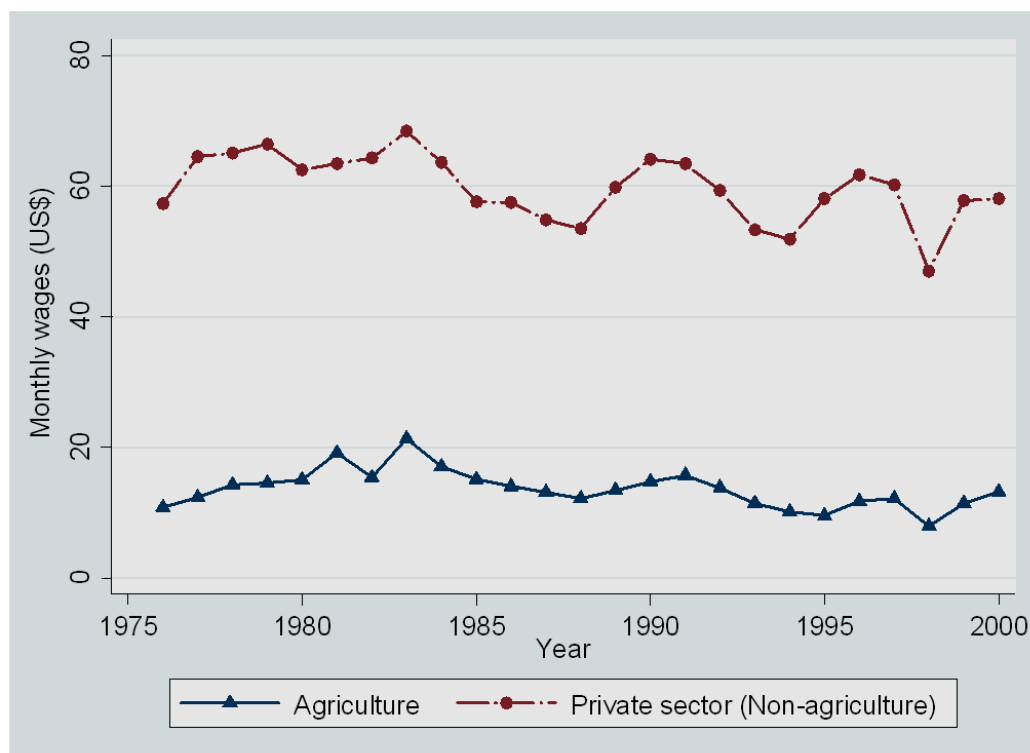
Appendix 1: Poverty reduction strategies in Malawi

As with many other African countries, poverty reduction policies in Malawi can be said to have been closely tied to the views of the World Bank and IMF. This is largely because when most African countries got their independence in the 1960s, they lacked two main resources to strategize and fight poverty, namely expertise and finance. The World Bank and IMF were – and still are – dominant purveyors of such resources. With a strong team of research economists of high technical ability, the two international financial institutions have managed to influence the attitudes of most third world countries (Hodd, 1987).

At first, Malawi had no clearly documented policy on poverty reduction, despite the overwhelming evidence of wide-spread poverty in the country. As indicated in section 1.1, up until the late 1980s, it was illegal to openly discuss or write about poverty in Malawi given the then official stand that poverty was non-existent in the country. However, silently, Malawi was all along toeing the World Bank policy line in which poverty was largely regarded as lack of income. This being the case, it was thought that the best way to reduce poverty was to increase income through economic growth.

By mainly supporting growing of lucrative exportable crops such as tobacco (Harrigan, 1991), the government believed that income accrued by the well-to-do estate owners would trickle down to smallholder peasants mainly through employment in the agriculture sector. However, much as some jobs were created and that to date the agriculture industry remains the largest employer in the country, only a small percentage of job seekers were and have been able to get employed. The majority of smallholder peasants, making up to over 80 percent of the population, are still self-employed largely growing food crops and some cash crops which usually fetch low prices on the market. Amongst the employed, the majority still lives below the poverty line. This is because generally wage rates, particularly in the agriculture sector, have been very low and have hardly improved in real terms as indicated in Figure A1.1 below.

Figure A1.1: Monthly earnings per employee in agriculture and non-agriculture private sector (US\$)



Source: Reserve Bank of Malawi (1997, 1998, 1999, 2005, 2010) and World Bank (1996)

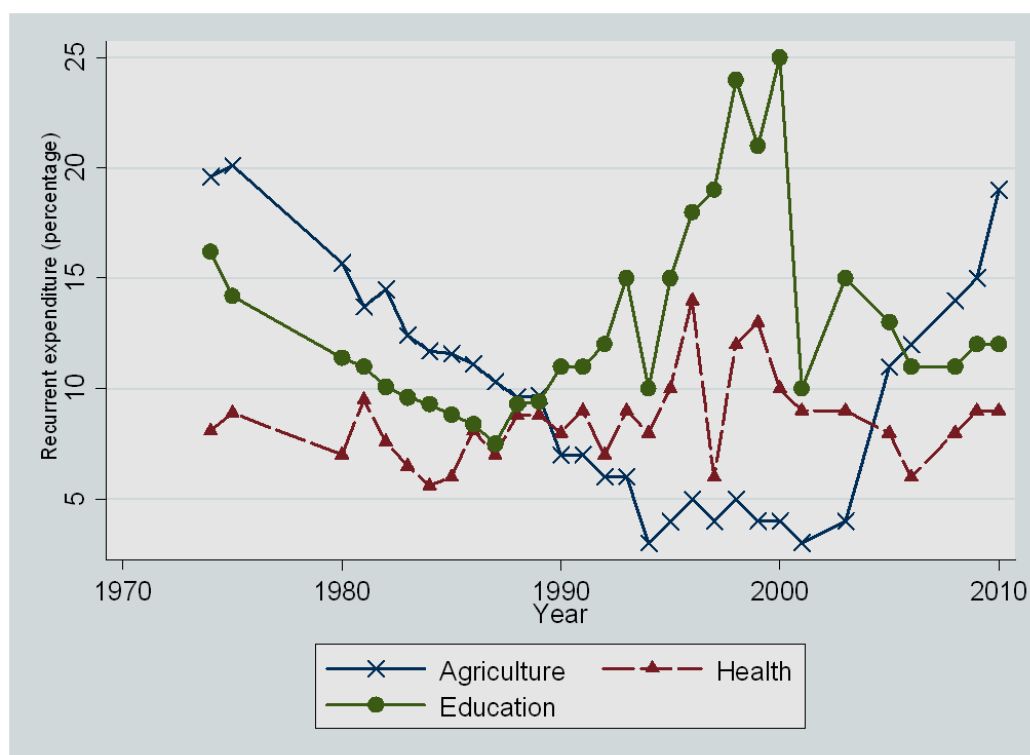
Figure A1.1 suggests that in general wages in Malawi are low but the situation is worse in the agriculture sector than in the private (non-agriculture) sector. On average, between 1976 and 2000, wages in the agriculture sector stood at 21.4 percent of wages received in the private sector. Poor wages in Malawi, are largely attributable to the Wage and Income Policy of 1969 in which no employer was empowered to increase wages without prior government approval⁵¹. It was believed that by keeping wages very low, the economy would maximize employment creation and discourage capital intensive methods of production (Mkandawire, 1999). To a great extent, the policy helped to avoid “both wage-led inflation and high rates of rural-urban migration, so providing the expanding estate sector with cheap supplies of labour” (Harrigan, 1991, p. 204). Although

⁵¹ Initially, this policy was only applicable to the public sector but was later extended to the private sector.

the policy was silently abandoned in the mid 1990s, the culture of low wages has been deeply inculcated and with rising unemployment, the situation is very unlikely to improve in the near future.

At the time when much attention was put on the agriculture sector, the social sector, especially the education sector, was accorded very low priority. The recurrent expenditure on the education sector was generally a small proportion of total government expenditure falling from 14 percent in the 1970s to below 9 percent in the mid-1980s (see Figure A1.2 below).

Figure A1.2: Government recurrent expenditure patterns on key ministries



Source: GoM (2001a, 2002, 2003a, 2004, 2005a, 2006a, 2007a, 2008a), Reserve Bank of Malawi (2010) and GoM (2001b, Chapter 3, p. 3)

Although agriculture continued to receive more attention as compared to the other sectors, there was a general decline in government expenditure in all sectors starting from the late-1970s to the late-1980s (Rose, 2003). These downward trends emanated from two fronts. Firstly, there were budgetary problems due to

domestic as well as external economic shocks that battered the country starting from 1978 (see section 1.3). Secondly, the conditionalities of the SAPs as prescribed by the IMF and World Bank called for a reduction in government total expenditure.

In relative terms, during the first two years of structural adjustment programme the education sector experienced the largest decline in government's financial support, particularly at the primary school level. This situation put the viability of primary education at great risk, so there was an urgent need to identify other sources of financing primary education in the country. In 1982, the World Bank carried out research regarding demand for primary education in the country and their findings indicated that there was excess and inelastic demand for primary school education. As a result, an immediate increase in primary school fees was recommended and implemented (Thobani, 1984). Unfortunately, contrary to the World Bank hypothesis, increase in fees was followed by a drop in enrolment by as high as 50 percent in standard one (Rose, 2003).

By the end of the 1980s, it was apparent that Malawi's general economic performance was no longer as good as it used to be in the 1970s. Contrary to the government's expectations based on predictions made by the international financial institutions, poverty was on the rise and nearly all sectors were not ticking. In particular, the agriculture sector, on which much hope for Malawi's poverty reduction had rested, was in great trouble. This marked the beginning of the search for alternative ways of fighting poverty as discussed below.

A1.1 Poverty reduction paradigm shift

The general failure of the economic growth policies to reduce poverty in poor countries, particularly in the 1980s invigorated calls to tackle poverty from a different perspective other than the income approach. From 1990 there was a paradigm shift in which social issues started to attract more attention than

economic ones. The human capital theory⁵², which was developed by Schultz (1960), was resuscitated and embraced by the international agencies such as the United Nations and the international financial institutions. As a result, ‘lack of education’ became a key word in explaining poverty in poor countries to the extent that some researchers started using the two phrases – ‘lack of education’ and ‘poverty’ – synonymously (e.g., Boateng *et al.*, 1990, p. 27). It was therefore envisaged that the best way to get rid of poverty was through promotion of basic education. Education was regarded as the vehicle that was required to advance not only economic development but also equality, participation and democracy especially in Africa.

The campaign for universal education as an escape route from poverty grew at an alarming rate so much that in March 1990 the World Conference on Education for All (EFA) was organized in Jomtien, Thailand. The conference revived the Universal Declaration of Human Rights, adopted in 1948, which declares that “everyone has a right to education.” In 1996, there was a Mid-Decade Review of EFA held in Amman which reaffirmed the commitment to the Jomtien resolutions. Later, the Dakar Conference on EFA of 2000 reviewed developments in achieving universal education with a particular focus on the African continent.

One of the major resolutions of the Dakar Conference was “eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015.” The Millennium Development Goals (MDGs) of 2000 endorsed the Dakar Conference resolutions and emphasized that by 2015, children everywhere, will be able to complete a full course of primary schooling. These resolutions were made at a time when the concern, focus and publicity on basic education had completely dwarfed other poverty indicators such as income and health. Appearing to be in favour of this development, Townsend (2002, p. 3) argued that “during the last half-century, the conventional wisdom has been that

⁵² “According to the notion of human capital, people acquire skills and knowledge which is perceived as a form of capital, and a substantial part of this acquisition is a deliberate investment. Human capital, therefore, provided education with an explicit economic value, seeing it as an important explanation for economic progress. Increased productivity as a result of education was perceived to benefit individuals as well as society as a whole” (Rose, 2003, p. 68).

poverty can be diminished automatically through economic growth. This has got to change.” These sentiments were echoed by Gordon (2002, p. 59), when he pointed out that “income is important but...education is of equal or greater importance, particularly in developing countries. These are the views of the governments of the world and poverty measurement clearly needs to respond to them.”

Soon after the EFA World Conference in Thailand, the donor community, especially the World Bank, started to insist on policies that were clearly aimed at providing basic education and elimination of illiteracy, particularly among the youth. In the case of Malawi, the World Bank made a U-turn on its earlier strong recommendation for primary school fees hike and, instead, it financially supported the government’s poverty alleviation program where free primary education was regarded as the key escape route from poverty.

Given that at that time nearly 60 percent of its total spending was donor funded, it was not surprising that Malawi started to realign its economic and social policies to suit the thinking of the donor community. There was a big shift in spending away from agriculture in favour of the social sector with education getting the lion’s share of the government’s recurrent expenditure (see Figure 3 above). Within the education sector, primary school education was the most favoured. On average, between 1994 and 2000, primary education received about 57 percent of total funding for the education sector (GoM, 2001b).

A1.2 Free primary education in Malawi: A panacea to illiteracy and poverty?

Malawi was the first African country to renounce the cost-sharing policy in the education sector. Free primary education was introduced in October 1994 following its announcement in June by the newly democratically elected United Democratic Front (UDF) Government. The seemingly hurried implementation of free primary education by the then new Malawi Government might have been

due to two main reasons. Firstly, free primary education was its main campaign tool so the government had an obligation to quickly honour its promise to the electorates in order to prove that democracy was more efficient and trustworthy than dictatorship. This would also help in safeguarding its position for the subsequent general elections. Secondly, and more importantly, free primary education was what the donor community wanted and the Malawi Government had to obey if at all aid were to be maintained. This had a great appeal to the new government because memories were still fresh regarding the way the previous government suffered when aid was withdrawn in 1992 to pave way for democracy.

Following the introduction of free primary education, enrolment rates increased by more than 80 percent. In 1993, there were about 1.6 million pupils in primary schools and the number jumped to over 3 million in 1994. However, the immediate and biggest challenges of such rapid enrolment increases were pressure on classroom facilities, insufficient qualified teachers and inadequate teaching and learning resources. By 1997, the teacher: pupil ratio had shot up to 1: 127 against the recommended national standard of 1: 60. Lack of enough classrooms meant that pupils had to learn under trees, a sad experience that continues to haunt pupils in many parts of the country. Since most pupils start primary school at the age of six, the hardships of learning in the cold, rain and wind, as indicated in Figure A1.3 below, have mostly proven to be unbearable.

Figure A1.3: Phombe primary school in Nsanje district, Malawi



Source: Concern Worldwide (2010)

Before the introduction of free primary education, teachers were required to undergo pre-career college based training for two years at any of the six primary school teacher training colleges situated in various parts of the country. However, the UDF-led government regarded such training as too expensive and lengthy to produce the desperately needed teachers at that time. It therefore closed all primary teacher training colleges and instead recruited untrained teachers most of whom lacked the required minimum educational qualifications⁵³. The basic pre-career college based training system was replaced by the Malawi Integrated In-Service Teacher Education Programme (MIITEP) which was designed to provide a maximum of four months college-based training (Kunje *et al.*, 2003). However, due to pressure and demand for teachers, only a limited number of teachers received training for at most three weeks.

⁵³ Initially, for one to qualify as a candidate for a teaching career at primary school, they were supposed to have at least Junior Certificate of Education which was attained after two years of secondary school education. However, by 1990 most candidates had Malawi School Certificate of Education, which is equivalent of British O-level. The certificate is obtained after four years of secondary school education.

By 1998, of the 39,900 primary teachers in Malawi, less than half, i.e., only 46.1 percent had been trained and by 2001, only 24,400 of the 47,800 primary school teachers had received MIITEP training. This is deplorable especially when compared with other African countries such as Mauritius where 100 percent of its primary school teachers received formal training during similar periods (EFA, 2005).

The newly world renowned route to poverty reduction through free primary education soon became too bumpy for Malawi as primary school teachers became demoralized due to poor salaries⁵⁴, poor housing and lack of teaching and learning materials. As a result, pupils also became disoriented as most of them could not receive the much needed attention from their teachers. Pupil disorientation culminated into unprecedented dropouts barely two years after the introduction of free primary education.

By 2001 the dropout rate was 20.5 percent in standard one; 6.1 percent in standard two and 15.1 percent in standard three. In standard four and five, the dropout rates stood at 14.8 percent and 21.5 percent, respectively (EFA, 2005). When asked to explain why they had dropped out of school, most respondents cited lack of interest as the main reason. According to the UNDP (2010) report, currently about 64.3 percent of the pupils quit school before they finish their primary education and based on second integrated household survey of 2005, most of primary school dropouts are from the rural poor households (National Statistics Office, 2005). This is by all means worse than the time even when primary school fees were highest in the early 1980s during which the entire primary school dropout rate was at an average of 2 percent (Rose, 2003).

Amongst pupils that satisfy the school attendance requirements, the majority of them do not acquire essential knowledge and skills. This was revealed by two rounds of studies conducted by the Southern Africa Consortium for Monitoring Education Quality (SACMEQ) in 1998 and 2002. The studies were aimed at

⁵⁴ Most teachers, especially in the remote areas could stay for several months without pay.

assessing achievement levels in reading and writing in primary schools in the south-eastern Africa region. Results indicated that pupils from Malawi had remained least performers. In addition, pupils from Malawi registered a decline of about 7.1 percent in their reading and writing scores over the same period. Classifying the Malawian situation as “something of an extreme case”, EFA (2005, p. 227) summarises the SACMEQ findings as follows:

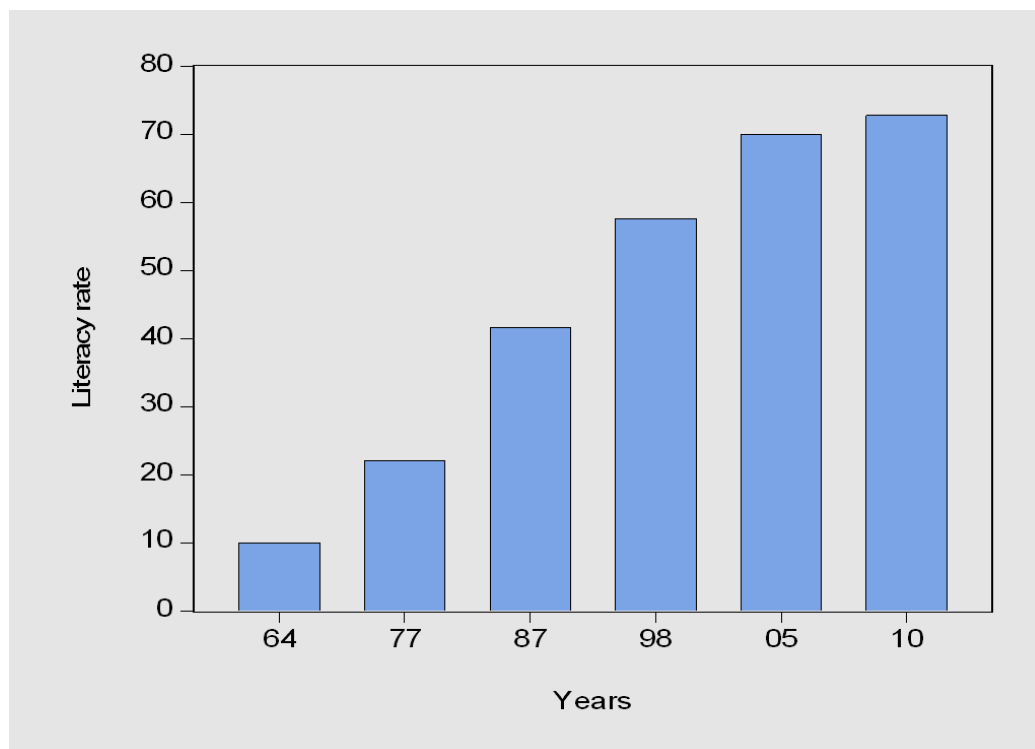
Thus, for example, in Malawi, where about 90% of children attended primary school in the mid-1990s, only about 30% stayed in school to grade 5, and as few as 7% achieved the minimum acceptable reading standards in grade 6. The fact that the NER⁵⁵ in Malawi at the time was close to 70% seems rather irrelevant to whether the average child was benefiting in a minimally acceptable way from attending primary school.

With regard to literacy rate, statistics show that the total literacy rate⁵⁶ stood at 80 percent in 2005 suggesting that free primary education has had an impact on reduction of illiteracy in the country as suggested by the national literacy rates in Figure A1.4 below.

⁵⁵ “The net enrolment ratio (NER) comes close to being an indicator of school quality because it captures the extent to which children who are in the official age group for a specific level of schooling (e.g. primary) are enrolled” (EFA, 2005, p. 16)

⁵⁶ In Malawi, total literacy rate is computed by taking into account the literacy of the population of at least 5 years of age. One is considered literate if they are able “to read and write a simple statement in Chichewa, English or any other language(s)” (National Statistics Office, 1998, p. 52).

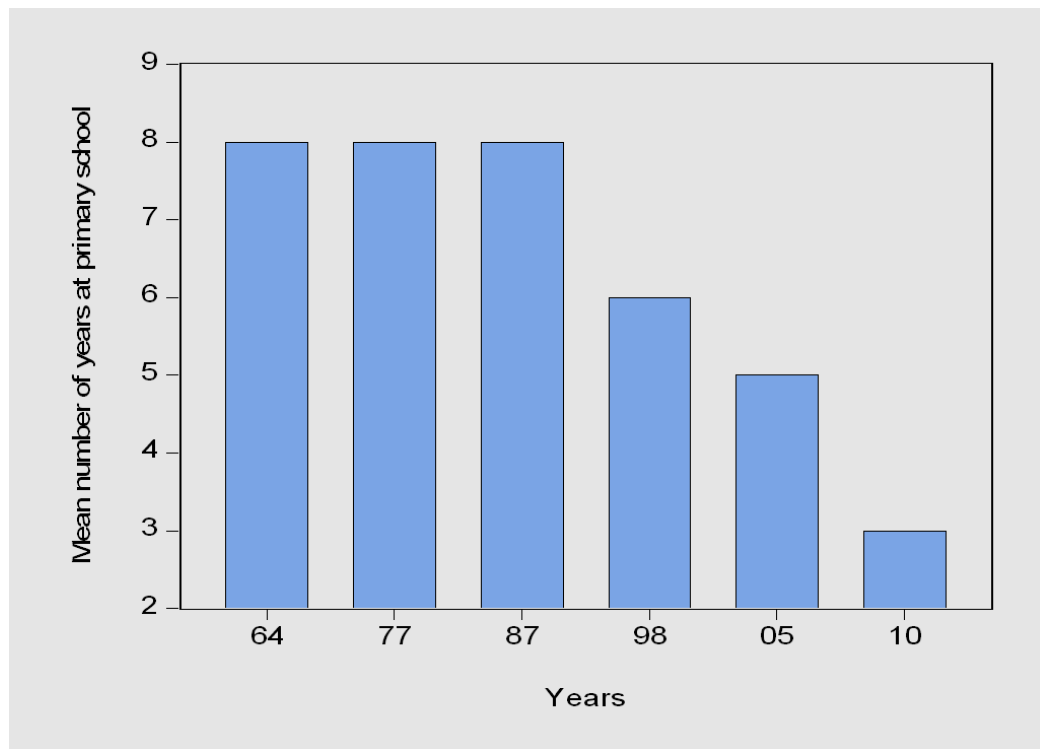
Figure A1.4: Literacy rates in Malawi (1964-2005)



Source: National Statistics Office (1998, 2005) and UNDP (2010)

Over the last four decades, total literacy rate in Malawi has increased remarkably. The highest improvement in literacy rate, according to Figure A1.4 above, occurred between 1964 and 1977; and between 1977 and 1987 where in both cases it nearly doubled firstly, from 10 percent to 22 percent; and secondly, from 22 percent to 41.6 percent. Between 1987 and 1998, it increased by 16 steps to 57.6 percent. The increase between 1998 and 2005 was by 12.4 steps to 70 percent and from 2005 to 2010, it has increased by 2.8 steps to 72.8 percent. However, from the foregoing it is difficult to attribute improvement in literacy rate to free primary education alone. In an effort to surmount this difficulty, a comparison is drawn between Figure A1.4 above with Figure A1.5 below which indicates the mean number of years a pupil spends in primary school.

Figure A1.5: Per capita mean number of years at primary school (1964-2010)



Source: National Statistics Office (1998, 2005, 2010)

From Figure A1.5, it can be noted that from 1964 to 1987, the average years a pupil spent in primary school was 8. However, the 1998 Population and Housing Census revealed a drop in the mean number of years spent by a pupil at primary school to 6. According to the Integrated Household Survey of 2005, the primary school mean years dropped further down to 5 and by the year 2010 it stood at 3. Although Figure A1.4 suggests that literacy rate has increased steadily since 1964, Figure A1.5 reveals that an increasing number of pupils are spending less years in school over the past one-and-half decades than before.

At the centre of free primary education has been the desire to alleviate poverty, particularly amongst the rural poor by increasing their access to education. However, studies indicate that just as was the case during cost-sharing approach to education, literacy rate and school attendance have remained higher amongst pupils that come from the relatively well-off households (National Statistics Office & World Bank, 2005). For instance, 78 percent of youths from the richest

20 percent were literate in 1998 and the number increased to 81 percent by 2005. On the other hand, of the poorest 20 percent, only 51 percent of the young population was literate in 1998 and the number marginally increased to 52 percent by 2005 (National Statistics Office, 2005). In 2010, the inequality-adjusted education index⁵⁷ for Malawi was at 0.256, representing a 34.7 percent loss (UNDP, 2010). This suggests that equality in education is far from being achieved. It can therefore be concluded that poverty reduction via free primary education has so far proven to be elusive in Malawi.

Eliminating gender disparities in primary education by 2005 as resolved by the Dakar Conference also seems to have failed in Malawi. By the end of 2005, more girls (28 percent) were illiterate than boys (19 percent) with the worst affected being girls from the income poor households (40 percent) (National Statistics Office, 2005). Statistics for the year 2010 indicated that of all students that were able to attain post primary school education, girls represented only 10.4 percent compared to 20.4 percent in the case of boys (UNDP, 2010).

⁵⁷ Computation of education inequality index varies from one study to another depending on data availability and objectives. For instance, according to Lloyd & Hewett (2009, p. 8), “the inequality index is calculated as one minus the ratio of the percent completing primary school from the poorest 40 percent of households, relative to the best-off 20 percent of households. This measure of educational inequality ranges from zero to one, with zero representing complete parity of attainment between the best-off 20 percent and the poorest 40 percent in a given country, and one indicating a complete lack of parity in educational attainment by the poor. A measure of 0.5 implies that the poor have reached 50 percent of the levels of educational attainment of the best-off.”

A1.3 Turns on domestic poverty reduction policies

By the mid-1990s, the education sector had become government's icon through which the largest amount of foreign aid was being channelled into the economy. On the other hand, the agriculture sector, which had always been regarded as the economy's mainstay was conspicuously neglected marked by a decline in financial support for the sector. For instance, the agricultural inputs and food subsidies were removed in the 1994/95 fiscal year. At the same time, the Natural Resources College (NRC)⁵⁸, which was the only government training centre for the country's agricultural extension facilitators, was commercialized and public jobs for the NRC graduates were no longer guaranteed. This implied that the institution had to repackage its traditional courses and hike fees for it to thrive. Unlike before commercialization of the college, the new entrants would not necessarily train to work with poor farmers in the rural areas. As such, commercialization of NRC meant that the rural poor farmers would no longer access free supervision that the government trained facilitators used to offer.

Lack of trained personnel to work with the rural poor farmers, reduction in government recurrent expenditure and unfavourable policy reforms in the agriculture sector had immediate economy-wide implications. By 1995, the country was hit by an unprecedented food shortage as most farmers were unable to purchase fertilizer for their maize production. In addition, they lacked proper technical guidance to strategically reposition themselves in a wake of high input costs. In the commercial agricultural sector, most smallholder farmers were equally unable to grow tobacco and other cash crops due to similar problems. Such socio-economic catastrophes led to large depreciation of the Malawi

⁵⁸ The decision to set up a Natural Resources College was made in 1969 by the then Ministry of Agriculture and Natural Resources of the Government of Malawi. The College was to provide training for technical assistance in the field of agriculture, and would include all pre-service training for the Ministry's extension staff. The trained staff was expected to mainly work with the rural poor farmers in helping the latter acquire modern, improved farming techniques. In 1977 the Government of Malawi asked the Government of Canada through its International Development Agency (CIDA) for help in the development of the College. Work to develop the College started in 1984 and the College was officially opened on 4th February, 1986.

currency, rising inflation and food insecurity especially amongst the rural poor (Kherallah et al., 2001). Incidentally, this unparalleled economic meltdown culminated in a huge dropout rate in the primary school especially in standard one (EFA, 2005) as children would not manage to go to school on empty stomachs.

The foregoing economic hardships forced the Malawi Government to reconsider its attitude towards agriculture. By 1997 two agricultural programmes were launched that reflected government's effort to reverse the economic crisis, namely (1) the sustainable livelihoods and food security programme and (2) the Malawi agriculture and irrigation sector investment programme. In addition, the government started to negotiate with the donor community for support in its endeavour to save the country from economic doom. Towards the end of 1997, the donor community was implored to financially support the Malawi Government's initiative to improve agricultural productivity and food security for smallholder farmers (Kherallah et al., 2001). This culminated into a U-turn on the 1994/95 decision to remove the agricultural inputs and food subsidies and since 1997 smallholder farmers have enjoyed government support through free fertilizer and maize seed (see chapter four, section 4.3).

Although towards the end of the 1990s the government had shown commitment to resuscitate the agriculture sector, this was not immediately reflected in its recurrent expenditure allocation. The largely donor driven education sector continued to get the highest allocation and the gap between agriculture and education continued to widen. However, things started to change in the 2003/04 fiscal year when the government was forced to substantially increase its financial allocation to the Ministry of Agriculture following another spate of hunger that spanned from 2001 to 2003 mainly due to drought.

Largely owing to the debt relief of 2004, the government was able to continue allocating more funds towards its deserving ministries and agriculture was apparently prioritized. In 2006, government recurrent expenditure allocated to the agriculture sector dwarfed that for the education sector and the agriculture sector has since been getting the lions share just as was the case before 1990.

A1.4 Lessons from Malawi's poverty reduction policies and strategies

From the way Malawi has handled its poverty reduction strategies, two lessons can be learnt which may be worth considering as Malawi continues to put a fight against poverty. Firstly, Malawi's poverty reduction strategies have generally been marred by poor or lack of planning. For instance, free primary education was introduced without a proper situation analysis regarding the availability of enough trained teachers, classroom facilities and adequate teaching and learning materials. Unfortunately, this is not an isolated case; nearly all African countries that embarked on free primary education programmes did this without proper planning. In most countries, free primary education was announced immediately after the election of a new government⁵⁹. Reduction in quality of education standards, particularly at primary school, might be a reflection of poor planning and hasty implementation of policies. This weakness must be addressed.

Secondly, as is the case with most African countries, Malawi's poverty reduction policies are often mere political ploys and rhetoric designed to safeguard political and economic interests of the elites. With democratic winds blowing across Africa, free primary education has been one of the major campaign tools used by political parties to firstly gain access into government and secondly hold on to power. In this regard, the principal focus is quantity and not quality of education. An influx of pupils in primary schools is not only a political score that helps them

⁵⁹ In the case of Malawi, free primary education was introduced in 1994 by the newly elected UDF Government; in Tanzania it was introduced in 2001 by the newly elected Chama Cha Mapinduzi (CCM) Government; and in Kenya, it was introduced in 2003 by the newly elected National Rainbow Coalition (NARC) Government. This trend applies to many other African countries such as Ghana, Zambia, Mozambique and Ethiopia.

win another election and stay in power but it is also the bait that is used to convince the donor community, such as the World Bank, to continue with the much needed financial support. If the current trend of events continues, then Malawi's and sub-Saharan Africa's high literacy rates will be nothing more than just statistics of those who can barely read and write after spending a year or two at school but with limited effects on poverty reduction.

A1.5 Summary

Appendix 1 has indicated that the way poverty is officially viewed, measured and interpreted has had a major impact on the way the Malawi government has endeavoured to tackle poverty in the country. From 1964 to the late 1980s, Malawi believed that poverty reduction would only be achieved through economic growth, particularly via the agriculture sector. This approach was largely abandoned from the early 1990s to the mid 2000. During that time it was understood that poverty reduction would be achieved more effectively through the development of the education sector, especially at primary school level. Currently, the pendulum has oscillated back toward economic growth. These developments form the basis of discussion in the subsequent sections.

Appendix 2: Smallholder tobacco prices versus what estate owners get: A mean equality test

Here, mean equality tests are conducted to examine whether the mean prices received by farmers have been the same for estate owners and smallholders. The aim of these tests is to determine whether the tobacco marketing and pricing policies have had a positive impact on narrowing the income gap between the poor smallholders and the rich estate owners. This entails dividing the sample into three categories, namely the pre-1995 era (when ADMARC was the sole buyer), the IB era (when competition was promoted) and the post-IB era. Since the IB era was there for seven years (from 1995 to 2001), the other two categories have also been allocated seven years for comparability purposes. As such, the sample for the first category includes the period from 1988 to 1994 while the post IB era category runs from 2002 to 2008. Data for the tobacco export prices and the prices that ADMARC paid to smallholders were obtained from the National Statistics Office (2008b) and Reserve Bank of Malawi (2008) publications. Where necessary, equation (A2.1) was used to compute the prices received by each subgroup.

At the core of this mean equality test is the understanding that if the subgroups, i.e., estate owners and smallholders, have the same mean then the variability between their sample means ought to be the same as the variability within their subgroups.

From the foregoing, if we consider the j -th observation in subgroup m as $y_{m,j}$, where $j = 1, 2, \dots, n_m$ for groups $m = 1, 2, \dots, M$, then the sum of squares between the sample means (SS_B) and within the subgroup (SS_W) would be defined as follows:

$$SS_B = \sum_{m=1}^M n_m (\bar{y}_m - \bar{y})^2 \quad (\text{A2.1})$$

$$SS_W = \sum_{m=1}^M \sum_{j=1}^{n_m} (y_{jm} - \bar{y}_m)^2 \quad (\text{A2.2})$$

where \bar{y}_m is the within-group sample mean and \bar{y} is the overall sample mean. In this regard we carry out the test of the null hypothesis that the tobacco mean price that estate owners get (\bar{y}_{EO}) is equal to that received by smallholders (\bar{y}_{SH}), i.e:

$$H_0: \bar{y}_{EO} = \bar{y}_{SH} \quad (A2.3)$$

$$H_1: \bar{y}_{EO} \neq \bar{y}_{SH} \quad (A2.4)$$

If we assume that the subgroups are large, independent and normally distributed with identical means and variances then the F -statistic for the equality of means would be computed as follows:

$$F = \frac{[\sum_{m=1}^M n_m (\bar{y}_m - \bar{y})^2] / (M-1)}{[\sum_{m=1}^M \sum_{j=1}^{n_m} (y_{jm} - \bar{y}_m)^2] / (N-M)} \quad (A2.5)$$

where N denotes the total number of observations while $M - 1$ and $N - M$ are degrees of freedom for the numerator and denominator, respectively.

However, compared to the sample size for the efp tests where the number of observations was 114 (see chapter 3, section 3.3.2), in this case the sample sizes can be regarded as small (42 observations per subgroup). With small sample sizes, differences between prices received by smallholders and estate owners may suggest a strong possibility of heterogeneous variances. This being the case, the F -statistic computations for the equality of means as stipulated in equation (A2.5) may yield spurious results (Cochran, 1937; Welch, 1947). Technically, the tests in question “may sometimes operate in such a fashion that differences in the standard deviations...may mask differences in the means...with the result that judgments of non-significance may be too frequently made” (Welch, 1938, p. 351). To circumvent this problem we adopt the Welch (1951, p. 334) version of the test statistic which modifies the F -statistic to account for the unequal variances by incorporating the Cochran (1937) weight function:

$$w_m = \frac{n_m}{s_m^2} \quad (A2.6)$$

where s_m^2 is the subgroup sample variance. The modified F -statistic therefore becomes:

$$F^* = \frac{[\sum_{m=1}^M w_m (\bar{y}_m - \bar{y}^*)^2] / (M-1)}{1 + \frac{2(M-2)}{M^2-1} \sum_{m=1}^M \frac{(1-k_m)^2}{n_m-1}} \quad (A2.7)$$

where $\bar{y}^* = \sum_{m=1}^M k_l \bar{y}_m$ is interpreted as the weighted grand mean and $k_m = \frac{w_m}{\sum_{m=1}^M w_l}$ is the normalized weight. Equation (A2.7) implies that the numerator of the modified F - statistic is the weighted sum of squares between the sample means while the denominator is the weighted sum of squares within the subgroup means. Hence, F^* approximates the F -distribution with $(M - 1, DF^*)$ degrees of freedom, whereby:

$$DF^* = \frac{(M^2 - 1)}{3 \sum_{m=1}^M \frac{(1 - k_m)^2}{n_{m-1}}} \quad (\text{A2.8})$$

Table A2.1 below indicates results of the mean equality tests for the three categories, namely 1988-1994, 1995 -2001 and 2002-2008. Since in our case we only have two subgroups, i.e., ($M = 2$), the Welch (1951) basically becomes the Satterthwaite (1946) test. That is why the EViews simulation results include the Satterthwaite-Welch t -test whose probability values are identical to the Welch F -test. In addition, results include the t -statistic, “which is simply the square root of the F -statistic with one numerator degree of freedom” (Quantitative Micro Software, 2007, p 316). The probability values of the t -statistic are therefore the same as those of the Anova F -statistic. This being the case, we focus our interpretation of results on the Anova F -test and the Satterthwaite-Welch t -test.

Table A2.1: Test for equality of means between series

1988-1994 (Included observations: 42)			
Method	df	Value	Probability
t-test	82	8.269465	0.0000
Satterthwaite-Welch t-test*	48.31795	8.269465	0.0000
Anova F-test	(1, 82)	68.38405	0.0000
Welch F-test*	(1, 48.3179)	68.38405	0.0000
Analysis of Variance			
Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	547.5287	547.5287
Within	82	656.5471	8.006672
Total	83	1204.076	14.50694

1995-2001 (Included observations: 42)

Method	df	Value	Probability
t-test	82	7.255205	0.0000
Satterthwaite-Welch t-test*	54.60140	7.255205	0.0000
Anova F-test	(1, 82)	52.63801	0.0000
Welch F-test*	(1, 54.6014)	52.63801	0.0000

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	16530.71	16530.71
Within	82	25751.70	314.0451
Total	83	42282.40	509.4266

2002-2008 (Included observations: 42)

Method	df	Value	Probability
t-test	82	1.077982	0.2842
Satterthwaite-Welch t-test*	81.87029	1.077982	0.2842
Anova F-test	(1, 82)	1.162045	0.2842
Welch F-test*	(1, 81.8703)	1.162045	0.2842

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	2663.233	2663.233
Within	82	187931.7	2291.850
Total	83	190595.0	2296.325

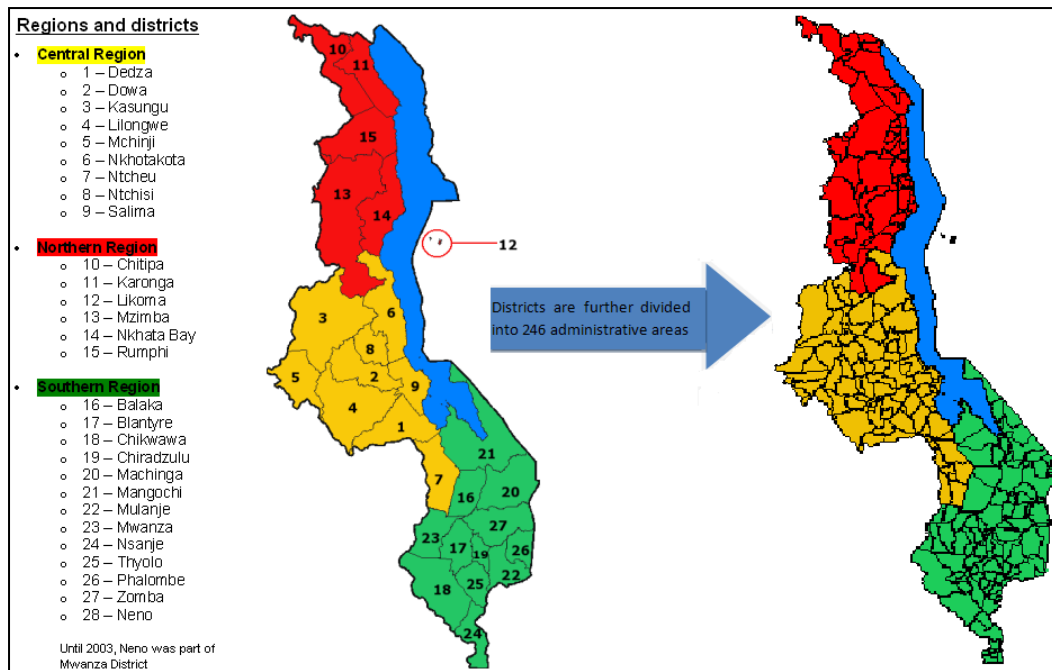
*Test allows for unequal cell variances

Results indicate that there is strong evidence that the tobacco prices that smallholders received differ from the prices that estate owners received during the pre-liberalization period of 1988 to 1994 when ADMARC was the sole buyer. Both the Anova F -statistic of 37.30 and the Satterthwaite-Welch t -statistic of 6.11 exceed the critical values as evidenced by their corresponding probability values of close to zero. The variability between the sample means (66.12) and that of within the subgroup means (1.77) are far apart implying that the price means of the two subgroups were indeed very different.

Between 1995 and 2001, the Anova F -statistic is 8.35 and the Satterthwaite-Welch t -statistic is 2.89. Their corresponding probability values however indicate that while at 5 percent significance level the null hypothesis is rejected, it is accepted at 10 percent significance level. This implies that with the introduction of the IB program which promoted competition, the mean difference between tobacco prices received by smallholders and that of estate owners was greatly reduced. However, differences in the mean squares (between and within) indicate that estate owners were in most cases still much better off than their counterparts.

In the final analysis, the third category results show the Anova F -statistic of 0.71 and the Satterthwaite-Welch t -statistic of 0.84 and both have high probability values (greater than 0.1), which imply that in both cases the null hypothesis cannot be rejected. This means that under the current system which started in 2002, the mean prices between the two subgroups are not statistically different.

Appendix 3: Breakdown of administrative areas in Malawi



Source: GOM (2009): Ministry of Agriculture and Food Security

There are three (3) regions, twenty-eight (28) districts and two hundred forty-six (246) administrative areas. The northern region has 6 districts which are broken down into 51 administrative areas. The central region has 9 districts with 85 administrative areas while there are 13 districts in the southern region which are disaggregated into 110 administrative areas. In the rural areas, administrative areas are overseen by traditional authorities (TAs) and senior chiefs while in the urban areas, administration areas fall under the authority of councillors and mayors. When it comes to distribution of coupons, which takes place primarily in the rural areas, officials from the Ministry of Agriculture and Food Security ensure that they involve TAs and senior chiefs (Dorward & Chirwa, 2011). Section 4.3.1 discusses how political influence affects the regional as well as the areal distribution of the subsidies.

Appendix 4: Normality test of regional maize production in Malawi (1964-2008)

There are various methods that are used to test whether the sample distribution is normal. Of these approaches, the following three are commonly used, namely Kolmogorov-Smirnov (K-S) test, Anderson-Darling (A-D) test and Shapiro-Wilk (S-W) test. The K-S test focuses on the largest vertical distance that separates the normal cumulative distribution function (NCDF) from the sample cumulative frequency distribution (CFD). However, the test is generally viewed as very weak with regard to detecting non-normality.

On its part, the A-D test is similar to the K-S test. The only difference is that the A-D test employs the sum of the weighted squared vertical distances between the NCDF and the sample CFD. It is this approach that gives the A-D test a slight edge over the K-S test. However, the most powerful method of testing for normality is the S-W test. This test, firstly arranges the sample in ascending order before computing the correlation between the ordered sample and the normal distribution. The only weakness is that it is less reliable in very large samples.

Despite the strength of some normality test approaches, many researchers recommend double-checking results from any of the above methods with normal plots. A normal plot indicates observations plotted on the x-axis versus the Z-score plotted on the y-axis. If the observations roughly follow the normal line, then it can be concluded that the sample is normally distributed. Results of the normality tests on regional maize production in Malawi (1964-2008) are indicated in the tables and plots below.

Table A4.1: Empirical distribution tests

Empirical Distribution Test for NORTH

Hypothesis: Normal

Sample: 1964 2008

Included observations: 45

Method	Value	Adj. Value	Probability
Lilliefors (D)	0.274308	NA	0.0000
Cramer-von Mises (W2)	0.732409	0.740547	0.0000
Watson (U2)	0.655600	0.662884	0.0000
Anderson-Darling (A2)	4.040918	4.112756	0.0000

Empirical Distribution Test for CENTRE

Hypothesis: Normal

Sample: 1964 2008

Included observations: 45

Method	Value	Adj. Value	Probability
Lilliefors (D)	0.233656	NA	0.0000
Cramer-von Mises (W2)	0.632025	0.639047	0.0000
Watson (U2)	0.547310	0.553392	0.0000
Anderson-Darling (A2)	3.372542	3.432498	0.0000

Empirical Distribution Test for SOUTH

Hypothesis: Normal

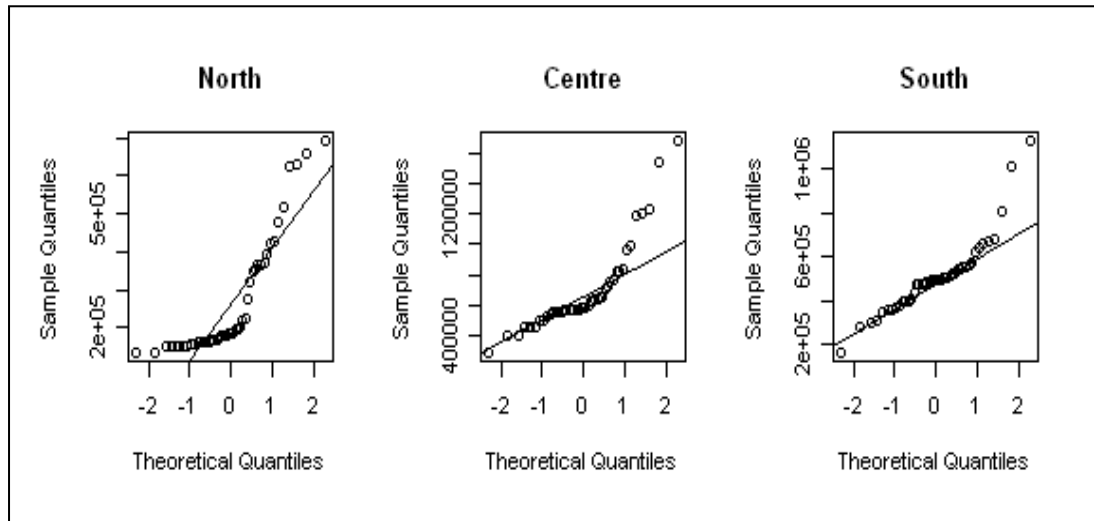
Date: 06/24/11 Time: 17:51

Sample: 1964 2008

Included observations: 45

Method	Value	Adj. Value	Probability
Lilliefors (D)	0.183659	NA	0.0006
Cramer-von Mises (W2)	0.298711	0.302030	0.0003
Watson (U2)	0.268416	0.271398	0.0003
Anderson-Darling (A2)	1.722143	1.752759	0.0002

The following figure is a collection of normal plots that are intended to augment the above normality tests.



Results from the normality tests and the plots indicate that the series of regional maize production in Malawi are not normally distributed.

Appendix 5: Mathematical summary statement for the Malawi CGE Model

“In its mathematical form, the model is a system of simultaneous, non-linear equations. The model is square in the sense that the number of equations is equal to the number of variables. This is a necessary (but not sufficient condition) for the existence of a unique solution.” Below, “the mathematical model is presented equation by equation. The equations are divided into four blocks: prices, production and commodities, institutions, and system constraints” (Lofgren, 2001, p. 6).

SETS			
Symbol	Explanation	Symbol	Explanation
$a \in A$	Activities	$c \in CMNX (\subset CM)$	Imported commodities without domestic production
$c \in C$	Commodities	$c \in CT (\subset C)$	Domestic trade inputs (distribution commodities)
$c \in CX (\subset C)$	Domestically produced commodities	$f \in F$	Factors
$c \in CE (\subset C)$	Exported commodities (with domestic production)	$i \in I$	Institutions (households, enterprises, government and the rest of the world)
$c \in CNE (\subset C)$	Non-exported commodities (with domestic production)	$i \in ID (\subset I)$	Domestic institutions (households, enterprises, government)
$c \in CM (\subset C)$	Imported commodities	$i \in IDNG (\subset ID)$	Domestic non-government institutions (households and enterprises)

$c \in CNM (\subset C)$	Non-imported commodities	$h \in H (\subset IDNG)$	Households
$c \in CMX$ ($\subset CM$)	Imported commodities with domestic production		
PARAMETERS			
aac_c	Shift parameters for domestic commodity aggregation function	$qdst_c$	Quantity of stock change
ad_a	Efficiency parameter in the CES production function	$\overline{qg_c}$	Base year quantity of government demand
aq_c	Armington function shift parameter	$qginv_c$	Quantity of government investment demand
at_c	CET function shift parameter	$\overline{qinv_c}$	Base-year quantity of private investment demand
cpi	Consumer price index	$shrtr_{ii}$	Share of domestic institution i in income of domestic non-government institution i '
$cwts_c$	Weight of commodity c in the CPI	$shry_{if}$	Share of domestic institution i in income of factor f
ica_{ca}	Quantity of c as intermediate input per unit of activity a	ta_a	Tax rate for activity a
$icd_{c'c}$	Quantity of commodity c' as trade input per unit of c produced and sold domestically	te_c	Export tax rate
$ice_{c'c}$	Quantity of commodity c' as trade input per exported unit of c	tm_c	Import tariff rate
$icm_{c'c}$	Quantity of commodity c' as trade input per imported unit of c	tq_c	Rate of sales tax

pwe_c	Export price (foreign currency)	$\overline{tr_{ii'}}$	Transfer from institution i to institution i'
pwm_c	Import price (foreign currency)		
Greek letters			
α_{fa}	Share of value added to factor f in activity a	γ_{ch}	Subsistence consumption of commodity c for household h
β_{ch}	Marginal share of consumption spending of household on commodity c	θ_{ac}	Yield of output c per unit of activity a
δ_{fa}^a	CES production function share parameter for factor f in activity a	ρ_a^a	CES production function exponent
δ_{ac}^{ac}	Share parameter for domestic commodity aggregation function	ρ_a^{ac}	Domestic commodity aggregate function exponent
δ_c^q	Armington function share	ρ_c^q	Armington function exponent
δ_c^t	CET function share parameter	ρ_c^t	CET function exponent
EXOGENOUS VARIABLES			
\overline{FSAV}	Foreign savings (FCU)	$\overline{TY_i}$ or $\overline{TY_f}$	Direct tax rate for domestic institution i or factor f
\overline{GADJ}	Government consumption adjustment factor	\overline{WFDIST}_{fa}	Wage distortion factor for factor f in activity a
\overline{IADJ}	Investment adjustment factor		

ENDOGENOUS VARIABLES			
EG	Government expenditure	QE_c	Quantity of exports
EH_h	Consumption spending for household	QF_{fa}	Quantity demanded of factor f from activity a
EXR	Exchange rate (LCU per unit of FCU)	QG_c	Government consumption demand for commodity i by household h
$GOVSHR$	Government consumption share in nominal absorption	QH_{ch}	Quantity consumed of commodity c by household h
$GSAV$	Government saving	$QINT_{ca}$	Quantity of commodity c as intermediate input to activity a
$INVSHR$	Investment share in nominal absorption	$QINV_c$	Quantity of investment demand for commodity c
MPS_i	Marginal propensity to save for domestic non-government institution	QM_c	Quantity of imports of commodity c
PA_a	Activity price (unit gross revenue)	QQ_c	Quantity of goods supplied to domestic market (composite supply)
PDD_c	Demand price for commodity produced and sold domestically	QT_c	Quantity of commodity demanded as trade input
PDS_c	Supply price for commodity produced and sold domestically	QX_c	Aggregate quantity of domestic output of commodity
PE_c	Export price (domestic currency)	$QXAC_{ac}$	Quantity of output of commodity c from activity a
PM_c	Import price (domestic currency)	$TABS$	Total nominal absorption

PQ_c	Composite commodity price	$TR_{i'}$	Transfer from domestic non-government institution i' to domestic institution i
PVA_a	Value-added price (factor income per unit of activity)	WF_f	Economy-wide factor wage
PX_c	Aggregate producer price for commodity	YF_{if}	Transfer of income to domestic institution i from factor f
$PXAC_{ac}$	Producer price of commodity c for activity a	YG	Government revenue
QA_a	Quantity (level) of activity	YI_i	Income of domestic non-government institution
QD_c	Quantity sold domestically of domestic output		

EQUATIONS

#	Equation	Domain	Description
Price Block			
1	$PM_c = pwm_c(1 + tm_c) + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c}$	$c \in CM$	Import price
2	$PE_c = pwe_c(1 - te_c)EXR - \sum_{c' \in CT} PQ_{c'} \cdot ice_{c'c}$	$c \in CE$	Export price
3	$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c}$	$c \in CX$	Demand price of domestic non-traded goods
4	$PQ_c \cdot QQ_c = (PDD_c \cdot QD_c + PM_c \cdot QM_c) \cdot (1 + tq_c)$	$c \in C$	Absorption
5	$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c$	$c \in CX$	Domestic output value
6	$PA_a = \sum_{c \in CX} PXAC_{ac} \cdot \theta_{ac}$	$a \in A$	Activity price
7	$PVA_a = PA_a \cdot (1 - ta_a) - \sum_{c \in C} PQ_c \cdot ica_{ca}$	$a \in A$	Value-added price

Production and Commodity Block			
8	$QA_a = ad_a \cdot \left(\sum_{f \in F} \delta_{fa}^a \cdot QF_{fa}^{-\rho_a} \right)^{\frac{1}{\rho_a}}$	$a \in A$	Activity production function
9	$W_f \cdot \overline{WFDIST}_{fa} = PVA_a \cdot ad_a \cdot \left(\sum_{f \in F} \delta_{fa}^a \cdot QF_{fa}^{-\rho_a} \right)^{\frac{1}{\rho_a}}$ $\cdot \delta_{fa}^a \cdot QF_{fa}^{-\rho_a}$	$a \in A$ $f \in F$	Factor demand
10	$QINT_{ca} = ica_{ca} \cdot QA_a$	$a \in A$ $c \in C$	Intermediate demand
11	$QXAC_{ac} = \theta_{ac} \cdot QA_a$	$a \in A$ $c \in CX$	Output function
12	$QX_c = aac_a \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_a^{aa}} \right)^{\frac{1}{\rho_a^{aa}}}$	$c \in CX$	Output aggregation function
13	$PXAC_{ac} = PX_c \cdot aac_c \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_a^{aa}} \right)^{\frac{1}{\rho_a^{aa}} - 1}$ $\cdot \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_a^{aa} - 1}$	$a \in A$ $c \in C$	First order condition for output aggregation function
14	$QQ_c = aq_c \cdot \left\{ \delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right\}^{\frac{1}{1 + \rho_c^q}}$	$c \in CMX$	Composite supply (Armington) function
15	$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1 + \rho_c^q}}$	$c \in CMX$	Import-domestic demand ratio
16	$QQ_c = QD_c$	$c \in CNM$	Composite supply for non-imported commodities
17	$QQ_c = QM_c$	$c \in CMN$	Composite supply for non-produced imports

18	$QX_c = at_c \cdot \{\delta_c^t \cdot QE_c^{\rho_c^t} + (1 - \delta_c^t) \cdot QD_c^{-\rho_c^t}\}^{\frac{1}{\rho_c^t}}$	$c \in CE$	Output transformation (CET) function
19	$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{\frac{1}{\rho_c^t - 1}}$	$c \in CE$	Export-domestic supply ratio
20	$QX_c = QD_c$	$c \in CNE$	Output transformation for non-exported commodities
21	$QT_c = \sum_{c' \in C'} (icm_{cc'} \cdot QM_{c'} + ice_{cc'} \cdot QE_{c'} + icd_{cc'} \cdot QD_{c'})$	$c \in CT$	Demand for trade inputs
Institution Block			
22	$YF_{if} = shry_{if} (1 - \overline{TY}_f) \cdot \sum_{a \in A} WF_f \cdot \overline{WFDIST}_{fa} \cdot QF_{fa}$	$i \in ID$ $f \in F$	Factor income
23	$YI_i = \sum_{f \in F} YF_{if} + \sum_{i' \in IDNG} TR_{ii'} + tr_{i\text{gov}} + EXR \cdot \overline{tr}_{i\text{row}}$	$i \in IDNG$	Institution income
24	$TR_{ii'} = shrtr_{ii'} \cdot (1 - \overline{MPS}_{i'}) \cdot (1 - \overline{TY}_{i'}) \cdot (YI_{i'} - EXR \cdot \overline{tr}_{rowi'})$	$i \in ID$ $i' \in IDNG$	Intra-institutional transfers
25	$EH_h = \left(1 - \sum_{i \in ID} shrtr_{ih} \right) \cdot (1 - \overline{TY}_h) \cdot (YI_h - EXR \cdot \overline{tr}_{rowh})$	$h \in H$	Household consumption expenditures
26	$QH_{ch} = \gamma_{ch} + \frac{B_{ch} \left(EH_h - \sum_{c \in C} PQ_c \cdot \gamma_{ch} \right)}{PQ_c}$	$c \in C$ $h \in H$	Household consumption demand
27	$QINV_c = qinv_c \cdot IADJ$	$c \in C$	Private investment demand

28	$QG_c = \overline{qg_c} \cdot \overline{GADJ}$	$c \in C$	Government consumption demand
29	$YG = \sum_{f \in F} YF_{gov f} + \sum_{i \in I} \overline{TY_i} \cdot YI_i + \sum_{i \in IDNG} TR_{gov i} +$ $EXR \cdot \overline{tr_{gov row}} + \sum_{f \in F} \overline{TY_f} \cdot \sum_{a \in A} WF_f \cdot \overline{WFDIST_{fa}} \cdot QF_{fa}$ $+ \sum_{c \in C} tq_c (PDD_c + PM_c \cdot QM_c) +$ $\sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in C} tm_c \cdot EXR \cdot pwm_c \cdot QM_c +$ $\sum_{c \in C} te_c EXR \cdot pwe_c \cdot QE_c$		Government revenue
30	$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in IDNG} \overline{tr_{i gov}} + EXR \cdot \overline{tr_{row gov}}$		Government Expenditure
31	$GSAV = YG - EG$		Government saving
System Constraint Block			
32	$\sum_{a \in A} QF_{fa} = \overline{QFS_f}$	$f \in F$	Factor market
33	$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QT_c$ $+ QINV_c + qginv_c + qdst_c$	$c \in C$	Composite commodity markets
34	$\sum_{c \in C} pwm_c \cdot QM_c + \sum_{i \in ID} \overline{tr_{row i}} = \sum_{c \in C} pwe_c \cdot QE_c$ $+ \sum_{i \in ID} \overline{tr_{i row}} + \overline{FSAV}$		Current account balance for ROW (FCU)
35	$\sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c + \sum_{c \in C} PQ_c \cdot qginv_c =$ $\sum_{i \in IDNG} MPS_i \cdot (1 - \overline{TY_i}) \cdot (YI_i - EXR \cdot \overline{tr_{row i}}) + GSAV$ $+ EXR \cdot \overline{FSAV}$		Savings-investment balance
36	$\sum PQ_c \cdot cwtsc_c = cpi$		Price normalization
37	$TABS = \sum_{h \in H} \sum_{c \in C} PQ_c \cdot QH_{ch} + \sum_{c \in C} PQ_c \cdot QG_c$ $+ \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c + \sum_{c \in C} PQ_c \cdot qginv_c$		Total absorption

38	$INVSHR.TABS = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qginv_c$ $\sum_{c \in C} PQ_c \cdot qdst_c$		Ratio of investment to absorption
39	$GOVSHR.TABS = \sum_{c \in C} PQ_c \cdot QG_c$		Ratio of government consumption to absorption

Source: Lofgren (2001, pp. 27-34): A CGE Model of Malawi

Appendix 6: CGE simulations and sectoral performance (% change)

Sectoral performance	Fertilizer subsidy		
	25%	50%	95%
1 Maize	1.01	2.03	3.9
2 Rice	1.3	2.61	5.02
3 Cereals	1.42	2.86	5.49
4 Roots	1.41	2.84	5.47
5 Pulses	1.24	2.5	4.8
6 Groundnuts	1.4	2.81	5.41
7 Vegetables	1.22	2.45	4.71
8 Fruits	1.24	2.49	4.78
9 Tobacco	0.63	1.27	2.43
10 Cotton	-0.88	-1.77	-3.4
11 Sugar	-0.8	-1.61	-3.08
12 Tea	-0.76	-1.52	-2.9
13 Other crops	1.3	2.62	5.03
14 Poultry	1.24	2.49	4.78
15 Livestock	1.37	2.76	5.32
16 Fishing	1.32	2.66	5.11
17 Forestry	1.2	2.42	4.65
18 Mining	-0.63	-1.26	-2.39
19 Food processing	1.08	2.17	4.16
20 Beverages	0.85	1.7	3.25
21 Textile	1.13	2.27	4.36
22 Wood	1.27	2.55	4.88
23 Chemicals	1.32	2.65	5.1
24 Machinery	-1.76	-3.54	-6.81
25 Construction	-1.55	-3.15	-6.14
26 Electricity	1.82	3.67	7.03
27 Agricultural trade	1.59	3.2	6.18
28 Non-agricultural trade	0.97	1.95	3.73
29 Traded services	-0.34	-0.71	-1.4
30 Communication	1.13	2.27	4.35
31 Banking	1.22	2.45	4.7
32 Real estate	0.89	1.78	3.41
33 Community services	1.34	2.69	5.18
34 Government administration	0.52	1.05	2
35 Health	1.01	2.02	3.89
36 Education	0.99	1.99	3.81