1 Introductory Remarks

1.1 Introduction

Ghana is situated on the west coast of Africa. It is an agricultural country with a population of about 15.5 million, and an annual population growth rate of 2.6 per cent. The economy of Ghana, which was buoyant at the time of independence, deteriorated consistently over the decade 1973-1982. A positive annual growth rate of 5.1 per cent in GDP and 5.7 per cent in total agricultural output was registered between 1955 and 1960. But this bright outlook for the economy gave way to persistent decline in almost all sectors. According to the World Bank (1984), between 1973 and 1982, GDP fell by 1.3 per cent annually, and food production declined by 2.7 per cent per annum. Real GDP remained almost stagnant with per capita incomes declining at an annual rate of 3.1 per cent and inflation averaging 44 per cent. Per capita food availability in 1982 was estimated to be 30 per cent lower than ten years before as strong disincentives developed for production. In effect the economy had fallen into a spiral of decline in performance over the years because of the circular relationship between the macro-economic parameters (Asiedu-Saforo 1989).

Up to the 1980s, the economy was characterised by periodic and localised food shortages which often called for Emergency Food Import drives from donor countries. As the economic situation continued to deteriorate, imports of tradeable foods, such as maize and rice fell, except when food aid could be obtained. Consequently, domestic grain prices were largely divorced from those of the world market and instead were determined principally by local conditions of demand and supply (Stryker 1990).

With the avowed aim of the government to increase agricultural production to feed adequately the fast-increasing population, various policy initiatives were introduced. Among them, in 1974, the government instituted a Guaranteed Minimum Price (GMP) scheme for the maize sub-sector (at the farmgate), and price ceilings (at the retail level). The GMP can be described as a pre-specified floor price determined by the government and used to maintain a minimum market price for maize delivered to the government procurement agency, Ghana Food Distribution Corporation (GFDC). Raising the producer price of maize was considered one way to increase the level of domestic production. The government also expressed its commitment to the poor consumers by subsidising maize consumption, although the system of support to consumers operated mostly in urban areas. This was in the form of a price ceiling and it was partly in response to pressure from trade unions, civil servants and consumer

organisations. Prices by the government were set in a pan-territorial and pan-seasonal manner.

The dispersed nature of maize production, involvement of large number of small farmers, and seasonality of the crop called for such a scheme to adjust supply with demand, and stabilise price and supply. The objectives of government price intervention in the maize sub-sector were outlined as follows (Ministry of Agriculture 1986, p 5-6):

i. to ensure returns to farmers that provide them with adequate levels of incomes and incentives to produce more efficiently;

ii. to reduce dependence on imports by raising domestic production to the level of self-sufficiency;

iii. to ensure consumer food supply at "reasonable" prices;

iv. to stabilise maize prices; and

v. to reduce the risk of transitory food insecurity through the maintenance of an adequate buffer stocks.

As part of the Structural Adjustment Program (SAP) prescribed by the World Bank for Ghana in 1983, an increasing emphasis has been given to the liberalisation of the economy, correction of policy-induced distortions and minimisation of government intervention in economic activities. As pointed out by (Husain and Faruquee 1994 in Ekouevi and Adepoju 1995), the main thrust of the ERP is to reorient the economy to respond to signals of the classical free-market system where prices are set by supply and demand. Consequently, there has been a reduction in the extent and coverage of commodities covered by price fixing, price controls, price monitoring and enforcement by the various government and quasi-public agencies. Output and input pricing in agriculture has undergone a major shift towards reliance on and promotion of competitive marketing to establish a fair price. Import policy has also become more flexible with a wide variety of agricultural products becoming eligible for imports with reduced tariff protection.

More importantly, the government has since 1991 completely de-regulated the maize sub-sector and abolished the GMP scheme. It is argued by the World Bank (1984) that such liberalisation policies can help restore economic growth in Ghana through the elimination of critical bottlenecks in the country's resource allocation.

Table 1.1: Changes in some key economic indicators under the ERP, 1980-87
(%)

	1980	1981	1982	1983	1984	1985	1986	1987
Population	2.8	2.6	2.6	2.6	2.7	2.7	3.0	3.1
Real GDP	1.3	-21.8	-2.5	-4.5	5.3	14.9	19.7	4.3
Real GDP per capita	-1.4	-23.8	-5.0	-6.9	2.8	11.9	16.2	1.2
CPI	50.1	116.5	22.3	122.8	39.6	10.4	24.6	39.8
Food price index	52.3	111.2	35.8	144.8	11.0	-11.4	20.3	38.5
Millions of Cedis								
Govt. revenue	2951	3279	4856	10242	22642	40311	73626	111040
Budget deficit	-1808	-4707	-4848	-4933	-4843	-7579	+299	+8911

Source: Adapted from Asiedu-Saforo 1989.

According to Asiedu-Saforo (1989) the results so far indicate an upturn in the economy from the dismal levels prior to the ERP. Referring to Table 1.1, some progress has been made towards the achievement of the objectives of stabilising and engendering growth in the economy. This is confirmed by the Ministry of Agriculture (1990, p.3), that 'good progress has been made in removing several of these basic distortions through reduction of the fertiliser subsidy and adjustment in support prices for maize and rice'.

In this Chapter the subject matter of the study is expanded. The importance of agriculture in Ghana is presented in Section 1.2, followed with the important role of the maize sub-sector. A discussion of the agricultural pricing policies in the country is undertaken in Section 1.4. The objectives of the study and the hypotheses to be tested are outlined in Section 1.5. Finally, the rationale for the study is presented along with a plan for the rest of the presentation.

1.2 Agriculture in Ghana's Economy

Agriculture, which includes livestock, fisheries and forestry, constitutes the largest sector of the Ghanaian economy. The major agricultural product is cocoa, accounting for about 18 per cent of the total agricultural output. On the other hand, food crops mainly maize, rice, cassava, yam, sorghum and millet account for 62 per cent; livestock 7 per cent; and fisheries 3 per cent (World Bank 1984). Agricultural products make up only about 20 per cent of the total value of imports, but the sector accounts for approximately 65 per cent of the total export earnings (Stryker 1990).

Many have viewed the protracted decline in the economy in the 1970s and early 1980s as traceable to the decline in the agricultural sector.

A recent World Bank Study on sub-Saharan Africa concluded that 'if Africa is to avert hunger and provide its growing population with productive jobs and rising incomes, its economies need to grow by at least 4 to 5 per cent a year. The primary source of this growth can only be agricultural production' (Ministry of Agriculture 1990) The primacy of agriculture in the economy and in the sustenance of the livelihood of the majority of the people is true for Ghana as it is for the rest of sub-Saharan Africa. The agricultural sector is the mainstay of the economy and it employs about 55 per cent of the total labour force and accounts for almost 70 per cent of merchandise exports (Ministry of Agriculture 1990). About 70 per cent of the population live in rural areas where they depend directly or indirectly on agricultural and related activities.

As Table 1.2 illustrates, the share of agriculture in real Gross Domestic Product (GDP) fluctuated from year to year, but on average remained around 50 per cent from 1970 to 1985.

Table 1.2: The importance of agriculture in the Ghanaian economy

Year	Share Agriculture in Real GDP (%)	Share Agriculture in Labour Force (%)	Share Agriculture Exports in Total Export (%)
1970	51	58	72
1971	50	58	64
1972	54	57	60
1973	51	57	56
1974	52	56	65
1975	48	56	70
1976	49	55	64
1977	45	55	70
1978	49	54	71
1979	52	54	75
1980	53	53	64
1981	54	N/A	44
1982	55	N/A	N/A
1983	53	N/A	N/A
1984	54	N/A	N/A
1985	52	N/A	N/A

Source: Stryker 1990, p.22.

Note : N/A = Not available.

In every respect therefore, agriculture has been and continues to be the prime mover of the economy. Despite the sector's recent growth, its performance has been outstripped by that in other sectors and agriculture's share of total GDP has slipped steadily from a peak of 55 per cent in 1982 to 47 per cent in 1988 (Ministry of Agriculture 1990).

The performance of Ghana's agricultural sector has been poor since the early 1960s and has deteriorated sharply since the mid 1970s. According to World Bank (1984), the food self-sufficiency ratio was 83 in 1964-66; 71 in 1978-80; and 60 in 1982. Estimates indicate that the average Ghanaian family consumed at least 30 per cent less food in 1982 than in 1970. With this background, self-sufficiency in food production in the face of a large increase of population seems extremely difficult to achieve.

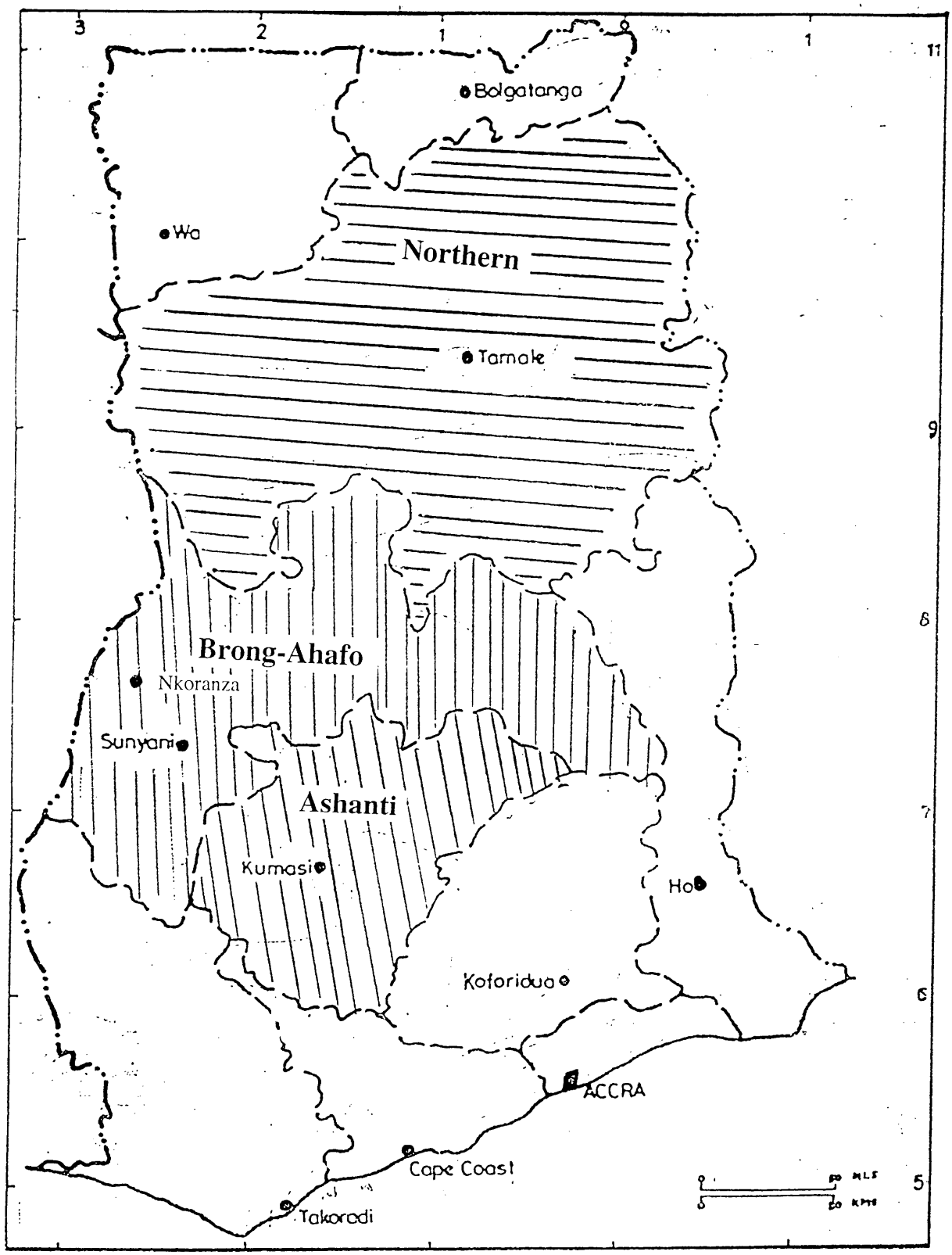
1.3 The Maize Sub-Sector

The maize sub-sector plays a crucial role in Ghana's agriculture. Maize is perhaps the single most important food commodity in Ghana. It is the leading staple food in the country and as such, public policy with regard to its production, pricing and marketing is crucial. Governments in Ghana have announced maize self-sufficiency as a national goal. Governments have also expressed their commitment to poor maize producers by subsidising production (Ministry of Agriculture 1985; 1990).

Maize forms about 50 - 60 per cent of the total cereal production in the country. It constitutes over 40 per cent of domestic food trade. Maize and its various processed forms provide approximately 33 per cent of the caloric supply to the average Ghanaian (Ministry of Agriculture 1985). Between 1974 and 1990, annual domestic consumption of maize averaged 339.75 thousand metric tonnes and per capita demand was estimated at 24.62 kilograms for the years 1968 - 1990 (World Bank 1984). According to ODA (1991), in 1990, maize formed about 22.6 per cent of the total starch staple production in the country.

Maize is grown as a staple crop throughout the country, and as a cash crop in three leading regions, namely, Brong Ahafo, Ashanti, and Northern - which contribute about 85 per cent of the maize sold commercially, as shown in Figure 1.1 (Ministry of Agriculture 1991a). It is grown mainly under rainfed conditions as part of a monocrop or intercrop system. It survives on relatively marginal soils and in uncertain climatic conditions, making it the major food crop planted throughout the country.

Figure 1.1 Map of Ghana showing major maize-growing regions



As shown in Figure 1.2, the trend in national maize production has been steadily increasing for the past twelve years, except in 1983 when there was an exceptional decline as a result of the incidence of national drought and bush fire. Maize output again declined in 1985 due to marketing problems that farmers experienced in 1984 (Ministry of Agriculture 1990). The general trend in increasing in output can partly be attributed to expansion of cultivated area mainly in the existing production zone and to yield increases through effective promotion of high-yielding varieties. About 80 per cent of the maize is produced by small holders and production per farmer is usually between about 5 to 20 maxi bags (100 kg) (ODA 1991). Consequently, maize production is directly associated with rural poverty because of its scale of production. Logically, the performance of the maize sector has important implications for the pace and direction of the rural development and overall development in the country.

Marketing of maize in Ghana involves a large army of small-scale private traders (who handle about 94 per cent of the marketable surplus), and the GFDC, which is the major government institution directly involved in domestic food marketing. The government sector works in parallel with the private trading sector and tries to influence the latter through competition.

The marketing activities of the GFDC, were oriented mainly towards implementing the minimum guaranteed price of maize, creation of buffer stocks and stabilisation of

Figure 1.2: National maize production

Source: Ministry of Agriculture 1991, p.9 (data post 1985);

Stryker 1990, p.177 (data prior to 1985).

prices for both producers and consumers. The corporation handled about 6 per cent of the average annual marketable surplus and was not legally bound to purchase all the marketable surpluses. Private traders were also not legally obliged to comply with the government-determined prices and so they operated a free market system. There are three main streams of private traders : the itinerant traders, the market based traders and the food contractors (FAO and Statistical Service of Ghana 1990).

Maize demand involves three main components: (a) staple food constituting about 92 per cent of production; (b) animal feed, 6 per cent, and (c) industrial use, 2 per cent. (Ministry of Agriculture 1990). Consumption is highest in April - July and lowest in September - January when there are many starchy food substitutes. In rural areas it is one of the three main staple foods consumed by farmers; in urban areas it is the main input into 'kenkey' and 'banku', key components of urban workers' diets. The livestock industry, has however, contributed to the emergence of a year-round demand for maize. The major areas of consumption of marketed maize are the coastal savanna agro-ecological zones, whereas production is in the Guinea savanna and Transitional zones.

Based on regional production and demand estimates, six of the ten regions are food-deficit, hence inter-regional transfers are estimated to be about 140,000 tons of maize annually (ODA 1991). Table 1.3 summarises the inflows and outflows of maize and shows the surplus production and deficit regions.

Maize pricing policies, under the GMP, fixed rural producer prices below urban retail prices, but both exceeded the average world price. The government then adopted

Table 1.3: Estimated annual inter-regional flows of maize ('000 tonnes) (negative = outflow, positive = inflow)

Region	Maize
Western	8
Central	10
Gt. Accra	82
Eastern	2
Volta	14
Ashanti	-1
Brong-Ahafo	-73
Northern	-27
Upper East	24
Upper West	-1

Source: Overseas Development Administration 1991, p.11.

fiscal, trade and monetary policies to restrict imports into the country. In this respect, Ghana's policies differed from those of many other developing countries, where both the urban retail and rural producer prices of the key staple are below the world price.

1.4 Agricultural Pricing Policies in Ghana

1.4.1 Economy-wide policies

In Ghana, the state has never controlled the majority of economic activity, but macro-economic policies of the 1960s and 1970s contributed to serious overvaluation of domestic currency and low prices for agricultural producers (ODA 1991). For instance, by 1982, farmers were receiving only 60 per cent of 1970s prices in real terms. Ghana's past economic policies were characterised by a bias in favour of import substitution and against export promotion, and greater reliance on administered allocative mechanisms than on relative prices (World Bank 1984). The overvaluation of the local currency (cedis) has had an especially important effect on the pricing of inputs, favouring capital-intensive, mechanised techniques over those that absorb more labour. In effect, the most important influence on agricultural prices was not agricultural price and trade policy *per se*, but the overall macro-economic environment in which these policies were formulated and implemented.

The proliferation of marketing boards - grains, cocoa, meat, fish, cotton, and timber - increased state intervention in the input supply and output marketing, and a system of price controls characterised the institutional setting.

Some government measures, however, benefited agricultural producers. For instance, since early 1970, the government intervened in agriculture to encourage production through the provision of subsidised inputs and credit; through its research and extension services; and through interventions by specialised agencies in specific areas and crops (Stryker 1990). On the import substitution side, agriculture benefited from the restrictions on grain and other food imports, which caused their domestic prices to rise steeply in relation to c.i.f. prices converted at the official rate of exchange (Stryker 1990). In the past, it was not possible to import or export several agricultural commodities without the government's approval. In order to encourage farm mechanisation, all farm machinery in Ghana were imported duty free. In addition, tractor services were for many years provided at subsidised rates by the Mechanisation and Transport Division of the Ministry of Agriculture. Under Ghana's Tariff Code, virtually all inputs to agricultural production were exempted from duties (Ministry of Agriculture 1990).

1.4.2 Sector-specific policies

Sector trade policies seemed to encourage maize production. For instance, in 1985, domestic prices of maize were about 50 per cent above the world market prices (Ministry of Agriculture 1990). As a consequence of these trade policy differences, domestic maize farmers received almost triple the level of nominal protection as was received by rice farmers in 1988 (Ministry of Agriculture 1990). Unlike the protection received by domestic grains producers, Ghana's cocoa farmers were relatively more heavily taxed. Because of the taxation of the cocoa sector and the protection of domestic grains producers, an important price distortion developed between the cocoa and food crop sectors. The general price environment discriminated against cocoa production, and in favour of maize and food crops production - resulting in the decline in the domestic ratio of cocoa producer price to maize price (Ministry of Agriculture 1990).

In general, the bias against tradeable agriculture resulting from trade, price and exchange rate policies was only to a minor extent offset by input subsidies and cheap credit - especially for the small, peasant farmers.

1.5 Objectives and Hypothesis

Output price support and administered ceiling prices do not represent the full range of options available to the government for encouraging maize production, achieving price stability and improving the economic surplus of both farmers and consumers. The study is not meant to evaluate the various options, but to assess the GMP monopolicy as it operated in Ghana. The dual objective pursued by the government - providing subsidies to both farmers and consumers - has resulted in an increasing operational deficit for the government procurement agency, GFDC. The corporation reported of a total loss of 380 million cedis on its maize operations from 1986 to 1989 (GFDC 1991). This loss was said to have resulted from three main sources namely:

- during purchasing at government support prices at the farm-gate;
- during selling at government-determined ceiling prices, and after all costs of operations had been accounted for; and
- in carry-over stocks as a result of government directives to reserve stocks in anticipation of food shortages.

This trend of loss was not surprising because as total production (and especially production per hectare) increased, prices were bound to fall, but the guaranteed price had been increasing over the 4-year period at a rate of about 20 per cent (GFDC 1991). This was because producer prices were administratively determined on the basis of criteria related to the cost of production.

The GMP policy has been criticised because it places a fiscal burden on the government and because it is untargeted. The policy also raised distributional issues between urban and rural areas and within rural areas, because not all rural producers grow maize and only a subset of maize producers are net sellers.

The discontinuation of the GMP scheme has attracted many protests and complaints from maize producers and consumers. Many of the farmers have strongly favoured the scheme and have therefore criticised the current totally free market system. Their reaction seems to confirm arguments by Dantwala (1967); and Hayami, Subbarao and Otsuka (1982); that such procurement by government agencies leads to an increase in the average price received by farmers. It reduces the riskiness of their farm income, allows them to plan ahead with confidence, provides them with better guides for planning production, and therefore can have a positive impact on their well being. Their feelings seem to be confirmed with a statement by Commander *et. al.* (1989) cited in ODA (1991) that relative real food crop prices in Ghana have fallen in response to increased supply resulting from the ERP.

Widely fluctuating prices can lead to inefficient use of resources, both in production and processing, if producers are induced to overexpand when prices are high and then forced to liquidate assets when prices fall to unprofitable levels (Tomek and Robinson 1991). A study by Gsaenger and Scmidt (1977) quoted by Child, Muir and Blackie (1985) suggested that given the low income and price elasticities of demand for maize, consumer welfare (particularly of low income groups), will fluctuate widely under free market conditions - an undesirable and politically destabilising situation.

Currently, the government faces a dilemma as to whether to give in to the pressure from the farmers and urban consumers, or to keep to its current policy prescribed by the World Bank/IMF. The objective of the study is to make quantitative estimates of benefits and costs of the GMP scheme by analysing the impact of the policy on producers' and consumers' incomes, government budgetary burden and foreign exchange savings. The results are to be used to assess the two policy options.

The hypotheses examined in the study were that:

i. Implementation of GMP in the maize sub-sector has not improved the welfare of the Ghanaian maize farmer.

ii. Implementation of an administered ceiling price of maize at the retail level has not improved the welfare of the Ghanaian maize consumer.

iii. Intervention in the maize market by the government does not involve any budgetary expenditure.

Hypothesis (i) is set to examine whether implementation of the GMP in the maize sub-sector did improve the welfare of the Ghanaian maize farmer, as would be evident in the changes in their producer surplus.

Hypothesis (ii) is set to examine whether implementation of the government ceiling price for maize did improve the welfare of the Ghanaian maize consumer, as would be evident in the changes in their consumer surplus.

Hypothesis (iii) is set to examine whether implementation of the support policies in the maize sub-sector involved any government expenditure.

The results for testing the three hypotheses will be useful for assessing the social costs or benefits of the GMP.

1.6 Rationale for the Study

The World Bank and IMF are currently being criticised for the apparent failure of some of their economic prescriptions for some developing countries. Many observers have questioned the impact of SAPs on the social and economic development in sub-Saharan Africa. It is generally felt that their targeted beneficiaries who are mostly the poor, small-scale, rural farmers have in most instances suffered economic losses and a worsening standard of living under some of their programs. The growing frustration with the biting effects of SAPs, especially on vulnerable groups led the United Nations Children's Fund and the International Labour Organisation (ILO) to advocate an adjustment with a human face and the Economic Commission for Africa (ECA) to push for an adjustment with transformation (Cornia *et. al.* 1988a; ECA 1991a; ILO 1992; all in Ekouevi and Adepoju 1995). The findings of the study will guide policy makers in Ghana and other developing countries in assessing the effectiveness of some of the World Bank prescriptions under the current Structural Adjustment Programs.

An emerging consensus seems to be the need for a different type of adjustment in the sub-Saharan region in tune with long-term social and economic development objectives and which is sensitive to the welfare of the vulnerable groups in the society. This can be buttressed with an observation by Stein (1994, p.302) that 'during the past year, Asian governments have begun to reconsider the policies that have been promoted by international agencies in Africa. They have seen little evidence to support the contention that structural adjustment is working. Moreover, the experience of their own countries seems at odds with the policies that are being encouraged by the World Bank and IMF. Japan, for one is currently designing bilateral programs which will lay out alternatives to adjustment'. The results of the study can be used as an input to an assessment of such an assertion.

It is officially reported that since Ghana began its ERP in 1983, the country's growth has averaged over 5 per cent a year and the trend has helped reverse the decline in living standards. The official growth figure has been doubted by some economists. For instance, it has been argued by Mensah (1995) quoted in Lothian (1995b) that even when the economy was said to be growing by 5 per cent, the figures had little to do with reality. He attributed the said growth to rather, a growing money supply coupled with rising prices and plenty of imports - leading to 'growth without development', and what Pastor (1987, p.249) described as 'increased capital inflow induced by the IMF's 'seal of approval". The results of the study can be used to assess how the said improvement in standard of living (if any) has affected maize farmers and maize consumers. They can also be used to assess whether the maize farmers and consumers are justified in calling for the re-introduction of the scheme.

The underlying data in Figure 1.2 suggest that the maize sector has responded to the ERP. They confirm the view expressed by supporters of the Program that the adjustment policies have since 1984 reversed the declining trend of maize production in the country (Ministry of Agriculture 1990). But, according to Loxley (1988); Pearce (1989); and Frimpong-Ansah (1992) this impression is misleading. They concluded from their assessment of the present ERP in Ghana that the rural sector, outside the cocoa industry, has not benefited from the economic improvement that is associated with the program. Any improvement in maize production can therefore be attributed to other existing policies such as, the GMP and not the ERP. To some extent, the results of the present study will enable policy makers make a balanced judgement on this topical and sometimes emotional issue.

A study on the 'income distribution and poverty profile in Ghana' by Baffoe (1992, p.26-7), suggested that about 60 per cent of the contribution to national poverty is

from the rural areas and non-cocoa farmers. He continued to suggest that as a short-term measure to improve on their standard of living, the government may aim at increasing producer price of food crops. The irony is that the IMF's and the World Bank's financially assisted economic recovery programs do the opposite by insisting on the reliance of market forces to direct price movements in developing economies (Baffoe 1992). Such research findings and observations can be critically assessed against the results of the present study.

Finally, a strong emphasis is currently placed by donors on price reforms. This reflects the view that one of the main factors restraining agricultural sector growth has been the use of price controls by governments of developing countries. The results of the study can be used as an input to an assessment of such an assertion.

Ghana's experience provides an interesting case because the country is 'trumpeted as an African success story by the World Bank and the IMF' (Lothian 1995a, p.27). It is regarded as a strong reformer by the World Bank and donor support is being sustained (ODA 1991). The study also provides a comparative example of a relatively liberalised grain marketing in the sub-Saharan Africa (ODA 1991).

To date, there is no study that has addressed a particular policy issue on a major staple food in Ghana. Haessel and Vickery (1975) did not go beyond estimating the social profitability of subsidies for the aggregate agricultural exports. Stryker (1991) limited his studies to the aggregate effects of price interventions on the country's agricultural sector. This study is to fill the existing gap.

1.7 Scope and Outline of the Study

The study is divided into seven chapters. Chapter 2 contains a discussion of the theories relating to the study and a brief review of previous studies on price support programs. Chapter 3 includes some selected models for evaluating output price support policy. The methodology adopted for the present study is presented in the same chapter. Values of demand and supply elasticities of maize in Ghana (as estimated by other researchers) are assumed and discussed in Chapter 4. Chapter 5 comprises an outline of the data used and the results of the analysis. It also includes sensitivity analysis of the key variables used in the study. The policy implications of the study are presented in Chapter 6. The final chapter consists of a summary of the results, weaknesses of the study and an outline of areas for further research.

2 Price Support Theory and Literature Review

2.1 Introduction

Studies relating to price support policies (floor and ceiling prices) have emerged as the subject of much theoretical and empirical investigation and controversy. More often than not, these policies have aimed at improving producers' and consumers' welfare through stabilisation of domestic prices. The desirability of price stabilisation from the standpoint of welfare has long been debated in economics literature (Brook, Grilli and Waelbroeck 1977). In most cases, these studies have been based on the concept of economic surplus to both producers and consumers, and they have been both theoretical and applied in nature. In practice, price stabilisation measures often turn out to be indistinguishable from price support policies because of pressure from producers to acquire stocks when prices are low and resistance to disposing of accumulated stocks when prices are rising (Tomek and Robinson 1991).

The purpose of this chapter is to review some of the extensive literature on output price support policies in both developed and developing countries. Initially, a review is made of the relevant theory that relates to the study in Section 2.2. Studies on agricultural price support programs are discussed along with a review of their implications, usefulness and weaknesses in Section 2.3. A review of specific studies on some selected developing countries and Ghana is presented. A final summary and conclusions are outlined.

2.2 Theoretical Analysis of Price Support Programs

2.2.1 Introduction

Support pricing policy constitutes one of the most common forms of intervention in product markets. It covers a wide spectrum of possibilities, as support prices could be fixed either above or below the level they would have normally reached in the absence of intervention (Reca 1983).

Agricultural price support means a transfer of income from the non-agricultural to the agricultural sector. It also means, in some cases, that the level of agricultural production will be maintained at a higher level than would otherwise be the case.

Implementation of price guarantees requires the government to make good to the farmers the deficiency between market prices and predetermined guaranteed prices. This form of subsidy, is therefore widely received by farmers regardless of need or of efficiency (McCrone 1962).

2.2.2 Reasons for price support

Many agricultural economists are convinced that free market agriculture is non-Pareto optimal (Wallace 1962). This is because supply usually 'outruns' demand in agriculture as a result of the efficacy of agricultural research and technology. Supporters of price support programs therefore argue that government intervention to fix prices above market equilibrium is necessary to provide farmers with a 'fair' return for their land and capital (Tomek and Robinson 1991). Because of the difficulties in agricultural adjustment, it is not always possible to rely completely on the market price mechanism (Hallett 1981).

Economies of scale and monopolies, externalities in production and consumption and imperfect information in the absence of complete contingency markets have long offered theoretical justification for interventions designed to correct such market failures.

Government intervention in pricing, if it leads to more stable and predictable prices (provided that they are consistent with long-run equilibrium levels), can make a positive contribution to efficiency in the use of capital. Johnson (1947) pointed out that price risks can lead to 'capital rationing', which means that creditors tend to limit the amount of capital they will lend to farmers and/or farmers tend to borrow less than optimum quantities because of discounting for uncertainty. As argued by Reca (1983), support prices are advocated on the basis of removing uncertainty and in that sense, working in favour of a better allocation of resources.

Most governments intervene in agricultural pricing to stabilise domestic producer and consumer prices. In food-deficit countries, price support programs have been introduced and maintained in an attempt to reduce dependence on imports, and conserve foreign exchange. Developing countries confronted with chronic food deficits may seek to stimulate production by adopting what Krishna (1967) calls positive price policies (Tomek and Robinson 1991).

In some instances (Brazil, for example) support prices are used as guidance to allocate subsidised credit (Reca 1983). In developed countries such as in Europe and Japan,

price support programs are used to protect and preserve small-scale farms (Tomek and Robinson 1991).

Free markets in farm products are prone to volatile price changes (Ellis 1992). These occur due to variability in the natural conditions of farm production and also due to the lag between planting decisions and the harvesting of the output. Most developing countries lack the risk-diffusion mechanisms needed to help agricultural producers adapt to highly volatile world prices (Schiff and Valdes 1992). The governments therefore resort to support policies in an attempt to insulate domestic producers from international price instability (Tomek and Robinson 1991)

Governments seek to stabilise farm prices for several reasons. On the production side, the aims may be to reduce risk, increase marketed supply and stabilise farm incomes. On the consumption side, the aims may be to ensure stable wage costs for the non-farm economy and to protect the urban poor from malnutrition or starvation (Ellis 1992).

2.2.3 Methods of price support policy

The methods of price support fall into two groups - methods (i) that affect market prices and (ii) subsidies. All methods that work through market prices are based on the principle that a decrease in the supply coming on to the market raises the price, and an increase lowers it (Ellis 1992). The extent of the price rise or fall is determined by the price elasticity of demand.

Farm output prices can be altered by government intervention indirectly through trade policy instruments, exchange rate policies and taxes and subsidies. Governments can also seek to influence prices by direct controls on the price formation, marketing and storage of agricultural commodities (Ellis 1992). According to Tomek and Robinson (1991, p.265), governments attempt to support or raise commodity prices above market equilibrium through a number of policy instruments including: minimum purchase prices; price-support loans; guaranteed or target prices; supply reduction schemes; and some types of quantitative restrictions. The policy instruments most frequently adopted in an attempt to depress or hold down commodity prices are the following: price ceilings; relaxation of import controls; release of stocks from government-controlled reserves; and embargoes on exports.

2.3.4 Impact and effects of price support policies

The purpose of this section is to consider briefly the impact and effectiveness of price support policy instruments in three main areas: increasing farm output, stabilising prices and incomes, and influencing income distribution. The economic effects of government programs designed to support or raise farm prices depend on the level of support, the methods employed in an attempt to raise prices and the slopes of the relevant demand and supply schedules (Tomek and Robinson 1991).

According to Brown (1978, p.86), price support programs are based on the principle that higher prices may stimulate agricultural production by:

- causing producers to move closer to their production possibility frontier by better use of resources;
- encouraging use of more labour and other variable inputs to reach higher production-function and output levels; or
- inducing investment and the discovery and adoption of new agricultural technologies that result in new, lower-cost production functions.

Available evidence shows that farmers in developing countries are only willing to innovate for an increase in output if the risk of reducing their average net return is not large (Lim 1975). Since the rate of actual absorption of inputs and knowledge by farmers depends very much on the ratio between the expected return from the recommended package and the cost of the package, floor prices may be required to improve this ratio (Brown 1978). They raise it directly by increasing the actual average return per unit of output sold, and indirectly by reducing the 'risk fraction' which the farmer may be supposed to use in calculating the expected average return net of risk. According to Chopra (1984), the outstanding achievements of India in the production, distribution and consumption of food since the mid-1960s was partly attributable to the favourable output-input price ratios. The very fixing of a floor price reduces the risk of buying the package. As pointed out by Krishna (1967), favourable price movements can speed up the diffusion of innovations, the absorption of new inputs, the utilisation of the idle capacity and even institutional adjustments.

The link between price incentives and private investment in inputs, labour, and other measures to increase farm output is almost axiomatic. Studies of diffusion of new technologies and of new investment in developing countries indicate that where profitability of adopting a new technique or investing is very high, the new techniques will be rapidly adopted and the new investment quickly made (Yasin 1965; Eckert

1974). Thus, a good price policy complemented by an orderly marketing arrangement can help trigger the adoption of new technologies as they become available.

The most important long-run effects of price incentives on production may be through price-induced shifts in the production function, rather than through greater efficiency of resource use with existing production functions (Ellis 1992). The long-run effects of price incentives on production depend upon the extent to which the incentive structure has an effect upon technological change, on public and private investment related to agriculture and on institutional change affecting agricultural output (Brown 1978). Higher prices for agricultural products will make at least the nominal or financial rate of return to agricultural projects more attractive. The more attractive financial return may induce highly productive institutional development, such as more effective agricultural research and extension systems, and input distribution and output-marketing systems (Arndt, Dalrymple, and Ruttan 1977 in Brown 1978).

Rao (1989) held a similar view, in the sense that, at an intersectoral level, an improvement in the terms of trade of agriculture would lower the relative rate of return to capital in the non-farm economy and raise the relative rate of return in agriculture. Consequently, agricultural output will rise to the extent that public inputs increase.

Nearly all studies show high marginal saving rates among even poor farmers (for example, Adams 1976). Thus, an important part of the additional income accruing to farmers through higher prices is likely to result in greater savings and investment in agriculture. As argued by Brown (1978), generalities about most small farmers as 'subsistence' farmers unaffected by agricultural prices are at best misleading. Price incentives may cause farmers to use improved seeds, along with more fertiliser, pesticides and other agricultural inputs.

In contrast to the views discussed above, McCrone (1962) pointed out that some farmers react very little if at all to any increased earnings they are able to obtain. In this case the price support goes directly to the farmers' private consumption or saving, without making any difference to the investment carried out on the farm or to the level of output. Hence, the support becomes no more than a social transfer payment with one section of the community supported by the rest. Moreover, it has the disadvantage that by this, the more inefficient section of the farming community is preserved in its inefficiency because it is protected from the economic forces which would compel it either to improve on its performance or get it out of the industry. Present production patterns may be maintained indefinitely without the price stimulus of a free market (Dardis 1965).

According to Krishna (1967, p.503), if and when a positive price policy does become a part of growth policy, it has three functions:

i. to accelerate the growth of agricultural output as a whole,

i. to accelerate or decelerate the growth of the output of individual crops, and

iii. to secure adequate increases in the marketed supply of food crops in countries where a large part of output is retained by the peasants for home consumption.

For various reasons discussed above, in order to formulate an effective price policy we need reliable empirical knowledge about the degree of responsiveness of supply (in the three meanings distinguished above) to the relevant relative price movements.

Timmer and Falcon (1975) found a close rank correlation between unhulled rice (paddy) prices and rice yields among Asian countries. They explained the pattern of inter-country relationships between prices and yields as indicative of the long-run responsiveness of production to incentives. They concluded from the nine countries studied, that the three with the highest yields - Japan, South Korea and Taiwan - had the poorest soils. The high prices to farmers in these countries appeared necessary to cover the costs of achieving these yields under the given climatic, soil and other conditions. A recent study on sub-Saharan African countries by Acharya (1981) concluded that failure to maintain incentives in these countries' agricultural sectors was the major reason for their poor performance in agricultural production.

One important point raised in the context of price stabilisation is whether price support stabilises or destabilises farm incomes. According to Schmitz (1984) and Ahmed (1988), in the situation of supply instability, if the elasticity of demand is above 0.5, producer incomes fluctuate more with stable prices than with unstable prices. At the farm level, Lipton (1980) argued that price support stabilises or destabilises farm incomes depending on whether a farmer is a deficit or surplus food producer. It is therefore incorrect to think that stability, whether of prices or incomes is solely dependent on price policy instruments

Governments attempt to use price support policy in order to achieve desired changes in income distribution (Ellis 1992). In the developed countries, farm income considerations are paramount in determining the level of farm prices. In developing countries, it is more likely for the incomes of urban consumers to feature strongly in farm price decisions. Other objectives, such as narrowing regional income disparities or raising the incomes of poor farmers growing particular types of crop, are also sometimes considered.

Agricultural price regulation often involves the balancing of conflicting village-city interests. Even when the importance of raising to some extent the relative price of agricultural output as an inducement to agricultural growth is fully recognised, the importance of setting limits to increases in the cost of living should not be overlooked (Krishna 1967). In effect, a policy to restrict increases in urban prices may accompany producer price support.

Arguments that higher food prices hurt low-income (partially urban) consumers tend to ignore even relatively short-run adjustment processes that reduce the income loss, and the fact that in low-income countries, urban wages usually respond fairly quickly to the cost of basic foodstuffs (Brown 1978). Consequently, the postulated equity effects of positive price policy on rural producers and urban consumers does not always hold. It cannot be assumed 'as is often done', that all rural dwellers benefit from a rise in real food prices (Eicher and Spencer 1987). This is because a significant number of poor farmers in most countries are net food purchasers. In Kenya, for example, price controls on meat and maize transfer income from low-income herdsmen and farmers for the benefit of middle- and upper- income urban dwellers (Brown 1978).

According to McCrone (1962) if land ownership is heavily concentrated, as in most developing countries, raising farm prices in the name of helping agricultural 'producers' may largely benefit the land-owning elite.

Price and production controls nominally intended to provide low-cost food to poor urban groups may also divert production away from those crops. For example, in Peru, low official prices have greatly reduced production of *frijol canario,* a popular bean which has been a major source of protein for low-income urban consumers, and the limited output is being channelled through black markets at prices about 60 per cent above the official control prices (Brown 1978).

Those who credit a public floor-price scheme with raising price substantially also admit that the expense to the public treasury is very large. Although the price floor raises minimum price, the increased carry over stocks reduce the chance of high prices. As a scheme proceeds, this latter effect gains more weight. This can be well explained with the statement by Shepherd (1945) quoted in Williams and Wright (1991, p.374), that 'whatever is put into store must eventually come out and when it comes out it will depress prices about as much as it raised them when it was put in'.

It was further argued by Williams and Wright (1991), that the more the public storage under a floor price scheme represents additions to total storage, the more the total

amount of storage is socially excessive since undistorted private storage is the socially optimal amount of storage.

One of the most difficult tasks in the administration of price support policy is to determine the level at which prices might be fixed or supported (Campbell and Fisher 1991). Many factors other than the income situation of the industry in question need to be considered. Another problem is that any support price scheme requires the operation of a buffer stock which in turn requires an outlet for ultimate distribution to consumers.

To cap it all, Krishna (1967, p.525) described a price support program as 'unavoidably a disequilibrium program'. If effective, it may convert a disequilibrium of shortages into a disequilibrium of surpluses in the markets for selected commodities. The effectiveness of a price support program on output expansion depends on its size as on its timing, consistency, spatial pattern and surrounding marketing administration (Krishna 1967).

It is important to stress that non-price incentives are needed in a complementary policy package in order to argue for the beneficial effects of positive pricing policies. After reviewing the literature on pricing policy, Krishna (1967) concluded that a congenial price regime is a necessary but not a sufficient condition for agricultural growth (Eicher and Spencer 1987).

2.3 Studies on Agricultural Price Support Programs

In both developed and developing countries, markets for storable commodities are often subject to public interventions in the name of market stabilisation. The high support price situation is common in the high-income countries where governments can afford to support farm income or achieve self-sufficiency in selected agricultural products through high price support. However, one can find instances of high price supports in some low-income countries. As pointed out by Johnson (1977), greater agricultural productivity per hectare in industrial countries is a phenomenon that has occurred largely since the 1930s and within the period of differential price policies. Greater emphasis in the development literature on employment-led and rural-development strategies and on strategies to meet basic needs has provided new intellectual support for price policies more favourable to agriculture (Brown 1978).

An array of price support programs has evolved in the United States since such programs were first introduced during the depression years of the 1930s. In the United Kingdom, such programs have been in existence since World War II (Tomek

and Robinson 1991). The most dramatic evidence of the turn to a positive price policy comes from the communist countries. For example, in Soviet Russia 'there have been successive increases in purchase prices and various changes in the system of state deliveries since 1953' (Krishna 1967, p.502). Price intervention measures have grown so universal that even non-agricultural countries, such as Japan, support their producers at price levels sometimes considerably higher than world market prices. A large body of empirical studies has demonstrated how price support programs have been in operation in most developing countries. Even the most successful developing countries, in the East and Southeast Asia, have openly rejected the free market approach for primary foodstuffs, especially rice and wheat, in favour of interventions to stabilise and support agricultural prices. This has led to a school of thought in the region labelled as a 'stabilisation' school (Timmer 1989).

Telser (1957) tried to find out whether a price support program had resulted in more stable prices of cotton in the US from 1933 to 1953. He noted that, in principle, the market price and the support prices were identical when cotton was being sold to the government. He observed that the acquisition and the disposal of stocks might or might not stabilise the price depending on the timing and appropriateness of the government's action. He estimated a net gain of 274 million dollars to the US government as a result of the support program. He concluded from his study that the support program resulted in more stable cotton prices.

On the cost of protecting the Australian dairying industry, Parish (1962) found the type of protection to be in the form of a home price in excess of the world price. It was paid by consumers of butter and cheese according to the amount they consumed. It fell most heavily on low income recipients who spent a relatively large part of their incomes on basic foods, including butter and cheese. The system of protection gave benefits to all dairy farmers, rich and poor alike. As a result, some were receiving very high incomes; others were receiving incomes which, despite protection, were still inadequate as a return on their capital and for their labour and that of their families. Despite the assistance given to the industry by protection and subsidy there was a continuing problem of excessively low net incomes being earned by possibly 25 to 30 per cent of dairy farmers (Schapper 1961). The policy was therefore deemed inappropriate as a welfare payment.

Parish (1962) found that subsidisation and price discrimination involved transfer payments from taxpayers and consumers to dairy farmers. He also found that the distortion of prices caused by the protective devices resulted in misallocation of producers' and consumers' expenditures and consequent losses in real income. He

estimated that between 1956/57 and 1958/59 approximately 30 to 40 million pounds sterling had been transferred annually to dairy farmers via subsidies and charges for butter and cheese in excess of export parity. He concluded that any estimate of the actual magnitude of the social costs resulting from protection of the butter industry depends critically on the assumptions that are made regarding the elasticities of supply and demand for butter and their cross-elasticities.

In a related study, Downing and Karmel (1960) argued that although the transfer of income itself did not involve loss of real income, it imposed loss of real income on the community. If there were no protection given to the dairying industry, some dairy producers would have moved into other industries where they could have earned higher incomes. The real cost to the community was therefore the excess of the income they could earn in other occupations, over the export parity valuation of their production in the dairying industry. A second real cost to the community arose because of the distortions to consumer spending, and consequent loss of consumer satisfaction, arising from the artificially high prices of dairy products and from restrictions on margarine (Downing and Karmel 1960).

Wallace (1962) investigated the social cost of agricultural protection in the United States. He defined social cost as a loss in consumer and producer surplus resulting from deviations from competitive equilibrium. He used the criterion of social cost in examining three stylised types of agricultural policies. He found that the magnitude of social cost of any agricultural program is related to the elasticities of demand and supply schedules of the commodity involved.

In a follow-up to Wallace's findings, Cavin (1962) suggested that an incentive of guaranteed prices above the equilibrium level, would not only make farmers expand output along the existing supply curve, but that the curve would shift to the right and hence increase the social cost involved.

Using a partial equilibrium model based on linear demand and supply function, Dardis (1965) estimated the welfare cost of grain protection in the United Kingdom for the crop year 1959-1960. Only a production cost was estimated since the system of deficiency payments in operation in the United Kingdom meant that producer prices were higher than consumer or free market prices. She found the production cost as a function of the degree of protection, the elasticity of domestic supply and the value of domestic production (Dardis 1965). The degree of protection was obtained by comparing producer and consumer prices. She found that the cost of grain protection for the crop year 1959/1960 ranged from 2 to 6 million pounds sterling or approximately $6 to $18 million. This cost ranged from 3 to 10 per cent of the change

in producers' surplus. She found this cost to have arisen from increased grain production in response to high producer prices and the consequent employment of excess resources in the grain sector. Her findings indicate the influence of a particular method of support for agriculture on the cost of protection. They also indicate the importance of domestic supply conditions and their relation to the cost of protection.

Dardis' findings have been criticised on the grounds that they neglected the indirect effects of the removal of agricultural protection. They also neglected the impact of protection on other countries.

Johnson (1965) used the traditional welfare tools of consumers' and producers' surplus to calculate the social gains and losses from the tobacco program in the United States. The analysis used was in the spirit of the 'economics of second best', and was based on the normal assumptions of the Marshallian welfare approach. From his study, the complete accounting of short-run welfare gains and losses in operating the flue-cured tobacco program placed the annual cost somewhere between a possible gain of $30 million and a possible loss of $60 million. The study was criticised on the grounds that the welfare measures used assumed that the marginal utility of money was the same everywhere. As a result, the distribution of income was ignored. The analysis was still partial equilibrium, and all effects on all goods were ignored.

Josling (1969) presented what he termed 'a formal approach' to agricultural price policy when he used economic analysis to examine the relative efficiency of several alternative methods of price support for agricultural commodities. This was the period when the United Kingdom faced the two major objectives of saving on food imports and effecting a transfer of income to the farm sector. His study departed from the traditional viewpoint of such policies because he sketched out a method of formal analysis by which criteria in addition to the efficiency of resource allocation were considered. His paper was designed to illustrate one way in which formal economic analysis could be used to answer the questions 'what level of support is justified?' and 'in what way should the support be given?' (Josling 1969, p.190). Though his analysis could provide the basis for a rational and realistic agricultural policy, it has been criticised as being static (Capstick 1969; Weightman 1969).

A number of studies have been done in evaluating how self-sufficiency in food grain can be achieved with the use of either of the two policy options - output price support or input price subsidy. Using a partial equilibrium model, Barker and Hayami (1976) examined the relative efficiency of a price support and fertiliser subsidy program for the Philippine rice economy. They developed a model to compare, in a fairly limited context, the benefits and costs associated with alternative policies to achieve self-

sufficiency. They found that the total social benefit produced by a price support program is quite large but the net social benefit is negative due to government costs.

Ahmed (1979) adapted the Barker and Hayami (1976) model to study the relative merits of price support and a fertiliser subsidy as alternatives for achieving self-sufficiency in rice production in Bangladesh. He concluded that a fertiliser subsidy was superior in terms of net social benefit.

Bayes, Parton and Piggott (1985) presented a method of evaluating combined price support and fertiliser subsidy policies. They allowed for differences in emphasis on each policy. In the study, they suggested the solution to the optimal mix of the two policy options and provided an indication of the opportunity cost of departing from the optimal mix.

Although the above studies seem to suggest input subsidisation as a more preferable policy option for increased agricultural production, they cannot be taken to mean that it can be a complete substitute for product price guarantees (Krishna 1967). Both are needed as complementary instruments of policy, for different reasons. It is true that in some typical Asian settings input price support has been found to be more socially beneficial than output price support. But even there, the private benefits to the food producers were decidedly greater under the price-support program than under the input-subsidy program.

According to Krishna (1967), in developing economies, the insurance farmers need urgently is the insurance against downward fluctuations in product prices rather than against upward fluctuations in the cost of purchased inputs which form a small part of their total cost. Product price guarantees induce the better use of traditional as well as new inputs, whereas input subsidies can cover only the purchased new inputs. In practical terms, it is difficult to directly subsidise the better use of land or family labour which accounts for a major part of cost; only fertilisers, pesticides, implements and irrigation can be subsidised (Krishna 1967).

Helmberger and Chen (1994) estimated annual budget outlays of over $2 billion in some years as a result of the dairy price support program which was badly managed in the 1980s in the US.

2.4 Selected Country Studies of Price Support Policies

2.4.1 Changes in some developing countries

During the past years, a number of developing countries have had to turn to a positive price policy because they were unable to realise the minimum required rate of growth of agricultural output without it (Krishna 1967). They have acted to significantly increase agricultural relative to non-agricultural prices. An FAO survey (1965, p.152) cited in (Brown 1978) reported, 'that the relatively low level at which, in the interest of the consumers, prices had hitherto been held in many of these (developing) countries is incompatible with the incentive needed for a steady increase in production. Systems of guaranteed prices for basic food crops are therefore increasingly being adopted in developing countries, in addition to the national stabilisation schemes for export products that were already in operation in early years'. Too often developing countries have worried only about the political power of consumers and have disregarded producers.

Indonesia offers a good example of a market intervention and pricing program built around a narrow but crucial food crop - in this case rice, supplemented with maize. For most of the 1950s and 1960s, Indonesia faced problems of domestic food deficits and imports similar to those facing many sub-Saharan African countries today. A more and aggressive policy for national food sufficiency was adopted in 1969 under the first five-year-plan (*Repelita I*), with the objective of achieving an increase of 50 per cent in the domestic output of rice. Output grew by an impressive average of 4.6 per cent a year, partly from expansion of the acreage cultivated but mostly from increased productivity in response to the acceptance of high-yielding varieties and the application of fertiliser. But the really critical element in the story, as Timmer (1981) emphasised, was the governments' decision to pay farmers an incentive price from 1968, that is a year before the launching of *Repelita I*. This was after having learned the hard lesson in 1967 that investment policies, import subsidies, and social mobilisation do not constitute an adequate strategy (Timmer 1981).

According to Brown (1978), the Ivory Coast raised the domestic price of rice (a small-farmer crop) substantially above world market levels and moved from a production deficit to surplus position. The Ivory Coast is providing both incentive prices and a package of productivity-increasing inputs to producers of other than coffee and cocoa. In a study by Cleaver (1985), Ivory Coast was lauded as perhaps Africa's greatest development success among nine selected sub-Saharan African countries. Cleaver (1985) classified it as the country with the lowest degree of farm price discrimination -

less than 15 per cent - accompanied by an average growth rate of 4.7 per cent a year in its agricultural production between 1970 and 1981.

Despite the increasing trend of output price support programs in the agricultural development in developing countries, there have been a few reported cases of its failure. For example, producer price support has not been a significant factor in Thailand's rice development. The experiment of 1969 to 1971 aimed at both increasing farm income and stabilising market prices did not succeed. It has been observed by Bertrand (1980) that the market-intervention experiments of Thailand have been more successful in decreasing rice prices than increasing them, with consequent asymmetrical effects on the welfare of both the consumers and the producers. The urban consumers have been cushioned when prices were high, while the farmers have remained unprotected when prices were low.

Of late, governments of developing countries are motivated to discontinue with subsidy programs for their food systems and simultaneously to support farm-gate and consumer prices. Even among developed countries, those based heavily on agriculture (such as Australia) can hardly afford such programs. According to Reusse (1987, p.302) 'desubsidization makes deregulation and divestment possible and eventually unavoidable'. Reusse (1987, p.302) identified the following as some of the situations motivating such government decisions:

- incapacity to prolong price support subsidies;
- incapacity to cope with successive bumper crops;
- incapacity to cope with inefficiency and corruption;
- drastic decline of export industries;
- external persuasion; and
- insurmountable budgetary and balance-of -payment problem.

2.4.2 Studies on Ghana

Though many studies have been done on agricultural pricing policies in Ghana, there has been no special focus on output price support programs. As such, this section deals with the governments agricultural price interventions and how they involved and/or affected price support.

According to Akoto (1987) in 1969 rice was singled out for official price support because of the prospects for its production in the northern savanna zone and the rising demand in urban areas. To encourage its production, a minimum guaranteed price was introduced in 1969 and a special line of credit was established by the Agricultural Development Bank (Akoto 1987). Subsidies on agricultural chemicals and improved seeds were increased and more import licences allocated for the import of heavy agricultural machinery such as combine harvesters and tractors. In contrast, agricultural exports like cocoa and coffee continued to attract high taxes. The effect of all these measures was to increase the divergence between domestic prices and their corresponding border prices for all these commodities.

Stryker (1991) estimated the effects of price distortions on agricultural production between 1954 and 1985 in Ghana. The crops chosen were cocoa, rice and maize. In addition, three non-tradeable foods were included in the analysis to determine how movements in the domestic prices of the tradeable food - rice and maize - correlated with price movements of the non-tradeables. The results of his study suggested that the effect of direct intervention on the output of maize and rice was generally positive. He observed that increases in domestic food prices, combined with a restrictive trade policy, resulted in the positive protection. He also noted that the negative protection in the producer price of cocoa encouraged the production of alternative crops such as maize and rice. According to Stryker (1991), the impact of price distortions on production depends on the relative importance of the own-price and cross-price elasticities. For maize, these effects resulted in a consistently higher equilibrium level of output.

Stryker (1991) estimated the effect of government price intervention on consumption for the same period by incorporating equilibrium consumer prices into estimated demand functions to predict the levels of consumption that would have existed in the absence of direct and total intervention. He found that in most years, especially after 1962, import restrictions resulted in a substantially lower consumption of maize than would have occurred if imports of these foods had been freely admitted.

Using a simple partial-equilibrium demand and supply model, Stryker (1991) calculated transfer to or from agriculture resulting from both direct and indirect effects of price distortions for the same period - 1954 to 1985. For maize, he found both of them to be positive, especially when distortions were severe. As a result, both direct and indirect intervention tended to transfer resources into the maize sub-sector.

2.5 Summary and Conclusion

The results reported from various studies are not comparable with each other nor are they equally useful for the present study. The studies were conducted under different circumstances and in varying economic, social, political and institutional conditions. With respect to objectives, assumptions made, data base and estimation techniques, each study has unique characteristics. However, most of the writers used partial equilibrium analysis which is purported to provide the most practical method of measuring economic surplus. The neglect of the indirect effects of the method on the validity of the resulting estimates has been recognised by most researchers.

All the studies have pointed out the benefits of subsidies in providing support prices to farmers and consumers. But the crucial question is whether these benefits are as great as their economic and social costs of providing them.

Theoretically and empirically, the present study derives much of its flesh from the partial equilibrium analysis by Barker and Hayami (1976), and Ahmed (1979). The distinguishing feature of the present study is that it considers both consumers' and producers' surpluses, and not only the latter as most of the early studies did.

3 Method of Analysis

3.1 Introduction

For different reasons, many countries (both developed and developing) have instituted agricultural price support policies. The policies affect the allocation of resources within the protecting country. Resources are shifted out of the unprotected industry into the protected one. In addition, the policies affect the pattern of consumption by raising the relative prices to consumers of unprotected goods. The resulting distortions in production and consumption patterns comprise the welfare cost of protection to the protecting country (Dardis 1965).

The purpose of this chapter is to discuss the models which have been used for evaluating price support policies as instruments for achieving price stabilisation, self-sufficiency and savings in foreign exchange resulting from the reduction in the volume of imports. Given the plethora of analyses previously completed, only a relevant cross section of the models available is examined in Section 3.2. In Section 3.3 the various models are evaluated and discussed. This section provides an attempt to answer the central question: which is the best method for the present study? In the light of the discussion, a framework for the present study is presented in Section 3.4. The final section covers a brief, analytical description of the model for the present study.

3.2 Models for Evaluating Output Price Support Policy

3.2.1 The "Brannan Plan" (1962)

Wallace (1962) used a Brannan type policy of price subsidy to compare some stereotyped agricultural policy proposals on the basis of social costs. The Brannan Plan suggested setting a 'fair' price for agricultural products, somewhere above competitive equilibrium. To resolve the problem of surpluses, the Plan proposed that consumers should pay a price consistent with demand at the new output and that income transfer from taxpayers make up the difference to the farmers.

The method of analysis was based on the following premises:

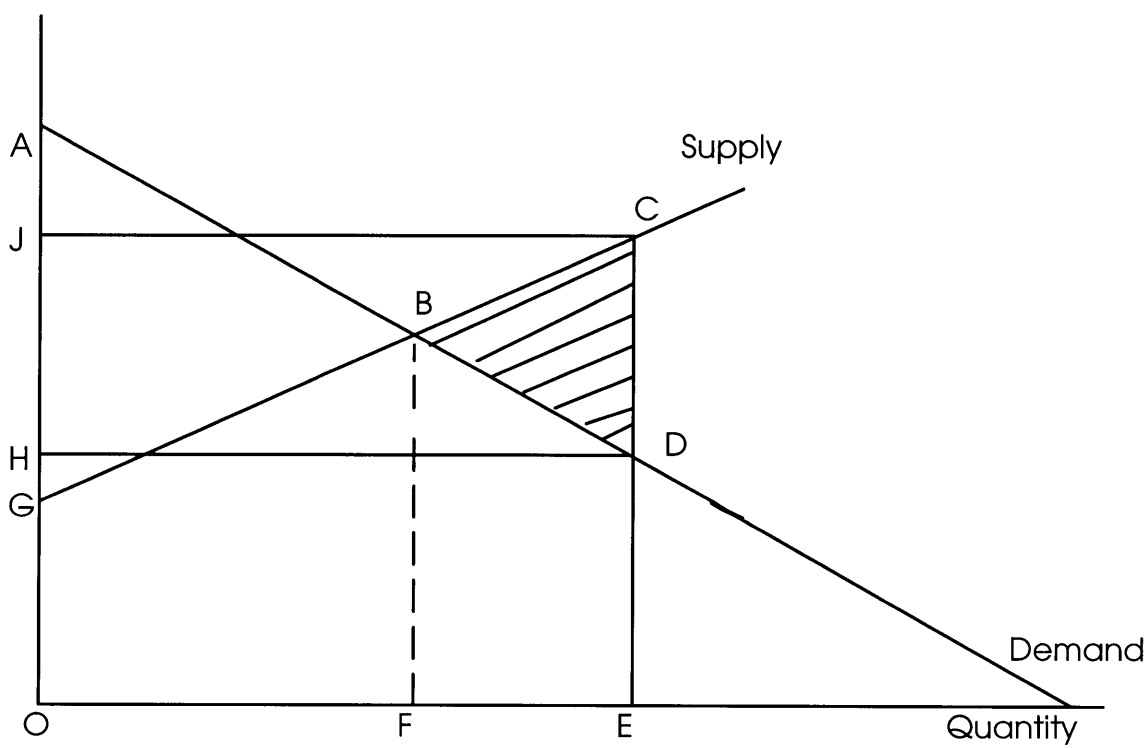
i. total area under the demand curve to the left of a given quantity represents total utility for that quantity;

ii. the supply curve reflects opportunity costs of variable resources used to produce each quantity; and

iii. the applicability of a distributed lag model to supply response in agriculture.

The Plan is diagrammed in Figure 3.2.1. Employing the first two premises (as stated above), ABFO represents total utility for competitive equilibrium. The area ADEO is total utility after implementation of the program, so there is a utility gain of magnitude FBDE. Under competition, the value of variable resources is OGBF. After the program is implemented, other resources are used in agriculture that "cost" society an additional amount FBCE. Deducting the utility gain from the resource costs, the triangle BCD represents the net social costs of implementing the program. The area HJCD represents an income transfer into agriculture.

Figure 3.2.1: The Brannan Plan



Source: Wallace 1962, p.583.

Note:

J = 'Fair' price

H = Consumer price.

An approximate formula for the social cost triangle associated with the Brannan Plan can be derived as:

$$S(B) \cong \frac{1}{2} P_1Q_1 \tau^2\varepsilon(1+\frac{\varepsilon}{\eta})$$

where:

$S(B)$	= social costs of the Brannan Plan;
P_1Q_1	= the value of farm output under competition;
η and ε	= respectively the absolute values of the price elasticities of demand and supply; and
τ^2	= the square of the percentage increase in the 'fair' price over the price that would exist in the absence of the program.

It can be noted from this social cost formula that:

i. Social cost increases as the supply elasticity increases, *ceteris paribus.*

ii. The more inelastic the demand in the critical neighbourhood of the demand function, the greater is social cost, *ceteris paribus.*

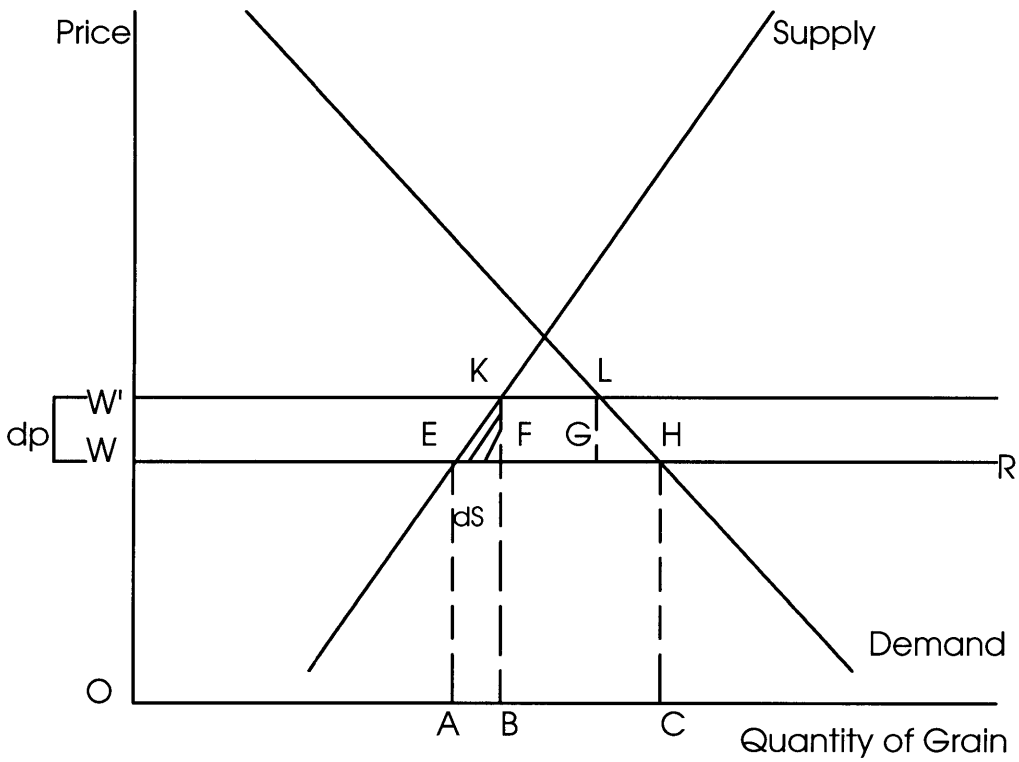
3.2.2 The Dardis (1965) model

Using a partial equilibrium analysis, Dardis (1965) estimated the welfare cost of grain protection in the United Kingdom for the crop year 1959-1960.

The domestic demand and supply curves for grain in the United Kingdom are shown as linear functions in Figure 3.2.2. The world supply of grain (WR) is perfectly elastic on the assumption that the world price of grain (OW) is unaffected by changes in the United Kingdom. This price is also the consumer price in the United Kingdom, since consumers are permitted to buy on the free market. The price received by producers (OW') is determined administratively, a process resulting in a deficiency payment of W'W per unit of production.

Under the deficiency-payment system, production is equal to OB and consumption to OC, with imports (BC) accounting for the difference between demand and supply.

Figure 3.2.2: Dardis model



Source: Dardis 1965, p.600.

According to Dardis (1965, p.601), the cost of protection under the deficiency-payments system may be expressed in terms of the supply function as follows:

$$\text{cost} \cong \frac{1}{2} mdS \cong \frac{1}{2}\, mf'(p)\, dp \cong \frac{1}{2} t^2 \eta V$$

where:

p	= the producer price of the protected good;
dp or m	= is the fall in price of this good when protection is removed (deficiency payment or degree of protection);
t	= equals m/p (W'W/OW in Figure 3.2.2);
η	= is the elasticity of domestic supply under protection; and
V	= is the value of domestic production under protection.

When using this policy, the formula indicates the importance of supply elasticity and the degree of protection in determining the cost of protection.

3.2.3 The Barker and Hayami model (1976)/ The Ahmed model (1979)

Barker and Hayami (1976) developed a partial equilibrium model to evaluate price support and fertiliser subsidy policies in developing market economies such as the Philippines. Later, Ahmed (1979) adapted the Barker and Hayami (1976) model to the Bangladesh economy. The adaptation included incorporation of rice-jute substitution and the market for rationed rice. He, however, retained most of the essential features of the model. Using a framework that outlines the interrelationship among important variables, Ahmed evaluated the impact of the two policies on producer and consumer incomes, government budgetary burden, foreign exchange savings, and distribution of benefit (Ahmed 1979, p.59).

For the purpose of the present study, only the sections dealing with price support policies of both models are considered essential for discussion. Specific references are made to the model presented by Ahmed (1979).

Figure 3.2.3, shows the domestic supply and demand curves of rice at the existing prices of fertiliser. The vertical line D_hH represents the demand curve of producers for home consumption. Here it is assumed that producers households consume the same quantity of their produce irrespective of price and sell the rest in the market. This is based on studies in subsistence economies like India and the Philippines (Toquero, Duff, Anden-Lacsina and Hayami 1975, p.709). MD represents the market demand for the product - the horizontal distance between D_hMD and D_hH measures the quantity purchased by urban (non-farmer) households. The total demand for rice is represented by D_hMD. P_r is the ration market price level. At the 'normal' (that is non-ration) price, OP_d, the equilibrium quantity demanded and supplied is OQ_o. An additional quantity $(Q_c - Q_o) = (AB)$ is imported and distributed through rationing. Domestic production can be substituted for this quantity of imports.

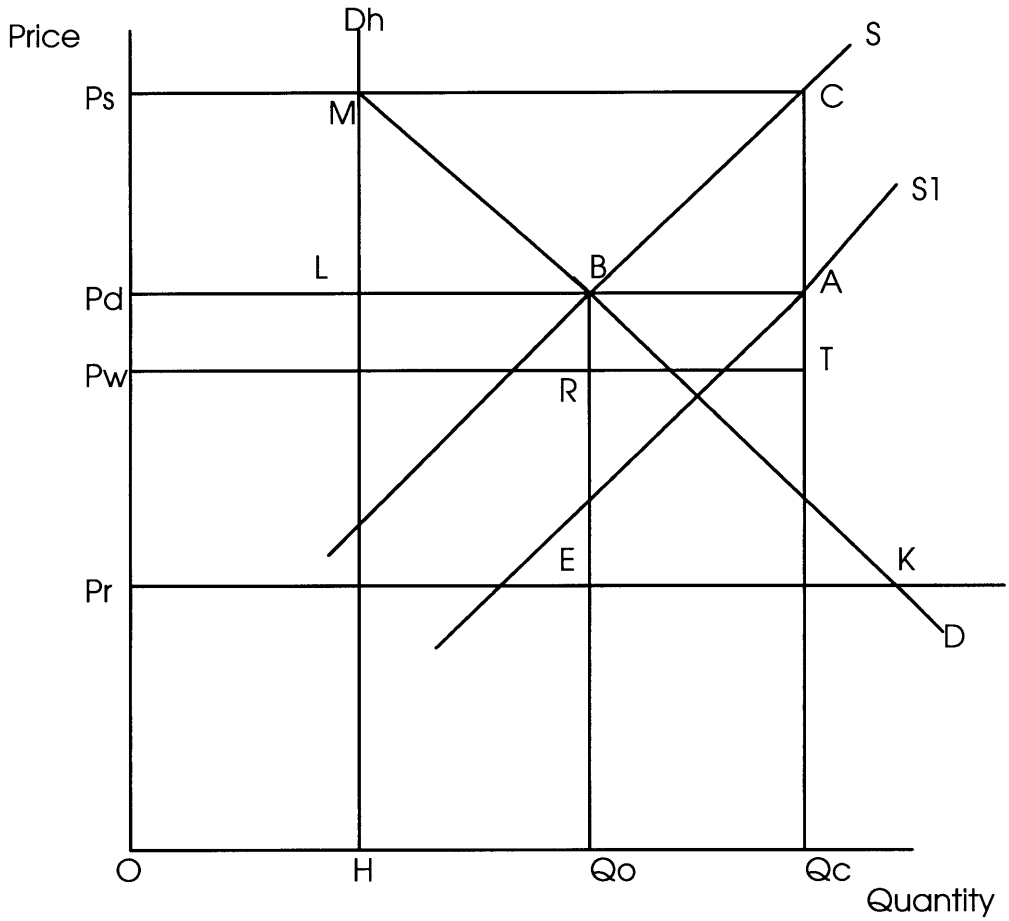
To have OQ_c available for consumers, Barker and Hayami (1976) identified three possible alternatives:

i. import AB;

ii. Support the rice price received by producers at OPs; or

iii. Subsidise fertiliser prices sufficiently to shift the supply function from S to S_1.

Figure 3.2.3: Model of price support



Source: Ahmed 1979, p.61.

It should be noted that in all three cases the government maintains the price level to consumers at OP_d through the procurement of quantity AB for the rationing system. This condition is based on two critical assumptions as follows:

i. the normal and ration markets can be kept separate;

ii. the price in the ration market is maintained at OP_r - an impossibility given that the government only holds the quantity AB.

The second alternative, which is the focus of the present study can be associated with the following effects (Ahmed 1979, p.620-1):

i. government cost is the area ACLM which is the difference between the procurement price (OP_s) and sale price (OP_d) multiplied by the quantity procured,

ii. the increase in producers' revenue is the area ACLM plus area ABQ_oQ_c,

iii. the increase in producers' surplus from rice production is the area BCLM. To obtain the net effect on producers' surplus, the decrease in producers' surplus from jute production must be deducted from the increase in producers' surplus from rice production,

iv. consumer welfare remains unchanged due to unchanged OP_d and OP_r, and

v. net foreign exchange savings is the area RTQ_cQ_o minus the foreign exchange cost of additional imports of fertiliser (more fertiliser is used in order to expand production to OQ_c).

Ahmed (1979) also considered the impact of a rice price support policy on jute acreage, production and the resulting foreign exchange implications. As rice and jute are competing crops the rise in rice price causes a reduction in jute acreage in response to the shift in relative rice-jute prices. To arrive at a net social effect of the policy to support rice price, 'the loss of income and foreign exchange earnings resulting from the reduction in jute production, as determined by the supply and demand elasticities of jute, must be deducted from gains in the rice sector' (Ahmed 1979, p.62).

3.3 Evaluation of the Different Models

Barker and Hayami (1976) and Ahmed (1979) used a partial equilibrium model to analyse the effects of both price support and input subsidy policies. A partial equilibrium analysis concerns the study of a restricted subset of the economic system - a set of consumers and producers of a particular product or of closely related products - in isolation from the conditions prevailing in the rest of the economy (Colman and Young 1989). Partial in the sense that the changes within the market are assumed not to spill over into other markets. Despite the fact that the partial equilibrium approach ignores some indirect economic and non-economic effects of the policy, it allows some useful conclusions to be reached (Corden 1957). The method provides the most practical approach to a measurement of cost due to protecting a particular industry. This is because the indirect effects of such policies are generally not easily measurable. The approach highlights some important links and enables one to obtain rough estimates of the gains and losses to various groups.

The general equilibrium approach looks more useful because of its ability to capture most of the indirect effects and long-run consequences. It recognises the interdependence among all sectors in the economic system and looks more useful in attempts at quantifying the costs of market distortions. This is more especially in developing countries where simulation of market behaviour requires careful portraying of a large variety of economic and institutional rules (De Mello 1977). Despite these obvious advantages, its data requirements are forbidding and beyond the scope of the present study. These data, even if they exist, are difficult to obtain.

According to Wallace (1962), given existing estimates of elasticities, application of the Brannan Plan on a crop-by-crop basis is not feasible. The method is useful for several groups of farm products, but the summation of the individual estimates would provide a highly misleading figure (Wallace 1962). A justifiable aggregation of social cost estimates would have to be based on solutions to simultaneous sets of demand and supply relationships that fully characterised cross elasticities on both the demand and supply sides. Since 1962 when Wallace (1962) pointed out that quantification of these interdependences was not sufficiently advanced, especially for supply relationships in agriculture, there have been considerable advances in our understanding of these relationships. Nevertheless, in Ghana the basic supply analyses have not been performed, and it would require heroic assumptions to incorporate the cross-price effects.

Inspite of the fact that Dardis' (1965) model was based on a partial equilibrium approach, it dealt with only production cost. This was because the deficiency-payments system employed in the United Kingdom ensured that consumer prices were equivalent to free market prices.

Considering the strengths and weaknesses of the various models, it is decided that the core model for the present study should be that used by Ahmed (1979). However, it is important to recognise the limitations of that approach.

3.4 Framework for the Present Study

Procurement at the primary level by GFDC for the support of guaranteed prices is inadequate in terms of financial resources; geographical coverage; and volume and timeliness of purchases (Ministry of Agriculture 1987). This leads to the inability on the part of the organisation to purchase all the amount offered by the farmers. Thus, the farmers have to rely on traditional market intermediaries for disposing of most of their produce even at prices lower than the guaranteed prices fixed by the government.

A similar situation exists with respect to maize distribution to consumers at the ceiling prices. A majority of consumers are 'compelled' to buy from the open market at prices higher than those determined by the government due to the problem of stock availability and /or inaccessibility to the corporation's outlets.

A number of assumptions and simplifications are made in the present study. Though the underlying assumptions are the same as those made by Ahmed (1979), there have been some modifications and an extension for the Ghanaian situation.

i. It is assumed that producers and consumers are price takers. This allows for the specification of unique demand and supply functions. The demand and supply functions are assumed to be linear.

ii. There is no shift in the supply curve for maize since the study focuses on price support monopolicy and ignores any likely impact of government subsidised inputs such as fertiliser, seeds, and credit. In the Ghanaian maize sub-sector, the most important input is fertiliser as many farmers use their own seed and few use pesticides (ODA 1991). At the regional level, out of the total government storage capacity of 75,000 tonnes for fertiliser, only 28.6 per cent is located in the 3 main maize growing regions (Ministry of Agriculture 1987). Moreover, these few warehouses and depots are located in the cities and are far from the farmers. As a result, a few large-scale producers and middlemen had access to them at the subsidised prices and captured the rents created as secondary markets developed in which inputs were sold at prices much higher than those officially authorised (Stryker 1990).

According to Stryker (1991) most of the subsidised inputs frequently found their way on to the private market, where prices exceeded official prices by many times. Consequently, the smallholders, who produce about 80 per cent of the average total national output still operate below potential, mainly because of a poor input supply and a weak agricultural support service (Ministry of Agriculture 1987). They did not have direct access to government subsidised inputs.

Available evidence also suggests that the relative price movements of maize and fertiliser were not favourable for farmers to use more fertiliser for maize production. According to Ministry of Agriculture (1987), between 1979 and 1985, the price of a bag (50kg) of compound fertiliser was 44 times higher, whereas a wholesale price of maize increased during the same period by only 12 times. The situation was well summarised by Stryker (1990, p.127), 'in the end,

input subsidies and cheap credit never effectively reached the smaller farmers who were responsible for most of the nation's agricultural output'.

iii. The competitive and complementary relationships among maize and other staple food items are too complex to identify. Hence, it is assumed that cross elasticities of demand and supply in the food market are zero. This is a strong assumption because even though his study covered a period during which there was a free market, Haessel (1976) showed otherwise in his study on 'the demand for agricultural commodities in Ghana'.

iv. The government's administered support prices (both floor and ceiling prices) are assumed to be generally above and below the market-determined purchasing and retail prices respectively. This means that the government's procurement agency, GFDC, operated within a narrower price band than the private trading sector. As such the maize sub-sector involved distortions in both the consumer and producer prices and this entailed both production and consumption costs of protection. Unlike Ahmed's (1979) model which estimated only the producers' surplus, the present study is to estimate both producers' and consumers' surpluses. The model is therefore modified to reflect the consumer prices that existed in both the public sector and the open market.

v. The government's support prices could influence market prices, but could not necessarily determine them. This was because the quantity of maize over which the government exercised *defacto* control (through its procurement agency, GFDC) was small; about 5 to 6 per cent of the national marketable surplus (ODA 1991).

vi. Maize farmers and maize consumers are treated as homogenous despite the fact that Lim (1975) has shown that differences exist in the nature of supply and demand responses for small-scale and large-scale producers and consumers. The reason is to keep the modelling and the study within manageable proportions. Besides, there is limited information available, especially, on the classes of consumers.

vii. The on-farm demand curve for maize farmers in Ghana is assumed to be inelastic, although greater than zero. It has been drawn sensitive to prices on the basis of evidence from Ezekiel and Mathur (1961, p.397) that ' farmers sell that amount of the output which will give them the amount needed to satisfy their cash requirements and retain the balance of their output for their own consumption'. In his study on 'elasticities of marketed surplus of foodgrains in

Ghana', Haessel (1975, p.114) concluded that 'the farmers are price and income responsive as consumers and higher prices will result in larger quantities marketed'. It also confirms the findings by Behrman (1966) and Krishna (1967) that for subsistence crops, the farmers' demand curve may shift when the price changes, since their income changes. This is in contrast with Ahmed's (1979) model which assumed a perfectly inelastic on-farm demand curve for rice farmers in Bangladesh.

viii. Maize farmers typically produce more than one product. It is because of the existing substitution possibilities with other farm products that the supply curve in Figure 3.5 has a positive slope. But for the purpose of simplicity, the analysis focuses exclusively on the impact of the GMP policy on maize.

ix. The model assumes that output depends on current price and abstracts from dynamic considerations that result from production lags and storage.

x. All farmers and consumers receive and pay the same support prices under the program.

xi. The only policy considered is price support.

xii. It is assumed that both the private and government trading sectors are integrated and that marketing margins are the same for both markets. This is a strong assumption because there is enough evidence to suggest that margins are lower in the government sector as a result of high operational costs and marked degree of corruption, inefficiencies and inertia. This observation can be confirmed by the studies by The World Bank (1986) and Mwanaumo, Preckel and Farris (1994).

The criteria used for the policy evaluation are the same as those used by Barker and Hayami (1976) and Ahmed (1979). They include net producer benefit, net government cost, the foreign exchange premium and net social benefit (the sum of the preceding three). It should be noted that in the following analysis, costs and benefits are measured as incremental costs and benefits resulting from the current equilibrium (Bayes 1984).

3.5 The Model

The method to be used for the study is the partial equilibrium analysis which is well known for both its usefulness and limitations (Bale and Lutz 1979).

3.5.1 Maize price support monopolicy

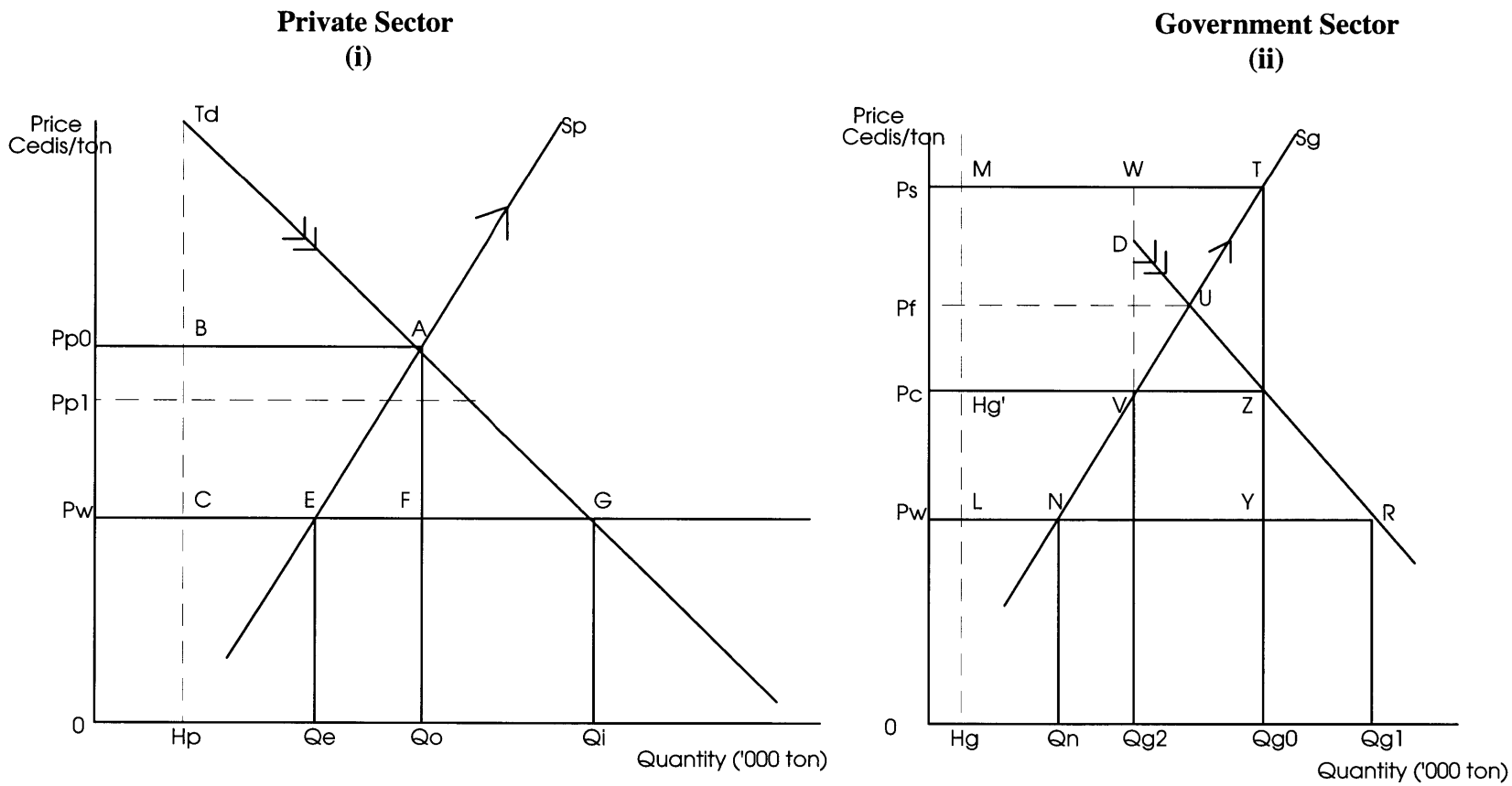
The first step in estimating the changes in consumers' and producers' surplus is the specification of the demand and supply schedules. The model used for the analysis is depicted in Figure 3.5. Figure 3.5a(i and ii) represents the private and government trading sectors respectively. It is important to note that even though the government, through its procurement agency, controls only about 6 per cent of the total national marketable output of maize, its support prices- both floor and ceiling prices- impact significantly on the private market. For instance, referring to figure 3.5a(ii), at the government's support price of P_s, GFDC purchases quantity OQ_{g0}, while the private sector may operate at a lower purchasing price P_{p0} as shown in Figure 3.5a(i). When the government's support price falls to P_f, quantity purchased by GFDC falls. Its short-run effect on the private sector market is to increase the quantity of stocks available for sale and thus induce a decline in the private producer price from P_{p0} to P_{p1} in figure 3.5a(i). An increase in the government support price works vice versa on the private sector market.

Figure 3.5b represents a combined private and government sectors. It captures all the relevant variables in both sectors of the market. As shown in the figure, supply represents the domestic supply curve of maize. The steep demand line D_hH represents the demand curve of producers for on-farm consumption. It has been drawn slightly sensitive to prices on the basis of evidence from (Ezekiel and Mathur 1961). Total demand is shown by D_hMD, and it represents the combined demand for both maize producers and non-producers. The horizontal distance between D_hMD and D_hH measures the demand by non-farm households. Other assumptions made in constructing the model were provided earlier.

Referring to Figure 3.5b, the initial situation shows that a quantity JQ_o of maize is sold to consumer at the domestic price of P_d. An additional quantity AB (= Q_c-Q_o) is imported and sold at the government ceiling price (P_c) through government Food Agencies such as GFDC and the Ghana National Procurement Agency.

If the producer price falls from OP_d to OP_c, the level of farmers' home consumption rises to OG and if the price rises to OPs, the level of home consumption falls to OR. This confirms Haessel's (1976) findings in his study in Ghana that the price-elasticity of home consumption is negative. It also confirms a survey by (Asante *et. al.* 1989 cited in ODA 1991, p.14) that 'majority of maize farmers in Ghana gave anticipation of higher prices as their main reason for storage at the producer level'.

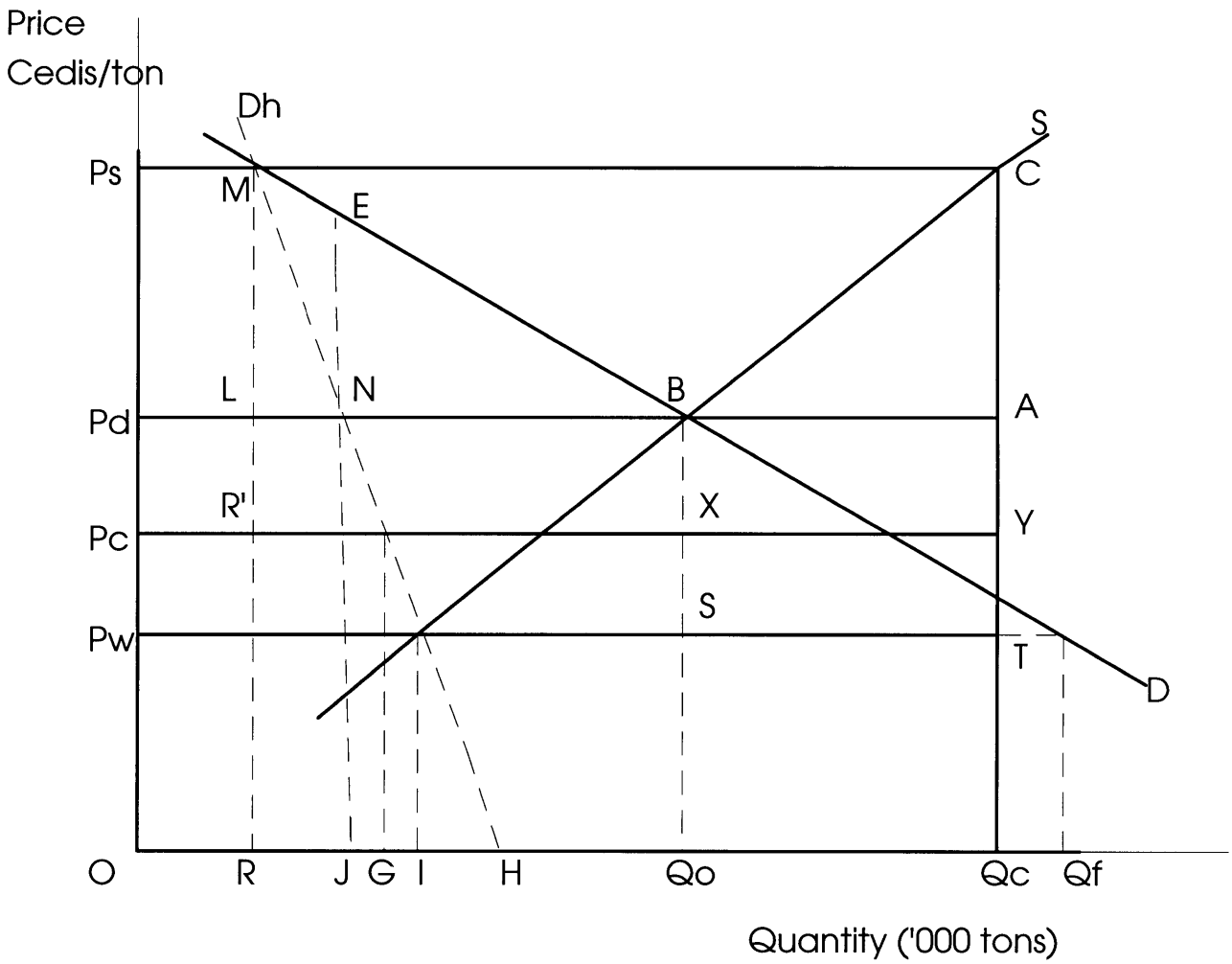
Figure 3.5 a: Dissaggregated maize market



Note:

They are not drawn to scale.

Figure 3.5b: Combined private and government sectors



Under the price support monopolicy, if Q_oQ_c is to be made available from domestic production rather than being imported, then producer price is to be increased from OP_d to OP_s in Figure 3.5b.

As shown in Figure 3.5a (i); (ii) and 3.5b, the various variables can be defined as follows:

Private sector {3.5a(i)}:

S_p = supply curve of farmers who sell to the private sector.

OQ_o = equilibrium quantity of maize supplied and consumed (94 per cent of the total national output).

OH_p = farmers' household consumption {94 per cent of the estimated household consumption at the market-determined price; assuming the price-elasticity of home consumption to be (-2.0)}.

P_{p0}; P_{p1} = market-determined producer price (with government support price in place).

Pw = world price of maize.

Government sector {3.5a(ii)}:

S_g = supply curve facing the government procurement agency.

OQ_{g0} = quantity of maize supplied and demanded at the government support and ceiling prices (6 per cent of the national total output).

OH_g = farmers household consumption (6 per cent of the estimated household consumption at the government support price).

P_{so} = government support price determined exogenously.

P_c = government ceiling price determined exogenously and estimated without any margin for the corporation.

Pw = as defined earlier.

The Combined sector (3.5b):

S = domestic supply curve of maize;

D = domestic demand curve for maize;

D_hH = demand curve of producers for on-farm consumption;

D_hMD = total demand for maize.

3.5.2 Analytical description of the model

The description which follows is that which was provided in Bayes, Parton and Piggott (1985) with some modification and an extension to suit the Ghanaian situation. In Figure 3.5b, supply represents the domestic supply curve of maize. Assuming a fixed domestic supply schedule (S), the quantity Q_oQ_c of maize can be

attained by increasing producer price to OP_s. If the government maintains the consumer price at OP_d, providing a price of OP_s to farmers would involve a cost to the government of ACML. However, since the government maintains a ceiling price at OP_c below the market-determined selling price, providing a price of OP_s to farmers would involve a cost to the government of MR′YC as producers respond to the higher price OP_s in their home consumption decision making. With a support price of OP_s, area Q_oSTQ_c represents the government's savings in foreign exchange due to the import substitution of maize.

Implementation of a guaranteed price at OP_s rather than a free market results in consumer surplus losses and producer surplus gains. Referring to Figure 3.5a(i), area ABCG and ABCE represent changes in consumer and producer surplus respectively on the private trading sector. Area Hg′LYRZ and MLNT represent the changes in consumer and producer surplus respectively on the government trading sector {as shown in Figure 3.5a (ii)}.

From the model, it is important to note that the size of the various surplus areas in Figure 3.5 depends on the price elasticity of demand, supply and home consumption for the commodity under consideration.

4 Demand and Supply Elasticities

4.1 Introduction

Most empirical attempts at measuring the welfare costs of domestic distortions due to government interventions are based on the concept of economic surplus. Under it, the welfare cost of protection is derived in terms of domestic elasticities of supply and demand (Bale and Greenshields 1978). These parameters quantify the responsiveness of producers and consumers to price movements and provide the basis for a forecast of production and consumption changes induced by the market intervention (Scandizzo and Bruce 1980). The values of the price elasticities of demand and supply are important because they determine the relative burden borne by producers and consumers. Unfortunately, it is not possible to estimate the demand and supply elasticities in the study because of resource constraints. Consequently, values obtained by other researchers like Haessel (1976) and Stryker (1990) are to be assumed for the analyses.

The purpose of this chapter is to examine the said values of demand and supply elasticities to be used. In Section 4.2 the theoretical basis of demand and supply elasticities are provided. The statistical model used as a basis for estimation as specified by Haessel (1976) and Stryker (1990) along with their results are described in Section 4.3. Section 4.4 contains a discussion of the type of model used and a summary of what are seen as significant issues arising from this type of modelling work. Additional elasticity estimates are considered in Section 4.5.

4.2 Theoretical Basis of Demand and Supply Elasticities

Elasticities have a long-standing conceptual and numerical meaning to economists. They measure the proportional change in one variable in response to a proportional variation in another (Tisdell 1982). Elasticity of demand and supply relate to the degree to which the quantity demanded and the quantity supplied respond to changes in prices.

The price of the product is the most important factor in a demand function and generally consumers tend to consume more when the prices fall and vice versa. The own-price elasticity of demand is used to measure the degree of consumer

responsiveness. It is a ratio that expresses the per percentage change in quantity demanded associated with a given percentage change in price (Tomek and Robinson 1990). Its mathematical definition is:

$$Ep = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \left(\frac{\Delta Q}{\Delta P}\right)\left(\frac{P}{Q}\right) \tag{4.1}$$

where:

Q = quantity demanded

P = price

Δ = a change

The theory of consumer behaviour points to the following as the major determinants of the value of price elasticity (Colman and Young 1989):

i the availability of substitutes;

ii the number of uses to which a commodity can be put;

iii the proportion of income spent on a particular product; and

iv the degree of commodity aggregation.

The elasticity of supply is defined as the percentage change in quantity supplied divided by the percentage change in price, other factors held constant (Colman and Young 1989). It indicates the speed and magnitude of output adjustments in response to changes in product price. In algebraic terms, it is expressed as follows:

$$Es = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \left(\frac{\Delta Q}{\Delta P}\right)\left(\frac{P}{Q}\right) \tag{4.2}$$

where:

Q = quantity supplied

P = price

Δ = a change

The supply function for a farm product could exhibit changes in elasticity at particular prices. As such, a particular elasticity estimate should be defined and interpreted in terms of the price and length of run to which it applies.

Supply elasticities are influenced by time and the availability of factors of production and other inputs (Killick 1989).

4.3 The Statistical Model and Results

Using the Theil-Goldberger mixed estimation technique and a 2-stage least-squares regression analysis, Haessel (1976) found the elasticity for the demand for maize (estimated alone) in Ghana to be very high and statistically insignificant. Therefore, the own-price elasticity of total coarse grain cereals consumption was used in place of the elasticity estimated directly for maize because of the high correlation between the prices of different coarse grains. This is partly because maize and other coarse grain cereals - namely, millet and sorghum - are substitutable for one another so that their prices tend to move closely together (Stryker 1990). Combining coarse grain cereals with root crops, such as yams and cassava, Haessel (1976) as cited in Stryker (1990), estimated the demand equation of maize for the period 1954 to 1970 as follows:

$$\ln C_t^c = \underset{(.14)}{2.960} - \underset{(.99)}{1.689} \ln P_t^c - \underset{(.92)}{0.823} \ln P_t^t + \underset{(.59)}{0.427} \ln P_t^r + \underset{(.54)}{0.917} \ln Y_t \quad (4.3)$$

where:

C = consumption

P = price

Y = per capita income

The superscripts c = coarse grain cereals; t = roots and tubers; r = rice; and

Figures in parenthesis are the standard errors for the regression coefficients.

Stryker (1990) did not indicate the adjusted coefficient of determination ($\overline{R}^2$) and it is not possible to estimate it from the data available. Consequently, it is impossible to comment on the explanatory power of the regressor variables.

Although all the coefficients are statistically insignificant, their signs conform with prior expectations. There is an inverse relationship between the quantity demanded and the price of coarse grains. It is reasonable to expect a direct relationship between the price of rice and the quantity demanded for coarse grains. As a substitute product in consumption, it is reasonable to have a positive relationship between the price of roots and tubers and the quantity demanded for coarse grains. Apart from coarse grains, all the other variables show inelastic elasticity values. The own-price elasticity estimated is fairly large in absolute terms. This may be due to the poor quality of the data resulting in biased estimates (Haessel 1976).

As Stryker (1990) admitted, aggregation of the three cereals - namely, maize, millet and sorghum could have led to misspecification in the model.

Haessel (1976) estimated the own-price elasticity of demand for maize (cereals) to be (-1.689). No distinction is, however, made between short- and long-run elasticities since it is assumed that the entire consumption response would occur within one year. The tentative conclusion based on the above evidence is that Ghanaian consumers respond significantly and substantially to changes in the price of local foodstuffs (Haessel 1976).

Following an examination of the theory of demand and supply and a review of the literature on the maize industry in Ghana, Stryker (1990, p.164-5) collected data and estimated the regression equation of maize supply for the period 1954 to 1985 as follows:

$$\ln Q_t^m = \underset{(3.434)}{4.304} + \underset{(2.535)}{.142 \ln Q_{t-1}^m} + \underset{(2.519)}{.794 \ln P_{t-1}^m} - \underset{(1.771)}{.267 \ln P_t^{co}} - \underset{(1.802)}{.440 \ln P_{t-1}^{ca}} \qquad (4.4)$$

$$\overline{R}^2 = 0.328$$

where:

The superscripts m = maize; co = cocoa; ca = cassava; and

Figures in parenthesis are the t-statistics for the regression coefficients.

Stryker (1990) estimated the short-run supply elasticity for maize with respect to its own price as (0.79) and the long-run elasticity as (0.93). He found these values to be reasonable, given the high substitutability in production with cocoa and other food crops such as yams, cassava, millet and sorghum.

As observed by Stryker (1990), all the coefficients have the expected signs and those for the lagged values of Q^m and P^m are statistically significant at the 0.05 level. The estimators for the cross-price elasticities for cocoa and cassava are statistically significant at the 0.10 level. All the coefficients exhibit inelastic values. With the adjusted coefficient of determination ($\overline{R^2}$) being only 0.328, it means the regressors do not explain a large proportion of the variations in the regressed variable. The poor fit of the model could possibly imply that (Griffiths, Hill and Judge 1993):

i the data were not well represented;

ii the model was misspecified; or/and

iii some important variables were omitted (as explained in section 4.4).

4.4 Observations on the Model and Method Used

In the demand equation, (as shown in 4.3), Stryker (1990) could not distinguish the separate influence of the maize price variable. The results therefore represent that of maize, millet and sorghum lumped together. Using wholesale prices rather than retail prices may also introduce biases, although tests of this proposition indicated this was not the case (Haessel 1976).

According to Ministry of Agriculture (1985), there has been an increasing consumption of maize as a result of shift in consumption pattern. This has been due to the increasing rate of urbanisation and changes in taste. Haessel (1976) could have included a trend term in the demand model to account for such miscellaneous factors.

In the supply equation (as shown in 4.4), Stryker (1990) used lagged market price of maize for one year as a proxy for producer price expectations by maize farmers in Ghana. The model, is therefore, based on naive expectations and assumes that farmers fully adjust to their desired output each season according to the price level in the previous season (Anderson 1974). However, according to Nerlove (1956), each past price represents only a very short-run market phenomenon - an equilibrium of those forces present in the market at the time. Kohls and Paarberg (1956), as cited in

Nerlove (1956), expressed a supporting view that farmers' price expectations depend only to a limited extent on what the previous year's price was. They are shaped by a multitude of influences, so that a representation of expected price as a function of a past price may not be a convenient way to summarise the effects of these many and diverse influences.

The traditional cobweb model, as used by Stryker (1990), cannot be used realistically to explain the Ghanaian maize supply response due to the following reasons:

i. Maize prices fluctuate considerably from year to year around a longer term trend. Farmers' expectations of future prices are therefore likely to depend not just on immediate past prices but on a number of past seasons' prices, from which the farmers would arrive at an expected price level.

ii. Despite the fact that maize is an annual crop and Ghanaian maize farmers primarily grow other staple food crops, the problem of 'asset fixity' still prevails in the industry. The farmers cannot fully adjust their output to the desired level each season due to some technological and institutional constraints such as availability of inputs and suitable land.

iii. The maize industry in Ghana therefore involves lags in both the formation of price expectations and acreage adjustment, which may be large enough to require inclusion in the supply model.

Due to the reasons discussed above, other alternative proxies for price expectations such as distributed lags of past prices, or the 'moving average' method would have been more realistic.

In the supply equation, the dependent variable Q^m_t is weather-influenced, but no chance variable was included in the model. In view of the practical problems involved in the determination and interpretation of weather conditions, rainfall could have been included as a proxy for the impact of weather, since maize in Ghana is produced under rain-fed conditions.

Some other potential variables such as prices of inputs and technological changes were also omitted by the researcher. It is difficult to believe that maize production in Ghana is not affected by technology. It is true, as Ministry of Agriculture (1987) pointed out, that there has been a growing tendency towards the adoption of improved methods among the small scale farmers. Consequently, the increased use of improved seeds and husbandry practices is thought to have been an important technological

influence on supply. According to Ministry of Agriculture (1985) the high-yielding varieties of maize, such as the 'okumasi' have proved popular and high yields are consistently achieved with the result that many farmers normally classified as subsistence, are now producing a small surplus as a cash crop. This trend should have been better captured in the model.

Stryker's (1990) model covered a period of about 30 years within which the country has been under seven different governments - both military and democratically-elected. The frequent changes in government have led to frequent changes in agricultural policies and organisational responsibilities. The effects of these changes on output could possibly have been captured by a dummy variable.

4.5 Comparison of Elasticities with Those of Other Studies

The purpose of this section is to review the empirical values of demand and supply elasticities in some developing countries and draw lessons from a few African studies. Table 4.1 shows the results of similar studies that have been done on the demand and supply elasticities of maize and other food grains in some developing countries. The studies are dated but there seem not to have been any recent studies on demand and supply elasticities of maize in recent years.

Although most of the developing countries whose elasticity values are cited differ greatly in their geographical and physical conditions and weather patterns, they have similar economic structures. Despite the assumed similarities in terms of socioeconomic profile, production, or consumption structure and policy environment, there will always be differences between any two countries. As noted by Stryker (1990) the short-run price elasticity of maize of 0.79 seems somewhat high in relation to most estimates for cereals in developing countries. It is, however, within the range of elasticities estimated in Nigeria for cotton and groundnuts, annual crops that may be substitutes for maize.

The other African countries, namely, Sudan, Kenya and Tanzania operated extremely different agricultural production and marketing policies that are not comparable with the analytical framework in Ghana. Their estimated elasticity values can therefore only provide a guide, but will not be reliable enough to be used for the present study. In the words of Tsakok (1990, p.166), 'it will be too risky to import the elasticity estimates for any adaptation'.

Table 4.1: Price elasticity of demand and supply of food grains in some developing countries

Country	Item	Demand/ Supply	Period	Elasticity	Researcher
Bangladesh	food grains	demand	1950 - 1968	-0.2800	Alamgir, Belage
Tanzania	maize	demand	1964 - 1977	-0.8978	Gerrard
Ghana	rice	demand	1954 - 1985	-1.2500	Stryker
Sudan	maize	supply	1951 - 1965	0.5600	-
Kenya	maize	supply	1950 - 1969	0.9500	-
Tanzania	maize	supply	1964 - 1977	0.3590	Gerrard
Ghana	rice	supply	1954 - 1985	0.4300	Stryker

Unfortunately, apart from Haessel (1976) and Stryker (1990), not much has been done by way of estimation of demand and supply elasticity values for maize or any other annual staple crop in Ghana. However, the emphasis of the study is not to estimate a 'new set' of elasticity values, but to 'borrow' the existing values for the present evaluative study.

4.6 Conclusion

From the observations noted in section 4.4, the model appears to be an oversimplification of the real Ghanaian situation and fails to recognise the structure of agricultural production in the country. Elasticity estimates must, however, be obtained from models that approximate the realities of the economy they represent if these elasticities are to be relied upon for policy analyses (Ogbu and Gbetibouo 1990). It is reasonable to expect different values for demand and supply elasticities of maize in Ghana, depending on the data or estimation technique used (Colman and Young 1989; Ellis 1992). It is likely that the non-recognition of some potential variables (as indicated in 4.4), may lead to serious specification bias (Griffiths, Hill and Judge 1993).

Since elasticity estimates may differ, it will be necessary to demonstrate the sensitivity of the results to changes in elasticities. As pointed out by Ellis (1992) it is unwise for the policy analyst to depend on a single elasticity estimate when calculating policy outcomes since elasticity parameters are very difficult to estimate with precision. Because the assumed elasticity values cannot be taken to be an exact representation of the reality, a sensitivity analysis was conducted to deal with the possible problem of uncertainty and arbitrariness associated with the estimated values.