

**Liberalisation and Smallholder
Agricultural Development:
A Case Study of Coffee Farms in Kenya**

Andrew Mwihia Karanja

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A Case Study of Coffee Farms in Central Kenya**

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Abstract

Agricultural production and market participation by smallholder farmers in Kenya continues to decline despite the market reforms undertaken in the last one decade. This study examines the factors behind this decline. The objectives of the study are to evaluate agricultural price evolution and volatility, institutional changes, smallholder farmer's resource allocation and productivity as well as their efficiency in the advent of market reforms. The study focuses on smallholder coffee farms in Central Kenya province.

Four separate but related analytical models are applied in this study. Various time series statistical methods including an ARCH (M) model are applied to analyse the price evolution and volatility for the period 1985 to 1999. Institutional changes are analysed using an exchange configuration framework, which is theoretically founded on new institutional economics. A bivariate probit selectivity model that relates household's credit and land constraints to resource allocation and farm productivity is also applied. Finally, a stochastic translog cost frontier model is applied to measure cost efficiency.

The study shows that market reforms in Kenya, although of the priciest type, did not create sufficient conditions to completely reverse the decline in agricultural sector terms of trade and producer prices in the previous years. Nevertheless, market reforms reversed the negative trends in prices which were prevalent during the pre-reform period. The reforms are also associated with higher price volatility with attendant increases in price volatility costs to smallholder farmers. Institutional reforms lagged behind the market reforms, a situation that constrained access to agricultural services, supply of agricultural credit, private sector participation, while increasing transaction costs to agricultural producers. The study also shows that constraints in factor markets, high transaction costs and risks tempered resource allocation towards subsistence production with consequent declines in productivity and market participation. Smallholder farmers in Kenya are shown to have medium to high level of production efficiency that is comparable to efficiency levels in other developing countries. The study consequently concludes that smallholder-based development strategy is still an efficient mode of organising agricultural production. While there is still room for improving smallholder farmer levels of efficiency through better resource allocation and re-allocation, the highest source of growth is likely to come from technology development that shifts the production frontier outward.

The conclusions points to the need for policy interventions that mainly focuses on creating institutional frameworks necessary for reducing transaction and production costs, price and institutional performance risks, increasing access to production resources, services and markets by smallholder farmers. The study also identifies and recommends specific policies to enhance private sector participation as well as the social capital of smallholder farmers. This study views these as the main challenges to be tackled in the second-generation reform programs for agricultural development, prosperity and poverty alleviation in Kenya and Sub-Saharan Africa in general.

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Acronyms

ADB	African Development Bank
AFC	Agricultural Finance Corporation
BBC	British Broadcasting Corporation
CBK	Coffee Board of Kenya
CBS	Central Bureau of Statistics
CFC	Common Fund for Commodities
CRF	Coffee Research Foundation
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GNP	Gross National Product
HCDA	Horticultural Crops Development Authority
ICAs	International Commodity Agreements
ICO	International Coffee Organisation
IMF	International Monetary Fund
ITF	International Task Force on commodity risk management
KARI	Kenya Agricultural Research Institute
KCC	Kenya Co-operative Creameries
KPCU	Kenya Planters Co-operative Union
KDB	Kenya Dairy Board
KTDA	Kenya Tea Development Authority/Agency
KTGA	Kenya Tea Growers Association
KUSSTO	Kenya Small-Scale Tea Growers Association
LAB	Land Agricultural Bank
LDCs	Least Developed Countries
MoA	Ministry of Agriculture
NBFIs	Non-Bank Financial Institutions
NCPB	National Cereals and Produce Board
NIE	New Institutional Economics
SACCOs	Savings and Credit Co-operative Societies
SAPs	Structural Adjustment Programmes
SSA	Sub-Saharan Africa
TBK	Tea Board of Kenya
ToT	Terms of Trade
TRF	Tea Research Foundation
UNCTAD	United Nations Conference on Trade and Development
WB	World Bank

Units

Ksh	Kenya Shilling (1 Ksh = US \$ 78 in 2000/2001)
MT	Metric Tonne (1 MT= 1,000 kg)

CHAPTER 1

INTRODUCTION

1.1 Agriculture and development in Sub-Saharan Africa

Much emphasis in development economics, both in historical and theoretical perspective, has been laid on identifying the role agriculture plays in the process of development. In the majority of developing countries, agriculture is the dominant sector accounting for a major share of GNP as well as employing more than half of the labour force. This contrasts strongly with developed economies where less than 10% of GDP and employment can be attributed to agricultural activity (Hayami & Ruttan, 1985). Developing countries are, therefore, heavily dependent on agriculture for the investment resources necessary for economic growth. The generation of increased agricultural surplus requires raising the productivity of agriculture resources. This can only be achieved through technological, market and institutional changes that enhance resource allocation and productivity in agriculture.

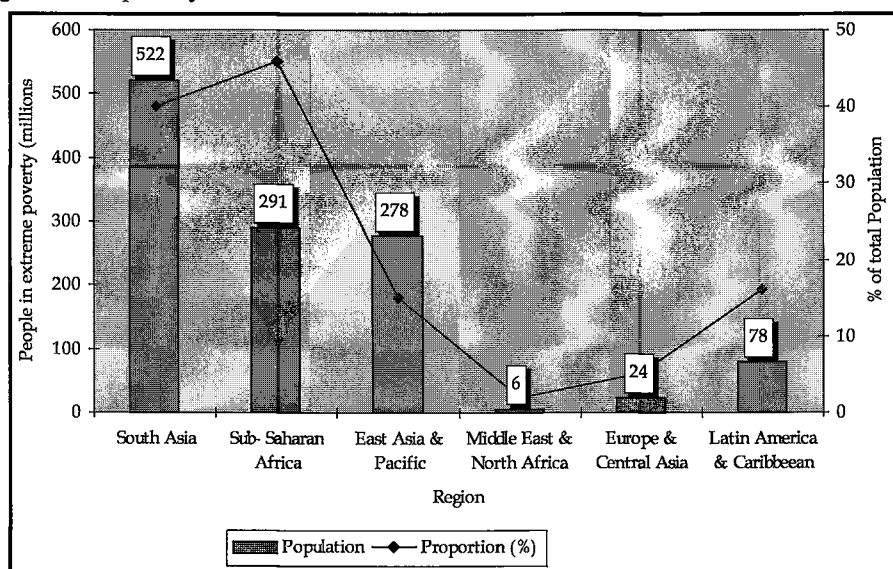
In Sub-Saharan Africa (SSA), agriculture accounts for 35% of the region's GNP, 40% of exports and 70% of employment (World Bank, 1998). While agriculture needs to be the engine of growth in these economies, its performance in the last two decades has been disappointing with the sector's growth being exceeded by increases in population. This poor growth in the agricultural sector coupled by a heavy external debt burden led to an economic crisis in the region with massive poverty, hunger and decline in general welfare of the region's 630 million people. To address the economic crisis and to rejuvenate development in the region, the international community led by multilateral financial institutions mainly World Bank and IMF, in collaboration with governments in the region, introduced Structural Adjustment Programmes (SAPs) in the early 1980's. The programmes were intended to accelerate economic growth through economic liberalisation and structural reforms. The SAPs were premised upon new ideas about the roles of government and the private sector both in national economies and society in general (Stiglitz, 1998; Moll, 2000).

After more than a decade of structural adjustment, economic growth in SSA has started to pick up. GDP grew at an average rate of 3.3% between 1993-1997 compared to 1.3% in the period 1988-1992. Nevertheless, despite these recent gains, per capita GDP in 1996 was estimated to be below that realised in 1990 and poverty was increasing (ADB, 1997; World Bank, 2000a). This evidence is supported by Collier & Gunning (1999), who indicate that per capita GDP in Africa declined by 1.8 % per annum between 1990-1994 as compared to a decline of 1.3 % per annum in 1980s. These facts have made the question of how far SAPs contribute to economic growth, development and poverty reduction one of the most contested developmental issue in recent years (Raikes, 1997; Mosley *et al.*, 1995).

Although the direction of policy in most SSA countries has generally been towards liberalisation, implementation has often been slow, inconsistent, erratic, untimely and sometimes half-hearted. This has meant that results are not always clearly visible. However, consensus is emerging that structural adjustments policies have mainly concentrated on market reforms aimed at 'getting the prices right', while other reinforcing measures, policies and institutional frameworks have lagged behind (Thorbecke, 2000; Kuyvenhoven, *et al.*, 2000). However, there is no doubt that the liberalised market systems emerging from structural adjustment have fundamentally changed the economic landscape across SSA. These changes are mainly visible in emerging market and non-market exchange configurations and contractual arrangements between market participants. Changes in relative prices, access to both factor and

commodity markets as well as institutional changes have been the driving forces behind the changes in economic and social environment in which farmers and other participants operate. Farmers and other market participants are therefore being forced to re-order their priorities to conform with the new economic environment. Therefore, there is a clear need to evaluate the effects of these policy changes on agricultural development.

Agriculture development in most SSA states centres mainly on smallholder farmers who are engaged in subsistence and export commodity production. At the macro economic level, most LDC economies are highly dependent on the revenues derived from the export of agricultural commodities for a large proportion of their annual budget. As can be seen from Appendix 1.1, for example, the export of agricultural commodities account for over 50% of total merchandise exports in 32 African countries in 1997 (World Bank, 1999). The viability of the agricultural commodity sector is therefore inextricably linked to future prospects for growth, employment generation and poverty reduction of most LDCs, and SSA countries in particular. In 1998 (see Fig.1.1), 291 million people or 46% of the entire SSA population were living in extreme poverty on less than one US dollar a day (World Bank, 2000a). The majority of these poor people live in rural areas and are mainly engaged in agriculture. Thus, if the World Bank's set goal of reducing poverty levels in the region to 24% by the year 2015 is to be met agriculture has to play a major and central role. The challenge is, therefore, to place the production and marketing of agricultural commodities centre stage in order to ensure economic growth and poverty reduction in a liberalised market environment.



Source: World Bank: World development report, 2000/2001

Figure 1.1 Number and percentage of people living in extreme poverty in various regions of the world, 1998

At the micro-level, there is also need to evaluate how smallholder farmers, who form the bulk of producers in SSA economies, are adjusting their portfolio choice to meet their food and income needs. Such an evaluation will clarify the direction that agricultural development policy needs to take and specifically the role that the smallholder farmer can be expected to play. It will also provide an insight into the trade-offs likely at household level. This is hoped to contribute towards policy formulation aimed at enhancing resource productivity while addressing the emerging issue of identifying the roles of various institutions and their relevance to the noble goal of poverty alleviation.

The issues identified above have far-reaching policy implications both at the macro and micro-economic level. For this reason they form the focal point of the present study and will be examined in the context of smallholder farming in Kenya. Because coffee is not only a major export crop in Kenya but also elsewhere in SSA, this thesis deals specifically with the smallholder coffee farmers.

1.2 Review of structural adjustments in Sub-Saharan Africa

The SAPs have their theoretical underpinnings in the neo-classical school of thought, with its intellectual roots in Adam Smith's 'invisible hand'. This is as opposed to the structuralist paradigm that encouraged elaborate central government planning and participation in development, particularly through investments in commercial enterprises and strong administrative structures. The philosophy of SAPs emphasises the advantages of encouraging the free play of market forces (*laissez-faire* principle) and the reduction of government participation in economic activities. It is argued that such an approach will help developing countries overcome their excessive dependence on a few export commodities and stimulate self-reliant growth and development. In addition it can open the way to tackling such problems as large and growing government deficits, balance of payments disequilibrium, low productivity, stagflation, unemployment, and external debt.

The term 'Structural Adjustment' came into common use in the early 1980s¹. The policies associated with it are mainly directed to the supply side of the economy and the removal of market distortions are emphasised as a way of promoting economic growth (Corbo & Fischer, 1995, Mosley *et al.*, 1995). Stabilisation policies on their part are directed at the demand side of the economy, with the purpose of improving balance of payments position and reducing inflation (Mosley *et al.*, 1995).

The term structural adjustment has commonly been taken to be almost synonymous with the term liberalisation. However, in its broadest sense, structural adjustments has been used as a catch word emphasising trade liberalisation policies (for instance devaluation, reduction and harmonisation of tariffs) as well as institutional (structural) changes mainly with regard to the roles of state and private sector (Thorbecke, 2000). Trade liberalisation policies are mainly geared towards 'getting the prices right' with a view to allowing the market (price) system to play its rightful role in efficiently allocating resources, rationing of goods and services and determining the final mix of output in an economy. The structural changes are primarily concerned with reducing the role of the public sector while enhancing the private sector role in the economy, or what Lipton (1990) terms as the 'market relaxation-state compression hypothesis'. However, even with structural changes, the leading role of government in the development process can hardly be contested (Moll, 2000; Stiglitz, 1998)².

¹ According to O'Brien & Ryan (1999), the then World Bank President McNamara announced the Bank's intention to launch a new program of lending in support of structural adjustment at Manila UNCTAD conference in April, 1979.

² The term "Washington Consensus" has also been used to describe the lowest common denominator of policy advice being addressed by the Washington institutions (mainly World Bank and IMF), initially to Latin American countries but later extended to other developing countries (Williamson, 1990, 2000). The term has also come to be associated with free markets with minimalist role of the governments or what Soros (1998) calls 'market fundamentalism'. Stiglitz (1998) has argued that the Washington consensus was limited in as far as the role of the government was concerned. He argued that the task of making the state more effective is considerably more complex than just shrinking its size. In this regard he calls for a post-Washington consensus which among other things recognises the role of governments as a key institution in development.

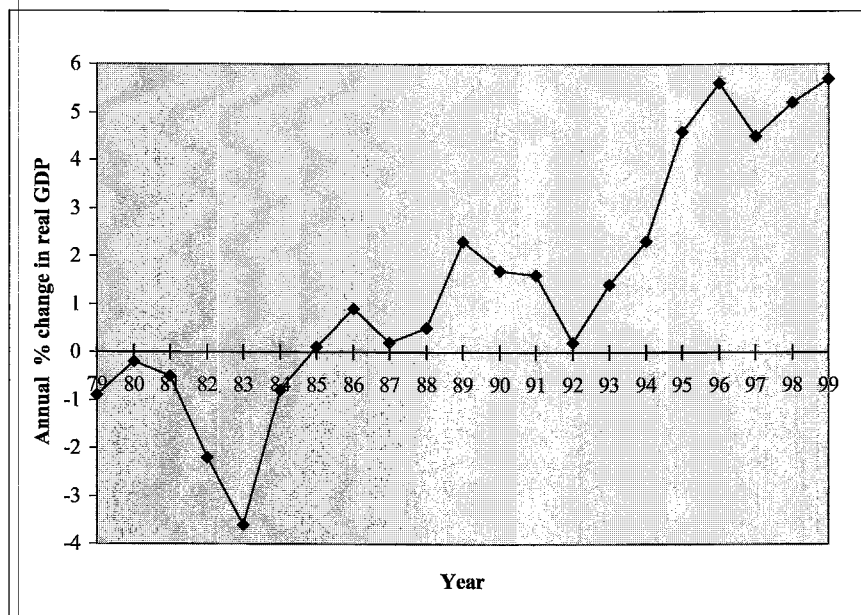
In 1984 the World Bank in its influential report on *Accelerated Development in Sub-Saharan Africa: An Agenda for Action* (the Berg Report) drew attention to the fact that living standards across the African continent and more so SSA, have been declining for most part of the 1970s. Between 1970 and 1982 agricultural production per capita rose in only five out of 46 countries in the region (Ghai & Smith, 1987). This decline was attributed to the vagaries of the weather, political conflicts, world demand and also mistakes made in policy making. To revitalise economic growth the report recommended three major policy actions: more suitable trade and exchange rate policies, a more efficient use of resources in the public sector, and finally improved agricultural policies. Thus, according to Corbo & Fischer (1995) the adjustment programs focus primarily on trade regimes and the operations of the public sector. In sector terms reforms have focused on agriculture, trade and finance.

The prominence given to financial sector reforms can be explained by the perception that efficiency in the financial sector is crucial to economic growth and the fact that there was a widespread failure of financial institutions during the debt crisis (World Bank, 1989). The agricultural sector has featured prominently in the SAPs in most SSA countries not only because it plays a dominant role in these countries' economies, but also because of the extensive government interventions that were prevalent in the sector (Commander, 1989). According to Krueger *et al* (1992), these government interventions in the agricultural sector were responsible for the slow economic growth in the region.

Evaluations of structural adjustment programs in the developing countries and in SSA in particular have been inconclusive and often extremely controversial. As reviewed by Corbo and Fischer (1995) the evaluations of SAPs have been bedevilled by various complications. These include the quality of data available, issues of cross country comparability, appropriate time frames, the selection of performance indicators and the isolation of the marginal contribution made by SAPs in a counterfactual analysis. Alternative approaches have also been used to evaluate the effectiveness of SAPs, thereby bringing in the issue of comparability of results.

The World Bank has undertaken several evaluations on the effectiveness of SAPs in SSA (World Bank, 1988, 1994). Earlier evaluations covering the period 1985-1989 indicated that the region's economic growth rate- as measured by real growth in GDP - had taken an upward turn. Mosley *et al* (1991) in their econometric evaluation of adjustment policies came to the conclusion that for the period 1980-1986 the World Bank SAPs had a weak positive effect on GDP growth. The authors also find a significant and negative effect of the SAPs on investment rates.

Conway (1990) undertook a 76 cross-country evaluation of the SAPs. He concludes that there is a significant association between World Bank structural adjustment programs and growth in real GDP, and a lower ratio of domestic investment to GNP. In 1994, the World Bank issued another evaluation report assessing the progress and prospects that set the agenda for recovery in Africa. The report highlighted a policy shift from one that had emphasised structural adjustment to one that advocated for stabilisation. Reports from the World Bank indicate that it believes SAPs have achieved their objective of increasing efficiency and economic growth. As Figure 1.2 shows, the negative annual growth in real GDP that typified SSA between 1979 and 1985 had been turned to positive growth by the late 1980s. The growth in real GDP accelerated in the 1990s reaching an annual rate of about 5.8% in 1999.



Source: World Bank development report (various)

Figure 1.2 Annual growth in real GDP in Sub-Saharan Africa, 1979 to 1999

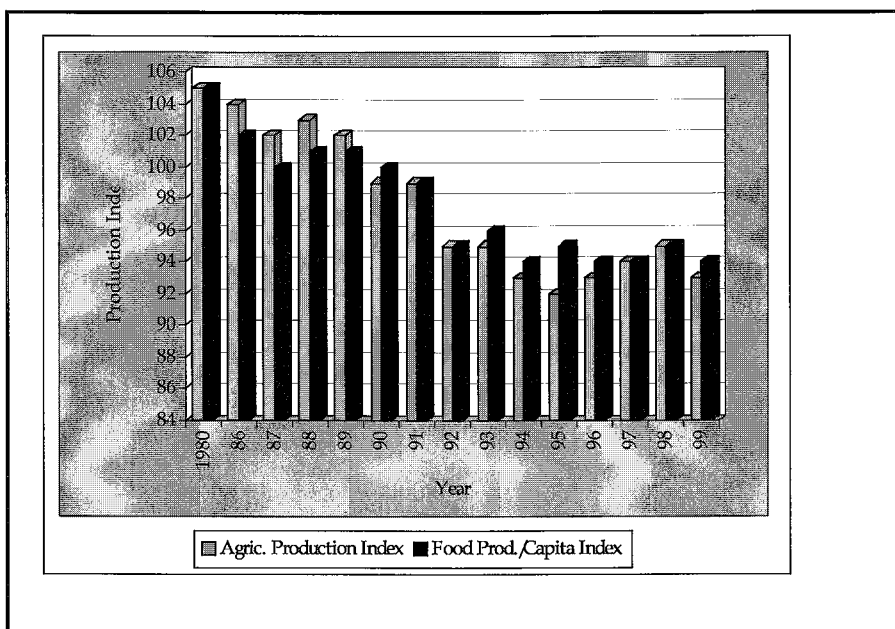
However, the role played by SAPs in this positive turn of events is not entirely clear. Furthermore, the sustainability of the benefits derived from this growth and their distribution remains a source of concern, particularly because of the growing numbers of households in SSA that live in poverty (ADB, 1997; World Bank, 2000a). Indeed, the World Bank evaluation report of 1994 concedes as much by stating:

“ Current growth rates among the best African performers are still too low to reduce poverty much in the next two or three decades. So far the rebounds have merely brought countries to their historical trend of low growth, and it is not clear whether they are shifting onto a higher growth path. Without further substantial increase in agricultural, investment, export and GDP growth, Sub-Saharan Africa will continue to lag behind other developing regions” World Bank (1994 p.132).

These concerns have been used as basis for criticising the effects of SAPs in the region. One such critique of the World Bank's evaluation of the SAPs in SSA region is provided by Mosley *et al* (1995). The authors acknowledge that the SAPs have mainly been effective in the area of real exchange rate devaluation and reducing the taxation imposed via marketing boards and other mechanisms. It was subsequently supposed that such changes at the macroeconomic level have resulted in an improvement in the prices paid to farmers. However, there is dearth of analytical work to verify this assertion, a gap that needs to be filled. The way forward emphasises stabilisation policies (World Bank, 1994), the enhancement of industrial capabilities to enhance investments, technical innovations and agricultural diversification (Mosley *et al.*, 1995). A more recent report from the World Bank suggests a more holistic approach should be adopted in elaborating Africa's development agenda (World Bank, 2000b). The report proposes strategies for ushering in a self-reinforcing process of economic, political and social development that focuses on four core areas: improving governance and resolving

conflicts, investing in people, increasing competition and the diversification of economies while reducing the dependency on aid and strengthening internal and local co-operation.

The effect of SAPs on agricultural production in SSA has also not been impressive. There is no evidence that per capita decline in agricultural output evident in the region since 1970 has been arrested (Mosley & Smith, 1995; Raikes, 1997). As shown in Figure 1.3, the per capita food production and agricultural production in the region declined by an annual average rate of 0.5 percent and 0.6 percent, respectively between 1990 to 1999.



Source: World Bank(1997): African development indicators (various)

Figure 1.3 Agricultural production and food production per capita in SSA in 1980 as compared to 1986 to 1999

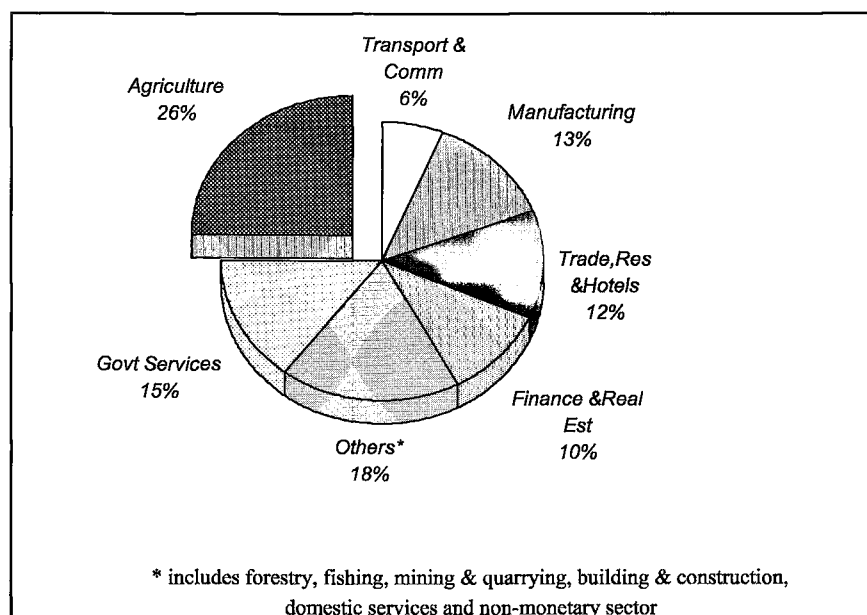
The policies recommended by the Breton Woods institutions- mainly with regard to pricing policy, interest and exchange rates and reduction in budget deficit- remain, in most cases, only partially implemented owing to various political and institutional constraints. One major area of concern has been the decline in government development spending particularly as far as agricultural services such as research, rural infrastructure, extension and credit are concerned. This can directly and adversely affect the fragile momentum of smallholder agricultural development. Although an attempt to increase agricultural production through price-based incentives is a good strategy, there is also a need to give more emphasis to changes in agricultural technologies and the institutional framework to support the price incentives. Technology development and dissemination and other production and marketing institutional arrangements happen to have a 'public good' component. This limits the amount of investments the profit-motivated private sector is prepared to make. Dorward *et al* (1998) have argued that relatively little attention has been given to the capacity of the private sector to provide agricultural services or to what these services might be given the economic, political and social conditions prevailing in most SSA states. Indeed, the disappointing response to market liberalisation can be attributed to the unduly optimistic view held by liberalisation enthusiasts on the potential of privatisation in SSA settings.

Despite the less than appealing impact of SAPs at both the macro and sector level, there is documented evidence that, in the short term, market reforms increased the mean and variance of agricultural prices in SSA (Barrett, 1997; Krueger *et al.*, 1988; Lapp & Smith, 1992). As far as the welfare of agricultural producers are concerned, these price changes have been differential in their impact (Baffes & Gautan, 1996). An equally important conclusion is that reforms have increased the scope for enhancing efficiency gains by removing market distortions thereby allowing a more efficient allocation and re-allocation of resources by smallholder producers. The impact of the institutional framework emerging to supporting smallholder agriculture is, however, not well understood. Equally, most of the studies undertaken in SSA to evaluate the impact of market reforms are concentrated at macro-economic and sector levels. There are few studies that link macro-economic and sector performance to the micro-economic level. This is despite the importance of household responses in determining aggregate sector and national responses and the insights such evaluations can bring to policy formulation. As in most SSA countries agricultural development policies are based on the promotion of smallholder agriculture, there is a need for a better understanding of the way in which these important production entities have been affected by market reforms. The current study hopes to contribute towards bridging this empirical gap.

1.3 Kenya's economy and the role of agriculture

Like most of other developing countries, Kenya's economy is agriculturally based with 80 % of the population living in rural areas mainly engaged in agriculture related activities. In 1999, agriculture sector accounted for approximately one quarter of Kenya's GDP as shown in Figure 1.4. The sector also employs more than two thirds of the Kenyan labour force and accounts for about 70 percent of total export revenue. In addition, the sector produces almost all of the country's food requirements and provides significant proportions of raw materials used in agro-based industries, thus forming crucial forward and backward linkages with the rest of the economy. Smallholder sub-sector contributes about 75 per cent of the county's total value of agricultural output, 55 per cent of the marketed agricultural output and over 85 per cent of the total employment within the agricultural sector (Republic of Kenya, 1998).

Coffee, tea and horticultural crops are the main agricultural exports. In 1999, for example, these three commodities had an export value of Ksh 45 billion (US \$ 596 million) equivalent to 45% of total export earnings (Republic of Kenya, 2000). In terms of foreign exchange earnings, the coffee sub-sector, which is the main focus of this study, was ranked forth in 1999 after tea, tourism and horticulture, contributing 11 % of the total foreign exchange earnings. In 1997/98 production year coffee exports were valued at Ksh 15 billion (US \$ 260 million) that was equivalent to 10 per cent of agricultural GDP or 2.7 percent of national GDP.



Source: Kenya economic survey, 2000.

Figure 1.4 Structure of Kenya's economy, 1999

During the first two decades after political independence in 1963, Kenya's development had registered a remarkable performance. The development strategy rested on promotion of agricultural production, particularly smallholder agriculture. This strategy helped the country's GDP to grow at a rate of 6.6% per annum during the 1960s (Table 1.1) with the annual growth rate within the agricultural sector running at almost 5%. Although the oil crisis resulted in growth slowing to about 4% per annum in the 1970s, GDP continued to grow at a rate that was above average for comparable low-income countries. Public and private investments yielded education and social indicators well above the average social indicators for Sub-Saharan Africa (Swamy, 1994). The investments in social amenities, mainly health and education, and high economic growth buoyed population growth. By the late 1970s, Kenya - with an increase of 3.8% per annum - had one of the highest population growth rates in the world. By the 1980s, the effects of strong population increase combined with poor economic management were starting to take their toll on economic growth and development (Table 1.1). The poor economic growth and deteriorating balance of payment position acted as the precursor for initial introduction of SAPs in the mid 1980's. As Swamy (1994) and Ng'ethe & Owino (1997) concede, lack of political goodwill thwarted initial attempts to reform the Kenyan economy. It was not until 1991 that SAPs began to be consistently implemented in Kenya.

Table 1.1 Kenya's real and per capita GDP growth rates, 1963 to 1999

Year	Real GDP Growth (%)	Real per capita GDP Growth (%)
1963-1973	6.6	3.0
1974-1979	4.0	2.0
1980-1985	3.8	-0.5
1986-1990	4.9	0.8
1991	2.3	-0.7
1992	0.4	-2.8
1993	0.2	-2.8
1994	3.0	0.2
1995	4.8	1.9
1996	4.6	1.8
1997	2.3	-0.6
1998	1.8	-1.1
1999*	1.4	-1.5

*Provisional estimate

Source: Statistical abstracts and Kenya economic surveys (various)

At the macro-economic level the structural reforms have focused, *inter alia*, on liberalisation of foreign exchange and interest rates, input and commodity prices, rationalisation of government budget and the divestiture of state owned corporations. The overall objective has been to increase market competition and efficiency. In turn this is expected to enhance economic growth through private sector led initiatives. Nevertheless, the economic results during the reform period are, to say the least, disappointing. Except for the periods 1986-1990 and 1994-1996 when there was a respectable level of growth in GDP growth, overall performance has been poor (Table 1.1). Per capita GDP growth was negative for most of the 1990s. As might be expected from such economic trends, poverty levels have increased while social indicators such as life expectancy, child mortality and school enrolments have deteriorated (Republic of Kenya, 2000). Underlying the record of poor economic growth in the 1990s was the failure of structural adjustments to promote either the sustained recovery of private investments or export growth. According to O'Brien and Ryan (1999) this finding holds for both domestic and foreign investments. Direct foreign investments in Kenya, for example, declined from an annual average of US\$ 38 million in 1980-84 to just US\$11 million in the period 1992-96. The poor track record in implementing SAPs and deficiencies in creating the essential prerequisites for higher investment such as political stability, good governance and physical infrastructure could account for this slow down in Kenya's economic growth.

In a restructured economy, the government is expected to remain a key participant, but with its role being confined to creating a legal and economic environment conducive to private sector growth. Macro economic reforms were also expected to improve the terms of trade and growth in the agricultural sector. The extent to which this has been achieved, especially within the dominant agricultural sector has not been well documented. This is a clear oversight and the present study hopes to make a contribution to bridging this gap.

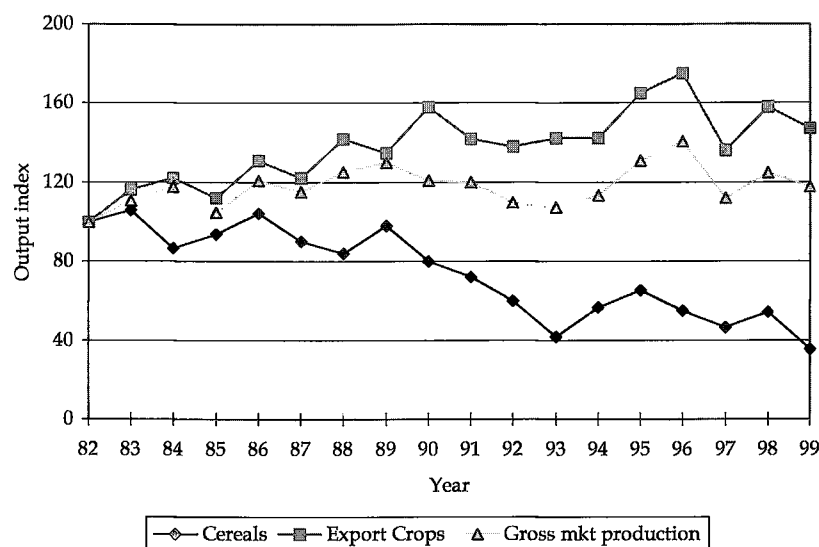
The devaluation's of the Kenyan currency has reduced the heavy implicit tax arising from an over-valued currency thereby benefiting exporters like coffee farmers. However, trade in export commodity - mainly tea and coffee - is conducted in US dollars and farmers are paid in the same currency. The floating exchange rate has introduced the risks associated with fluctuation in foreign exchange to farmers and their agents whose knowledge of currency hedging mechanisms are very limited. As a result wide variations can occur in farmers' revenues even during the course of the same season. High interest rates and government deficit financing have tended to crowd out private sector access to formal institutional finance. This has severely constrained agriculture sector credit

in general and smallholder farmers access in particular. The situation has been made worse by short-term limitations imposed on credit access when most government and donor subsidised credit schemes were abolished.

Agriculture sector reforms on their part have mainly been geared towards creating market competition through encouraging more private sector investments and participation. Price controls for agricultural produce and inputs have been abolished while most marketing boards have been restructured and their roles confined to regulation and promotion. Agricultural services with potential appeal to private sector have been privatised while government continues to provide services with large public goods component such as research and extension.

Thus, it is assumed that economic reforms, both at macro and sector level have improved the terms of trade in the agricultural sector, the pricing system and access to both factor and commodity markets especially for smallholder farmers. At the institutional level, it was hoped that market reforms would lower transaction costs and give smallholder farmers a more participatory role in control and governance. These changes were further expected to result in a rise in smallholder farm productivity, production efficiency and general welfare.

Despite these reforms and their worthy objectives, the volume of agricultural production marketed has not increased as expected. As Figure 1.5 shows, the amount of marketed food crops and gross marketed production continued to decline despite the market reforms introduced in 1991. The increases registered by export crops were buoyed by increases in tea exports and conceal the 55% decline in production that occurred in the coffee sector during the reform period (Karanja, 1998). The decline in marketed agricultural production indicated that production and farmers' market participation might have declined with the advent of market reforms. If this was the case, why then would a declining agricultural production continue unabated despite introduction of market reforms which were expected to offer more competitive prices and better institutional set-ups necessary for increased production and market participation? This study attempts to answer this question by focusing on smallholder coffee farms in Kenya.



Source: Kenya, economic surveys (various)

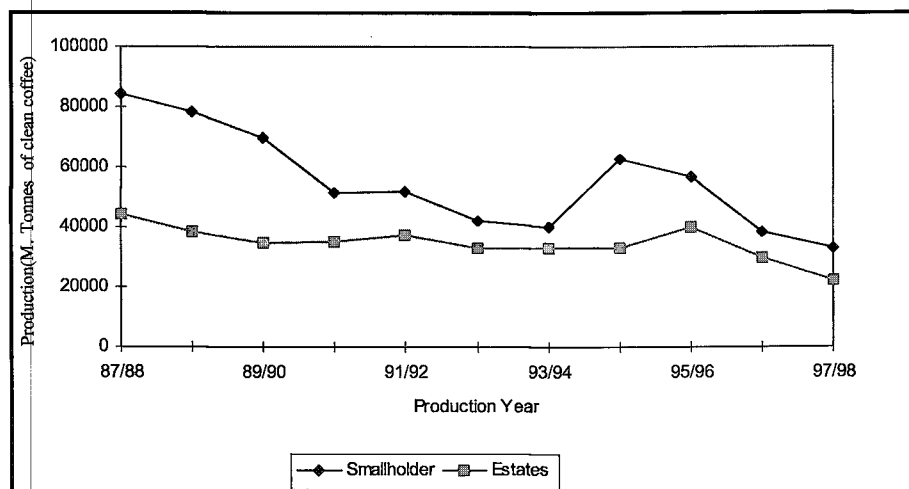
Figure 1.5 Output index of agricultural commodities marketed in Kenya, 1982 to 1999

1.4 Role and trend of coffee production in Kenya

Approximately 600,000 smallholder farmers and 1,300 large-scale farmers produce coffee in Kenya. The smallholder farmers process and market their coffee through 330 co-operative societies while the estate farmers process their coffee in their own farms. Coffee production takes place mainly in high to medium potential land. These areas account for only 20% of country's arable land but accommodate 80% of the population (CBS, 1994). The rapidly increasing population (current population growth rate estimated at 2.9 % per annum) and the increase in food demand will call for intensified and sustainable land use practices especially in coffee growing areas.

Coffee production history is closely intertwined with Kenya's economic development, as coffee has been the number one foreign exchange earner since independence in 1963 until 1989 when it was surpassed by tourism. Apart from its role as a foreign exchange earner, government has relied on coffee for taxes to finance recurrent and development expenditure. Due to the large number of smallholder farmers directly engaged in coffee production, coffee also served an important equity role, one that could not be matched by capital intensive service sectors like tourism. At the household level, income from coffee accounts for a major proportion of total farm income in the coffee growing areas. These incomes have important multiplier effects in the national economy and more so in rural development. Rural financial markets which offer credit to farmers are also highly intertwined with coffee marketing systems in the coffee growing areas. Coffee, therefore, plays a major development role in Kenya and its performance has far-reaching socio-economic implications.

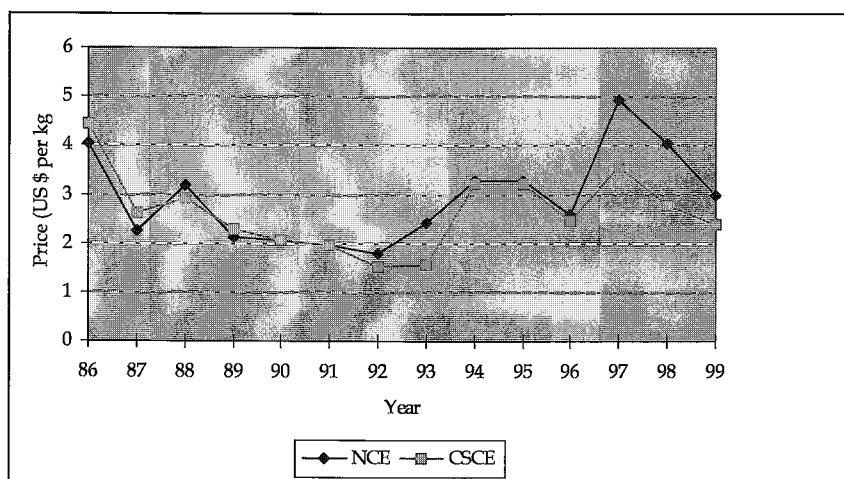
Smallholder coffee production has declined persistently in the last decade. Smallholder production declined by 61% from 84,300 metric tonnes in 1987 to only 32,900 metric tonnes in 1997/98 as shown in Figure 1.6. During the same period, estimated yield has also declined from 680 kg to 340 kg per hectare (CBK, 1998). Indeed, the 1997/98 production and yields were the lowest ever recorded from smallholder farms for the last 25 years. Large-scale farms, however, were able to maintain an average annual production at around 32,000 metric tonnes during the same period despite slight decline in yield (Figure 1.6).



Source: Coffee Board of Kenya annual reports (various)

Figure 1.6 Coffee production by small and large farms in Kenya, 1987/88 to 1997/98

Some of this decline could have been accounted for by the depressed coffee prices that followed the collapse of the International Coffee Agreement (ICA) in July 1989. However, both international and domestic coffee prices began to increase after 1992/93 as can be seen from Figure 1.7. Nevertheless, price increases did little to arrest declining smallholder production. During the same period larger farms faced with these price trends maintained almost steady production. This seems to indicate that smallholder coffee farmers were confronted with a unique and unfavourable set of economic and non-economic conditions that affected their supply response. One such economic factor is the high volatility of coffee prices witnessed after the collapse of ICA and the liberalisation of foreign exchange markets in some producer countries. Studies carried out by the International Coffee Organisation (ICO) and United Nations Conference on Trade and Development (UNCTAD) indicate that, as far as prices are concerned, coffee is one of the most volatile of the tropical beverages. This was even more so after the suspension of the ICA in 1989 (ICO, 1997; UNCTAD, 1995). The extent to which this increased volatility in prices has affected risk-averse smallholder coffee producers globally and particularly in Kenya is not well documented.



Source: Coffee Board of Kenya & ICO market reports (various)

Figure 1.7 Average coffee prices in the Nairobi Coffee Exchange (NCE) and New York Coffee, Sugar and Cocoa Exchange (CSCE), 1986 to June 1999³

Studies done elsewhere in SSA also clearly indicate that both small and large scale farmers in the region are as price responsive as farmers in other regions (Bond, 1983; Binswanger, 1989; Jaeger, 1992). In Kenya, Kirori & Gitu (1991) have estimated that both small and large scale coffee producers have a short term supply response elasticity ranging from 0.13 to 0.39 as compared to long term elasticity of between 0.33 and 0.98. Thus, the persistent decline in smallholder coffee production in the last decade- and more so after 1993- are not only unexpected and may have originated from price distortion factors and other non-price factors facing smallholder farmers.

The decline in smallholder coffee production accelerated with the onset of market reforms. This decline in production amidst market reforms that aimed to improve the terms of agricultural trade and of export commodities in particular seems to be both unexpected and a major contradiction. According to Lele and Agarwal (1989), smallholder coffee farmers in Kenya have a comparative advantage (as measured by domestic resource cost) over large-scale coffee producers.

³ For long term trend in international coffee prices, see Appendix 1.2.

Furthermore, as Jaeger (1992) has shown total agricultural production, food production and staple food production responds positively to increases in the prices of export crops in SSA countries. The study therefore suggests a positive correlation between growth in export crops, such as coffee and that of food crops. The study goes further and suggests a number of reasons for this correlation. First, food crops do benefit from the availability and actual application of inputs secured through the sale of export crops. Secondly, higher incomes from export crops can lead to higher investments in food crops. In addition, as the income from export crops increase farmers may devote less time to off-farm employment in order to supplement their income and, therefore, have more time to allocate to food production. Finally, the study points out that a better policy environment as proxied by higher export crop prices and more competitive exchange rates may help promote the growth of both export and food crops. Thus, the decline in smallholder coffee production could also have adversely affected food crop production and have a major and adverse affect on food security at national and household level. However, there is little empirical evidence to clarify the linkage of the effects of market reforms on commodity prices, price risks and smallholder farmers' decision-making in these new institutional settings.

Given, the major economic role coffee plays in the SSA countries and Kenya in particular, the issues identified above have far-reaching policy implications both at the macro- and micro-economic level. It is for these reasons that this study focuses on these issues and uses smallholder farmers in Kenya as its central reference point.

1.5 Study objectives and research questions

1.5.1 Study objectives

The study has three objectives:

- (i) Determination of the effects of market reforms on the agricultural sector terms of trade, evolution of smallholder farmers' commodity prices and price risks in Kenya.
- (ii) Assessment of the institutional changes brought about by market reforms and their impact on smallholder farmers' transaction costs, access to factors of production and inputs and the attendant changes in market co-ordination and control⁴ in various commodity systems.
- (iii) Assessment of the effects of economic, institutional and household factors on smallholder farmers resource allocation decisions and their subsequent effects on farm productivity and efficiency in a liberalised economy.

1.5.2 Research questions

SAPs both at macroeconomic and sectorial level are hypothesised to have fundamentally changed the price policy and institutional environments in which smallholder agricultural production takes place in Kenya. These changes have not only affected the level and volatility of prices paid to smallholder farmers but also the level of transactions costs. In their endeavour to cope with the emerging economic and institutional arrangements, the risk-averse smallholder farmers were forced to review their resource allocation decisions as well as their level of market participation. The land-constrained environment within which the smallholder coffee

⁴ Market co-ordination and control are important determinants of market structure, which in turn affects market performance. Co-ordination refers to the arrangement of independent market activities in a bid to match supply and demand conditions. Control refers to the ability of market participants to exercise influence on key variables in a commodity system with an aim of influencing scale economies and exchange of property rights. (Jaffee & Morton, 1995).

farmers in the study region operate has also played a significant role in determining nature and level of market participation, resource reallocation decisions and efficiency of agricultural production. In making these decisions smallholder farmers have endeavoured to minimise price risks, production costs and transaction costs in order to maximise economic welfare.

This synopsis leads to the following research questions:

- (i) Have the market reforms introduced as part of SAPs improved the agricultural sector terms of trade as envisaged? How have changes in agricultural sector terms of trade affected the general level of input and commodity prices paid to/by smallholder farmers?
- (ii) Has the market driven pricing system adopted after market reforms introduced higher price risks to the risk-averse smallholder farmers?
- (iii) How have market reforms affected smallholder farmers' market institutions and how have these institutional changes affected farmers access to factor and commodity markets, levels of transaction costs and farmers decisions on market participation?
- (iv) To what extent do the prevailing economic, institutional and natural factors in the study region influence smallholder farmers' resource allocation decisions and their farm productivity? Specifically, what role do land constraints and access to credit play in determining the resource allocation behaviour and farm productivity?
- (v) Are there major differences in production efficiency among smallholder households in the study region and what factors determine the level of efficiency?
- (vi) Which policy instruments can be applied to enhance smallholder agriculture pricing policies, farm productivity and efficiency for a sustainable smallholder agricultural development and improvement of general welfare in Central Kenya region?

1.6 Demography and agricultural production in the study area

Kenya is situated along the East African coast and stretches from 4° South and 4° North of the equator. Kenya is divided into eight provinces (Figure 1.8). In 1999 Kenya had an estimated population of 28.9 million people. The country has in total 44.6 million hectares of land, of which 8.6 million hectares (20 %) is of medium to high potential (Republic of Kenya, 1986). This 20 % accommodates 80% of the population with the remaining 80% living primarily on semi-arid or arid land. Kenya has one of the world's fastest growing populations, having witnessed a 40% increase in the 1980s. Between 1979 and 1989 the annual growth rate was 3.4%: today estimates run at 2.9% (Republic of Kenya, 2000). In the last couple of years per capita income has declined and in 1998 was estimated at US \$ 281. Poverty levels have also been increasing from 30% of total population in 1977 to about 52% in 1997 (Republic of Kenya, 2000).

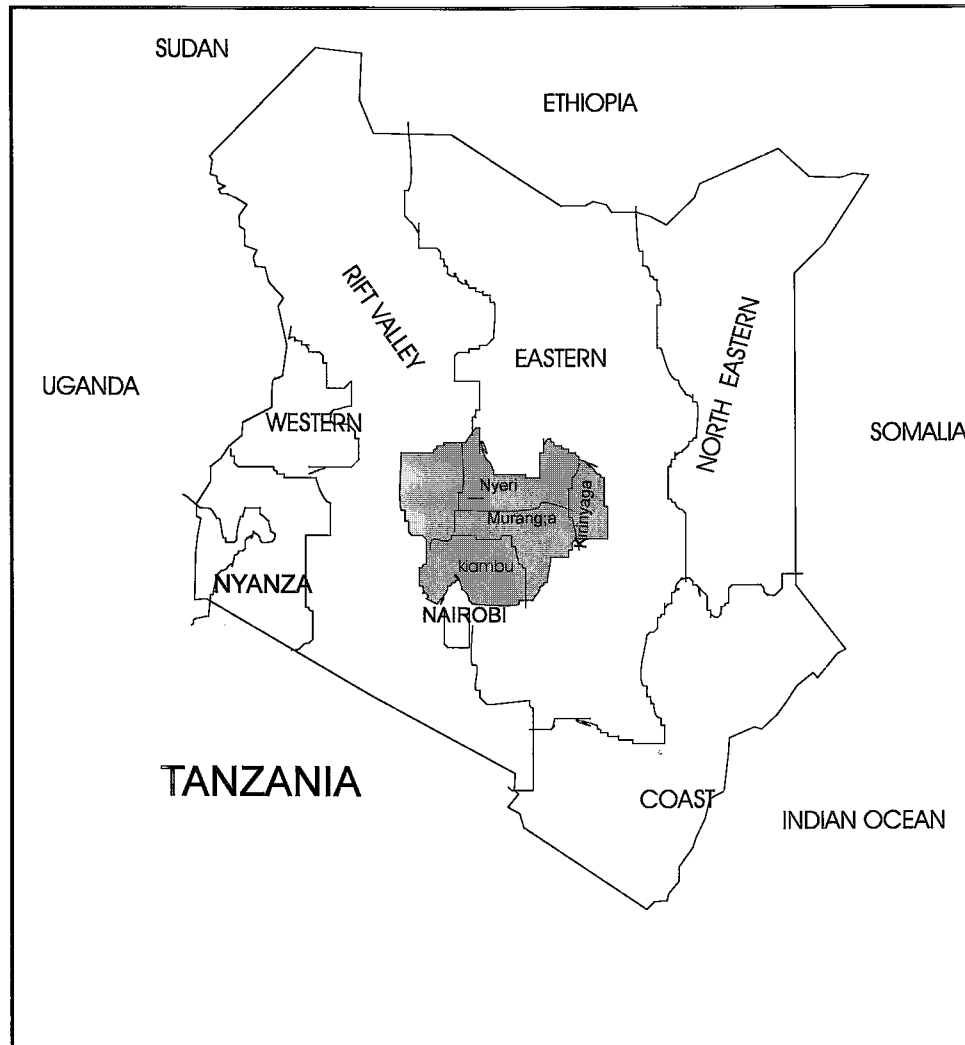


Figure 1.8 Kenya's administrative boundaries and the location of the study region

Central Province, which is the study area, is one of the provinces with high agricultural potential in the country. The Province borders Nairobi City in the south and Mt. Kenya and Aberdare ranges in the north and eastern side. The province is divided into five districts; Kiambu/Thika, Murang'a, Nyeri, Kirinyaga and Nyandarua (Figure 1.8). The first four districts in the province are the main coffee growing areas accounting for over 50% of the national coffee production of which smallholder farmers produce 35 percent. According to the 1989 population census, the four districts had a population of 2.8 million people, with 1999 provisional estimates of 3.3 million people (Republic of Kenya, 1994, 2000). The districts are highly populated with densities of up to 342 inhabitants per square km as compared to the national average of 49 persons per square km (Table 1.2). According to 1992 Kenya demographic and health survey and 1994 welfare monitoring survey undertaken by the Kenya government, there were a total of 683,066 households in the province, 27% of which could be

categorised as poor⁵ (Republic of Kenya, 1998). By 1997, the number of households had increased to 754,601 and 26% of these were identified as living in absolute poverty⁶ (Republic of Kenya, 2000). However, the region maintains the lead as being the least poor in the country.

*Table 1.2 Summary of Kenya's and study area's demography in 1989 and 1999**

	Population (‘000’ inhabitants’)		Agricultural land (ha)	Household size in 1989	Agricultural land/household (ha)	
	1989	1999			1989	1999
Kenya	21,443 (37)	28,679 (49)	8,600,000	4.92	2.5	1.7
Central Kenya						
Kiambu District	914 (353)	1213 (469)	142,200	4.3	0.67	0.51
Kirinyaga District	391 (264)	455 (307)	95,500	4.9	1.19	1.11
Muranga District	858 (340)	1,019 (403)	180,800	4.9	1.03	0.96
Nyeri District	607 (186)	655 (201)	158,900	4.6	1.20	1.11
Total/Average	2,770 (285)	3,342 (342)	577,400	4.8	1.02	0.92

*Projections based on provisional results of the 1999 Kenya population and housing census. Figures in parenthesis represent population density in persons per km²

Source: CBS statistical abstracts (various)

Land holdings in the province are small, averaging 1.5 ha per household with agricultural incomes accounting for 26 per cent of total household income in 1994 (de Graaff, 1986; Republic of Kenya, 1994). The region has a bi-modal rainfall pattern and two cropping seasons with long rain season from March to August and the short rain season from October to mid February. Cash crops in the region are coffee, tea and horticultural crops such as vegetables and cut flowers. Maize; beans and bananas are the dominate and staple food crops while dairy and small ruminants are the dominant livestock activities (de Graaff, 1986; Burger 1994). Coffee growing is spread over three ecological zones in the Upper Midland zone (UM1, UM2 and UM3). These zones are classified according to climatic conditions (temperature, rainfall) soil types and crop suitability. UMI is the coffee/tea zone, UM2 is the main coffee zone while UM3 is the marginal coffee zone (Jaetzold & Schmidt, 1982).

Smallholder farmers in the region, like many of their counterparts in other developing countries, practice intensive polyculture farming systems and rely on a diversity of crop and livestock enterprises for their livelihoods. Depending on the agro-ecological zone, it is also

⁵ An absolute poverty line derived from monetary value of the consumption of food and non-food items was used to distinguish between the poor and non-poor households. In 1994, the poor household in rural areas had an income of Ksh 978 (US \$ 22) per month per adult equivalent as compared to an income of Ksh 1,490 (US\$ 33) for urban households.

⁶ The 1997 absolute poverty line for rural households was Ksh 1,239 (US\$ 21) per adult equivalent per month as compared to Ksh 2,648 (US\$ 45) for urban households.

common practice for most smallholder farmers to inter-crop especially where food crops are being grown. An earlier study undertaken in the region identified 27 different crop combinations (Burger, 1994). Thus, although this study focuses on smallholder coffee farmers, these farmers also have other farm enterprises with coffee being the *main common* farm enterprise.

1.7 Thesis outline

This thesis follows an outline consistent with objectives set out in section 1.5. Chapter two reviews the theoretical considerations and econometric specifications of the analytical procedures applied in this study. The data collection methods and types of data collected for empirical estimation of the analytical models are also detailed in this chapter. Chapter three reviews Kenya's agricultural development strategies and policies that culminated in the implementation of the SAPs. Emphasis is placed on market reforms implemented in the agricultural sector and specifically those affecting the smallholder commodity marketing systems relevant to this study.

Chapters four, five, six and seven form the core of this thesis. Chapter four analyses and documents the effects of market reforms on the general level of producer price, changes in relative prices and price volatility. Further this chapter also analyses the cost of price volatility to smallholder coffee farmers under various policy scenarios. Chapter five reviews the institutional changes that have resulted from market reforms and both the direct and indirect changes in market institutions that impact on marketing, transaction costs and returns of various commodity exchanges are analysed. Household resource allocation decisions across farm enterprises and factors determining allocation decisions as well as farm productivity is considered and documented in Chapter six while the efficiency of resource allocation and conditioning factors are analysed in Chapter seven.

Chapter eight discusses the results and draws conclusions from the study. Various policy interventions towards enhancing smallholder commodity pricing systems, market participation, resource use, farm productivity and production efficiency in the study region and Kenya in general are also identified.

CHAPTER 2

THEORETICAL BACKGROUND AND RESEARCH METHODOLOGY

2.1 Introduction

This chapter develops a conceptual framework that is based on the theoretical foundations of new institutional economics (NIE) and emphasises the transaction costs approach. In line with the objectives of this study (see section 1.5), this framework focuses on the inter-relationships between macro-economic and agricultural sector reforms and the commodity prices and institutional arrangements that affect smallholders. At the household level, this conceptual framework also relates market reforms to smallholder farmer's productivity and efficiency. Details of this framework are given in section 2.2.

Section 2.3 of this chapter elaborates the descriptive and econometric models applied in this study. The analytical models developed analyse the four main issues central to this study. These models have considerable inter-dependency and complementarity. The description of each analytical method is preceded by a review of its theoretical foundations and empirical applications.

First, however, agricultural sector development policies and their effects on the sector's performance are reviewed from an historical perspective. The agricultural development and pricing policies pursued by the Kenyan government are evaluated and the nature of the market reforms described. The review covers the period 1963-1999 and focuses primarily on five commodities - coffee, tea, maize, milk and horticultural crops.

Subsequently an analysis is made of the effects of market reforms on the terms of trade in the agricultural sector and the evolution and volatility of selected agricultural commodity prices in Kenya including those for coffee, tea, maize and milk. This analysis is based on time-series data for the period 1985-1999. An estimation of the costs of price volatility to smallholder coffee producers has also been made and simulations have been undertaken in order to quantify the cost implications of various possible policy interventions.

The second model is based on the *exchange configuration analytical framework*, which is rooted in the NIE. The model analyses the institutional changes occasioned by market reforms as they affect smallholder farmers' level of transaction costs and their access to markets and services. The model also analyses changes in trade contracts and the extent to which farmers' control and co-ordination roles has been altered as a result of these emerging market institutions.

The third and fourth analytical models described in this chapter focus on the micro-economic level. The first micro-economic model analyses smallholder household resource allocation and productivity. The model takes into consideration the land constraints confronting smallholder farmers in the study region. As shown elsewhere in this study, credit constraints faced by smallholder farmers have tended to increase in the era of market reforms. The model has been formulated to take these credit constraints into account. Finally, the fourth model has been formulated to estimate the production efficiency of smallholder farms and factors that determine levels of efficiency.

Section 2.4 describes the sources from which data has been drawn and the way this data was collected. Finally, in the last section of this chapter the inter-relationships between the analytical models developed are highlighted and their usefulness in answering the research questions posed by this study discussed.

2.2 Conceptual framework

In the neo-classical economic model formalised by Arrow and Debreu (1954), the market system performs the role of rationing goods and services while determining both allocation of resources in production and final mix of output. In essence this has been the rationale behind market liberalisation and structural adjustment reforms aimed at getting the 'prices right'. The decentralised mode of operations of a private sector based market system, emphasised in market liberalisation, is expected to be more flexible and therefore more responsive to changes in supply and demand conditions as opposed to a regulated market system.

Pricing and marketing policies undoubtedly have the most important affect agricultural commodity production. This is due to the direct impact they exert on the economic incentives that elicit immediate producer response. Thus, macro-economic and agricultural sector reforms are conceptualised in this study as having induced a shift in internal terms of trade in favour of agriculture by enhancing the commodity prices received by farmers. Nevertheless, concerns have been raised about the effects of market reforms on variance in agricultural prices and how this might affect the supply response of risk-averse smallholder producers (Krueger *et al.*, 1988; Barrett, 1997). The present study focuses on the impact of market reforms on the price system that confronts smallholders and price levels and risks, resource demand, farm productivity and production efficiency in particular.

The standard neo-classical model assumes existence of factor, commodity and risks markets as well as a free flow of information. Recent economic literature has argued that due to existence of incomplete or thin markets, imperfect information, non-market contracts and transaction costs there is need to have a different conceptual framework that can take into consideration these market imperfections (Hoff *et al.*, 1993). In this new conceptual framework, institutions play a major role as responses to missing markets and missing information. Attention is increasingly focused on aspects of household income and enterprise diversification to reduce land and capital market failures, non-market contracts and household risk-coping and risk-sharing strategies. As shown in Figure 2.1, the institutional framework within which farmers make their production and consumption decisions is taken as a crucial determinant of market prices, transaction costs and access to social amenities. Furthermore, the institutional framework is intricately related to household's property rights on factors of production and the nature of trade contracts. These factors are crucial and significant in determining household's resource allocation behaviour, productivity, efficiency as well as level of market participation.

Apart from their effects on prices, the market reforms introduced in Kenya can also be expected to have had a fundamental affect on the institutional arrangements in which smallholder producers make trade and production decisions. Institutional changes have affected market co-ordination and control as well as transaction costs in most agricultural commodity systems. In an effort to analyse the effects of these changes, the NIE approach has been widely applied. According to Delgado (1998), the application of NIE concepts to smallholder agriculture in Africa has provided a seminal breakthrough in understanding how structural constraints operate to hinder a farmer's market participation. With this in mind, the present study analyses the institutional changes heralded by market reforms in order to understand their effects on the level of transaction costs and hence the efficiency of smallholder farmers. In this study, the NIE framework is used in an attempt to analyse the effects of market reforms on the exchange and non-exchange institutions in which smallholder farmers in the study region participate.

In an effort to arrive at a better understanding of how households are trying to cope with the changes brought about by market reforms, the present study also focuses on factors that influence resource allocation, productivity and efficiency at the micro economic (household) level. In order to gain an analytical entry point at this level, the concept of

'household' has been employed widely in empirical work Ellis (1993), for example, has defined the household⁷ as 'a social unit sharing the same abode or hearth'.

In neo-classical theory, farm households form the basic decision-making units as far as production and consumption are concerned. In their attempt to understand the decision-making process within farm households - especially with regard to resource allocation - researchers have proposed a number of hypotheses. Schultz (1964) hypothesised that farm families in developing countries were 'efficient but poor'. This hypothesis has continued to generate interest in farm household economics. Lipton (1968, 1986) hypothesised the farm household as a utility maximizer. A number of empirical studies have been carried out in India (Hopper, 1965; Chenareddy, 1967; Saini, 1969), Nigeria (Norman, 1974) and Kenya (Wolgin, 1975) to test these hypotheses. Although results have been mixed and varied, the profit and utility maximisation hypothesis continues to provide a basis for the economic analysis of the farm household with modifications to suite different sets of assumptions.

Ellis (1993) summarises the theories used to understand peasant behaviour under different sets of assumptions. In doing so he defines several categories of peasant: "profit maximising peasants", "risk averse peasant", "drudgery- adverse peasant", "farm household peasant" and the "share-cropping peasant". Meanwhile a growing body of literature on intra-household resource allocation under conditions of uncertainty continues to stimulate interest in the dynamics present within households (Doss, 1996a, 1996b; McElroy & Horney, 1981). In these studies, household risk management decisions are treated as the contribution made by each individual household member and the decisions eventually made by a household are explained by collective bargaining models (Doss, 1996b; Quinsubing, 1996). The development of these models challenge the widely held assumption that individuals within a household maximise a single utility function. The result, as Doss (1996b) makes clear, questions the validity of using the household as a unit of analysis while simultaneously encouraging theories that conceptualise the individual as the main actor. However, as indicated by Haddad *et al* (1997), the use of intra-household economic approaches based on bargaining theories do not necessarily yield different predictions about a household's resource allocation behaviour. It is for this reason that the present study maintains the concept of the consensual household as the main, micro-economic study unit.

⁷ The term 'farm household' is often interchanged with the term 'peasant household'. However, in this study the term peasant is not used as it has a connotation of a distinct social group and also suggests the existence of "non-peasant groups" in the rural areas.

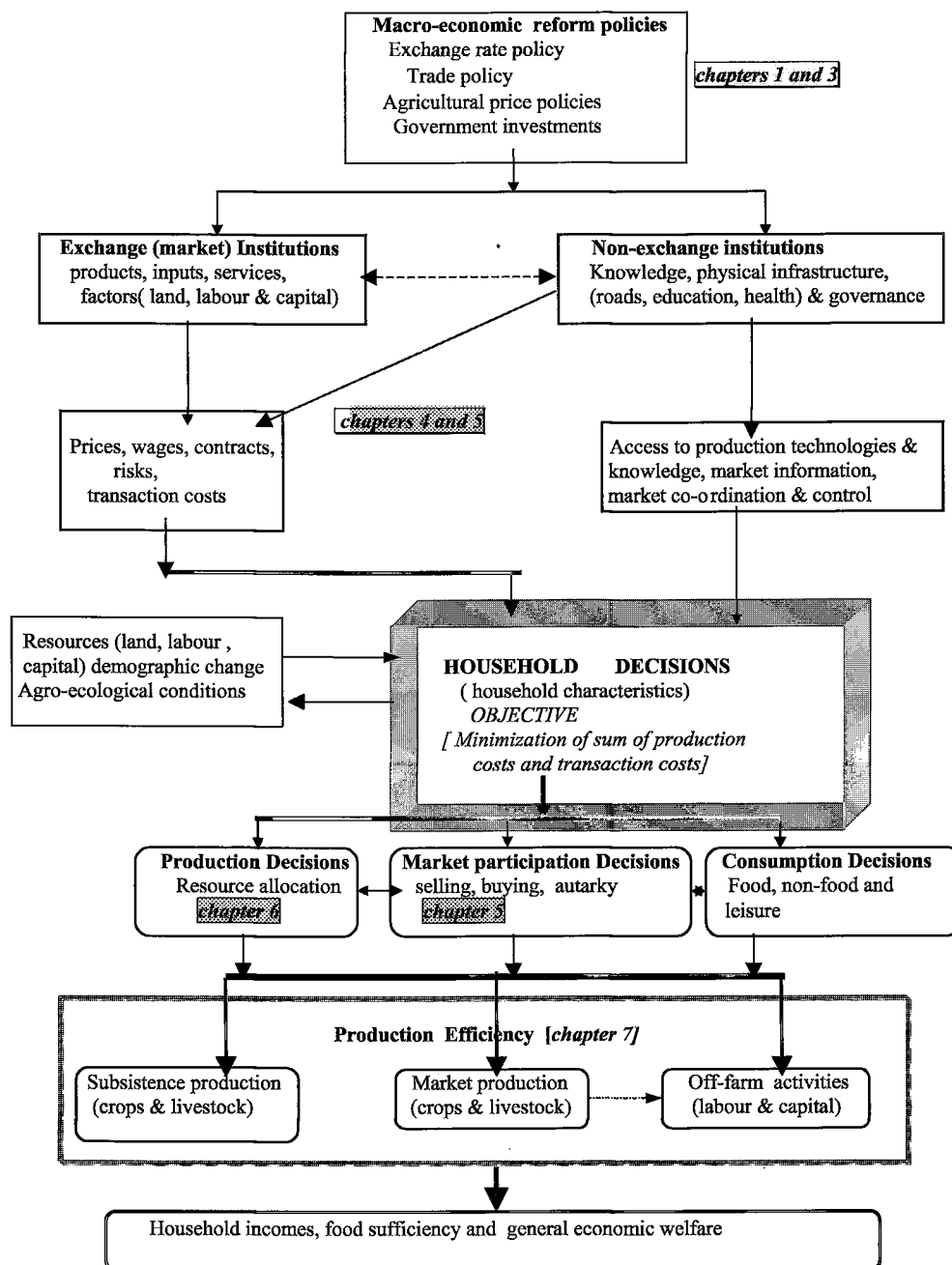


Figure 2.1 Structure of the conceptual and analytical framework

A consensual household is defined by a common abode, a resource-pooling strategy and a common decision-making process that cross cuts generations and use of income (Ellis, 1993, 1998). The consensual household assumption avoids problems related to the intra-household distribution of income. Furthermore, it can be argued that a household in which individual members pool risks can act as an avenue for risk management.

Farm households are conceptualised in this study as utility maximizers, a goal that is achieved through the minimisation of both production and transactions costs. Because of imperfect markets and other distortions, household decisions are taken in the light of farm-gate prices rather than observed market prices. The household objectives are taken to be realised through allocation of resources to farm production activities (both crops and livestock), off-farm activities and leisure in a two-step decision process. The first decision, which is discrete in nature, involves selecting appropriate farm enterprises. On a *priori* basis expectations are that households will choose different off- and on-farm enterprises (off-farm activities include participation in labour markets). Plausible explanation being that different households face different resource constraints and transaction costs thereby realising different benefits of choosing different enterprises depending on their resource endowment and risk perception. The second decision faced by the household is of continuous nature where available resources are allocated to the chosen enterprises. This thesis focuses on the analyses of factors that condition this second decision and efficiency of production within a context of imperfect markets.

The conceptual framework, developed in this study (see Figure 2.1) is, therefore intended to determine the effects of government policies and imperfect markets characterised by transaction costs and binding credit constraints, on optimal production response across different categories of households. Transaction costs, capital (credit) and land constraints arising from imperfect markets are assumed to make producers face low and differentiated effective farm gate prices (decision prices) depending on each household equilibrium trading position: net buyer, net seller or non-participant (Goetz, 1992, Janvry & Sadoulet, 1994). Depending on the equilibrium trading position, transaction costs are hypothesised to reduce the expected optimal supply response and also to induce a higher subsistence orientation in resource allocation. This implies that an enterprise like coffee, that is essentially produced for the market, is less likely to be allocated production resources than food-related enterprises such as maize and dairy that have greater subsistence orientation. Imperfect financial and land markets that constrain access to and availability of credit both for investment and consumption also induce households to add or deduct a premium or a discount to the price of the credit constraining and credit generating activities, respectively (Janvry & Sadoulet, 1994). Thus, faced by credit constraints, households will engage their resources in enterprises or exchange contracts that have more liquidity such as dairy (where weekly payments are possible) and off-farm employment. This contrasts sharply with an enterprise like coffee where the exchange contract can take months before it is settled. Thus, the differences in transaction costs, liquidity and land constraints across households can be used, *inter alia*, to account for differences in resource allocation and farm productivity. This theoretical position is adopted in this study.

The implicit implication of sub-optimal production response arising from transaction costs, credit and land constraints, is that supply response, resource-use efficiency and incomes are lowered. This occurs because households tend not to choose enterprises based on the highest returns per unit of input in accordance with neo-classical profit-maximisation and cost-minimisation model.

The rest of this chapter details the specific theoretical considerations and analytical methods adopted to test these broad conceptual considerations. The analytical modules as indicated in Figure 2.1 follow closely production and market participation decisions made by the household. Although household's consumption decisions are important and inseparable from production decisions, this study has chosen to focus mainly on production. Nevertheless,

where need arises, and with data allowing, the effects of household's consumption decisions are integrated into the analysis.

2.3 Research methodologies

2.3.1 Review of agricultural development in Kenya

This section analyses development policies implemented in the agricultural sector by both the colonial (before 1963) and independent (1963 to present) Kenyan governments. The review summarises the major strategies and policy instruments applied in the agricultural sector in general and the smallholder sub-sector in particular. Prominence is given to policies related to agricultural output pricing, marketing and those affecting to factors of production. Apart from reviewing general agricultural development policies, relevant policy changes implemented in various commodity systems (coffee, tea, dairy, maize and horticulture) are also summarised.

For convenience purposes, the review is sub-divided into two parts: the era of government controls which spans from pre-independence days up to early 1980's and the liberalisation era that covers the period from late 1980's up to 1999. In both periods the review uses time-series data to highlight the performance of the agricultural sector, smallholder sub-sector and the five commodities under study.

2.3.2 Analysis of commodity price evolution, volatility and terms of trade

2.3.2.1 Theoretical considerations

One of the stated objectives of SAPs is to enhance growth and net exports from the agricultural sector. This was to be achieved through market reforms aimed at improving the internal terms of trade for agricultural products as well as through measures that enhance productivity and efficiency in agriculture (Kuyvenhoven *et al.*, 2000). This section is focussed on the agricultural terms of trade and price policies with issues of productivity and efficiency being dwelt with in latter sections.

Market reforms were envisaged to improve the terms of trade in the agricultural sector by correcting the macro-policy bias against the sector. Measures that were expected to enhance the terms of trade and prices for agricultural products included: exchange rate devaluation; trade and tax reforms; the abolition of price controls; a better targeting of subsidies; the enhancement of market competition through the abolition or reduction of public monopoly and tariff reforms. As pointed out by Kuyvenhoven *et al* (2000), the SAPs sought to turnaround the agricultural sector performance by restoring equilibrium and enhancing supply response from agricultural producers.

The micro-economic theory of the firm under uncertainty (Sandmo, 1971) presupposes that output increases as mean prices rise while output decreases with increase in variance of product price. Thus, *ceteris peribus*, liberalisation policies that increase the mean of commodity prices are expected to elicit positive supply response from producers. It is therefore the hypothesis of this study that market liberalisation has benefited smallholder producers through increasing the agricultural terms of trade and real commodity prices paid to producers. Nevertheless, there are bound to be inter-commodity differences depending on whether the commodity in question is tradable, non-tradable or potentially tradable⁸.

⁸ A tradable commodity is one which is traded internationally (unless government policy prevents or hinders such trade). The domestic price paid to such a commodity is thus expected to equal or closely approximate the export parity price in case of an export. For instance, coffee and tea in Kenya. A non-tradable commodity has its price formed wholly by domestic variables as there are no international markets for the commodity. A

Market reforms also advocated the removal of farm-input subsidies as well as the privatisation of input markets in order to enhance input supply and create competition. It was hoped that this would eventually enhance the availability of inputs at lower prices. However, the removal or reduction of State monopolies in the acquisition and distribution of inputs may also lead to loss of economies of scale especially in the thin and geographically dispersed markets that typify most developing countries. This loss of economies of scale may outweigh the benefits arising from competition and thereby lead to higher input prices. Furthermore, the exchange rate devaluation may increase the prices of inputs, many of which are imported. Nevertheless, the generally held view is one that associates market reforms with low-input prices especially in the long term. The price level of inputs does not only affect their usage but also the output to input price ratios and hence the profitability of input use. Moreover, as Heerink (2000) has pointed out, changes in monetary and exchange rate policies may change the price ratios of traded versus non-traded outputs and imported inputs versus output prices. Thus, from a theoretical point of view, market reforms have an ambiguous effect on relative prices. Although the current study focuses primarily on output prices, it also attempts to determine the effect of market reforms on output to input ratio and relative prices.

Apart from real and relative prices, removal of price controls may also affect the price variability, both over time and across regions in a country. Despite the importance of interregional price differences and their implication to trading and supply management strategies, this study will focus on temporal price variability arising from market reforms.

Two opposing factors govern producers' reactions to commodity price risks. Risk aversion implies that producers will be willing to pay an insurance premium to reduce or eliminate the variability of revenues on their consumption expenditures (Newbery & Stiglitz, 1981). In a perfectly competitive market, price variability can also allow producers to benefit by reallocation of resources to production of risky commodity in periods in which prices are expected to be high (Oi, 1961). As pointed out by Gilbert (1998) and Barrett (1997), when the producer is also a consumer, the effects of price variability from a theoretical context become ambiguous. In practice however, the last decade has brought widespread empirical evidence that many smallholder producers are net buyers of food crops they grow (Deaton, 1989, Weber *et al.*, 1988, Barrett & Dorosh, 1996) and at the same time they are price risk averse (Filkelshstain & Chalfant, 1991). Equally, most commodity producers in developing countries operate in markets that are far from perfect thereby substantially reducing the gains they can derive from resource re-allocation as postulated by Oi (1961). Thus, the supply response and resource allocation of smallholder farmers will depend on household level of risk aversion, income elasticity and level of food self-sufficiency (Fafchamps, 1992). It is also generally supposed that smallholder risk aversion is high and supply elasticity is low with the implication that price variability has a negative impact on producer welfare (Newbery & Stiglitz, 1981). Thus, in the context of incomplete price hedging mechanisms and credit markets, expectations are that the price distributions - increased means and variances - brought about by market reforms (Krueger *et al.*, 1988), can cause shifts in enterprise choice and resource allocation by risk averse smallholder farmers.

Gilbert (1998) argues, that except in situations where farmers are highly specialised or very risk averse, the costs of price exposure are relatively modest and are likely to be outweighed by the benefits accruing from market reforms. It is nevertheless important to have an indication of the price exposure which has resulted from reforms in an effort to decipher further indications on resource allocation at household level. In this respect, this study hypothesises that market reforms in Kenya differentially increased price volatility of agricultural commodities,

potentially tradable commodity has an existing world market but due to domestic demand and supply factors or government intervention the commodity is not generally traded e.g., maize and milk in Kenya. For the latter two commodities, changes in world market prices do not necessarily affect domestic price.

thereby affecting enterprise choice and resource use efficiently of majority of smallholder producers, many of whom are risk averse and net food buyers.

2.3.2.2 Analytical methods

Agricultural terms of trade

To get a general perspective on the evolution of agricultural commodity prices, the trend in the real composite price indices among the various crops and livestock categories are analysed and compared during and after market reforms. In this study, 1985-1991 is referred to as the period of pre-liberalisation and 1992-1999 as the period of liberalisation⁹. The general trend in commodity prices is compared to the trend in agricultural input prices. This ratio is referred to as output to input price ratio (O/I ratio). The O/I ratio is derived by dividing the agricultural output price index by the agricultural input price index. A increasing O/I ratio indicates an increasing margin between output and input prices, an indication of improved gross margins while the vice versa is true. To evaluate the effects of market reforms on the agricultural sector terms of trade (AgrToT), a comparison is made between the agricultural output price index and the rural non-agricultural consumer goods price index for the period 1985 to 1999. Thus, the agricultural sector terms of trade index is calculated:

$$\text{Agricultural terms of trade index} = \frac{\text{index of agricultural output prices}}{\text{Index rural non-agricultural consumer goods}} \times 100$$

(AgrToT)

The rural non-agricultural consumer goods index is constructed using the prices of manufactured goods used by rural households. As such the index offers a good indicator of the trends in non-agricultural output prices. Furthermore, as the index is focused on rural areas, it is free from urban-related consumption trends which are in most cases unrelated to actual consumption trends in rural areas where agricultural production takes place. An AgrToT index below 100, indicates deterioration of agricultural sector terms of trade as the change of non-agricultural prices outweigh the change of output prices, while the converse also holds true. The trends in AgrToT are compared to the general economy terms of trade (ToT) which is derived as the ratio of export to import prices.

Evolution of nominal, real and relative commodity prices

A detailed price analysis of commodity prices paid to smallholder farmers is undertaken. The nominal market prices for coffee, tea, maize and milk are compared before (1985 to 1991) and during (1992 to 1999) liberalisation. To arrive at the real commodity prices, the nominal prices are deflated by the Nairobi middle income consumer index. The rural consumer price index would have been preferred, but data on the index is not available for the entire 15-year period. The trends in real commodity prices are contrasted with the trends in real prices of inputs and production factors. Considering the importance of the various inputs and factors of production in smallholder agriculture and the availability of consistent time series data, only fertiliser and labour prices are used in the analysis to represent input and factors used in production.

To assess the changes in relative prices among the four commodities, the real commodity prices are expressed as a ratio of real maize and fertiliser prices. Maize is the staple food of most Kenyans and therefore is considered an ideal reference against which to compare changes that have taken place in the value of other commodities. Fertiliser, a major agricultural input used extensively by many farmers, is also regarded as a good reference value.

⁹ As shown elsewhere (section 3.3) in this study, the initial attempts to reform the Kenyan economy in the early 1980s were a total failure and it is only after 1991 that consistent reforms were implemented. Furthermore, complete set of data for the period before 1985 was not readily available.

Volatility of commodity prices

Price volatility is a measure of price variability. Volatility can be a good indicator of the price risks faced by a commodity producer, in any given period. According to Gilbert & Brunnet (1998), volatility can be measured in a number of ways:

- (i) Historical volatility can be measured by calculating the coefficient of variation (CV) of weekly or monthly prices. As the name suggests, historical volatility reflects on what happened in the past.
- (ii) In- trading volatility can be measured as the standard deviation between the low and high price quotations within every trading day.
- (iii) Implied volatility can be calculated for futures and options price quotations and can be used to project on expected price volatility in terminal markets.

For the purposes of this study and considering the available data set, a modified form of historical volatility measure is applied. The CV of monthly prices for the four commodities at the Nairobi consumer markets for the period January 1985 to December 1999 is adjusted by a coefficient of determination of the trend function with the best goodness of fit to arrive at a price instability index as derived by Cuddy & Della Valle (1978):

$$V^* = V\sqrt{(1 - R^2)} \quad (2.1)$$

Where,

- V^* = The corrected coefficient of variation
- V = Coefficient of variation of the price time-series (based on monthly prices)
- R^2 = The coefficient of determination of the trend function with the best goodness of fit, also based on monthly prices..

Most price time series tends to have a cyclical nature. In most cases they rally in the same direction over a given period of time. This calls for de-trending of the time series to separate the trend and actual variability. This is the idea behind the Cuddy and Della Valle formulation in equation 2.1. The index has been empirically applied by Hermann, Burger & Smit (1990) to analyse the instability effects of compensatory financing schemes on the world commodity markets. A more recent application has been by Badiane (2000) on the study on liberalisation on food markets in Africa. The index is simple to apply but it does not take into account other non-trend factors that might be a source of price volatility, thereby tending to overestimate price volatility.

Analysis of factors determining price means and variance

In an effort to gain more empirical insight into the macroeconomic and specific commodity factors responsible for the movements in price means and variance, the data is subjected to further analysis using the Autoregressive Conditional Heteroskedastic (ARCH) regression model. This model allows for simultaneous estimation of conditional means and variances of a dependent variable over time (Engle, 1982). Bollerslev *et al* (1992) provides a theoretical and empirical review of the application of the model in finance. Bera & Higgins (1995) provide a more recent review. The original model was proposed by Engle (1982) and generalised by Bollerslev (1986). One recent empirical application of the model in agricultural price analysis is by Shively (1996), in the analysis of maize prices variability in Ghana. The study indicated that economic reforms in Ghana were accompanied by higher maize prices and a reduction in volatility of maize prices. Another recent application is by Barrett (1997), who analysed the effects of liberalisation on food prices in Madagascar. The study indicated that the short-term effects of liberalisation on the mean and variance of food prices varied substantially by

commodity, region and season. However, the long-term effects of liberalisation were to increase both the mean and variance of food prices.

The ARCH model assumes an error structure in which the sign of the disturbance is not predictable, but in which the size of the forecast error is. Thus, the unconditional variance is homoskedastic but the variance at any time t , conditional on prior period information, is heteroskedastic. With the assumption that the mean and variance move in the same direction, the ARCH-in-Mean-(ARCH-M) variant is applied in this study. The ARCH-M(p) form developed by Engle *et al* (1987) allows price modelling with time varying risk premium, i.e., the increase in expected rate of return (mean price) is associated with an increased risk in rate of return (variance). The econometric details of the model are as shown in Appendix 2.1.

A crucial assumption underlying ARCH models is that current prices affect next periods mean price (Shively, 1996; Bera & Higgins, 1995). This assumption is mainly satisfied in situations where hedging and stockholding play an important role in price determination in any two consecutive periods. As such, the model is more applicable to non-perishable commodities like cereals in an environment where stockholding is important. This could explain why the two recent empirical applications by Shively (1996) and Barrett (1997) concentrated on food items that, in most cases, are non-traded or potentially tradable. No attempt has been made to apply the model on traded commodities like coffee and tea. This is despite earlier studies by Cuddington (1992) and Deaton & Loroque (1992) that indicated that most agricultural commodity prices-especially the traded ones- tend to show high first-order autocorrelation and persistence of price shocks. Furthermore, farmers and marketing agents engage in substantial stockholding of coffee and tea in an effort to regulate supply and benefit from possible price movements. In Kenya, for example, co-operatives, plantations, marketing agents, the Coffee Board of Kenya and coffee exporters all engage in stockholding. In the same way, in the tea marketing chain, there is stockholding by tea factories, Kenya Tea Development Authority (KTDA), plantations and tea exporters. It is for these reasons that this study attempts to expand the application of the ARCH model to these important agricultural commodities.

The ARCH model used in this study is as summarised in equation (2.2) and (2.3):

$$P_{it} = \beta_0 + \sum_{i=1}^4 \beta_i P_{i,t-1} + \beta X_t + \lambda h_t^{1/2} + \varepsilon_t \quad (2.2)$$

$$h_{it} = \alpha_0 + \sum_{j=1}^4 \alpha_j \varepsilon_{i,t-1} + \lambda Z_t + v_t \quad (2.3)$$

Equations (2.2) and (2.3) describe the conditional mean price (P_t) and price variance (h_t) over time ($t = 1 \dots n$) and among commodities ($i = 1 \dots 4$), respectively. X_t denotes a matrix of pre-determined variables that typically contain time-subscribed information influencing the mean, likewise Z_t matrix contains pre-determined variables that condition residual variance; β_0 and α_0 are constants, while β_i , α_j , and β' are estimation coefficients; λ is an estimation coefficient which reflects a risk premium with respect to the conditional standard deviation.

In this study, the dependent variable, monthly real price of each commodity (P_{it}), is treated as a first-order autoregressive process around the time trend (T), real exchange rate (RER)¹⁰ and border parity price (BP)¹¹. A dummy variable (L) is defined with the period

¹⁰ Real Exchange Rate (RER) is defined as the index of monthly average Ksh exchange rate adjusted by the ratio of Nairobi middle income consumer price index (CPI) to the U.S.A. wholesale price index (WPI) obtained from IMF international financial statistics.

¹¹ The New York Coffee futures (2nd and 3rd) position price was used as the coffee parity price as it is used as a reference price at the Nairobi coffee auction. The London tea auction prices were used as the parity price for tea.

coincident with liberalisation ($L = 1$) and ($L = 0$) for pre-liberalisation period. A positive coefficient for L in both the mean and variance regression is taken to indicate higher mean price and higher price volatility during the reform period. Conversely, a negative coefficient for L in the variance equation indicates decrease of price volatility with implementation of the market reforms.

To capture the effects of the price regulation mechanisms under the International Coffee Agreement (ICA) on price evolution and volatility, a dummy variable (ICA) is defined to coincide with the time the ICA price regulatory system was in place. Thus, in the coffee model, $ICA = 1$ for the periods, January 1985 to February 1986 and October 1987 to June 1987 when the regulation was in place and $ICA = 0$, elsewhere. Appendix 2.1 also details the variables included in each of the ARCH models estimated for each commodity.

Two-equation model is estimated for each of the four commodity (coffee, tea, milk and maize) price series for the entire period (both before and after reform) as univariate models. The univariate model is preferred over the multivariate system due to differences in data availability for different commodities and the differences in regressors in each model, factors which would have required sacrifice of a great portion of the data with fewer degrees of freedom. The estimation of the model is preceded by diagnostic tests to verify the suitability of the heteroskedasticity conditional variance as well as the order of autoregressive process (lag structure) of the dependent variable. The LaGrange¹² multiplier test statistic is used to test the presence of the ARCH process (Engle, 1982). The lag structure is evaluated through inspection of partial autocorrelation coefficients. The model is estimated using LIMDEP Computer Software (Green, 1995) which uses the maximum Likelihood Estimation (MLE) approach.

Estimation of cost of price volatility to smallholder farmers

As postulated by Newbery and Stiglitz (1981), the cost to a producer of a commodity whose price is volatile will depend on the following factors:

- (a) Relative risk aversion of the producer
- (b) Magnitude of the variability of the commodity price
- (c) Level of serial correlation of the commodity price i.e. the level of price forecastability
- (d) Share of income derived from the commodity by the producer

On his part Oi (1963) had earlier postulated that a firm (farm) can benefit from price volatility through re-allocation of resources to production of the risky commodity in periods when prices are expected to be high. Nevertheless, these benefits can only be maximised in a perfect market environment which allows free flow of market information to the firms. Using both these postulates, Newbery & Stiglitz (1981); Newbery (1996) and Gilbert (1998, 2001) have gone ahead and derived expressions to estimate the cost of price volatility that face a commodity producer:

$$C = \omega \left[\frac{1}{2} (\alpha \cdot r^2 \varepsilon), (1 - \alpha) \beta (1 \cdot r^2) \right] \sigma^2, \text{ with } \beta = \frac{\theta \lambda}{\sigma} \quad (2.4)$$

Where,

C is the cost of price volatility to a commodity producer (expressed as % of total annual income)

ω is the share of the farmer's income derived from the production of the commodity, hence, $1 - \omega$ is the extent to which the farmer is diversified.

α is the farmer's coefficient of partial risk aversion that is linked to the coefficient of

¹² The LaGrange Multiplier (LM) test statistic was computed as nR^2 , where n equals the number of observations per sample, and R^2 is the coefficient of multiple determination obtained from least squares regression of squared residuals (e_i) on a constant and lagged squared residuals (e_{i-1} and e_{i-2}).

relative risk aversion (ρ) by $\alpha = \omega\rho$.

r^2 is the extent to which the commodity price is forecastable over the recent period.

ε is the elasticity of commodity supply over the relevant period.

σ is the extent of price variability (measured as standard deviation of the log price shocks)

λ is the extent of output variability (measured as standard deviation of the log of production shocks) and θ is the correlation coefficient linking production and price shocks, β may therefore be interpreted as simple regression coefficient of production shocks on price shocks.

From equation (2.4), the first term, $\frac{1}{2}\omega\alpha\sigma^2 = \frac{1}{2}\omega^2\rho\sigma^2$, is the standard risk aversion term (Newbery and Stiglitz, 1981). This term is quadratic with production share (ω). As such, it is expected to decline as farmers become more diversified. The second term, $\frac{1}{2}\omega\alpha^2\sigma^2$, which is negative in the cost equation (2.4), is the potential benefit a farmer can get through enhanced profitability as a result of being able to respond to prices. This is referred to as the Oi (1963) term and is quadratic to both the price forecastability and variance. This means the higher the price variance and forecastability, the higher the profitability. The final term, $\omega(1-\alpha)\beta(1-r^2)\sigma^2$, shows the covariance between the farmer's production and the price received. The covariance is likely to be negative and as such will tend to offset the risk costs of price variability. Significant negative covariance may arise due to weather related shocks which affects all farmers in a country or region. This may also arise in cases where production shocks (from any source) affect the price, a case mainly possible for a country responsible for a significant share of the world market e.g. Brazil in coffee, Cote d'Ivoire in cocoa and maybe Kenya in black tea.

The cost equation 2.4 represents a special case where the commodity under consideration is not also a food item for the household. When the commodity whose price is variable also happens to be a food item, the cost of price volatility has also to take into account the share of the commodity to households' total consumption (Finkelstain & Chalfant, 1991; Fafchamps, 1992; Janvry & Sadoulet, 1994). This is over and above the other variables considered in equation 2.4. Thus, the cost of price volatility for food crop producers will depend on each household's equilibrium trading position i.e. seller, buyer and self-sufficiency. This further complicates the cost estimation especially where there is no clear distinction between buyers and sellers. Taking into account these considerations and the available data, this study estimates the cost of price volatility for only the coffee enterprise. Consideration is also made to the fact that coffee is the main commodity grown by all the households in the study region. Furthermore, coffee is a 'traded' commodity per excellence as it is traded in international terminal markets and has in the past been subject to an international agreement that regulated its price. These characteristics offer wide-ranging possibilities of policy intervention and distinguish coffee from the other four commodities considered in this study.

Equation (2.4) is used in this study to estimate the cost of price volatility for smallholder coffee farmers in the study region. The cost is estimated for three categories of smallholder farmers based on their coffee income concentration (ω) i.e. the % of total household income accounted for by coffee income. The changes in the cost are also simulated in scenarios to evaluate the effects of various policy options on the cost of price volatility to farmers. The cost of price volatility in each scenario is broken down to the three components i.e. risk aversion, the Oi and covariance terms. The assumptions made under each scenario are detailed in the relevant section.

The elasticity of coffee supply (ε) is estimated by simple regression of the production and price (with lags) over the last 15 years. The extent of price variability (σ) is estimated as earlier defined equation 2.1. The output variability (β) is estimated as defined in equation 2.4 above based on secondary coffee production and price data for the period 1985 to 1999.

2.3.3 Institutional analysis

2.3.3.1 Theoretical considerations

It is important to point out that, in the NIE literature, institutions are defined in a variety of ways depending on the author. Basically, institutions have been defined and understood from two different perspectives, the sociological and the economic. Sociologically, any behavioural regularity is taken as an institution (Bates, 1995) and as such these institutions have also been referred to as non-market institutions. Families constitute the most striking example of such an institution. While recognising the importance of non-market institutions, the objectives of this thesis and the need for analytical tractability means that this study has confined itself to economic institutions.

According to North (1990) institutions are rules of the game in a society or the humanly devised constraints that shape human behaviour. Hayami and Ruttan (1985, p.94) define institutions as "the rules of a society or organisations that facilitate co-ordination among people by helping them form expectations which each person can reasonably hold in dealing with others". Nabli and Nugent (1989) view institutions as "a set of constraints that govern behavioural relations among individuals or groups". NIE is thus concerned with organisational issues that seek to extend the applicability of neo-classical theory by considering how property-rights structures and transaction costs affect incentives and economic behaviour.

Two broad approaches are salient in NIE literature. They concern the concept of transaction costs and the theory of collective action. The main concern of collective action theory is the analysis and explanation of collective outcomes in terms of individual motivation and the elimination of the "free-rider" problem (Nabli & Nugent, 1989). Collective action is, therefore, concerned with issues such as use of public or common goods and the resultant "tragedy of the commons" as well as the relationship between interest groups and the state. Despite the importance of collective action in determining access to and use of resources, this study does not focus on collective action issues. Rather emphasis is placed on transaction costs because they have a direct bearing on resource allocation.

Studies into transaction costs and their role in economic organisation have been stimulated by the work of Williamson (1979) who combined the concepts of bounded rationality and opportunistic behaviour. In real-world situations, individuals (agents) have limited ability to acquire and process the information necessary to make decisions. This state of affairs is referred to as bounded rationality (Simon, 1961; Eggertsson, 1990). Thus, bounded rationality is associated with imperfect information. Equally, imperfect information may create room for an economic agent involved in a contractual arrangement to be dishonest and in so doing increase his or her benefits at the expense of the other party. This dishonest behaviour creates room for opportunism or what Williamson refers to as "self-seeking with guile". In order to overcome the bounded rationality and opportunism in contractual arrangements, agents incur transaction costs in their endeavour to maximise their benefits. This leads to the general hypothesis that institutions are transaction cost-minimising arrangements that may change and evolve with changes in the nature and sources of transaction costs. Transaction costs include the cost of searching for a trade partner; screening; bargaining with potential trading partners to reach an exchange contract; product transfer involving the transport, processing, packaging and change of title to goods; monitoring the contract to ensure conditions are fulfilled, and finally enforcing the exchange contract to ensure compliance (Bardhan, 1989). In an agricultural commodity system, therefore, transaction costs are those costs associated with buying, selling and transferring the ownership of goods and services. Transaction cost economics centres on the theme of property rights and incomplete and asymmetrical information that affect contractual arrangements.

The notion that the cost of arranging and carrying out exchange may reduce or even prevent exchange from occurring is now widely documented (Williamson, 1985; Bardhan,

1989, Janvry *et al.*, 1991; Hoff *et al.*, 1995). Important productivity gains can be achieved through implementing policies that aim to reduce transaction costs and thereby allow a greater degree of specialisation and exchange. According to Anderson (1988) and Williamson (1991), the level of transaction costs can be associated with three dimensions of the trading environment (exchange configuration): (i) asset-specificity; (ii) uncertainty and frequency of transaction and (iii) the market structure.

In any particular production and trading operation, producers may undertake general or specialised investments. Making investments in specialised assets exposes the producer or trader to potentially severe bargaining and contractual enforcement problems because such investments are likely to be 'locked-in' a particular production or trading activity, both in the short and in the medium term. Investments in coffee, tea, dairy and other perennial crops, specialised processing and post-harvest facilities, use of highly specialised production inputs and technical knowledge are only a few of the examples of asset-specific investments smallholder farmers and traders can make.

Apart from asset-specificity, the level of transaction costs will also be highly influenced by uncertainty and frequency of transactions. Uncertainty is related to lack of information, bounded rationality and the scope of opportunism by parties in a transaction (Williamson, 1991). Uncertainty can therefore manifest itself as uncertainty in prices, volumes traded and product quality. According to Jaffee & Morton (1995), uncertainty will vary with the physical, institutional and socio-economic characteristics of the environment, production system, the perishability of a commodity and market structure.

Uncertainty alone does not necessarily lead to actual financial loss in a transaction, as such a loss can only be incurred if a farm has invested in specific assets which cannot be recovered if the transaction fails. Uncertainty and asset-specificity thus combine to form a key determinant of the characteristics of a transaction. In turn this affects producers' and traders' contractual arrangements and can be used to reduce transaction costs.

Transaction costs will also be influenced by the prevailing market structure, especially the number of alternative buyers and sellers (Jaffee, 1993). The existence of a few alternative buyers or sellers can be expected to result into higher search costs, low screening costs and considerably higher bargaining and enforcement costs. Where relatively few alternative trading partners exist one would expect (i) less complete disclosure of interests in trade and product information (ii) better opportunities for strategic bargaining and (iii) more transaction enforcement problems since threats to terminate trade and deals with competitors would be less credible.

These three attributes of the trading environment must be combined with the nature of the commodity (product) traded to determine the most efficient and transactions cost minimising institutional arrangements. For the commodities which have high perishability and differentiation and that require a high level of asset specificity in production and processing, the most theoretically efficient institutional arrangement will be one dominated by vertically-integrated systems and long-term contracts. In contrast, for commodities with less demanding quality differentiation, low degree of perishability and asset specificity, the ideal institutional arrangement will be one that is mainly decentralised with trade relationships dominated by spot market or short-term contracts.

In keeping with these theoretical considerations the present study hypothesises that:

- Different smallholder commodity systems in the study region have differentiated levels of transaction costs depending on the nature of the product traded and their trading environment.

- Market reforms have created an enabling environment for the most efficient and transaction costs minimising institutional arrangements to prevail, given the product characteristics of the commodities considered in this study.
- Given that smallholder households face technology and market information rational boundaries at any one-production period, they will choose to participate in institutional arrangements that minimise their sum of transaction and production costs.

The enabling trade environment is evaluated using the concept of exchange configuration as developed by Thorbecke (2000) and which is expounded below.

2.3.3.2 Analytical framework and procedures

As pointed out by Thorbecke (2000) 'an initial necessary step towards understanding the process of exchange in developing countries is to identify the most important specific characteristics of elements that influence the *items* exchanged, the behaviour of the *actors*, the properties of the *environment* and the form of *transactions* that take place'. It is in line with this need that Thorbecke and Cornelisse (1991) developed the concept of exchange configurations. These can be thought of as channels through which specific transactions are effected along a commodity system. Both market and non-market (informal) exchange configurations are deemed to exist in any commodity marketing system.

As the central focus of the institutional analysis undertaken in this study is to determine the effects of market reforms on transaction costs faced by smallholder farmers, the concept of exchange configurations is considered to be the most suitable and has therefore been adopted as the main analytical framework. Each commodity system is thus analysed in terms of the products traded, product characteristics and types of contracts involved. The actors who take part in each exchange configuration along each commodity system are characterised in terms of their market co-ordination and control functions. The institutional environment in which production and exchange takes place is analysed at two levels. Firstly, an analysis is made of the availability and provision of production and marketing services to smallholder farmers. The services considered are extension, research, livestock services, market information and access to roads. Secondly, the prevailing situation in the factor markets evaluated. The factor markets considered here are credit, land and labour.

Although various exchange configurations are analysed along the hierarchy of each of the five commodity systems, the thrust of the analysis is the farm household configuration i.e. the beginning of the marketing chain. According to Thorbecke (2000), the farm household configuration combines a hybrid of market transactions that makes it a fascinating organisation to study, a view shared by this study.

Analysis of the production and trading environment

Public and other services provided by the government and other agents to facilitate production and marketing are important institutional factors that influence transaction costs and incentives. In recognition of this fact, this study analyses the institutional changes that have arisen from market reforms in the provision of agricultural services and rural financial markets. Smallholder farmers' access to factor markets, physical infrastructure and market information are also analysed.

Government expenditure on the provision of agricultural services, including extension, research and livestock services is used as an indicator of the changes that have occurred because of market reforms. Farmers access to technical information is analysed using data collected during household surveys and information on the number of contacts the household head has had with extension workers.

The amounts and proportion of agricultural credit advanced to the agricultural sector by formal financial institutions such as banks during the highly subsidised situation prevailing before market reforms is contrasted with the situation prevailing under market reforms. Farm-level data is also used to analyse the sources, types and amounts of agricultural credit given to smallholder farmers in the study region.

The distance to the nearest physical market and access to an all-weather road is used as an indicator of each household's access to a physical market. The expectation is that the distance to a physical market and all-weather road has great influence on the farmer's participation in labour, product and input exchanges as it has direct bearing on transport cost. Indeed, Ahmed & Rugtagi (1984) have shown that transport costs are a major transaction cost for most agricultural households in Sub-Saharan Africa. The potential effects of transport costs on cropping choices, market participation and hence resource-use efficiency have also been empirically demonstrated by Goetz (1992) in Senegal, Jayne (1994) in Zimbabwe and Omamo (1998) in Kenya. Access to market information is analysed according to source of information i.e. mass media and public agencies (least asymmetric), neighbours, traders and none at all (most asymmetric condition).

Market co-ordination and control (market actors)

The analysis of the actors involved in agricultural markets has traditionally focused on assessing the market structure and has drawn heavily on the industrial organisation model. This model emphasises analysing market structures as important determinants of market conduct and performance (Bian, 1968; Koch 1980). Conduct that primarily involves the analysis of human behaviour is not readily quantifiable. Market performance that refers to the impact of structure and conduct can be quantified in terms of prices, costs and output (Ferguson & Ferguson, 1985). The industrial organisation model, while emphasising the concepts of market integration, competition and efficiency, has a number of limitations as Harris (1993) has documented. These limitations have led to the current focus on NIE as a more robust approach to the analysis of agricultural markets particularly those in developing countries.

Within the NIE framework, emphasis is placed on analysing market co-ordination and control as important aspects of market structure (Jaffee & Morton, 1995). Co-ordination is arranging interdependent activities that require linking the decisions and actions of different production, technical and marketing aspects and ownership units. A major challenge in agricultural commodity systems is enhancing vertical co-ordination that can reduce the risks associated with transactions. Vertical co-ordination, therefore, involves a process of harmonising the decisions and actions of farmers, input suppliers, processors and traders in an effort to match conditions of supply and demand. The process may also facilitate the flow of information and other resources necessary to define and shift the incentives of various market participants. The absence of an effective vertical co-ordination process in any commodity system is therefore likely to result in resource mis-allocation, economic inefficiencies and the enhancement of production and marketing risks.

The ability to exercise influence over key variables in a commodity system, be it in production, processing or marketing, is also an important institutional issue usually referred to as market control (Jaffee & Morton, 1995). Both vertical and horizontal controls are important factors and influence the scale economies as well as exchange of property rights of market participants. Vertical control mainly deals with the right or ability to make strategic decisions that influence the activities and welfare of participants at different stages in a commodity system. Horizontal control is mainly the ability to influence prices, incomes and other results in a particular market that arise from one's market share and/or product differentiation.

In this study, market co-ordination and control in each commodity system is analysed through identification of institutions involved in production, processing and marketing activities before and after market reforms. A subjective rating of each commodity system co-

ordination and control is arrived at based on information collected through interviews with farmers, traders and government agencies. Published information on the various commodity systems is also used.

In market co-ordination analysis, the co-ordinating role played by respective government regulatory agencies before market reforms were introduced is contrasted with the current situation. Market control analysis focuses mainly on the control exercised by smallholder farmers before and after reforms in production, processing and marketing activities of each commodity system. The ultimate objective of analysing market co-ordination and control is to identify factors that may hinder the development of efficient and equitable institutional arrangements for each commodity. The changes in co-ordination and control dispensation as they affect information flow and transaction costs are also highlighted.

Analysis of the products traded, their contracts and trade margins

The objective of this analysis is to gain a broad understanding of the products traded at the farm level as a pre-requisite towards characterising their prices, contracts and transaction costs. Commodity production systems are analysed for their asset specificity using qualitative judgement based on the need of smallholder farmers to specialise in production, processing and other post-harvest activities. The Asset Specificity Index (ASI) for each commodity system is based on the need for smallholder producers for general and specialised investments as shown in Table 2.1. The higher the costs or level of farmer investment of the items in Table 2.1, the higher the level of asset specificity.

Table 2.1 Variables used to arrive at ASI for each commodity system

Production level	Post-harvest level	Marketing level
<ul style="list-style-type: none"> • Establishment cost / ha • Cost of a dairy animal* • Presence of permanent/ temporary structures • Need for specialised kits and equipment 	<ul style="list-style-type: none"> • Need for machinery and processing facilities • Need for own transport 	<ul style="list-style-type: none"> • Ownership of marketing agency e.g. shareholding • Need and ownership of warehouses • Need for other marketing facilities

* While appreciating that dairy animals are used by farmers to smooth their consumption through sale and purchase of the animals, the cost of the dairy animals is nevertheless regarded as an investment in the short-run which indicates a farmer's commitment to dairy production.

Commodity systems are also distinguished and contrasted based on each commodity's differentiation (grades), perishability and seasonality of trade and the relationship between these commodity attributes and their prices. These product attributes together with the analysis of the frequency of trade is then used to form a basis of analysing the expected forms of contracts.

Contracts are important in an exchange as property rights which are central focal point in NIE are transferred by contractual agreements when transaction costs permit. Contracts have been defined as a two-sided legal transactions in which two parties agree on certain mutual trade obligations including enforcement of the obligations (Williamson, 1985; Furubotn & Richter, 1991). In an effort to characterise contracts, Williamson (1979, 1985) classifies them along a dimension that ranges from the 'classical' to the 'relational' or incomplete contracts. The classical is a comprehensive contract with provisions fixed *ex ante* for all eventualities and within the duration of the contract. The relational contract, by contrast, allows for gaps in the agreement, as it is recognised that bounded rationality and high transactions costs make it impossible to agree *ex ante* on all future eventualities that may affect the trade relationship.

The structure and nature of the contract will to a large extent be determined by the nature of transactions. Where asset specificity is high, such as in coffee production, the expectation would be that a long-term contract would be preferred. This may lead to a foreclosed kind of classical contract. However, the uncertainty brought about by market reforms might put such contracts under severe pressure as producers try to move towards a more relational type of contract.

The analysis of contracts concentrates on the terms and conditions of the exchange contracts with regard to their specificity, uncertainty and frequency. A subjective rating of the types of contracts expected to prevail in each commodity system is derived from product and trade attributes. These expected forms of contract are compared to the contracts that prevail in each commodity system before and after reforms.

A comparison of the changes in marketing margins across four¹³ commodity systems is undertaken as a simple measure of the efficiency of marketing institutions before and after market reforms. According to Mendoza (1995) a marketing margin can be used as a measure of the final selling price (consumer price) that is captured by a particular agent in a marketing chain. In this study, interest centres on the proportion of the consumer price paid to the farmer. As market reforms aim to get prices right by removing distortions and marketing inefficiencies, it follows that, in a situation where market efficiency is improving, the farmers should be able to get a higher proportion of the consumer price if there were no price subsidies before market reforms were introduced.

In calculating the farmers' margin, the farm gate prices paid to milk producers is expressed as a percentage of the price paid per unit by consumers in Nairobi. Time-series consumer milk prices for Nairobi are readily available as they are used in computing consumer price indices. For coffee and tea, the free on board (f.o.b.) prices are used as the reference prices.

2.3.4 Analysis of resource demand and farm productivity

2.3.4.1 Theoretical considerations

A two-stage bivariate probit selectivity model is used to analyse resource demand (land and capital) and productivity in smallholder farms in the Central Kenya region. The first-stage probit analysis involves a joint estimation of the factors that determine smallholder farmers' credit and land demand as well as supply patterns. There are two objectives at this level of analysis: to estimate the demographic, economic and institutional factors that determine the participation of farm households in both credit and land markets and to analyse how land and credit demand conditions affect resource allocation and farm productivity. In the second stage, separate regression equations are used to model the production behaviour of farmers conditional on the selection criteria i.e. whether the farmer is credit or land constrained.

The theoretical foundation of selectivity models rests on discrete choice theory also known as qualitative response theory. Under discrete choice theory, individuals or households are assumed to make choices among discrete alternatives in a manner that yields the highest utility per choice action. The model has a structural microeconomic interpretation as demand functions derived from stochastic utility maximisation (MacFadden, 1981). Discrete choice theory is thus developed around the notion that there is a set of population choice behaviour, defined in terms of a set of individual behavioural rules and a structure of utility function that contains a stochastic component (Hensher & Johnson, 1981; Boich-Supan, 1991). Amemiya

¹³ Reliable time series data on horticultural products was not readily available and hence the marketing margins analysis did not include horticultural crops.

(1981) provides a comprehensive review of the application of discrete choice models. The probit and logit distributions are the two most widely used in qualitative response models.

The probit model, formulated with a normal distribution assumption, is theoretically attractive but computationally complicated and almost intractable for polychotomous choices, and hence restricted to binary choice (Lee, 1983). The logit model is based upon a very strong behavioural assumption of independence and identical distribution of error terms (Madalla, 1983). The model has also a major weakness in the property commonly referred to as *independence of irrelevant alternatives* that has limited its application. The model applied in this study is based on probit distribution.

A frequently encountered problem in empirical research is the quantification of an individual choice that may be influenced by unobservable behaviour or preference. Also individual-based data generally require the analysts to deal with potentially biased estimates arising from a selection process. For instance, when using cross-sectional household data cases are encountered where survey respondents participate in one activity while others do not. As clearly illustrated by Judge *et al* (1985), the missing data situation can be equated to a censored sample. To overcome this problem Heckman (1976) developed a procedure that transforms the problem from one of missing data on the dependant variable to one of specification error or omitted variable resulting from sample selection bias. Following Heckman's study of labour supply, many econometric models have been developed to generate and estimate actions not taken. These models are generally called switching regression or selectivity models (Lee, 1978; Madalla, 1983). Goetz (1992) applied a selectivity model to analyse household food marketing behaviour in Sub-Saharan Africa in situations where high fixed transaction costs exist. The model endogenously switches households into alternative market participation states, correcting for bias caused by the exclusion of unobservable variables affecting both discrete and continuous household decisions. Other empirical applications of the model include Feder *et al* (1990) on use of credit in Chinese agriculture, Fuglie and Borsch (1995) in analysing the use of nitrogen fertilisers in USA, and Freeman *et al* (1998) in an analysis of dairy production in the East African highlands. The majority of these studies have been based on probit selectivity models while the current model is based on bivariate selectivity model.

In a theoretically perfect situation, where markets forces are expected to ration goods and services, the supply and demand of factors of production can be expected to equilibrate at a given market clearing price. In such a situation, a constraint (shortage) of a factor of production is said to occur if the shadow price of an extra unit is sufficiently higher than the market-clearing price. Nevertheless, as argued in the conceptual framework (see section 2.2), this is hardly the case in most of the markets where smallholder farmers operate. Smallholder farmers will face constraints in factors of production due to market imperfections that hinder equilibration of supply and demand.

The approach adopted in this study recognises that a disequilibrium may exist in a household's credit demand and supply. It is postulated that borrowers and non-borrowers are not a homogeneous group. As clearly pointed out by Feder *et al* (1990), the implicit assumption that borrowers and non-borrowers are a homogeneous group is a major weakness that has been prevalent in many of the studies that have tried to quantify the marginal effects of credit on farm productivity. The homogeneity assumption is often not valid because many non-borrowers do not borrow either because they have enough liquidity from their own resources or because they cannot obtain credit. Thus, for the purpose of this study, farm households have been divided into two categories: those who are credit constrained and those who are not. A household is considered constrained if the household head expresses a willingness to borrow more; indicates credit requests have not been approved; there is no formal lender to offer credit or they indicated that they feared borrowing for one reason or another. Those farmers reporting there is no lender as well as those who feared borrowing are included in the credit constrained category as they have self-selected themselves due to assumptions of non-eligibility and risk-

aversion. Thus, each household's credit supply and demand condition is used as the first selection criterion in estimating the household selectivity model.

Farm households in the study region also face a disequilibrium in land supply and demand. This is primarily the result of high population pressure and the thin land market prevalent in the region. As the demand and supply equilibrium for land can affect access to formal credit, overall allocation of resources and hence farm productivity, the land supply and demand situation of each household is used as the second selection criterion. A farm household is considered land constrained if the respondent indicates a desire for more land or a desire to acquire more land either through buying or through lease.

From a theoretical standpoint, land and credit selection criteria are expected to correlate as land can be used to improve access to formal credit. Equally, access to formal credit can facilitate land acquisition. As such the two selection-criteria equations are estimated jointly with assumed correlation in the error terms.

2.3.4.2 *Econometric specification of a bivariate probit selectivity model*

Let Cr^* and L^* be the unobservable excess demand for credit and land for each household (i), respectively. Dropping the i term for convenience, the relationship between excess demand for credit and land and the vector of explanatory variables can be specified as:

$$\begin{aligned} Cr^* &= \alpha_a Z_a + \varepsilon_a \\ L^* &= \alpha_b Z_b + \varepsilon_b \end{aligned} \quad (2.5)$$

Where Z is a vector of exogenous variables, α is a vector of estimate parameters and ε_a and ε_b are correlated random disturbance terms. The excess demand functions for both credit and land are not observed but can be determined from the survey responses on household constraint conditions. The households are credit or land constrained if the demand for either credit or land exceeds their supply, that is; $Cr^* > 0$ and $L^* > 0$. The survey responses are used to define a criterion function which is un-observable dichotomous variables Cr and L , where,

$$\begin{aligned} Cr &= 1 \quad \text{iff} \quad \alpha_a Z_a + \varepsilon_a \geq 0; \quad Cr = 0, \text{ otherwise} \\ L &= 1 \quad \text{iff} \quad \alpha_b Z_b + \varepsilon_b \geq 0; \quad L = 0, \text{ otherwise} \end{aligned} \quad (2.6)$$

The production behaviour of each farm household can also be modelled by a reduced form equation specified by,

$$Y_i = \beta X + \mu_i \quad (2.7)$$

Where, Y_i represent output supply for each farm household, β is a vector of estimate parameters, X is a vector of exogenous variables and μ_i is the error term. The random disturbance terms ε_a , ε_b and μ_i are assumed to have a trivariate normal distribution (allowing them to be correlated) with variances $(1, 1, \sigma^2)$ respectively and correlation $(\gamma_a, \gamma_b, \rho_{ab})$.

Maximising the bivariate likelihood function for this kind of model is feasible but time consuming (Maddala, 1983). Therefore, following Lee (1978, 1983) a two-stage estimation method is used to estimate the system of equations (2.6) and (2.7). According to Maddala (1983), applying OLS to estimate β_i in equation (2.7) also yields inconsistent estimates as the expected value of the error term conditional on the sample selection is non-zero. To correct for the inconsistent estimates in the error term conditional on the sample selection, the inverse Mills ratio is incorporated in equation (2.6).

Following Green (1995); Feder *et al* (1990) and Freeman *et al* (1998), the inverse Mills ratio evaluated at $\alpha_a Z_a$ and $\alpha_b Z_b$ for each i can be summarised as:

$$\begin{aligned}\lambda_{j1} &= \phi(\alpha_j Z_j) / \Phi(\alpha_j Z_j) & \text{iff } Cr = L = 1 \\ \lambda_{j2} &= \phi(\alpha_j Z_j) / [1 - \Phi(\alpha_j Z_j)] & \text{iff } Cr = L = 0 \\ & & J = a, b\end{aligned}\quad (2.8)$$

Where, λ is the inverse Mills ratio, ϕ and Φ are the probability density function (PDF) and cumulative density function (CDF) of the bivariate normal distribution, respectively.

Incorporating equation (2.8) into equation (2.7) yields

$$\begin{aligned}Y_{1i} &= \beta X + \theta_{1j} \lambda_{1j} + \eta_{1j} & \text{iff } C = L = 1 \\ Y_{2i} &= \beta X + \theta_{2j} \lambda_{2j} + \eta_{2j} & \text{iff } C = L = 0 \\ & & J = a, b\end{aligned}\quad (2.9)$$

Where, $\lambda_{1j} = \lambda_{1a} + \lambda_{1b}$ and $\lambda_{2j} = \lambda_{2a} + \lambda_{2b}$ while η_{1j} and η_{2j} are the new residuals having zero conditional means. As Lee & Trost (1978), Lee *et al* (1980) indicate, the residuals in equation (2.9) are not only heteroscedastic but also have a downward bias in the standard estimates for all the parameters. They have gone ahead and suggested a standard weighting procedure for obtaining efficient parameter estimates. As for the bias in estimates, Goetz, (1995) points out that most analysts tend to ignore the bias problem and report their results as being 'conditional' on the selectivity term. However, Lee *et al* (1980) and Green (1995) have developed suitable variance-covariance matrices to correct for the bias due to the selectivity term. This procedure is adopted in the current study.

In estimating the current model, this study proceeds as follows. In the first stage, probit maximum likelihood method is used to obtain estimates of α_j ($j = a, b$) from equation (2.6). The estimated values of are then used to estimate λ_{1j} and λ_{2j} in equation (2.7). In the second stage, Equation (2.9) is estimated by WLS using the estimated λ_{1j} and λ_{2j} as instruments for λ_{1j} and λ_{2j} , respectively. The model is estimated using LIMDEP® computer software (Green, 1995).

2.3.5 Estimation of smallholder farms production efficiency

2.3.5.1 Theoretical considerations

Following the pioneering work of Farrell (1957), economic efficiency is dis-aggregated into two components; technical efficiency (TE) and price or allocative efficiency (AE). Technical efficiency refers to the ability of a firm to obtain the maximum possible output from a given set of resources and technology. Technical efficiency is therefore the ability of farm households to avoid waste by producing as much output as input usage allows or by using as little inputs as output production requires. On its part, allocative efficiency generally refers to a firm's ability to maximise profits, by equating the marginal revenue product (MRP) with marginal costs of inputs. Thus, allocative efficiency refers to the farmer's ability to combine inputs in optimal proportions given the prevailing set of prices (Fried, Lovell & Schmidt, 1993). In Farrell's framework, economic efficiency (EE) is an overall performance measure and is equal to the product of TE and AE (*i.e.*, $EE = TE \times AE$).

Economic efficiency is thus a more broader definition than the traditional efficiency concept which mainly dwelt on allocative efficiency (Ali & Byerlee, 1991). This modern efficiency concept is viewed more in terms of a system performance which includes farmers and farm support systems rather than focusing on farmer's rationality (Ali & Byerlee, 1991). In line with this modern concept of efficiency, interest centres on system inefficiencies that cause resource productivity to be below their potential. Economic efficiency has also a dynamic

context in that introduction of new technologies, and inputs and market reforms that shift the level of relative prices, can cause a destabilisation of allocation of resources thus creating temporal inefficiencies.

Analysis and measurement of farm household economic efficiency is therefore important as the level of efficiency has important implications for the development strategy adopted. Where farmers are found to be reasonably efficient, increases in productivity require new inputs and technologies to shift the production function upwards. This calls for development and delivery of both disembodied and embodied technical changes that can increase the productivity of one or all inputs or a specific input. On the other hand, low economic efficiency forms a basis for policies geared towards increasing productivity through more efficient use of resources and inputs within the current technology. This means investments will be needed in the areas of input delivery, extension, information systems and better pricing and marketing policies.

Technical efficiency is usually statistically estimated through production functions or through programming models that estimate the best output for comparison with an average or individual farmer's output. Allocative efficiency is, however, determined by comparing the marginal products of factors with their normalised prices. Following Farrell (1957) a host of models - collectively known as frontier models - have been developed. These models can further be classified into parametric and non-parametric models depending on their specific functional forms (Forsund *et al.*, 1980; Fried *et al.*, 1993). Another important distinction is between deterministic and stochastic production frontiers. The deterministic models assume that any deviation from the production frontier is due to inefficiency, while the stochastic approach allows for statistical noise.

The stochastic frontier models are the most commonly used to study production efficiency. According to Bauer (1990), there are two competing paradigms about the construction of frontiers namely the mathematical programming and econometric technique. The main advantage of mathematical programming or data envelopment analysis (DEA) approach is that no explicit functional form is needed to be imposed on the data. Färe *et al.* (1994) have comprehensively discussed these methods. However, most mathematical models belong to the deterministic type which have been characterised by sensitivity to extreme observations and non-composed error term. To overcome the extreme observation problem, Aigner *et al.* (1977) and Meensen & Van den Broeck (1977) independently developed the stochastic frontier model.

The stochastic frontier model incorporates a composed error structure with a two-sided symmetric and a one-sided component. The one-sided component reflects inefficiency while the two-sided component captures random effects outside the control of the production unit including measurement errors and other statistical noise typical of empirical relationship (Aigner *et al.*, 1977; Meensen & Van den Broeck, 1977). A recent extension of the stochastic frontier model by Jondrow *et al.* (1982) has solved the previous inability of deriving individual firm efficiency measures. Brava-ureta & Pinheiro (1993) and Ali & Byerlee (1991) provide a comprehensive review of the application of the stochastic frontier models in measuring the efficiency of agricultural producers in developing countries.

The production technology can also be represented in form of cost and profit functions. The cost and profit function represent the dual approach in that technology is seen as a constraint towards the optimising behaviour of firms (Chambers, 1983). In the context of cost or profit function, any errors of optimisation is taken to translate into higher costs or lower profits for the producer. However, the stochastic nature of the production frontier would still also imply that the theoretical minimum cost and maximum profit frontier would also be stochastic.

According to Lau & Yotopoulos (1971) and Ali & Flinn (1989), a production function approach may not be appropriate when estimating efficiency of individual farms due to

differences in prices and factor endowments. As such, estimation of efficiency should incorporate farm-specific prices and levels of fixed factors as variables in the analysis. Where there is major variability of input and output prices, as is the case in liberalised markets in Sub-Saharan Africa, the use of the dual models in estimating efficiency is expected to give superior results. Furthermore, as pointed out by Coelli (1995), the use of dual forms of production technology can also enable the simultaneous prediction of both technical and allocative efficiency. The dual forms are also flexible enough to account for multiple outputs, which are the norm in most smallholder agricultural systems¹⁴.

Given the factors mentioned above, this study has adopted a stochastic cost model to estimate the cost inefficiencies in smallholder farms in the study area. The cost function approach is preferred over the profit function approach to avoid problems of estimation that may arise in situations where farm households realise zero or negative profits at the prevailing market prices. As Carlos (1991) points out zero or negative profits can be a major estimation problem as the logarithm of a zero or a negative number is undefined

2.3.5.2 Econometric specification of a translog cost function

A cost function provides a convenient framework for analysing efficiency as it is easy to capture the multi-output technologies prevalent in the study region. From a cost function perspective, the households are assumed to minimise cost of producing a given level of output. As demonstrated by Chambers (1983), the cost function can be used to resurrect all the economically relevant information about farm households' technology. The cost function is generally positive, it is non-decreasing, concave, continuous and homogeneous to degree one in input prices. Chambers, (1983) gives detailed proof of the properties of a cost function. The translog cost function which is a second-order approximation of the output, input prices and fixed factors is applied in the current study. The translog cost function is chosen due to its flexibility and its variability of elasticity (Chambers, 1983; Sadoulet & Janvry, 1995). The stochastic translog cost function is defined as:

$$\begin{aligned} \ln C = & \alpha + \alpha_Q \ln Q + \sum_i^n \alpha_i \ln P_i + \frac{1}{2} \beta_{QQ} (\ln Q)^2 \\ & + \frac{1}{2} \sum_i^n \beta_i \ln P_i P_i + \sum_i^n \beta_{ij} \ln P_i P_j + \sum_i^n \beta_{Qi} \ln Q \ln P_i \\ & + \gamma_m \ln Z_m + \frac{1}{2} \gamma_{mm} (\ln Z_m)^2 + \sum_{m,i} \gamma_{mi} \ln Z_m \ln P_i \\ & + \sum_{m,Q} \gamma_{mQ} \ln Z_m \ln Q + \varepsilon_i \end{aligned} \quad (2.10)$$

The symmetry assumptions hold i.e., $c_{ij} = c_{ji}$ and $h_{mi} = h_{im}$

Where; C is total production cost, Q is the value of total farm output, P_i is a vector of variable input prices (fertiliser, pesticides, animal feed and hired labour), Z_m is the vector of fixed or quasi-fixed inputs (land and family labour) and ε_i is the disturbance term.

Following Aigner *et al* (1977) and Meensen & Van de Broeck (1977), the disturbance term (ε_i) is assumed to be two-sided term representing the random effects in any empirical system. The error term, ε_i is taken to behave in a manner consistent with the stochastic frontier concept:

¹⁴ Quiggin & Bui-Lau (1984) and Carlos (1991) offer good critical reviews of the use of the dual form functions and more so the profit function.

$$\varepsilon_i = V_i + U_i \quad (2.11)$$

The systematic component, V_i represents random disturbance in costs due to factors outside the scope of the farmer. U_i is one sided disturbance term used to represent cost inefficiency. Thus, $U_i = 0$ for a farm whose costs lie on the frontier, $U_i > 0$ for farms whose cost is above the frontier and $U_i < 0$ for farms below the frontier (inefficiency). U_i is assumed to be identically and independently distributed as $| N(0, \sigma_u^2) |$ i.e., the distribution of U_i is half-normal¹⁵. The population average efficiency is given by ;

$$E(\varepsilon^u) = 2\sigma_u^{2/2} [1 - \phi(\sigma_u)] \quad (2.12)$$

Where, ϕ is the standard normal distribution function. Following Jondrow *et al* (1982), the farm-specific estimates of inefficiency, U_i , for each observation are derived from the conditional distribution of U , given $(U + V)$. Given normal distribution of V and half-normal distribution of U , the expected value of farm-specific inefficiency U_i given $\varepsilon_i = U_i + V_i$:

$$E[U_i | \varepsilon_i] = \frac{\sigma_u \sigma_v}{\sigma} \left[\frac{\phi(\varepsilon_i \lambda / \sigma)}{1 - G(\varepsilon_i \lambda / \sigma)} \cdot \frac{\varepsilon_i \lambda}{\sigma} \right] \quad (2.13)$$

Where, σ_u^2 and σ_v^2 are the variance of V_i and U_i , $\lambda = \sigma_u / \sigma_v$, $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and ϕ and G are the standard normal density (PDF) and the cumulative distribution function (CDF), respectively, estimated at $\varepsilon_i \lambda / \sigma$.

The Maximum-Likelihood (ML) method is used to estimate equation (2.10) using LIMDEP[®] programme (Greene, 1995). The farm-specific efficiency index is then constructed using the results of equations (2.10) and (2.13). The resultant cost inefficiency (CI) index is used as the dependent variable in a second stage regression analysis aimed at decomposition of the efficiency performance at the farm level. The second stage regression analysis thus provides for the relationship between cost efficiency and farm characteristics, institutional and economic factors.

2.4 Data sources

Price data has been collected from various sources, mainly the marketing organisations concerned with the marketing or regulation of each of the four commodities. These are the Coffee Board of Kenya (CBK), the Kenya Tea Development Authority (KTDA) and Tea Board of Kenya (TBK). Monthly maize producer/wholesale prices on the Nairobi market as well as milk, fertiliser and other input prices were collected from various sources in the Ministry of Agriculture. Data on monthly producer prices published in statistical abstracts and other government documents were also used. The monthly exchange rate statistics and other monetary data were collected from the monthly and yearly Central Bank of Kenya publications. The international time series data for coffee prices were collected from the International Coffee Organisation and international price abstracts were used for the other commodities.

¹⁵ For comparison purposes, three models are estimated in this study. The models are based on half-normal, truncated and exponential distribution of the efficiency term.

Cross sectional surveys were also conducted for a sample of smallholder coffee producers in Kiambu/Thika, Murang'a, Kirinyaga and Nyeri districts in Central Province of Kenya. The sample comprised 200 households. Their distribution is shown in Table 2.2.

Table 2.2. Distribution of the sampled households across districts in the study region

District	No. of societies sampled	No. of Smallholders Sampled	No. of Small independent farmers sampled	Total
Kiambu/Thika	5	30	23	53
Murang'a	5	30	22	52
Kirinyaga	4	30	20	50
Nyeri	3	30	15	45
Total	17	120	80	200

A two-stage random sampling procedure was used to sample the households. During the first stage at least three coffee co-operative societies were sampled from a list of all registered societies in each of the four districts. The sampling was done in such a way that each of the three main coffee growing agro-ecological zones were represented at least by one society. The second sampling stage involved the random sampling of 120 coffee producers from the register kept by the societies previously sampled.

It was considered necessary to sample some independent coffee growers who were not members of a co-operative society. The small independent producers have their own coffee processing facilities and market their coffee directly to the Coffee Board of Kenya. These small independent producers usually have a larger coffee acreage and are more commercialised than their smallholder counterparts. A total of 80 small, independent producers were randomly sampled from the coffee growers' register kept by the Coffee Board of Kenya.

A structured questionnaire formed the main data collection instrument. The questionnaire was pre-tested on 10 smallholder farmers in the region. Data was collected over a four-month period from December 1999 to April 2000. Data on household characteristics, resource endowment, income and expenditure, resource allocations among different on and off-farm enterprises, household access to production factors and markets as well as access to physical infrastructure was collected. Where possible, the data collected from households was verified through other sources. For instance, data on the amount marketed and incomes obtained from commodities marketed through such organisations as co-operatives was verified from the records kept by these organisations.

2.5 Observations and conclusions on analytical procedures

This chapter documents both the theoretical background and the analytical methods applied in this study. The descriptive and econometric models developed in this chapter attempt to answer the six research questions outlined in section 1.5. The models are complimentary and inter-related as results from one-model builds a case for the next model. The first model which analyses agricultural term of trade, price evolution and volatility is geared towards answering the first two research questions set out by this study. The analysis is not counterfactual as it compares before -and-after scenarios. It is appreciated that in this type of analysis many variables may have changed in different directions exerting a variety of effects on terms of trade and prices. Nevertheless, the formulated model is considered good enough to show the general direction of the variables being analysed. Moreover, the ARCH-M model complements

the other statistical methods as it takes into account more variables and their specific effects on price means and variance.

The descriptive institutional analysis also developed in this chapter is central to this study. Outputs from the institutional analysis can indicate the level of transaction costs and smallholder farmers' access to production inputs (both factor and non-factor) and output markets, all of which have important implications for pricing, the allocation of resources, farm productivity and production efficiency. Equally, the institutional analysis also hopes to capture other institutional issues that have considerable bearing on economic variables. These include the governance of smallholder institutions, the structure of farmers' social organisation, the nature of contracts and asymmetries in market information. Nevertheless, despite the importance of this type of analysis, the institutional analysis model is characterised by a degree of subjective judgement because some variables cannot be easily quantified.

The third model developed in this chapter is the bivariate probit selectivity model to analyse a household's demand for credit and land allocation and how this effects productivity. The model is formulated to accommodate two constraints, i.e. the land and credit constraints faced by smallholder farmers in the study region. The land constraint is regarded as important because of there is high population pressure in the study region and because the market reforms undertaken in Kenya up to now have not focused on land markets. Credit is also taken as a constraint. Evidence introduced later in this study clearly indicates that market reforms have been associated with credit constraints. The model is therefore considered suitable as it facilitates the incorporation of these two major constraints while maintaining computational tractability. Nevertheless, due to the close interrelationship of factors that might determine the demand for credit and land as well as farm productivity, the estimation of the model may suffer from problems that relate to endogenous variables.

A stochastic translog cost function model has also been developed in this chapter to estimate the cost inefficiencies of smallholder farms in the study region. The model is preferred because of its ability to estimate both technical and allocative efficiencies and its flexibility in accounting for the multiple outputs common on smallholder farms while utilising the specific farm gate prices that can be expected in a reforming economic environment. However, despite its advantages, the translog model formulation tends to explode as the number of explanatory variables increase, thereby limiting the inclusion of many variables.

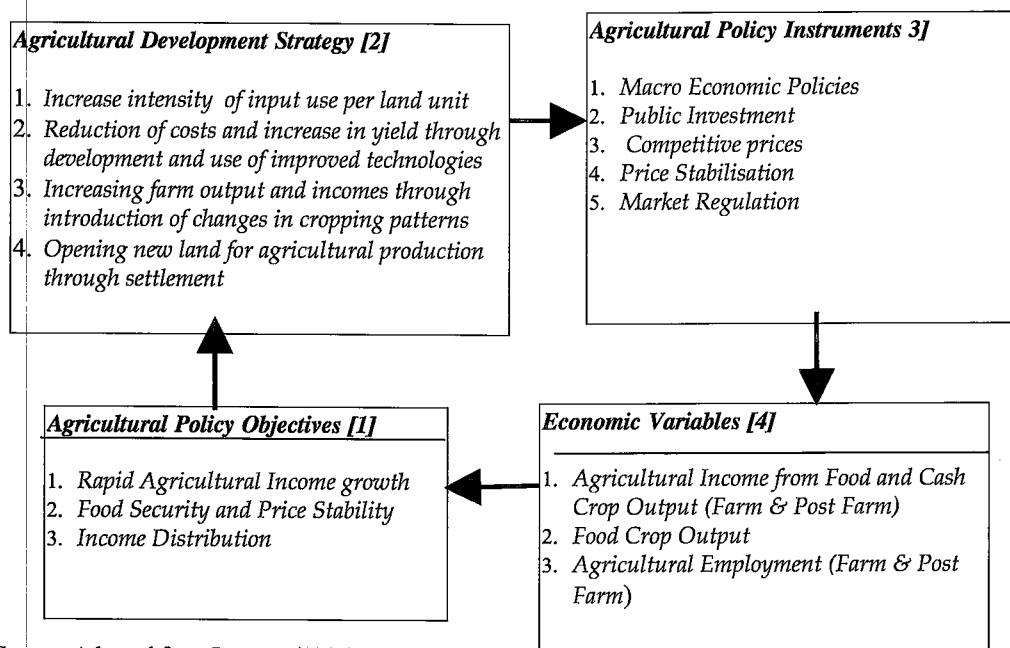
In conclusion, the formulated analytical models are considered suitable for the research questions that have to be answered. Furthermore, the models are formulated with the data and computational considerations in mind. Some specific estimation issues are, however, omitted in this chapter because they are discussed later in the chapters that report on the empirical results

CHAPTER 3

REVIEW OF AGRICULTURAL DEVELOPMENT IN KENYA

3.1 Introduction

Kenya's agricultural development has been geared towards meeting three principal policy objectives: a rapid growth of agricultural income; food security and price stabilisation; and income distribution (Republic of Kenya, 1986, Pearson, 1995). Various policy instruments and strategies have been advocated and applied throughout Kenya's colonial and independence¹⁶ history in order to realise these objectives as summarised in Figure 3.1.



Source: Adopted from Pearson (1995) p.8

Figure 3.1 Linkages among Kenya's agricultural development strategy, policies and objectives

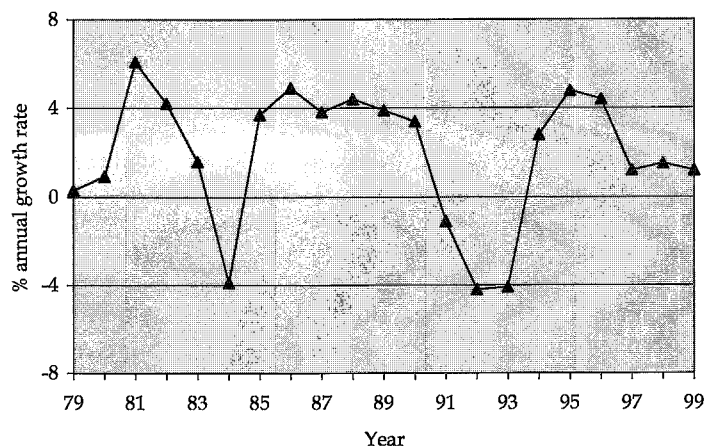
Since Independence, Kenya's main agricultural development strategy has been based on the promotion of smallholder farming. Smallholder-led agricultural strategy has been advocated to serve the dual purpose of increasing and intensifying resource use as well as addressing equity concerns. In implementing this development strategy a variety of policy instruments have been applied. Between 1963 and 1980, policies emphasised government intervention in nearly all aspects of agricultural production and marketing (Nyangito, 1999). These direct intervention policies related to market regulation and pricing of agricultural commodities and inputs. Indirectly, the government macro-policies in respect to interest rates, exchange rates, trade, wages and investment decisions in public goods (mainly research and

¹⁶ Kenya gained its political independence from Britain in December, 1963.

rural infrastructure) were also used to influence the direction and rate of agricultural development.

There was, however, a major policy shift from 1981, when government controls were gradually removed and initial attempts made towards market liberalisation. The liberalisation of markets was aimed at enhancing participation of the private sector in agricultural production and marketing while at the same time creating an enabling environment for market forces to determine the level of agricultural prices.

These shifts in policy are reflected in differences in the performance of the agricultural sector. Between 1963 and 1972, the sector grew at 6.4% per annum, a rate that dropped to 3% between 1973 and 1980. During the early years of liberalisation (1980-1990) recorded growth ranged from minus 4% to positive 6% with a mean of 3% as shown in Figure 3.2. Performance has been even more disappointing since 1990 when major reforms were implemented in the sector. The sector registered negative growth rate from 1991 to 1993 before taking an upward turn in 1994. The poor performance of the agricultural sector during the last twenty years has adversely affected the performance of the whole economy.



Source: Kenya economic survey (various)

Figure 3.2 Agricultural sector real growth rate in Kenya, 1979 to 1999

In line with the objectives of this thesis it is important to understand how Kenya's policy instruments have evolved over time, the direction they are likely to take in an era of liberalised economy, and their effects on agricultural development. Furthermore, the problems being addressed under SAPs and the need for SAPs in the first place can be clarified if seen from an historical perspective. Therefore, a brief historical overview of the policy instruments and strategies applied in both colonial and independent Kenya is given below. For convenience this review is sub-divided into two sections: the era of government controls which ran from the days of colonial rule to the early 1980s and the period of liberalisation (market reforms) from 1980 to 2000. The review not only summarises the major strategies and instruments applied in the agriculture sector in general, but briefly summarises the policy changes that have been implemented in the sub-sectors relevant to this study i.e. coffee, tea, dairy, maize and horticulture. Changes in factor and non-factor markets are also reviewed.

3.2 The era of government controls

3.2.1 *European settler led agricultural development*

From 1900 to the mid-1950s, agricultural development in Kenya was dominated mainly by the desire of the British government to encourage and support European settlers to engage in commercial agriculture. This was achieved through the alienation of land to create what was known as the 'White Highlands' (Sorrenson, 1968). From 1915 a series of Crown Land Ordinances were enacted that resulted in 7 million hectares of Kenyan highlands (20% of the arable land in Kenya) being reserved for European settlers (Colony and Protectorate, 1931). African families were deliberately consigned to 'African reserves', areas which were neglected as far as development was concerned.

Having acquired land, the settlers overcame labour shortages by forcing the African population into the monetary economy by imposing taxes. In response to land pressure, taxation and coercion, thousands of Africans moved to settle on the estates where they provided labour in exchange for access to land and a cash income to cover their tax burden. By 1928, as many as 40% of men of working age from Nyanza and Central Districts were employed on the European-owned farms (Kitching, 1980). This skewed pattern of land ownership created an agricultural system that persists even in present day Kenya.

Apart from land and labour, institutions and infrastructure were also established to serve the European settler community. Public investment in transport infrastructure, including the Uganda railway was almost exclusively to the benefit of the European farmer. Similarly, public sponsored agricultural research concentrated on crops suitable for large-scale production in the highlands such as coffee, tea, pyrethrum and maize (Smith, 1976). Export crops were 'scheduled' for European settlers ostensibly to ensure quality control and to safeguard African food supplies. Only cotton, which was ill suited to conditions in the highland conditions, could be legally grown by Africans as a cash crop.

Credit and marketing institutions were also tailored to the needs of European farmers. Through monopolistic marketing organisations, European farmers were able to access crop-secured loans. This set the pattern for monopolistic marketing and crop-secured lending practises that prevailed until the introduction of SAPs in the early 1990s.

As European agriculture was developing, intolerable pressure was building up in the African reserves. The colonial government response to this stress dramatically influenced the course of agricultural policy and development in Kenya. In 1954, in response to mounting resentment amongst the African population, the colonial government published a document - popularly referred to as the Swynnerton plan - setting out how the intensification of development in African agriculture was to be achieved (Colony & Protectorate, 1954). The plan aimed at creating a rural elite as the vanguard of development and the first defence against revolt. It contained a strategy for the development of smallholder agriculture that has remained the corner stone of agricultural policy up to the present day.

3.2.2 *Smallholder led agricultural development*

Central to the 'Swynnerton Plan' was the consolidation and registration of land held by Africans as overcoming failures in the land market was seen as mandatory to any development (Colony & Protectorate, 1954). The land reform consisted of determining the ownership of cultivated plots, consolidating fragmented plots and registering these parcels to individuals mainly within the Kikuyu¹⁷ reserves. 'Able, energetic and rich Africans' were expected to acquire more land, whereas the 'bad and poor farmers' would eventually sell property and became a landless class, employed on larger African farms (Nelson, 1995).

¹⁷ Kikuyu is the name of the largest ethnic group in Kenya who are mainly agriculturist occupying the Central Kenya highlands.

Swynnerton's plan also recommended relaxation of restrictions on the production of export crops by Africans. According to the plan, progressive African farmers were expected to grow coffee, tea or pyrethrum to generate cash income as well as employ the landless labour. Nevertheless, production controls to ensure quality standards were maintained.

Considerable public spending on infrastructure and extension backed this official encouragement of African agriculture. However, much emphasis was placed on development of progressive farmers in high potential areas (Heyer, 1981). The removal of cropping restrictions produced the impetus for smallholder agriculture development. However, in 1961, when agriculture accounted for 85% of Kenya's export earnings, the large-farm sector was still accounting for three-quarters of the output (Republic of Kenya, 1962). It was this duopolistic agricultural production system that the independent government of Kenya inherited in 1963.

The newly formed Kenyan government adopted 'development' as its principal objective and moved quickly to promulgate policies and programmes designed to ensure a smooth transfer of responsibility (Onjale, 1995). Thus, Kenya government policies with regard to agriculture and all other sectors of the economy were based on principles outlined in the sessional paper number 10 on *'African Socialism and its Application to Planning in Kenya'* (Republic of Kenya, 1965). The objective as described in the sessional paper were:

'to achieve high and rapid growth, equitably distributed, so that all are free from want, disease and exploitation, while at the same time guaranteeing political equality, social justice, human dignity and equal opportunities but also without prejudice to remedying the inequalities inherited from the past' (Republic of Kenya, 1965).

The major emphasis and underlying policy rationality during this period was to alleviate the pressing and immediate problems of transition while trying to establish a firm basis for rapid economic growth. The overall development strategy was one in which economic and social development would be planned at the national level. This orientation towards central planning was reinforced by the 'structuralists' paradigm that emphasised the proliferation of government activities, particularly through investments in commercial enterprises and administrative structures. The government was expected to provide a network of physical and social infrastructure as well as managing economic and social activities. It was argued that indigenous Kenyans were too poor to participate effectively in commercial activities and therefore the government had to take on a guardian role, investing in enterprises on behalf of the general public. The government thus created and invested heavily in the parastatals that became the hallmark of Kenyan economy in late 1960s and 1970s¹⁸. Rapid, equitable economic, social and regional development was to be guided through national planning while acknowledging the need to promote private sector participation in the task of nation building. The logical question then was what form should such participation take (Alila & Omosa, 1995).

In the context of agricultural development policy it was expected that the most favourable economic results would come from continuing development along the lines set out in the Swynnerton Plan. A World Bank Report drafted at the time supported this strategy stating: *'we recommend a programme devoted mainly to land consolidation, enclosure and development of cash crop production in non-scheduled areas'* (World Bank, 1963, p.49). From 1963 to 1973, in line with these policy objectives, the government undertook a number of strategies to deal with land re-distribution, market and price policies and credit and infrastructure. The basic tenets of these strategies are described below.

¹⁸ The state-owned enterprises (SOEs) continued to expand in the 1980s and by 1990/91 there were 240 SOEs in Kenya accounting for 11% of GDP (O'Brien & Ryan, 1999).

Land ownership

The change from settler-led agricultural development to one led by smallholders can be viewed as an induced institutional innovation. According to Hayami and Ruttan (1985) supply and demand factors can cause institutional change. Changes in factor endowments, technical change and growth in product demand factors can cause institutional change. On the supply side, institutional change can originate from the mobilisation of political resources and changes in cultural endowments.

The institutional change that occurred in Kenya after 1963 was driven primarily by supply. The change of political leadership ensured that the efforts of political entrepreneurs to introduce land reforms through changes in the tenure system received stronger political support. Thus, the settlement of African farmers and granting them freehold title was an attempt to address the long-standing problem of land tenure that had been one of the main issues in the struggle for independence.

The African resettlement process, initiated by the colonial government, was intensified immediately after independence. Land transfer was financed partly by Britain and other donors. The initial resettlement programme transferred over one million acres of land to about 35,000 African families in the former white highlands (Heyer, 1981). In order to preserve the large-scale sector, proportions of farms were transferred intact from European to African farmers.

To satisfy the remaining demand for access to land, the government focused on the allocation and registration of arable land that had remained under African occupation (Lofchie, 1989). This was justified as a mechanism for increasing lending to smallholder farmers and breaking capital constraints on land development¹⁹. The government also acquired national farms that were to provide essential inputs such as hybrid seeds and improved livestock. Co-operative and company-owned farms employing large-scale production techniques and processing were also encouraged. Thus, although the large-farm sector remained, the structure of Kenyan agriculture changed fundamentally after 1963, and by 1967 smallholder farmers were responsible for more than half the value of agricultural production (Republic of Kenya, 1971). Agricultural institutions and policies had to be re-oriented to match this transformation. In the next section some of the major institutional and policy changes which were made during this re-orientation are discussed. The shortcomings of these new institutional arrangements and policies culminated in the liberalisation of the economy in early 1990s.

Agricultural marketing and pricing policies

Marketing

Several statutory marketing institutions (boards) were inherited from the colonial era. However, there was need to restructure most of these marketing institutions to serve the growing ranks of smallholder farmers. Institutional changes to meet these new conditions widened and deepened the government's presence in the agriculture.

The marketing of most crops (excluding horticulture) and livestock was carried out through marketing boards. The main marketing boards were the Maize Marketing Board, Wheat Marketing Board and Kenya Co-operative Creameries (KCC) for dairy and dairy products. There were similar boards for the major export crops, coffee, tea and pyrethrum. The government also encouraged formation of co-operative societies as a major link between the boards and the smallholder farmers. The co-operative societies also offered bulking, transport, processing and other social facilities to smallholders. Smallholders were in turn required to

¹⁹The importance of land tenure reform to rural development in SSA has remained a matter of debate for the last four decades. Major debate issues remains on the relationship between individual property rights and its role in enhancing access to credit, higher security of land investments and the increase in land controlled by the most efficient farmers.

market their coffee, tea, pyrethrum and other products through these co-operatives (Heyer, 1981). As smallholder agriculture expanded, so did the importance of the co-operatives as shown in Table 3.1. Most of the co-operatives gained local monopoly status with the encouragement of the government. Producer organisations outside the official co-operative system received little government support.

Table 3.1 The growth of the co-operative movement in Kenya, selected years

Year	No. of co-operatives	Membership ('000')	Turnover (Ksh million)
Pre-liberalisation period			
1963	1,030	200	100
1983	3,314	1,921	4,634
1986	3,524	2,160	4,715
1987	3,809	2,122	5,550
1988	4,033	2,164	6,595
1989	5,183	2,460	6,985
1990	5,400	2,593	2,438
1991	5,594	2,652	5,589
Liberalisation period			
1992	5,832	2,682	5,578
1993	6,158	2,704	10,110
1994	6,293	3,986	12,451
1996	6,767	4,576	14,884
1997	7,564	4,800	15,000
1998	8,312	5,000	15,500
1999	9,151	5,300	15,000

Source: Gatheru & Shaw (eds.), 1998 & Kenya economic survey (various)

Agricultural pricing policies

Pricing policies in Kenya date back to the colonial era. The pricing control was given formal legislation in 1956 as the price control ordinance which was later re-named Price Control Act of 1972. Price control was justified as a means towards reducing fluctuations in farm incomes while ensuring affordable food prices to the consumers. Coffee, tea and pyrethrum producers received the world prices less the processing and marketing costs of the respective marketing boards. cotton was the only crop covered by price stabilisation and producer tax measures (Winter-Nelson, 1993). The pricing policies were however different in case of food crops especially the main staple- maize. The government concern to ensure that consumers could afford maize became a major pre-occupation. The maize marketing board which later became the National Cereals Produce Board (NCPB) was given the mandate of providing maize and other cereals to all parts of the country at prices consumers could afford and also to ensure that farmers had reliable outlets. Through the NCPB, the government tried to provide food security for urban consumers and ensure farmers of price security through a system of pre-announced, pan-territorial prices for maize at all stages of the marketing chain. The NCPB also controlled the physical movement of cereals within Kenya and had a monopoly over the export and import of maize. These price and movement controls were used to facilitate crop-collateralised lending to stabilise prices and to protect farmers and consumers from any rise or fluctuations in prices. However, in the early 1970's there was a progressive reduction of the net producer price for maize towards aligning it to the export parity price. This shift in policy was aimed at discouraging export surpluses which had arisen from the highly subsidised producer prices.

Milk was also effected by the drastic pricing changes introduced by government. During the 1960s there was little change in the differentiated milk pricing system based on quotas, contract and butterfat categories set by the Kenya Co-operative Creameries (KCC) that been operative during the colonial period. This system, however, was abolished in July 1970

and was replaced by one based on a fixed minimum price plus a yearly bonus. The bonus was dependent on the operating profits of KCC. In 1971, the pricing system was changed again. A fixed price was introduced per litre and with the possibility of a yearly bonus.

The pricing policies pursued by the various marketing boards especially with regard to cereals and milk continued to change over time and occupied the centre of policy debate in agriculture until the era of market reforms. The roles, functions and efficiency of the various agricultural marketing institutions has also attracted considerable concerns and policy debate in subsequent periods up to the era of structural adjustments.

Agricultural credit and inputs institutions and policies

At the time of Kenya's independence, there were two main agricultural credit institutions: Agricultural Finance Corporation (AFC) and the Land Agricultural Bank (LAB). AFC was responsible for advancing loans for development and production. LAB specialised in mortgage on land, a major and a critical area at the time due to the African resettlement programme. The LAB was later taken over by AFC which became the main agricultural credit institution. Producer co-operative societies were entrusted with the responsibility of providing short-term credit and inputs to their members, most of who were smallholder farmers. Kenya Tea Development Authority (KTDA) was established during this period and charged with the responsibility of managing smallholder tea production (including provision of farm credit and inputs) processing and marketing.

Due to collateral requirements involving land titles, most of the credit from AFC did not reach smallholder farmers, especially those outside the settlement areas. Consequently, the bulk of AFC loans went to large-scale producers (Vasthof, 1968). In response to the shortcomings of the land-based lending, crop-secured loans were encouraged. For smallholders, co-operatives became the primary conduits for crop-secured loans (Bates, 1989). According to Winter- Nelson (1993), this crop collateralization had two side effects. First, it demanded an increased bureaucratic presence in smallholder farming to ensure that appropriate production techniques were adhered to and the control of marketing channels available to farmers. This entrenched the presence of marketing boards and co-operative societies in smallholder agriculture, a phenomenon that persisted up to the structural adjustment era. Secondly, the crop-secured lending was generally subsidised and rationed through non-price mechanisms, thereby stimulating excessive use of capital in production and processing.

3.3 The era of structural adjustments

Kenya started the 1980s with more favourable economic structure, incentives and institutions than most other Sub-Saharan countries (Swamy, 1994, Onjale, 1995). Nevertheless, structural distortions were building up throughout the 1970s with the two oil crises in the 1970s leading to sharp deterioration in the terms of trade. Additionally, in the wake of the coffee boom of 1977 and 1978, fiscal discipline was severely eroded, thereby leading to major financial imbalances (Bevan, Collier & Gunning, 1988)²⁰. Because of these macro-economic problems the Kenyan government approached the Breton Woods institutions for quick-disbursement loans. In March 1980, Kenya qualified for a structural adjustment loan from the World Bank. According to O'Brien & Ryan (1999), Kenya was the first SSA country to receive structural adjustment funding from the World Bank and later an enhanced structural adjustment facility loan from IMF. This loan and those that followed until 1985 were focused on correcting macro-economic imbalances.

²⁰ During the boom period, consumer and government expenditures increased with the fiscal deficit rising to 9.5% of GDP in 1975/76 as compared to a deficit of between 3-6 % of GDP in early 1970s.

According to Swamy (1994), the first attempt at adjustment (1980-1984) was characterised by both a total lack of compliance because of design and timing problems as well as a lack of political commitment. Given the limited implementation capacity of the government and in the hope of building a greater consensus, it was decided that the World Bank would support adjustments on a sectorial basis and the IMF would monitor the macro-economic situation.

Accordingly, the first adjustment programme loan for the agricultural sector was concluded in 1986. Under the agreement the government was to provide greater incentives through an annual revision of commodity prices, an improved provision of inputs and by strengthen extension services to the sector involved. The government undertook to liberalise the marketing of grains, coffee, tea, sugar, cotton and livestock. However, very few of the stated objectives were implemented (Swamy, 1994; Onjale, 1995) and the first attempt to liberalise the agricultural sector in Kenya was a major failure.

On the policy frontier, the government promulgated the sessional paper No. 1 of 1986 on *Economic Management for Renewed Growth* (Republic of Kenya, 1986). The paper provided a broad policy framework, strategies and specific measures for economic growth. The government prepared a budget rationalisation programme aimed at increasing productivity and investments while advocating private-sector led development strategy in order secure an improvement in the economy. Consequently, the government started an industrial sector adjustment programme in 1988 and the following year introduced financial sector reform. The main economic reforms undertaken so far include²¹:

- Abolition of administrative controls on international trade such as import licensing and foreign exchange allocations.
- Removal of exchange controls on current account transactions together with partial removal on restrictions on capital accounts, including the 90 days foreign exchange surrender limit.
- Removal of restrictions on all foreign commercial borrowings as well as allowing Kenyan nationals to invest abroad up to US \$ 500,000 without reference to Central Bank of Kenya.
- Lifting of controls on interest rates and credit limits.
- Rationalisation of tariff rates, revenue collection reforms including introduction of Value Added Tax (VAT), formation of a tax authority in 1995, abolition of the selective 20% export tax and introduction of 2% presumptive income tax for marketed agricultural products.
- Removal of price controls for essential food items, petroleum products and agricultural inputs.
- In August 1992, foreign exchange retention accounts permitted for exporters of non-traditional goods and revision of import licensing to allow issuance of import licences for importers having their own foreign exchange. Exporters of traditional exports (mainly agricultural commodities) later allowed to retain 50% of foreign exchange in November 1992.
- Coffee and tea trade in both Nairobi and Mombasa auctions allowed to be conducted in US dollars in 1992.
- Monetary policy reforms and review of the Banking Act to allow for more participants in the financial market and enhancing Central Bank role to monitor and regulate the financial sector.
- Introduction of the civil service reform including a major retrenchment programme that was accompanied by government budget rationalisation programme.
- Privatisation and reform of parastatals.

²¹ For a detailed chronology of structural adjustment programs in Kenya, the amounts of loans involved, the conditionalities and donor experience for the period 1980 to 1994, see O'Brien & Ryan (1999).

- Social sector reform and introduction of cost sharing (user costs) in health and education sectors.

The macro-economic reforms involving the exchange rate and interest rate policies were of fundamental importance to the performance of the agricultural sector. During the early 1980s, the Kenya shilling was pegged to the special drawing rights basket of currencies in an effort to have a flexible exchange rate policy. However, the government controlled the exchange rate until 1993 when a floating exchange rate policy was adopted. According to Mosley (1986), even prior to SAPs, Kenya's real effective exchange rate had remained constant throughout the 1960s and 1970s. This trend continued in the first half of 1980s. The real exchange rate, however, depreciated by more than 40% in the second half of the 1980s and black market premiums declined from 110 per cent in late 1987 to 17% in the third quarter of 1991 (Swamy, 1994). The depreciation of the real exchange rate was expected to favour growth in exports in general and agricultural commodity exports in particular.

Market reforms have also been implemented in the area of domestic interest rates. Prior to 1992 the government through the Central Bank of Kenya used to control both deposit and lending interest rates. The government also regulated the interest rates charged on agricultural credit. During this period real interest rates were negative and declining. This trend was reversed in 1992 when commercial interest rates were de-regulated and allowed to adjust to the trends in inflation. This high interest rates arising from de-regulation and government deficit spending had a major adverse impact on availability of credit to agricultural producers. Moreover, the credit crunch and removal of input subsidies during the same period may have resulted to low usage of inputs in the agricultural sector.

Specific agricultural reforms, affecting the marketing and pricing of various commodities were also introduced from 1992. The next section is primarily concerned with reforms introduced among the five commodities of interest of this study - coffee, tea, maize (main staple food), dairy and horticultural crops. Equally important are the policy reforms that directly or indirectly affect farm prices, relative returns to each commodity and farm incomes.

3.3.1 Liberalisation of the maize markets

Maize is the most prominent staple in Kenyan agriculture, producing 40% of the population's caloric requirements. Indeed, food security in Kenya is equated to availability of adequate supplies of maize, both at national and household level (Republic of Kenya, 1994, Omosa, 1998). Maize is grown in almost all agro-ecological zones in Kenya, with the smallholder producing 70% of the crop. Maize acreage increased steadily from 447,600 hectares in 1963 to over 1.4 million hectares in 1998 (Table 3.2).

Table 3.2 Maize area, production, yields, imports and exports in Kenya, 1985 to 1999

Year	Area (‘000’ ha)	Production (‘000’MT)	Yield (MT/ha)	NCPB purchases (‘000’MT)	Exports (‘000’MT)
Pre-liberalisation period					
1985	1,210	1,411	1.25	587	18
1986	1,200	2,430	2.02	670	227
1987	1,200	2,890	2.40	652	248
1988	1,230	2,761	2.24	485	167
1989	1,260	2,631	2.09	549	110
1990	1,380	2,286	1.66	528	160
1991	1,310	2,340	1.78	305	19
Liberalisation period					
1992	1,407	2,520	1.79	488	0.4
1993	1,407	1,710	1.22	463	414
1994	1,400	3,060	2.18	535	13
1995	1,438	2,691	1.87	99.7	154
1996	1,402	2,160	1.54	61.9	221
1997	1,404	2,403	1.71	162	263
1998	1,410	2,300	1.63	9	9
1999	1,400	2,250	1.61	192.9	283

Source: Statistical abstracts and NCPB market reports (various)

Kenya is usually self-sufficient in maize and imports have been relatively rare. Indeed, as shown in Table 3.2, there have been substantial maize exports in most years. According to research work done under policy analysis matrix project (PAM eds., 1995) the self-sufficiency in maize is however threatened by population and income growth that might outmatch domestic production. New initiatives are therefore needed if Kenya is to remain self-sufficient in food. It is with this prognosis in mind that the government, with the help of multilateral agencies, started the cereal sector reform programme in 1988.

As indicated earlier maize marketing has been regulated by government for a long time and in recent years the system have received considerable attention²². As also indicated earlier, the National Cereals and Produce Board (NCPB) was mandated responsible for purchasing, storing and supplying maize throughout the country at a pan-territorial price. While NCPB's two main concerns have been the level and stability of prices to farmers and consumers, the Board has tended to emphasise measures that affect the prices farmers' receive for maize grain. In principle, such a policy provided farmers with a reference price on which to base their price expectations. Nevertheless, seasonal and inter-regional fluctuations in actual market prices made the costs of pursuing this policy prohibitive. Thus, the NCPB often incurred huge debts and by 1987 the Board debts exceeded 5% of GDP (Swamy, 1995). In most years, NCPB's budget could not maintain the official price and this resulted in payment delays of up to six months.

In response to these shortcomings in the maize marketing system, a process of market liberalising was initiated in 1988 under the Cereals Sector Reform Programme (CSRP). According to Gordon and Spooner (1992), the programme had four main objectives: restricting the role of NCPB to market stabilisation; enhancing the role of the private sector in maize marketing; removing administrative controls on the movement of maize and procurement and reserve stock management policy. Despite early official discomfort with the amount of food security provided by the new marketing arrangements, the reform process got underway in 1989. Major successes have been achieved in removing the administrative controls on maize trade especially as far as maize procurement procedures are concerned. This has enhanced the

²² Meilink (1999) gives a detailed review of maize market liberalisation policies in Kenya and their controversies for the period 1976 to 1996.

role of private sector involvement in the maize trade, especially in maize procurement and maize milling. According to the policy framework paper for 1994-1996 signed by the Kenya government, IMF and World Bank, the future role of the NCPB's in maize marketing would be limited to managing strategic reserves. The Board will buy maize at no more than export parity price and sell at no more than import parity price. This re-organisation is underway and had been hoped that it would have been completed before the end of 2000.

Another important impact of liberalisation has been to reduce the cost of transporting maize from surplus to deficit areas as transport loads increases and administrative barriers disappear (Kodhek *et al.*, 1993). This is expected to reduce marketing margins, raise returns to maize production, lower prices to consumers and result in greater market integration between producing and consuming areas. Sasaki (1995) reports that between 1992 and 1994, price differentials among trading regions narrowed and private transportation of maize increased substantially.

Liberalisation of maize markets has also implied adjustments in maize milling²³. Mukumbu (1992) and Kodhek *et al* (1993) conclude that there has been an important impact as far as maize milling is concerned. There has been adjustment towards a greater presence of small-scale urban and rural maize millers as opposed to the dominant large-scale miller prior to liberalisation. The large-scale millers have also broadened their activities in an effort to increase their capacity utilisation. Jayne *et al* (1997) further indicates that the liberalisation of maize meal markets have conferred substantial benefits to consumers in Nairobi. The study estimated that maize market reforms have led to a 31% decrease in real maize meal prices paid by households in Nairobi. Forty percent of the decline was attributed to decline in milling margins while the other 60% was due to lower maize grain prices. However, a comprehensive analysis of the overall effects of maize market reforms on the welfare of producers and consumers in rural areas and other urban centres has not been undertaken so far.

Nyoro (1995) for his part envisages that there will be large potential price swings due to limited increases in yield needed to lower production costs. Thus, maize producers are expected to face fluctuating incomes or resort to exerting pressure on the government to support the industry. Maize prices, the direction they have taken - and hence the incomes generated from maize production since liberalisation - is analysed in this study

3.3.2 Liberalisation of the dairy industry

Dairy farming is an important part of the agricultural production systems in Kenya. In 1997, it was estimated that the national dairy herd, consisting of over one million cows produced 240 million litres of milk. (Waweru, 1998; Republic of Kenya, 1998). Smallholder farmers produce 80% of the country's milk and derive almost half of their incomes from livestock (Republic of Kenya, 1998). Smallholder dairy production is carried mainly in the highlands under zero grazing²⁴ or semi-intensive production systems. Kenya is usually self-sufficient in milk except when there is drought. The major dairy products are whole milk, butter, cheese, gee, yoghurt and milk powder.

Milk sold by smallholder farmers - about half of production - goes either directly to consumers or to dairy co-operative societies. These societies can sell milk on the local market or deliver it to Kenya Co-operative Creameries (KCC). KCC started as a private, producer-controlled company in 1931. Over the years it has been the hub around which Kenya's dairy-marketing systems have developed. In line with market reforms in other sectors of the economy, the government commissioned a dairy sector study in 1990 that recommended *inter alia*, that KCC be opened to competition. As a result the de-regulation of the industry was officially announced in early 1992 (Staal and Shapiro, 1994). This policy shift was a direct

²³ Maize in Kenya is consumed mainly in form of whole grain or in milled form called "unga". The milled form accounts for almost 80 % of the disappearance of all maize formally marketed in Kenya.

²⁴ Zero grazing is an intensive production system where animals are confined in sheds.

reaction to the sorry state of affairs prevailing in the industry at the time. The country was facing declining milk production as a result of drought and KCC was having difficulties in paying farmers on time. Consequently co-operative societies were forced to delay payments to producers who, as a result, faced high risks and irregular cash flows.

Although liberalisation applied only to sales of processed milk in urban areas, with raw milk sales still officially illegal, it was interpreted differently by milk producers, processors and traders (Staal, Delgado & Nicholson, 1997; Ngigi, 1995). To many, liberalisation was taken to mean that all manner of milk market transactions were permitted. Since 1992, there has been a rapid development of various milk market innovations mostly relating to raw milk. These include 'self-help groups' and individual traders who collect and market raw milk. Furthermore, dairy co-operatives, once an integral part of the formal KCC milk collection system are marketing a larger proportion of their raw milk directly to urban markets (Owango *et al.*, 1996; Ngigi, 1995; Staal *et al.*, 1997).

Liberalisation of the dairy industry has also resulted in stiff competition in the processed milk markets. Some 60 new, private milk processing plants have been licensed to compete with KCC²⁵. Half the new market entrants operating in June 1998 were estimated to have a market share of 40%. Thus, the reforms introduced so far have resulted in major institutional changes in the dairy industry. These changes have far-reaching implications for the pricing, transaction costs, resource allocation and efficiency of dairy production in the country.

3.3.3 *Performance and liberalisation of the coffee industry*

Background

Since its introduction as a cash crop by missionaries in the 1900s, coffee has become one of Kenya's most important export crops. Prior to 1988, coffee was Kenya's top foreign exchange earner and currently it ranks fourth after tourism, tea and horticulture. Over 600,000 smallholders are engaged in coffee production and currently hold a 58% share of the market (Table 3.3). The remaining 42% is produced on some 1300 estates. Coffee production has experienced several ups and downs over the years, most of which are closely related to world coffee prices and general economic conditions (Table 3.3). While the large farms have been able to maintain production at around 35,000 metric tonnes per annum, the smallholder farmers' production has declined by 61% in the last decade although the area under coffee has increased (Karanja, 1998; CRF, 1999). This decline has reduced smallholder farmer's share of total production from 70 percent in 1985 to 58 percent in 1999 (Table 3.3).

²⁵ The low milk intake volumes, financial mismanagement and political interference forced KCC to be eventually closed in 1999. It was later put under receivership and in 2000 it was re-organised and farmer asked to buy shares of a new company called KCC 2000.

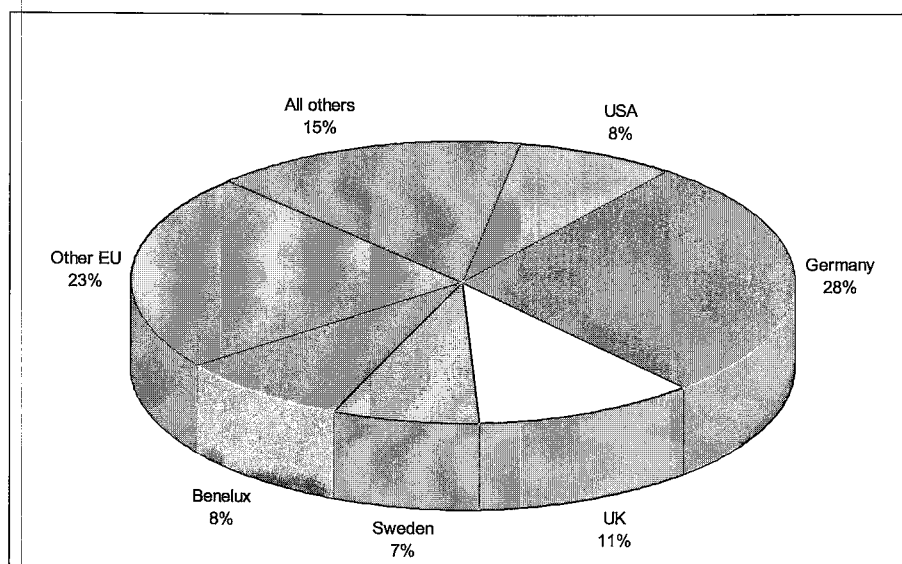
Table 3.3 Coffee area, production and exports, 1985/86 to 1998/99

Crop Year*	Area under coffee (ha)	Coffee production (MT of Clean Coffee)	Yield (Kg/ Ha)	Exports (60kg bags)	% share of total export revenue	Smallholders % share of total	
						Area	Production
Pre-liberalisation period							
1985/86	156,304	114,881	735	2,050,731	29.4	75	70
1986/87	154,527	104,288	675	1,784,443	40.6	75	65
1987/88	153,030	128,926	842	1,291,822	25.8	76	65
1988/89	155,666	116,969	751	1,678,072	26.6	75	67
1989/90	155,571	103,839	667	2,020,282	20.4	76	67
1990/91	159,262	86,571	543	1,649,401	18.5	76	56
Liberalisation period							
1991/92	158,262	89,494	565	1,339,081	14.0	76	58
1992/93	158,723	75,207	474	1,411,908	14.3	76	56
1993/94	161,032	73,516	457	1,459,785	15.6	76	54
1994/95	161,032	95,806	595	1,325,306	16.1	76	65
1995/96	162,410	97,576	601	1,895,485	14.4	75	58
1996/97	162,470	67,997	419	1,389,327	14.6	75	56
1997/98	162,000	55,042	339	805,965	17.0	75	56
1998/99	162,500	68,100	419	1,193,017	10.4	75	58

* Coffee crop year refer to the period from October to September

Source: Coffee Board of Kenya & Kenya economic survey (various)

Kenya has currently a market share of about 1.5% of the world coffee market with an average annual exports of about 1.5 million 60kg bags (Table 3.3). Kenyan coffee is of high quality and is mainly used for blending purposes. Over 95% of the coffee is exported and the European Union is a major buyer absorbing 70% of the exported crop. Major importers of Kenyan coffee are Germany, Sweden, United Kingdom and the Benelux States (Figure 3.3).



Source: ICO coffee statistics (1998)

Figure 3.3 Destinations of Kenya coffee exports in 1998

*Policy reforms*²⁶

Since October 1992, a number of policy reforms have been made in the coffee industry in an attempt to improve farmers' incentives and their control of the industry's affairs. In late 1992, the CBK was mandated to conduct the Nairobi coffee auction in dollars. Gradually permission was given for coffee farmers to be paid in dollars and they were also allowed to retain dollars for their own use. These policies were intended to make it possible for farmers to benefit from currency gains and to allow them to participate in foreign exchange dominated trade. Due to the overvaluation of the Kenya Shilling prior in 1992, exporters of commodities like coffee had a heavy indirect tax. Ephanto (1993) estimated the overvaluation of the Kenya shilling in 1992 resulted in coffee farmers and other agricultural exporters carrying an implicit tax burden of 29%. The flotation of the exchange rate and subsequent depreciation has removed this implicit tax burden. The retention of foreign exchange by coffee farmers has also allowed them to access cheaper foreign currency dominated credit from local banks. Nevertheless, the fluctuations in the exchange rate has exposed farmers to price volatility. The smallholder farmers who market their coffee through co-operatives have benefited marginally from these reforms as most of them lack the necessary skills needed in the money markets.

Another important policy change has been the introduction of an alternative, farmers' payment system. Although coffee farmers in Kenya have always received prices that are close to the export parity price (Swamy, 1994, Mosley, 1986), payment delays have been a major problem. The delays in payments arise from stock management problems and delays in the processing of proceeds along the marketing chain. Prior to 1993, coffee payments were pooled together by the CBK, which made several interim payments based on the averaged price for the season. A final payment was made after reconciliation of accounts. The pool payment system served the purpose of pooling price risks and maintaining as steady a flow of funds as sales realisation allowed. This system was reviewed in 1992, by allowing farmers to opt for a 'direct'-payment system. In this system, farmers are paid the amount their coffee fetches at the weekly Nairobi coffee auction less statutory deductions. Thus, the system eliminated the pooling of funds. Currently, 80% of Kenyan coffee is paid through the direct payment system and 20% through the pool. The main advantage of the direct system is that farmers are paid much more quickly and good quality coffee that fetches high premiums also receives the weekly auction price rather than the yearly average price. To some extent this avoids the adverse selection problem inherent in the former pool payment system. Nevertheless, adverse selection continues to be a major issue in smallholder coffee-marketing channels as coffee pooling is still practised at the co-operative society level. It should be noted, however, that the direct payment system coupled with the deregulation of exchange rates might have exposed coffee farmers to higher price risks.

Reforms have also been introduced into the coffee-milling sector with the licensing of more commercial millers. The coffee milling monopoly held by Kenya Planters Co-operative Union (KPCU) was dismantled in 1993 when four more commercial millers were licensed. This move has increased the installed coffee milling capacity in the country from around 140,000 metric tonnes to around 230,000 metric tonnes (Karanja & Ndirangu, 1999). This increase in installed milling capacity against a background of declining production has resulted in an over-capacity of about 60% in 1998. This low capacity utilisation is expensive to maintain and is a major constraint to securing lower milling charges which was the original objective of liberalising milling.

In an effort to enhance coffee production, major changes have been introduced into the way coffee planters are licensed. In 1996, the minimum acreage required for a farmer to be licensed as a coffee planter was reduced from 10 to 5 acres. This change has resulted in a doubling of the number of small estates (below 20 acres) from 630 in 1994 to over 1200 in 1997. Thus, the co-operatives continue to lose a sizeable number of their well-to-do members

²⁶ This section, unless otherwise stated, is based on Karanja (1998).

as these become licensed as planters. This has further lowered the capacity utilisation of those coffee-pulping factories owned by co-operatives while creating an increasingly important group of medium-sized coffee producers.

Neither have coffee producer co-operatives been spared in the reform process. The government removed its tight control over the way co-operatives operate in June 1998 when the new Co-operative Act was enacted. The government has retained a minimal regulatory role in the co-operatives while encouraging members of the societies to run them as economic units. The review of the Act and politicisation of the co-operative together with the new era of multi-party democracy in the country, have resulted into splits of the co-operatives into smaller units. While these splits might bring decision making closer to the smallholder farmers, the newly formed societies have a weaker capital base and this hampers their ability to provide services such as farm inputs to their members. The likely effects of these smaller societies on smallholder welfare and marketing costs are not yet clear.

3.3.4 Performance and reforms in the tea industry

Performance

Tea was introduced in Kenya in 1903, but was not grown commercially until the 1920s. During the early years tea was grown exclusively on large-scale commercial estates. With the launching of the Swynnerton Plan in 1954, smallholder participation in tea production was initiated and later expanded after independence in 1963. Tea cultivation occurs on three types of farms: large private estates under the umbrella of Kenya Tea Growers Association (KTGA); smallholder farms under the supervision of Kenya Tea Development Authority (KTDA); and the newly established (1986) government-run-estates called 'Nyayo Tea Zones' concentrated on the fringes of major government forests. Tea is currently produced in 15 districts in Kenya and in 1999 occupied an estimated area of about 120,000 hectares. Smallholder farmers control 86,700 hectares equivalent to 72% of the total area under tea in Kenya (Table 3.4).

Kenya's tea production has expanded substantially since its introduction and particularly in the last decade. Tea is now the second largest foreign exchanger earner after tourism. Tea production rose from 18,000 metric tonnes in 1963 to over 260,000 metric tonnes in 1998 with smallholders producing about 60% of the total crop (Table 3.4). The smallholder sector consists of more than 240,000 individual growers and, supervised by the KTDA, it has been the driving force behind tea expansion in Kenya.

Historically, Kenya has been the third largest exporter of black tea in the world, after India and Sri-Lanka. But this position has changed rapidly in the last decades. Kenya's share of the world tea market has more than doubled from 6% in 1971 to 15% in the 1990s while India and Sri-Lanka share has declined to just over 15% each (PAM, 1995).

Table 3.4 Tea area, production, exports and share of smallholder farmers in area and production

Year/ period	National area (Ha)	National production (MT)	Yield (Ton/ Ha)	Exports (MT)	% Share of total export revenue	Smallholders share (%) of total:	
						Area	Production
Pre-liberalisation period							
1985	83,837	147,093	1.75	126,303	24.4	67	56
1986	84,400	143,316	1.69	116,456	18.0	67	58
1987	87,400	155,807	1.78	134,627	21.7	67	49
1988	90,397	164,030	1.81	138,201	20.2	68	52
1989	93,394	180,600	1.93	163,279	27.2	69	56
1990	96,391	197,008	2.04	196,586	26.2	69	56
1991	99,830	203,588	2.03	175,555	24.7	69	55
Liberalisation period							
1992	102,000	188,072	1.84	166,518	27.8	69	54
1993	104,860	211,168	2.01	188,435	24.1	70	53
1994	105,910	209,422	1.97	174,926	20.2	70	57
1995	111,320	244,525	2.20	217,937	18.9	71	57
1996	113,680	257,161	2.26	262,146	19.9	71	56
1997	117,747	220,722	1.87	199,224	21.0	72	59
1998	118,650	294,165	2.50	263,771	28.8	72	60
1999	120,430	248,700	2.06	245,710	28.6	72	62

Source: Tea Board of Kenya reports & Statistical abstracts

Policy reforms

Problems with government policy interventions in the tea sub-sector started at the end of 1980s (MOA, 1991, Mukumbu, 1993). Major concerns were the efficiency of the marketing services (mainly processing and transport) provided to smallholder tea farmers by the KTDA, provision of road infrastructure by the government, and macro-economic policy issues relating to the regulation of foreign exchange.

Reforms in the tea industry have primarily been concerned with giving greater autonomy to smallholder tea factories and encouraging a greater involvement by the private sector in the services provided by the KTDA. Unlike the coffee-marketing sector, there are no co-operatives for smallholder tea producers. They are organised around processing factories that are private, limited liability companies owned by KTDA, smallholder tea farmers and, in some cases, the Commonwealth Development Corporation (CDC). KTDA exercises considerable administrative and financial control over the other parties. It buys the green leaf, transports and sells it to the tea factories, provides management and accounting services to the factories, and markets 'made' tea on their behalf (Mukumbu, 1993). Thus, the smallholder tea sub-sector is a vertically integrated market through KTDA. This market arrangement has caused considerable acrimony in recent years. Of late, KTDA has relaxed its tight control to some extent and has made policy pronouncement to the effect that smallholder tea factories will be autonomous by 2000. It is, however, still unclear how the share holding of smallholder tea factories will be distributed.

The KTDA has developed a payment system where smallholder tea growers receive a monthly payment per kilogram of green leaf delivered within the month (in 1999/2000 the rate was Ksh 6 per kg). A second payment (a bonus) is made at the end of the year. The bonus is directly related to the performance of the factory in terms of quality, prices of 'made' tea and profits. Tea auctions in Mombasa have been conducted in US Dollars since 1993. It is expected that farmers will be paid in the same currency, but this has not been possible for smallholders. KTDA converts the US Dollars into local currency and pays smallholder in Kenyan Shillings. Thus, smallholder tea farmers have not been able to benefit from currency gains as was originally intended.

From the above, it is clear that unlike the coffee industry where there have been major changes both in policies and institutions, the smallholder tea industry has remained relatively untouched. The contrasting scenarios in which smallholder tea production has increased whereas smallholder coffee production has suffered a major decline is worth further analysis in order to determine the institutional, pricing and production factors that underlie these differences in performance.

3.3.5 Performance and reforms in the horticultural industry

Horticultural production and exports in Kenya began in the 1930s. Since then, horticultural industry has expanded significantly both in terms of production and exports especially in the mid 1960s. Horticulture occupies 11% of total arable land, ranking third after dairy and maize and beans, which are usually inter-cropped. (Dijkstra, 1997).

Principal horticultural crops are vegetables, fruits and flowers (see Appendix 3.1). The commodities are used as staple foods (potatoes, bananas), complement staples (tomatoes, onions, kales) or grown for export (French beans, avocados, cut flowers and Asian vegetables). According to Horticultural Development Authority (HCDA, 1990), horticultural exports make up only 5% of the horticultural production in the country. The remaining 95% is destined for domestic consumption both in rural and urban areas.

Most smallholder horticultural farmers focus on production for home consumption and for the domestic market as shown in Table 3.5. There is also a sizeable number of smallholder who engage in production of export horticultural crops such as French beans and Asian vegetables (Nyoro, 1995; Dijkstra, 1997). The smallholder horticultural production is mainly rain-fed and concentrated in the Kenyan highlands where coffee, tea, dairy and maize production is also found. Medium and large-scale commercial farms are engaged in production and export of horticultural crops mainly fruits, cut flowers and French beans. This is a vertically integrated market with producers engaged in production, processing, packaging and export (Nyoro, 1995).

Table 3.5 Horticultural production by farm size

	Farm category		
	Small scale	Medium scale	Large scale
Export Market	% of production		
Fruits	70	20	10
Vegetables	80	15	5
Cut flowers	10	30	60
Domestic market			
Fruits	80	15	5
Vegetables	90	7	3
Cut flowers	70	20	10
Processing			
Fruits	25	5	70
Vegetables	80	15	5

Source: Ministry of Agriculture, 1996

The horticultural export market has registered tremendous growth with the value of total horticultural exports increasing by 18.2 % per annum between 1985 and 1993 as shown in Table 3.6. However, export growth has slowed down in recent years mainly due to unfavourable domestic and international market conditions.

Table 3.6 Exports of fresh horticultural produce from Kenya, 1985 to 1999

Year	Export Volume (000 Tonnes)	Value (Ksh million)	% of total export revenue
Pre-liberalisation period			
1985	84.5	1,060	7.7
1986	110.4	1,322	8.2
1987	136.9	1,542	12.5
1988	151.5	1,896	12.5
1989	134.2	2,242	11.2
1990	188.8	3,198	13.0
1991	169.3	3,696	11.5
Liberalisation period			
1992	152.6	4,176	12.2
1993	150.8	6,442	10.8
1994	65.2	4,936	9.9
1995	71.7	6,400	11.4
1996	84.8	7,700	11.9
1997	84.2	9,000	12.0
1998	78.4	14,937	13.0
1999	80.0	17,641	15.4

Source: HCDA & Statistical abstracts

Smallholder horticultural production, which is the centre of interest in this study, has evolved over time from its subsistence-orientation activity to a major commercial one. According to Dijkstra, (1997) horticulture production has become a major source of cash revenues in smallholder farms. Horticultural production is also viewed as a means through which smallholder farmers can diversify their production from the traditional export crops such as tea, coffee and cotton.

Unlike the traditional export crops such as tea and coffee, horticultural development has been based on active participation of the private sector with minimum government intervention (Nyoro, 1995; Kodhek, 1993). Thus, market reforms implemented under SAPs, except for foreign exchange and export trade regulation, have been minimal in the horticultural industry. It is therefore interesting to compare the institutional arrangements, production systems and their level of transaction costs, risks and efficiency of resource allocation across a privately run industry (horticultural) and the industries (coffee, tea, milk) where government control had been great. The lessons learned can be used to guide both the horticultural and the other sub-sectors policy directions.

3.4 Conclusions

The review of agricultural policies and performance both in the era of government controls and during the liberalisation period reflects the central role of the agricultural sector in Kenya's economic development. In the pre-liberalisation period, the government is shown to have exercised major controls in production, marketing and pricing of most agricultural commodities. Equally, the government played a major role in factor markets mainly with regard to land and agricultural credit. Earlier attempts to liberalise agricultural markets in the 1980s were shown to have failed due to various reasons. However, there has been a concerted effort in the 1990s to liberalise most of the agricultural commodity markets. The review indicates that institutional changes to go with the new policy environment seem to be still evolving.

The review also leads us to the conclusion that, since Independence, economic and agricultural development in Kenya has been based on smallholder agriculture. Equally, as in

other developing countries, agricultural export commodities remain the backbone of the economy accounting for a major share of national export earnings and the incomes of smallholder farmers. Indeed, three of the export commodities considered in this study, coffee, tea and horticultural crops accounted for over 54% of total export earnings in 1999. The mixed performance of the agricultural sector during the period under review indicates the need for consistent and effective policies and institutions for agricultural growth, in general and for smallholder agriculture in particular. The review also indicates that during the liberalisation period, smallholder agricultural production in the majority of the commodities considered was generally in decline despite the increases in supply response expected in such an environment. How smallholders farmers can capitalise on the reforms already undertaken to improve their production, farm profitability, market participation and, therefore, their incomes and general welfare remains a challenge.

CHAPTER 4

LIBERALISATION EFFECTS ON AGRICULTURAL COMMODITY AND INPUT PRICES

4.1 Introduction

This chapter documents the results obtained from analysing the effects of market liberalisation on the terms of trade in the agricultural sector in Kenya and the evolution and volatility of commodity prices. The analytical methodologies used have been documented in section 2.3.2. This chapter is organised as follows. Section 4.2 outlines the results of an analysis of the effects of market reforms on the terms of agricultural trade in Kenya. Section 4.3 analyses the effects of market reforms on the level of prices for four agricultural commodities - coffee, tea, maize and milk - and major input prices. The study hypothesises that market liberalisation has benefited smallholder producers by increasing the terms of trade in agriculture and the real commodity prices paid to producers. Section 4.4 documents an evaluation of relative commodity prices. Due to the emphasis placed on the promotion of export commodities and the central role these commodities' play in smallholder agriculture, the working hypothesis is that the relative price of these commodities has improved with market reforms as compared to those of food commodities. Section 4.5 contains an analysis of the trends in commodity price volatility and in section 4.6 the factors that affect both the mean and volatility of commodity prices in a liberalised economy are discussed. This study works with the hypothesis that market reforms in Kenya generally increased the conditional price variance (volatility) of agricultural commodities. The cost of coffee price volatility to smallholder farmers is estimated in Section 4.7. In this section, simulations are used to evaluate the effect of various policy options on the costs associated with price volatility. The final section of this chapter concludes and draws inferences from the results.

4.2 Effects of market reforms on agricultural terms of trade and input prices

To assess the overall effects of market reforms on the terms of trade in the agricultural sector, the index of prices received by farmers is compared to the index of prices paid by farmers for inputs and rural consumer goods as shown in Table 4.1. The annual rate of increase for both agricultural output and input prices as well as prices for rural consumer goods during the liberalisation period was in most cases higher than in the pre-liberalisation period (Table 4.1).

As also shown in Table 4.1, the agricultural output price index increased at a higher rate than that of farm input and rural consumer goods prices during the reform period. This affected the wedge between output and input prices during liberalisation as indicated by O/I price ratio. In the years immediately preceeding or following liberalisation, the index of input prices surpassed that of output prices. Results in Table 4.1 show that the O/I ratio declined from 98 points in 1988 to a low of 88 in 1996 before taking an upward turn in 1997. The decline in O/I ratio indicates that market reforms may have initially induced price changes that adversely affected the profitability of input use and farm gross margins. Nevertheless, this decline seems to have been reversed in the latter years of the reform period.

The ratio of agricultural output prices to that of manufactured goods (as represented by rural consumer goods) also steadily declined from 1986 to 1996 with significant differences between the averages in the two periods (Table 4.1). As indicated in section 2.2, this ratio is taken to be a good indicator of the terms of trade in the agricultural sector (AgrToT). This result therefore indicates that the AgrToT declined during the initial liberalisation period (1992-1996). Moreover, the rate of decline in AgrToT accelerated with the onset of market reforms in 1990 (see Table 4.1). In 1997 the prices of two of the main export crops - tea and coffee - improved by 30% and 80.8% respectively, thereby having a positive impact on the index of agricultural output prices. The terms of trade also declined marginally in 1999 as shown in Table 4.1. Nevertheless, the agricultural sector terms of trade grew by an annual rate of 3.1% in the reform period as compared to an annual decline of 0.6% in the pre-reform period.

Table 4.1 General trend in agricultural output and input prices in Kenya, 1985 to 1999

Year/Period	General Index of Agricultural Output prices	Index of purchased farm input prices	Index of rural consumer goods	Output to Input (O/I) price ratio	AgrToT
Pre-liberalisation period					
1982	100.0	100.0	100.0	100.0	100.0
1983	108.6	110.7	113.8	98.1	95.4
1984	118.6	125.6	134.0	94.4	88.5
1985	136.8	146.3	154.8	93.5	88.4
1986	149.0	150.7	159.9	98.9	93.2
1987	150.3	158.8	167.8	94.6	89.6
1988	168.7	170.5	178.6	98.4	94.5
1989	176.4	181.2	188.4	97.4	93.6
1990	187.0	196.5	205.9	95.2	90.8
1991	200.2	214.4	228.6	93.4	87.6
<i>Average (A)</i>	<i>149.6</i>	<i>155.5</i>	<i>163.7</i>	<i>96.4</i>	<i>92.2</i>
<i>Average annual change</i>	<i>7.9</i>	<i>8.3</i>	<i>8.7</i>	<i>-0.3</i>	<i>-0.6</i>
Liberalisation period					
1992	236.2	263.9	284.8	89.5	82.9
1993	324.2	442.3	430.3	73.3	75.3
1994	380.7	438.6	565.5	86.8	67.3
1995	442.7	505.3	572.2	87.6	77.4
1996	460.7	523.7	632.3	87.9	72.9
1997	568.7	565.4	650.4	100.6	87.4
1998	676.0	630.0	683.6	107.3	98.9
1999	642	610.0	727.3	105.2	88.3
<i>Average (B)</i>	<i>466.4***</i>	<i>497.4***</i>	<i>568.3***</i>	<i>92.3</i>	<i>81.3***</i>
<i>Average annual change</i>	<i>15.2</i>	<i>10.5</i>	<i>11.8</i>	<i>4.4</i>	<i>3.1</i>

** Significant average differences (average A - B), at 10% level or below based on two-sample T test, Average A and B are the average average prices for the two periods, respectively. Average annual change derived from the slope of the exponential curve which had the best fit on the data - indicates the % increase/decrease for each period.

Source: Kenya economic survey (various)

For comparison purposes, the trends in O/I price ratio and AgrToT are juxtaposed on the trend in terms of trade for the whole economy as shown in Figure 4.1. The results show that O/I price ratio remained above the AgrToT for the entire period. This indicates that the price wedge between agricultural output and inputs remained narrower than that between output and rural consumer goods. As also shown in Figure 4.1, the terms of trade for the general economy declined at a higher rate than that of agriculture during the pre-liberalisation period. However, the liberalisation of the Kenyan economy in 1992 seems to have affected positively the export prices thereby dramatically increasing the overall terms of trade for the economy. The improvement in the agricultural sector terms of trade seems to have lagged behind that of the

general economy. Equally, the AgrToT increased at a lower rate when compared to the TOT of the general economy.

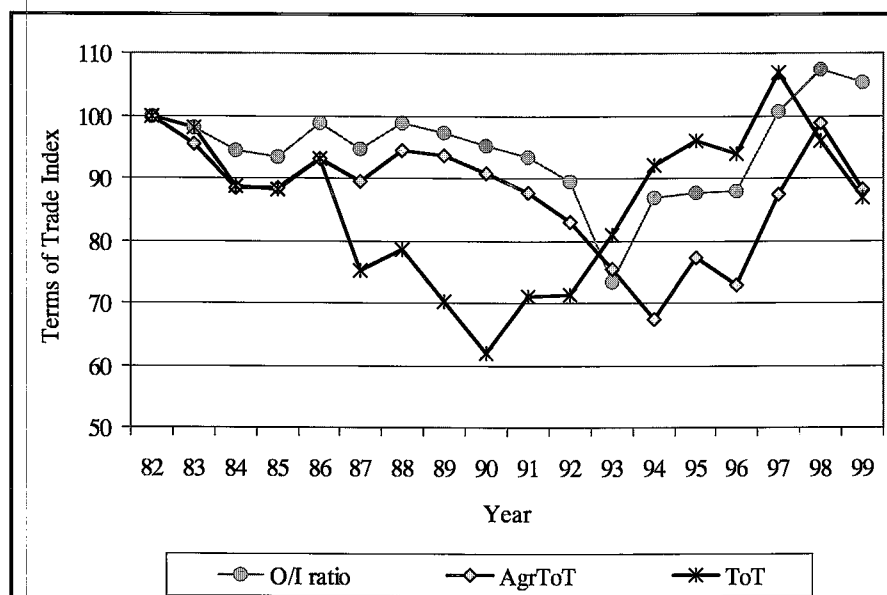
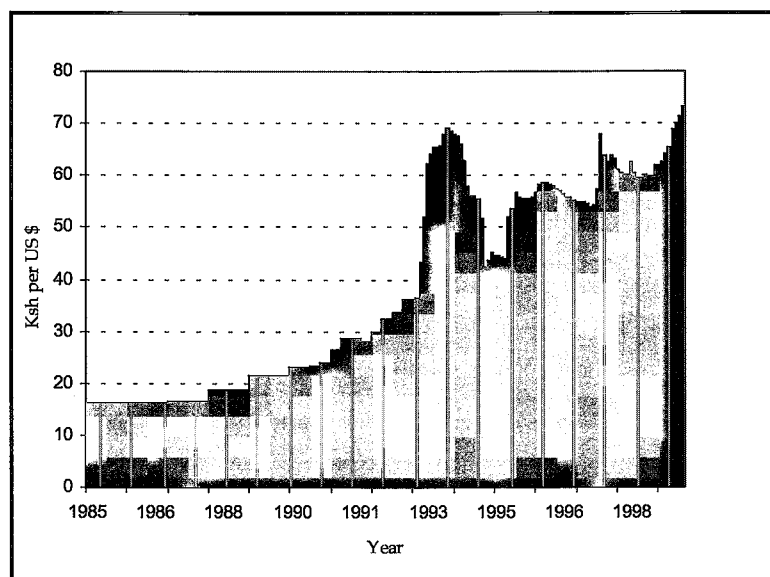


Figure 4.1 Agricultural sector terms of trade (AgrToT), Agricultural output to input price ratio(O/I) as compared to Kenya's economy terms of trade (ToT), 1985 to 1999

The increases in both agricultural input and rural consumer price indices from 1992 can be attributed to changes in price fundamentals particularly inflationary pressure and devaluation of Kenya shilling. Most traded inputs have a high import component that makes their prices sensitive to exchange rate movements. After the deregulation of the exchange rate in 1993, the Kenya shilling fluctuated and by the end of 1998 had depreciated by 66% (Figure 4.2). The depreciation of the Kenya shilling coupled with movements in other macro economic variables such as interest rates was passed on to farmers through high input and consumer prices. Apart from eroding the margin between output to input prices, the high input prices also may have compelled credit-constrained smallholder farmers to use less purchased inputs thereby depressing further their yields.



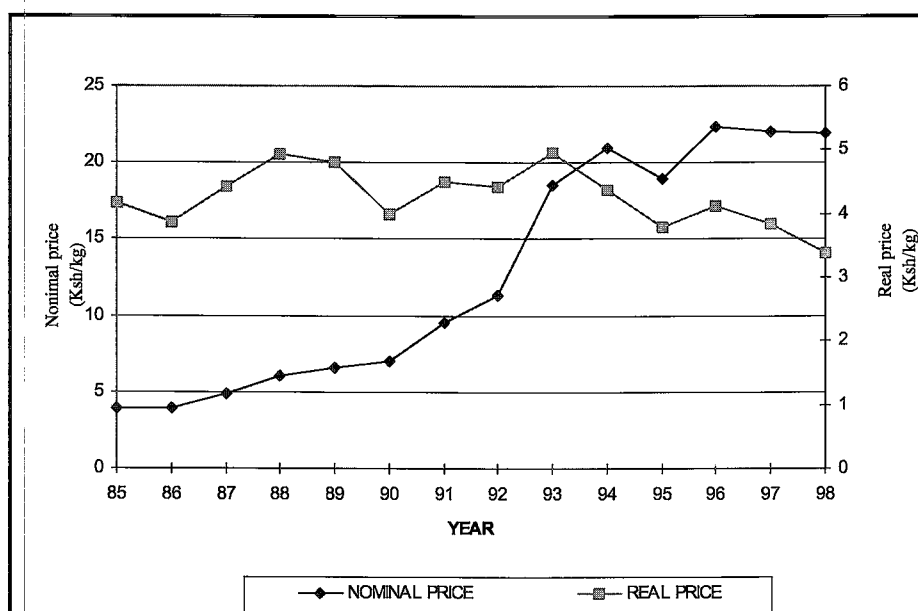
Source: Central Bank of Kenya statistical abstracts (various)

Figure 4.2 Monthly exchange rate movements, Kenya shilling to the US Dollar, 1985 to 1999

Fertilisers are the major purchased non-factor input used by most smallholder farmers. During the liberalisation period, the nominal prices of fertilisers increased by 178% while the real prices²⁷ have been declining since 1993 as shown in Figure 4.3 and Appendix 4.1. The increase in prices peaked in 1993 when fertiliser market was liberalised and fertiliser price controls abolished²⁸. Fertiliser usage decreased during that year before taking an upward turn as from 1994. (Appendix 4.2). Nevertheless, fertiliser usage as shown in Appendix 4.2 may be deceptive in as far as fertiliser usage in smallholder farms is concerned. The bulk of the fertilisers recorded are used in the plantations with very limited use in smallholder farms. A declining trend is more evident in the usage of pesticides from an estimated 10,000 metric tonnes in 1986 to 6,500 tonnes in 1998.

²⁷ The Nairobi consumer price index (CPI) is used to deflate all nominal prices to arrive at real prices.

²⁸ Fertiliser subsidies were abolished in Kenya back in 1978. However, in 1979 the government introduced a system of import licensing for fertilisers and price controls. The price was determined by a formula that added a mark-up for internal handling, distribution and profit margin to the c.i.f. price. During this period, the government was also heavily involved in fertiliser import and distribution. Some of the fertilisers were secured as aid but sold in the local market to raise revenue. These measures created major distortions in the fertiliser market despite the removal of direct price subsidies in 1978. Thus, the total liberalisation of fertiliser markets in 1993 involved abolition of import quotas and price controls.



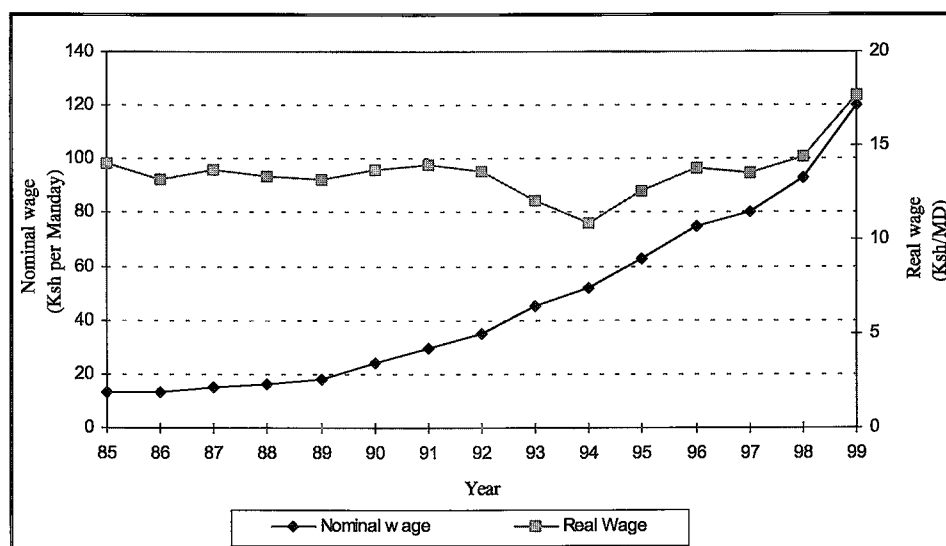
1986 = 100. Source: Author compilation.

Figure 4.3 Nominal and real fertiliser prices²⁹ in Kenya

Labour is the major factor input used by most smallholder farmers. Smallholder farmers hire-out or hire labour for farm activities such as land preparation, planting, weeding and harvesting. The government started liberalising the labour market in 1994 by initially adjusting the wage guidelines introduced in 1973. The guidelines now allow workers and employers greater freedom in wage negotiations based on productivity and inflation trends. Despite the high unemployment rates in the country and rural areas in particular, the nominal agricultural wages³⁰ have been steadily increasing in the last decade from Ksh 12 in 1985 to Ksh 120 in 1999, an increase of about 900% (Appendix 4.1). Major wage increases occurred during the liberalisation period as shown in Figure 4.4. These negotiated wages have put most smallholder farmers at a disadvantage as they are expected to pay equivalent wages to the plantations despite the productivity gap between the two categories of farms. This has greatly increased production costs, thereby eroding farm incomes especially for labour deficit smallholder farmers. However, the reforms in the wage guidelines seems to have arrested the stagnant or declining trend in real wages which was dominant before 1994. (Figure 4.4). The trend in real wages after 1994 indicates that incomes from off-farm employment might have increased in recent years for labour surplus households that are able to secure employment.

²⁹ Based on a composite price of the most popular fertiliser brands in Kenya (CAN, DAP, UREA and N:P:K) which account for 88% of all fertilisers consumed in the country.

³⁰ The agricultural wage refers to the casual worker wage rate negotiated by the Kenya Plantations Workers Union (KPAU), which is applicable to majority of plantation workers. As most smallholders' farmers compete with plantations for the available labour during peak periods, they are compelled to pay similar rates as those negotiated by KPAU. The government minimum agricultural wages, which are generally very low, are in most cases ignored.



*1986=100

Source: Author compilation

Figure 4.4 Nominal and real agricultural wage per manday, 1985 to 1999

4.3 Evolution of nominal and real commodity prices.

Table 4.2 shows the evolution of real price indices for crops and livestock products marketed through marketing boards in Kenya during the reform and pre-reform period. A comparison of the price indices indicates that the average prices in the reform period across crop and livestock products categories - except for cereals - are lower than in the pre-reform period. This difference in average real prices is statistically significant between the two periods for temporary and permanent crops, for total crops, for livestock & products, and for the overall index total crops and livestock. However, the average annual changes in price indices show that the negative price trend during the pre-reform period turned positive during the reform period.

The causes for the observed movements in real commodity prices are many and varied depending on each commodity's market conditions. Moreover, the composite price indices reported in Table 4.2 are highly aggregated thereby making it difficult to infer the actual causes in the observed differences in average prices, between the two periods. To overcome this aggregation problem, an analysis of the evolution of nominal and real prices of maize, milk, coffee and tea which are the center of interest in this study are undertaken and reported in Table 4.3.

Table 4.2. Real price index by agricultural commodity categories in Kenya, 1985 to 1999*

	Cereals	Temporary Crops	Permanent Crops	Total crops	Livestock & products	Total Crops & Livestock	NCPI**
pre-liberalisation period							
1985	170.78	146.23	153.99	154.41	126.35	148.67	94.1
1986	171.20	148.50	181.60	180.00	134.80	170.80	100
1987	163.78	137.14	128.38	130.20	137.04	131.57	109.6
1988	157.78	141.73	128.93	129.67	123.39	131.87	122.7
1989	146.07	139.46	113.30	123.00	132.99	118.22	136.1
1990	140.44	137.77	87.77	104.78	112.40	110.07	175.8
1991	138.97	119.70	85.55	99.76	99.95	101.94	211.7
Average [A]	155.57	138.64	125.64	131.68	123.84	130.44	
Average annual change	-3.95	-2.59	-11.25	-8.38	-3.84	-7.28	
Liberalisation period							
1992	154.68	113.17	80.24	97.78	107.83	99.77	256.6
1993	156.83	97.27	105.80	113.09	85.89	106.81	374.3
1994	170.11	135.71	99.10	107.96	85.59	102.78	478.8
1995	153.51	133.57	94.80	101.18	91.91	105.92	498
1996	170.05	119.06	83.99	103.83	72.55	98.31	542.9
1997	161.73	109.79	127.05	135.72	84.36	123.81	592.7
1998	167.93	122.30	126.56	132.89	76.82	121.84	647.9
1999	169.70	116.00	88.87	106.63	70.39	99.49	684.5
Average [B]	163.06	118.36	100.80	122.38	84.41	107.34	
Average difference	7.49	-20.28***	-24.84***	-19.30***	-39.42***	-23.10***	
Average annual change	1.13	0.68	2.70	2.56	-4.45	1.35	

For NCPI, 1986=100, *Cereals include maize, wheat and other minor cereals, Temporary crops include sugarcane & pyrethrum, Permanent crops includes coffee, tea, sisal and other tree crops, Livestock & products includes live animals, beef, dairy produce, chicken, eggs and other livestock products. **NCPI - Nairobi Consumer Price Index used to deflate the crop indices. *** Significant differences between the averages [B - A] at 5% level based on two-sample T test. Average annual change is derived from the slope of the exponential curve which had the best fit on the data - indicates the % increase/decrease for each period.

Source: Author compilation

During the pre-liberalisation period both maize and milk producer prices were tightly regulated by the government. The pan-territorial prices of both commodities were fixed along all the stages of the marketing chain. During this period, both milk and maize markets were characterised by mis-match of supply and demand that created shortages and a thriving black market. The prices offered in the black markets (un-official channels) were significantly higher than the regulated prices but no comprehensive documentation is available of such prices. When both these sub-sectors were liberalised in 1992, price determination was left to the forces of supply and demand. As shown in Table 4.3, the average nominal producer prices for both maize and milk were higher in the liberalisation period in comparison with the average prices in the pre-reform period. However, the real maize prices show an average annual decline in both pre- and post-reform periods. In fact, the rate of decline in real maize prices accelerated during the reform period as compared with the preceeding period. At the same time, the average real milk prices were higher in the liberalisation period as compared with the pre-reform period, with the average annual change changing from negative to positive in the two periods under review.

Table 4.3 Nominal and real commodity producer prices in Kenya, 1985 to 1998

Year/period	Nominal Prices (Ksh/kg/lt.)				Real Prices (Ksh/kg/lt.)			
	Maize	Milk	Coffee	Tea	Maize	Milk	Coffee	Tea
Pre-liberalisation period								
1985	2.65	3.50	4.06	3.50	2.82	3.03	4.31	3.72
1986	2.95	4.82	4.78	4.82	2.92	3.07	4.73	4.77
1987	3.25	4.62	3.25	4.62	2.97	3.10	2.97	4.22
1988	3.60	4.74	4.05	4.74	2.93	3.10	3.30	3.86
1989	3.75	3.80	2.89	3.99	2.76	2.87	1.12	3.93
1990	3.75	3.90	3.41	6.26	2.13	2.53	1.94	3.56
1991	5.60	5.30	4.04	6.95	2.65	2.50	1.91	3.19
Average[A]	3.65	4.38	3.78	4.98	2.74	2.88	2.89	3.89
Average annual change	10.78	2.26	-2.84	9.08	-3.13	-3.65	-16.95	-3.91
Liberalisation period								
1992	7.90	6.70	4.02	9.51	3.08	2.61	1.57	3.71
1993	10.0	7.80	10.91	16.03	2.67	2.08	2.91	4.78
1994	12.80	13.25	16.53	21.73	2.67	2.77	3.45	4.48
1995	8.70	13.70	11.83	11.10	1.75	2.75	2.38	2.23
1996	10.20	15.50	12.81	13.88	1.88	2.86	2.36	2.56
1997	15.80	16.95	22.73	16.10	2.67	2.86	3.83	2.72
1998	12.02	20.00	24.83	23.04	1.86	3.09	3.77	3.56
Average [B]	11.06	13.41	14.80	15.91	2.37	2.71	2.89	3.43
Average difference	7.4**	9.04**	11.02**	10.93**	-0.37	0.16	0.00	-0.45
Average annual change	7.20	19.57	26.92	8.23	-6.44	4.29	10.57	-6.26

For calculation of real prices, 1986= 100. ** Significant difference between the averages (B-A) at 5% level and below (based on two-sample T test). Average annual change derived from the slope of the exponential curve which had the best fit on the data - indicates the % increase/decrease for each period.

Source: Author's compilation.

Whereas, maize and milk are produced mainly for domestic markets, tea and coffee are grown mainly for export. As such coffee and tea prices are determined by both international and domestic market conditions. During the period under review, coffee prices were regulated under the international Coffee Agreement from 1985 to July 1989 when the export quotas were suspended. Thereafter, coffee prices have been mainly determined by fundamental market factors of production (supply), consumption (demand) and stocks. In Kenya, the domestic producer prices are mainly influenced by exchange rate and marketing costs. The average nominal coffee producer price in the liberalisation period was 259% above the average price in the pre-liberalisation period. However, there is no significant difference in average real coffee producer prices between the two periods (Table 4.3). Nevertheless, during the reform period, coffee prices increased by an annual rate of 11% as compared to an annual decline of 17% during the pre-reform period. It is, however, worth noting that the decline in real coffee prices started in 1989 was mainly due to the conditions prevailing in the global coffee economy. It is, therefore, difficult at this stage to ascertain the effects of market reforms on real coffee prices. Tea producer prices also significantly increased in nominal terms, but declined in real terms both during the pre-liberalisation period and during the liberalisation period. In fact, as shown in Table 4.3, real tea prices registered the highest average annual decline during the reform period.

The evolution of both nominal and real producer prices for the four commodities was in line with the general trend observed across the composite price indices reported in Table 4.2. The differences in average commodity prices between the two periods indicates that average real prices in the reform period are still lower than the average prices in the pre-reform period. However, the negative trend in the real prices of maize, milk, coffee and tea during the pre-

reform period turned positive for milk and coffee in the reform period, whereas the trend for maize and tea remained negative.

4.4 Relative commodity prices

Relative prices of the various commodities are analysed against the real prices of maize, fertiliser and agricultural wages as shown in Table 4.4. Maize is staple food of most Kenyans and is grown by all smallholder farmers. Furthermore, as food security is equated with the availability of maize, the price of maize can be an important reference against which the value of other commodities can be compared. The relative value of all three commodities increased during the liberalisation period by some 4 to 17 points (Table 4.4). Thus, the relative value of maize declined during the liberalisation period.

Table 4.4 Relative commodity prices (relative to real prices of maize, fertiliser and agricultural wage), 1985 to 1998

year/period	Maize			Fertilizer				Wage			
	milk	Tea	coffee	Maize	milk	Tea	coffee	Maize	milk	tea	coffee
pre-liberalisation period											
1985	102.4	81.0	94.6	96.7	99.1	77.8	91.0	96.7	98.7	78.3	91.1
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.6	87.2	61.7	101.8	101.5	88.1	62.5	101.8	101.1	88.8	62.6
1988	100.5	80.8	69.4	100.8	101.3	80.8	69.6	100.7	101.0	81.3	69.7
1989	99.0	65.3	47.6	94.6	93.7	61.3	44.8	94.6	93.4	61.7	44.8
1990	113.0	102.4	56.1	73.3	82.8	74.4	40.9	73.2	82.5	75.0	41.0
1991	90.1	73.9	44.5	90.8	81.9	66.7	40.2	90.8	81.6	67.1	40.3
Average [A]	100.7	84.4	67.7	94.0	94.4	78.4	64.1	94.0	94.1	79.0	64.2
Liberalization period											
1992	80.8	73.9	31.4	105.7	85.4	77.5	33.0	105.7	85.1	78.0	33.1
1993	74.3	98.3	67.3	91.8	68.2	89.5	61.5	91.7	67.9	90.2	61.6
1994	98.6	102.7	79.7	91.8	90.5	93.6	72.8	91.8	90.2	94.2	72.9
1995	150.0	78.3	83.9	60.0	90.0	46.6	50.1	60.0	89.7	46.9	50.2
1996	144.4	83.3	77.4	64.7	93.4	53.4	49.8	64.6	93.1	53.8	49.8
1997	102.2	62.5	88.8	91.6	93.5	56.8	80.9	91.5	93.2	57.2	81.0
1998	158.5	117.6	125.5	63.7	101.0	74.3	79.5	63.7	100.6	74.9	79.6
Average [B]	115.5	88.1	79.1	81.3	88.8	70.2	61.1	81.3	88.6	70.8	61.2
Average difference**	14.7	4.4	16.9	-13.5	-5.8	-10.4	-4.7	-13.5	-5.8	-10.4	-4.7

* 1986=100 **The average difference refers to the difference between the averages A and B.

Source: Author's compilation

Comparison of the relative prices of the commodities in relation to the price of fertiliser shows erosion of the real value of all the commodities during the liberalisation period. The same trends are observed when comparison is made between the real producer prices of the various commodities and the real agricultural wages with tea and maize registering the highest level of value reduction. (Table 4.4). There were, however, notable differences in the magnitude of value lost among the commodities with maize producers being the main losers and coffee producers losing the least. The changes in relative prices could have had an impact on the competitiveness of the various commodities, which result into shifts in resource allocation at the household level. The results also indicate that the productivity of fertiliser and hired labour in production of the four commodities could have declined (assuming that the agronomic response of the crops to fertiliser and labour use has not significantly declined).

These trends in relative prices are also in line with the declining output to input ratios as indicated in section 4.2.

4.5 Volatility of commodity prices

Using the trend adjusted coefficient of variation as documented in section 2.3.2, the real monthly producer prices for the four commodities are used to determine their instability index for the period 1985 to 1998. The results are shown in Table 4.5.

Table 4.5. Index of instability of monthly producer prices, 1985 to 1998

	Maize	Milk	Coffee	Tea
Pre-liberalisation period		Instability index (%)		
1985	1.2	4.5	3.8	1.1
1986	1.8	3.8	8.3	0.8
1987	1.2	3.8	8.4	1.1
1988	1.8	4.1	7.1	2.7
1989	3.3	3.9	9.2	3.4
1990	4.2	5.2	7.1	4.2
1991	6.0	3.7	6.0	4.6
Average [A]	4.2	3.4	6.6	3.4
Liberalisation Period				
1992	14.6	7.1	4.8	6.0
1993	6.9	2.4	16.2	8.4
1994	8.7	2.3	11.1	3.3
1995	4.2	1.5	4.3	1.9
1996	8.5	1.1	4.3	1.8
1997	4.1	2.7	9.8	1.8
1998	8.3	0.5	14.3	1.2
Average [B]	7.9	2.5	9.3	3.5
% Change in average*	88%	-26%	41%	3%

* % change between averages [A] and [B]

Source: Author's compilation

The pattern that emerges is a mixed one. Economic liberalisation is accompanied by higher degree of instability in the price of maize, coffee and tea price but lower instability in the price of milk. Maize prices showed the highest increase in instability during the era of economic liberalisation. The tight government regulation on maize producer prices could account for the high stability of maize prices during the pre-reform period. Market determination of maize prices coupled with the low and slow entry of private traders into the maize market are among the reasons for the high degree of instability evident in maize prices after liberalisation. The lack of a clear and consistent government policy in the initial years of maize market liberalisation lead to most potential, private maize traders shying away from the market. This may have affected the equilibration of supply and demand across surplus and deficit regions and might have lead to higher price instability.

By contrast, milk prices that were also regulated during the pre-reform period, showed the highest level of stability during the reform period. Indeed, the stability of milk prices improved during the liberalisation period (Table 4.5). This could be attributed to the entry of many small and large private milk traders who offered producers an almost uniform price per season.

During the reform period instability in coffee prices increased significantly while tea producer prices remained stable. However, as Table 4.5 shows, the level of price instability for both commodities increased during liberalisation. The high level of coffee price instability was mainly due to fact that coffee producer prices were based on the prevailing international coffee price. These prices exhibited a high degree of instability particularly after the suspension of the price regulatory mechanisms under the International Coffee Agreement (ICO, 1997; UNCTAD, 1995; Karanja, 1999). The volatility of the exchange rate also increased the volatility of producer coffee prices in Kenya shillings. The low volatility of tea producer prices is mainly the result of the current tea marketing system where smallholder farmers are paid a uniform price per kilogram of green leaves within a year with bonuses at the end of each year. This tea payment system has tended to shield smallholder farmers from international price and exchange rate volatility.

These results indicate that policy changes in marketing and institutional arrangements during the liberalisation period have increased the volatility of a number of agricultural commodities. Results also indicate that there are major differences in the levels of price volatility among the different commodities. This can be attributed to international and local marketing conditions in each commodity system.

4.6 Liberalisation effects on commodity producer prices -the ARCH-M model estimates

As noted earlier, the index of price instability does not statistically determine the contribution of the various factors that might be responsible for price instability. To overcome this shortcoming the ARCH-M model as specified in section 2.3.2 (Appendix 2.1 gives more details on specification and data) is applied to the data. The results of this analysis are the subject of this section. The results of the diagnosis of the model's suitability are reported first, followed by results on the application of the model in determination of the factors that influence both the level of average and volatility of producer prices.

4.6.1 Diagnosis of the model

Based on the LaGrange multiplier test statistic, the null hypothesis of homoskedastic conditional variance is rejected for both the ARCH(1,1) and ARCH(1,2) specifications as shown in the lower panel of Table 4.6. Secondly, the coefficients on the lagged variance term (risk term) in Table 4.6 are positive and statistically significant, thus showing the presence of heteroskedasticity in error terms of the mean equation. This result that is repeated across two of the models justifies the use of the ARCH model.

An inspection of the partial autocorrelation coefficients for each of the four price time series indicated that only the first-order autoregressive process is significantly different from zero as shown in Figure 4.5. This is further confirmed by the slope estimates of the first-order autoregressive process as shown by the regression estimates of the lagged price variable (P_{t-1}) in the ARCH-M mean equations (Table 4.6). The result justified the use of the first-order lag process in the mean equations.

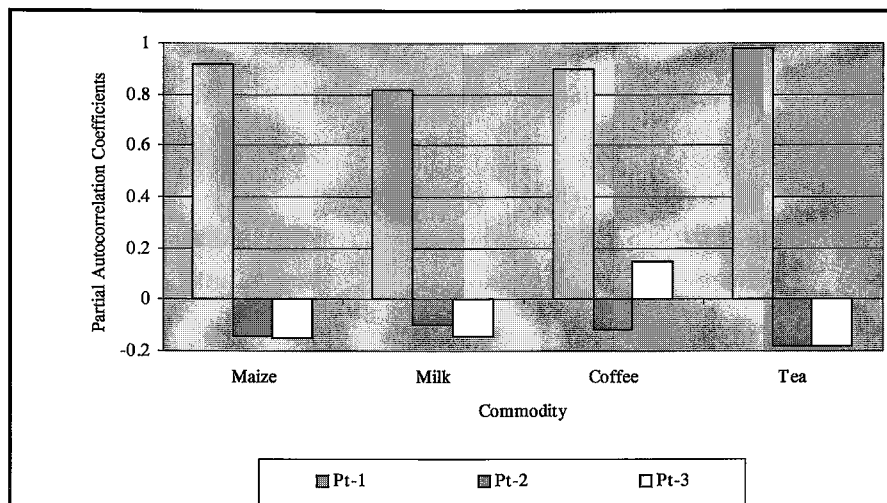


Figure 4.5 Partial Auto-correlation coefficients of the real commodity prices

4.6.2 Factors determining the level of mean producer prices

The ARCH-M regression estimates for the four mean equations are reported in Table 4.6. Except in a few cases, the ARCH estimates for the four commodities are robust in sign, magnitude and are statistically significant at the 90% confidence level. The negative estimation coefficients of the liberalisation dummy in the maize, coffee and tea mean equation model confirms the earlier results that indicated that during the period of market reforms, there was a decline in real producer prices. With these results the hypothesis set out in the introduction of this chapter is rejected i.e. market reforms increased real producer prices. Thus, the general assumption that market reforms increases the real prices received by agricultural producers is found not to be true for maize, coffee and tea producers in Kenya. It is only in the case of milk that this assumption is found to be true.

This is a surprising particularly because internationally traded commodities such as coffee and tea, were expected to attract better terms of trade in a liberalised economic environment. The result also explains in a way the declining smallholder production levels of maize and coffee alluded to earlier in chapter two. The rising production of tea against a background of declining producer prices remains as matter of conjuncture.

Table 4.6 ARCH - M estimates of real commodity prices

Mean equation: Dependent variable is real commodity prices (Ksh/kg/lt)

Independent Variable	Maize	Milk	Coffee	Tea
Constant	-0.138(0.205)	0.083(0.261)	-53.08(46.90)	-0.384(0.398)
Lagged price (P_{t-1})	0.758(0.049) ^a	0.828(0.055) ^a	0.469(0.069) ^a	0.780(0.085) ^a
Production	0.026(0.054)	-0.019(0.038)	-	-
Trend (T)	-0.049(0.067)	0.012(0.002) ^a	-0.307(14.55)	-4.163(0.002) ^a
Liberalisation(Dummy (L)	-0.042(0.132) ^a	0.092(0.031) ^a	-0.062(0.014) ^a	-0.028(0.016) ^c
Season Dummy	0.022(0.031) ^a	-0.071(0.029) ^b	-	-
Sales(S)	0.089(0.035) ^a	-0.002(0.02)	0.004(0.003)	-0.078(0.038) ^c
Imports	-0.058(0.065)	-	-	-
Real Exchange Rate(RER)	0.004(0.001) ^a	0.002(0.001) ^b	0.334(0.055) ^a	0.007(0.005)
Border Price (BP)	-	-	0.181(0.023) ^a	0.29(0.173) ^c
ICA dummy (ICA)	-	-	0.304(0.145) ^b	-
Risk term	0.560(0.32) ^c	-0.849(0.189) ^a	0.264(0.205)	0.272(0.271)
<i>n</i>	154	155	165	164
L-Likelihood	-118.6	-60.2	-133.2	-124.8
LM test	164 ^c	170.9 ^c	202 ^c	176 ^c
DW statistic	1.59	1.94	1.67	1.94

Note : Asymptotic standard errors in parenthesis; ^a significance at 1% level, ^b - 5% level and ^c - 10% level

Results in Table 4.6 also indicate that in all the four commodities, the lagged price (P_{t-1}) is a significant factor that influences the mean price. This indicates that the prevailing mean price during any one given period is highly dependent on the price prevailing in the preceding period. As such the prices of the four commodities do not follow a random walk. This result confirms earlier work by Deaton & Loroque (1992) who have indicated that most agricultural commodity prices tend to show high first-order autocorrelation. An inspection of the lagged price coefficients in Table 4.6 further indicates that this coefficient is relatively low for coffee when compared to other commodities. This indicates that the mean coffee price is less predictable based on the price prevailing in the preceding period.

The positive but non-significant production coefficient in the maize mean equation model may indicate that the decline in maize production for most of the 1990s did not have a positive effect as far as increasing producer prices were concerned. To even out supply, the NCPB, which prior to 1994 was the main buyer and seller of maize in the country, used and continues to use open market trade practices. These include export, import and the sale of its own maize stocks. These maize trading practices which can be expected to influence the determination and evolution of maize prices are analysed in the model by including NCPB sales and imports in the maize model. The importation of maize has been a major and controversial policy issue since the liberalisation of maize markets in 1994. Maize producers have continuously lobbied the government to limit maize imports by private traders and the NCPB arguing that imported maize is driving them out of business because of unfair price competition. In response to producer's pressure, the government has raised maize import duty as an anti-dumping measure on several occasions. The tax policy measure, therefore, seems to have little credibility given the non-significant effect of imports on producer prices in the mean equation maize model. However, the non-significance of the maize import variable could have arisen because private sector imports were not included and sometimes these have been more than NCPB imports in years following maize market liberalisation. Reliable time series on private sector imports were not readily available. Moreover, maize is imported mainly when prices are already high and in response to low production. This creates a simultaneity problem that could also explain the insignificance of the import variable.

The volume of NCPB sales significantly affected maize price determination despite its diminishing role in the maize market after 1994. Our results may indicate that one of the aims of the grain sub-sector reforms which was to free price determination from government control and allow market forces to operate more freely, has not yet become a reality. The negative sign of the non-significant trend variable confirmed earlier results that indicated there was a decline in maize prices during the period under study.

Among the four commodities analysed, it is only in the milk model where market reforms seems to have boosted producer prices. The stiff competition and multiplicity of marketing channels, which have evolved since the liberalisation of the dairy sub-sector in 1992, have tended to keep milk prices very competitive while reducing transaction costs in fresh milk markets. These factors may explain the increase in real producer prices during the reform period amidst the decline in other commodity prices. The result is confirmed by earlier work by Staal *et al* (1998) who estimated that between 1990 and 1995 the unintended large increase in the role of unregulated raw milk market, *inter alia*, contributed to an increase of up to 50 per cent in real milk prices in the country. As milk production has been steadily increasing during the review period against a background of declining sales volumes in formal market channels, the production and sales coefficients capture these trends in milk price determination.

Due to their seasonal nature, both maize and milk prices vary significantly during the course of a year and this is reflected in the significant season coefficients in their respective mean equation estimates. The sign of the season coefficient indicated that maize prices are depressed during the harvest season while milk prices are also lower during the rainy season. This seasonal variation in mean prices shows the need for inter-temporal supply management strategies such as storage. This is more relevant to maize than milk.

From a theoretical point of view, the price determination of export commodities such as coffee and tea is expected to be influenced by international market factors such as commodity price agreements and border parity prices (BP) as well as factors that affect the domestic economy. According to Gilbert and Brunett (1998) and Gilbert (1996), the main benefit of the International Coffee Agreements (ICA) in the period 1962 to 1989 was that they raised producer prices relative to the levels that might have prevailed had these agreements not been made. Indeed, Gilbert and Brunett (1998) have estimated that the agreements may have raised coffee prices by as much as 50 or 60%. A dummy variable (ICA) for the period when the ICA was operative is positive and significant indicating that Kenyan coffee growers also benefited from about 30% higher prices during this period (see Table 4.6). Local producer coffee prices were also closely correlated to New York coffee future prices as shown by the border price (BP) coefficient estimate in Table 4.6. The estimate indicates that the mean coffee producer price increased by around 18% for every unit change in border parity price. This low level of co-integration between producer and BP price could have arisen due to distortions in the exchange rate during the pre-reform period. Differences in coffee quality standards between raw (producer level) and green (at market level) coffee could also account for low price co-integration.

Kenya has however a 'small nation status' as the country accounts for only 1.5% of global coffee exports. As such, the coffee sales volumes in the country have very limited impact on world coffee prices but can influence the local auction prices. The sales volume coefficient had an insignificant effect on coffee price determination. This result gives the indication that Kenya coffee sales volume and by inference production levels are highly unlikely to influence producer prices. As such some coffee production expansion can occur without adverse price effects.

As far as the determination of international tea prices are concerned, Kenya is among the three biggest black tea exporters in the world accounting for about 17% of global trade. The

Mombasa tea auctions is second only to the Colombo (Sri Lanka)³¹ auction in trade volumes. As such, sales volumes in Mombasa are expected to have a substantial effect on prices. This is confirmed by the negative and significant sales coefficient in the tea model (Table 4.6). Unlike coffee, expansion in tea supply (production) in Kenya can only occur with adverse effects on producer prices unless appropriate supply regulations are put into place. As in the coffee model, the border parity tea prices (BP) estimation coefficient in the tea model is positive and statistically different from zero thereby indicating that the pricing of tea is co-integrated with international market prices. The result further indicates that tea producer prices show a higher co-integration with BP price as compared to coffee prices. Furthermore, the co-efficient for BP can also be interpreted to indicate the share of border parity price received by the farmers. The results therefore indicate that tea farmers receive a higher percentage of the border price as compared to coffee farmers.

The real exchange rate has been shown elsewhere to have indirect effects on domestic prices through consumer and producer substitution effects and through its impact on the cost of imported intermediate inputs (Krueger *et al.*, 1988). The real exchange rate is therefore expected to be a key factor in price determination of both tradable and non-tradable goods and services. Coffee producer prices exhibited the highest and significant response to the real exchange rate that has been depreciating during the reform period. Only tea producer prices were not significantly affected by the movements in real exchange rate despite the high co-integration of producer and international tea prices. The maize prices were also positively and significantly affected by the depreciation of the real exchange rate (Table 4.6). Due to its perishability and almost autarkic status, milk in Kenya has remained an internationally non-tradable commodity with little or no external trade. Furthermore, animal feeds (mainly dairy meal and maize bran) which are the main input used in dairy production are also non-tradable. Thus, the real exchange rate has a low effect on determination of milk prices as confirmed by the low but significant coefficient of the real exchange rate in the milk mean equation.

The ARCH-M risk term (premium) increased significantly for maize while it decreased for milk during the period reviewed. The risk term coefficient for coffee and tea is, however, not significant although it had the expected positive sign (Table 4.6). The short-term risk premium can be interpreted to indicate the necessary mark-up by an existing farm/firm to cover its price risks. These premiums can be expected to be low during pre-reform period characterised by administered food prices. Thus, the significant increase in maize risk premium indicates that maize producers have to put a significant mark-up to their maize prices to cover for price risks. Furthermore, the significant premium indicates that in the long-run the general equilibrium structure of the maize markets may have increased investment and market participation costs to households.

4.6.3 The ARCH-M estimates on commodity prices variability

The ARCH-M estimates for the price variability of the four commodities are summarised in Table 4.7. The estimated liberalisation dummy variable coefficients for maize, coffee and tea are positive and statistically significant from zero.

These results show that, when compared to the pre reform period, the conditional price variance (volatility) for these commodities increased during the years of market reform. Consequently, the hypothesis set out in the introduction to this chapter is generally supported i.e. market reforms increased the conditional price variance of agricultural commodities. Milk prices, however, show a lower volatility in the reform period. Furthermore, results indicate that the variance in maize, coffee and tea prices tends to persist over a longer period as shown by the significant lagged variance term in Table 4.7.

³¹ The London tea auction, which was the largest, was closed in August, 1998.

Table 4.7 ARCH - M estimates of commodity price variance

Variance equation: Dependent variable is conditional variance of commodity prices

Independent Variable	Maize	Milk	Coffee	Tea
Constant	-0.028(0.176)	-0.219(0.098) ^a	-10.15(0.908)	0.527(0.616)
Lagged Price(P_{t-1})	0.063(0.027) ^b	0.021(0.015)	-0.829(19.23)	0.205(0.084) ^b
Production	-0.036(0.407)	-0.253(0.159)	-	-
Trend (T)	0.021(0.054)	0.027(0.017)	0.014 (0.012)	0.032(0.021)
Liberalisation Dummy (L)	0.219(0.057) ^a	-0.021(0.017)	0.101(0.050) ^c	0.113(0.018) ^a
Season Dummy	0.023(0.007) ^a	0.25(0.083) ^a	-	-
Sales(S)	0.018(0.033)	0.162(0.135)	-0.172(0.146)	0.089(0.164)
Imports	-0.027(0.004) ^a	-	-	-
Real Exch. Rate (RER)	-0.006(0.011)	0.017(0.05)	0.11(0.014)	0.995(0.50) ^b
Border Parity Price (BP)	-	-	0.098(0.039) ^c	0.193(0.205)
ICA Dummy(ICA)	-	-	0.336(0.038) ^a	-
Lagged Variance (e_{t-1})	0.023(0.008) ^b	0.071(0.088)	0.302(0.077) ^a	0.019(0.009) ^c
LM test	24 ^c	18 ^c	38 ^c	8.74 ^c
DW statistic	1.72	2.02	1.95	2.01

Note : Asymptotic standard errors in parenthesis; ^a significance at 1% level, ^b - 5% level and ^c - 10% level

The lagged price, the season and the volumes of maize imports (Table 4.7) also significantly influenced the variance of maize producer prices. The significance of the lagged price indicates that maize price volatility exhibit a higher degree of autoregression that might be related to market conditions which are slow in establishing supply-demand equilibrium. This result identifies the need for improvements in maize markets to make them more responsive in correcting supply-demand equilibrium with a view of reducing the level of price volatility. As indicated earlier (section 4.6.2), the seasonal nature of maize production is also an important variable affecting the mean prices. This indicates that maize supply regulation mechanisms such as storage would be of considerable benefit to both producers and traders and would enable them not only to play a part in maize price determination, but also in managing risk associated with price fluctuations. Although the NCPB import volumes did not significantly affect the levels of maize producer prices, the results in Table 4.7 indicate that these imports played a crucial role in decreasing price variability. This may be due to the role imports play in correcting the supply-demand equilibrium in the domestic market.

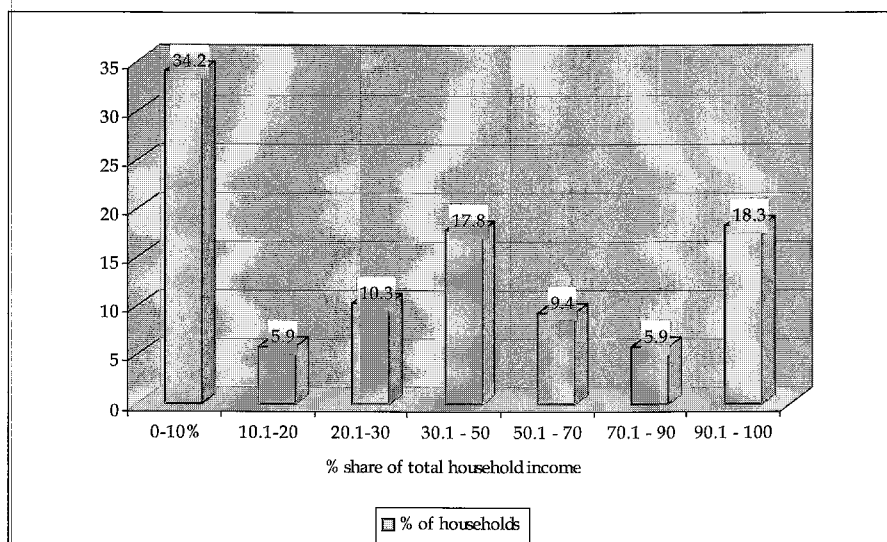
Apart from the liberalisation and the constant variable, only the season variable had a significant effect on price variability in the milk model. All other variables had the expected signs but are not significant. The result gave the indication that the volatility of milk prices in the country is weather induced with the volatility of prices increasing in the dry season.

Apart from the significant effect of liberalisation, volatility of coffee prices is highly co-integrated with the volatility of international coffee prices. This is as attested by the significant border parity price (BP) variable in the coffee model (Table 4.7). Thus, the observed volatility of coffee prices in the international markets (ICO, 1997; UNCTAD, 1995) also affects the volatility of coffee in Kenya. Equally, the variance of producer coffee prices in Kenya also significantly increased during the periods the price regulation mechanisms of ICA were not in place as indicated by the significant ICA dummy. In contrast, the variance of tea prices is not significantly influenced by the variation in international prices but is significantly affected by real exchange rate movements. These results indicate that the source of coffee price variability is more external unlike the variance in tea prices that is more determined by domestic factors. The volatility of tea prices in one given year, unlike that one of coffee prices, is significantly related to the prices prevailing in the preceding period as shown by the significant lagged price

(P_{t-1}) variable in the tea model. Thus, the volatility of tea prices has a higher degree of autoregression.

4.7 The cost of price volatility to smallholder farmers

The results discussed above indicate that price volatility of maize, coffee and tea increased significantly during the reform period. In this section an attempt is made to estimate the cost of price volatility to smallholder farmers in the study region. Due to the reasons stated in section 2.3.2.2, the cost of price volatility is only estimated for the coffee enterprise. Simulations are also done to determine the effects of various policy interventions on the cost of price volatility. Six scenarios are evaluated for their effects on three categories of households. The households are categorised according to their coffee income concentration. The coffee income concentration indicates the percentage of total household income derived from coffee enterprise in 1999. Figure 4.6 shows the coffee income concentration in the study area for the same period. Majority of the households in the study area are quite diversified with 50% of them deriving less than 30% of their income from coffee. For the purposes of this analysis, the households are categorised into low-, medium- and high-coffee income concentrations with mean income concentrations of 24%, 44% and 78%, respectively. The first three clusters in Figure 4.6 represent the low income concentration group while the next two consecutive clusters represent the medium- and high-income concentration groups, respectively. The six scenarios and their basic assumptions are as shown in Table 4.8.



Note: The mean share of coffee income to total farm income in 1999 is 40%.

Source: Household survey: 1999

Figure 4.6 Household's coffee income concentration in Central Kenya region.

Table 4.8 Description and assumptions made for each scenario

Scenario	Basic assumptions
I Base scenario	Represent the current situation in coffee market in Kenya. It is assumed that smallholder farmers can only forecast about 50% of the price before the start of every season. This is based on results obtained from Table 4.6. Smallholder farmer's coefficient of relative risk aversion (δ) is assumed to take a near extreme value of 2.
II Improved price forecastability	Represent policy environment where there is public investment in market information service that enhances coffee price forecastability. This improves, <i>ceteris paribus</i> , the coffee prices forecast from 50% in the base scenario to around 80%. The market information service is hoped to indicate the minimum price per season based on short and long term trends in international terminal markets. This scenario can also represent an environment where there are institutional arrangements that enable coffee farmers to use market price risk instruments (e.g. futures, options, warehouse receipts) that link local and international terminal markets.
III Lower smallholder risk aversion	Represent a policy environment that enables smallholder farmers to better mitigate risk thus lower their risk aversion. This is envisaged to occur through development of rural credit (financial) markets. Quantitatively this is assumed to lower the smallholder farmer's coefficient of relative risk aversion from 2 to 1.5, all other factors constant.
IV Lower price volatility	This scenario represents an environment where there is international market invention that lowers coffee price volatility. This can occur through a negotiated international commodity agreement or through an effective producer cartel which maintains prices within an agreed price band. In the simulation this is expected to lower coffee price volatility from the current levels (CV equal to 12.5%) to the ones existing when international coffee agreement was in place (CV of about 6%). This is as earlier documented in this study.
V Less household coffee income concentration	This scenario represents a long-term policy shift that encourages income diversification. This is envisaged to reduce the household's coffee income concentration by 50% from the base scenario.
IV Best case scenario	Represents improvements of base case scenario through combination of policies in Scenario II to V.

Based on the assumptions made in Table 4.8, the estimated cost of price volatility for smallholder coffee farmers in the study area are as shown in Table 4.9. The costs in each scenario are broken down into three components as specified in equation (2.4) section 2.3.2.2. These are the standard risk aversion term, the Oi (1963) term and production-price covariance term.

Table 4.9 indicates that the cost of price volatility (insurance premiums) to smallholder coffee farmers would vary from 0.09% to about 1% of their total income within the current prevailing situation (scenario I). This cost of price volatility is mainly related to farmers risk aversion, which overshadows the benefits they can derive from price response as postulated by Oi (1963). However, the Oi term is quite substantial for the highly specialised coffee farmers relative to their less specialised counterparts.

The results in Table 4.9 also indicate improvement of price forecastability has a small marginal effect on the cost of price volatility. Due to enhancement in price forecastability, the Oi term increases by about 2½ times thereby reducing the cost of price volatility. Indeed, the highly specialised farmers would actually face higher costs of price volatility under this environment as compared to the current situation. This result can also indicate that due to auto-correlation in mean prices, farmers are able to predict prices to a certain extent i.e. the general direction of prices is to some extent predictable. As indicated by Newbery, (1996), auto-correlation of prices reduces the benefits that can be derived from market risk management instruments such as futures. Nevertheless, as the cost of price volatility increases quadratically with price forecastability, then increasing price forecastability even by a small margin can still remain worthwhile to producers.

Policies geared towards lowering smallholder farmers risk aversion such as development of rural financial markets are also shown to reduce the cost of price volatility by a

around 23%. This reduction in cost occurs through major reduction of both farmers risk aversion as well as reducing the profits that can be derived from responding to price volatility. Thus, policies and institutional frameworks that reduce or enable farmers to pool and mitigate risks such as credit and availability of financial services can play a role in dampening the impact of price volatility.

Lowering coffee price volatility significantly reduces the cost smallholder would incur. As results in Table 4.9 indicate, a 50% reduction of coffee price volatility can result into 70% reduction of the cost of insurance premiums. Indeed, among all the policies considered in this analysis, the reduction of coffee volatility yields the highest reduction to smallholder farmers costs. However, the possibility of an international institutional arrangement to stabilise coffee prices remains remote.

The other option that can be used to mitigate volatility coffee price is the promotion of policies that stimulate household's income diversification. As the results of scenario V in Table 4.9, show, a 50% reduction in coffee income concentration would result in a 73% reduction in cost of price volatility faced by smallholder farmers. Nevertheless, income diversification can only be promoted as a long-term goal as it requires major investments in alternative income sources for the rural households.

The results of the best case scenario indicate that with a combination of appropriate domestic and international policies, the cost of coffee price volatility can be reduced significantly or eliminated altogether. In general terms the simulations carried out in this section may also indicate that the cost of price volatility will vary considerably between smallholder households depending on their income concentration, risk taking behaviour and the level of price volatility they face.

Table 4.9 The cost of price volatility (as % of total income) to smallholder coffee farmers in Central Kenya under various scenarios

Household Category	ω	ρ	$\alpha=\omega\rho$	r^2	ε	σ	β	Risk aversion term	Oi (1963) term	Covariance term	Cost of price volatility (%)	% change in cost from base case
Scenario I: Base case												
Low	0.24	2	0.48	0.5	0.05	0.125	0.05	0.090	0.023	0.008	0.095	
Medium	0.42	2	0.84	0.5	0.05	0.125	0.05	0.276	0.069	0.004	0.275	
High	0.78	2	1.56	0.5	0.05	0.125	0.05	0.951	0.238	-0.029	0.917	
Scenario II: Improved price forecastability												
Low	0.24	2	0.48	0.8	0.05	0.125	0.05	0.090	0.058	0.004	0.088	7.88
Medium	0.42	2	0.84	0.8	0.05	0.125	0.05	0.276	0.176	0.002	0.267	2.90
High	0.78	2	1.56	0.8	0.05	0.125	0.05	0.951	0.608	-0.012	0.919	-0.20
Scenario III: Lower smallholder risk aversion												
Low	0.24	1.5	0.36	0.5	0.05	0.125	0.05	0.068	0.017	0.009	0.074	21.94
Medium	0.42	1.5	1.17	0.5	0.05	0.125	0.05	0.207	0.052	0.009	0.212	23.92
High	0.78	1.5	0.63	0.5	0.05	0.125	0.05	0.713	0.172	-0.008	0.698	23.01
Scenario IV: Lower price volatility												
Low	0.24	2	0.48	0.5	0.05	0.06	0.05	0.021	0.005	0.007	0.022	76.96
Medium	0.42	2	0.84	0.5	0.05	0.06	0.05	0.064	0.016	0.004	0.063	76.94
High	0.78	2	1.56	0.5	0.05	0.06	0.05	0.219	0.055	-0.026	0.211	76.92
Scenario V: Less household coffee income concentration												
Low	0.12	2	0.24	0.5	0.05	0.125	0.05	0.023	0.006	0.005	0.027	71.92
Medium	0.21	2	0.42	0.5	0.05	0.125	0.05	0.069	0.017	0.007	0.074	73.95
High	0.39	2	0.78	0.5	0.05	0.125	0.05	0.238	0.059	0.005	0.239	73.09
Scenario VI: Best case scenario												
Low	0.12	1.5	0.18	0.8	0.05	0.06	0.05	0.004	0.002	0.003	0.004	95.96
Medium	0.21	1.5	0.32	0.8	0.05	0.06	0.05	0.012	0.008	0.004	0.012	95.77
High	0.39	1.5	0.59	0.8	0.05	0.06	0.05	0.041	0.026	0.005	0.04	95.65

Notes: x is coffee income concentration, s is farmer's coefficient of relative risk aversion, b is coefficient of partial risk aversion, r^2 degree of price forecastability, f is elasticity of coffee supply 1985 to 1999, t price variability measured as standard deviation of price shocks, c is regression coefficient of coffee production shocks to price shocks. A positive change from the base case indicates a reduction in costs, while a negative change indicates an increase in cost.

Source: Authors compilation

4.8 Conclusions

Results from this study indicate that during the period subsequent to macro-economic and agricultural sector reforms in Kenya, the agricultural terms of trade firstly deteriorated and improved towards the latter years of the reform period under study. The deterioration of agricultural terms of trade is shown to mainly result from high prices of rural consumer goods attributable to high inflation rates, devaluation of the national currency and a general decline in macroeconomic performance. Thus, the general held view, and one of the stated objectives of

market reforms of enhancing the agricultural sector terms of trade, is found only to be partly true for the Kenyan situation. The initial deterioration of agriculture terms of trade could explain the continued slow and depressed growth of agricultural sector in Kenya. It is also worth noting that the deterioration of agriculture terms of trade was occurring at a time when the private sector was being expected to invest in the sector after contraction of government services.

Analysis of the evolution of producer prices before and during reforms shows that during the latter period, agricultural producers realized higher nominal prices for their commodities. The nominal prices were, however, eroded by inflationary pressure and the development of the real commodity prices gives a mixed picture. The average real tea and maize prices were lower in the reform period, while the milk price was marginally higher, if compared with the average prices in the pre-reform period. The average real coffee price remained almost constant when a comparison was made between the two periods. The price trends during the reform period were also mixed with tea and maize prices declining while coffee and maize registered a positive annual growth. These results indicate that market reforms had a mixed effect on the real producer prices received by smallholder farmers. Equally, the wedge between output and input prices initially narrowed during the reform period as indicated by a declining output to input price ratio, but widened towards the end. This result indicates that the gross margins and hence profitability of most farm enterprises might have gone down during the reform period, to recover during the last three years of the analysis.

Analysis of the relative prices indicates that there is a decline of the value of maize relative to the other commodities and major inputs. Although there is no clear-cut shift across the various commodity relative prices, there is however a notable loss of value of all commodities relative to the prices of fertilisers and labour. These changes in relative prices, if they remain unchecked, may cause shifts in usage of productivity enhancing inputs resulting into changes in resource allocation among the various agricultural commodities.

Variability of agricultural producer prices is also shown to have increased during the period subsequent to the reforms. Volatility leads to uncertainty thereby affecting resource allocation among producers. Furthermore, as agricultural income forms a significant source of rural household incomes, the general increase in price volatility can translate to income instability. The low price response documented among smallholder farmers and their risk aversion implies that high price volatility induces costs that can reduce welfare. Theoretically, the magnitude of the costs has been shown to vary depending on the producer's degree of risk aversion, product concentration (degree of specialisation), price volatility and price forecastability (Newbery & Stiglitz, 1981; Gilbert, 1998). Simulations undertaken in this chapter (section 4.6.4) indicate that the cost of coffee price volatility to smallholder farmers can range from 0.09% to 1% of their total income. The results from the simulations also indicate that with an appropriate combination of domestic and international price risk management policies and institutions, the cost of coffee price volatility can be reduced significantly or eliminated altogether. Some of these policies and institutions cut across all commodities, while others, such as market based risk instruments, might be more applicable to international traded commodities such as coffee and tea. The significant seasonality effects in determining the mean and variance of maize producer prices also indicate that inter-temporal supply management strategies such as storage can be beneficial to both producers and traders.

Results from this study also indicate that there is a non-significant effect of coffee sales volumes in Kenya on both the mean and variance of producer coffee prices. This indicates that some increases in sales volumes or production levels in the country are unlikely to adversely affect coffee prices. However, the sales volumes in Mombasa tea auctions are shown to significantly affect the mean and variance of tea prices. This result indicates that as tea production (hence tea sales volumes) increases in the country, producer tea prices are likely to decline.

CHAPTER 5

SMALLHOLDER FARMERS' MARKET INSTITUTIONS IN A REFORMING ECONOMY

5.1 Introduction

As expounded earlier in the conceptual framework (section 2.2), the current study posits that institutions (both exchange and non-exchange) form the crucial linkage between the policy maker and agricultural producers. As such, it is vital that those institutions involved in the exchange process are effective. Not only do they exert a strategic influencing on the transaction costs that determine farmers' market participation, they also affect resource allocation decisions and production efficiency. The market reforms that have been introduced in Kenya can be expected to have a fundamental impact on the institutional arrangements in which smallholder producers undertake their trade and production decisions. The New Institutional Economics (NIE) approach has been widely applied in an attempt to analyse the effects of these institutional changes on the level of transaction costs and smallholder farmers market participation. According to Delgado (1998), the application of NIE concepts to smallholder agriculture in Africa has provided seminal breakthroughs in understanding how structural constraints operate to constrain market participation by farmers. It is with this in mind that the current study undertakes an analysis of the institutional changes heralded by market reforms in order to understand their effects on the level of transactions costs and thus on the efficiency of smallholder farmers.

This chapter describes the results obtained in the analysis of the institutional changes precipitated by market reforms and follows the analytical framework documented in section 2.3.3. The results are categorised into four main areas. The institutional changes in the provision of agricultural production and marketing services to smallholder farmers are documented in section 5.2. They highlight the changes in the provision of extension, research, livestock services, market information and physical infrastructure (roads). Sections 5.3 and 5.4 document institutional changes in the factor markets (land, labour and credit) and the effects of market reforms on smallholder farmers market co-ordination and control over the five commodity systems, respectively. The last but one section reports on the analysis of the changes in trade contacts and producer margins while the final section draws conclusions.

5.2 Institutional changes in the provision of agricultural production and marketing services

5.2.1 *Agricultural extension, research and livestock services*

Public expenditure in agriculture

Due to structural reforms, the government has reduced its involvement in provision of various agricultural production services, mainly in animal health. These services were supposed to have been taken over by farmer's organisations and the private sector. Consequently, the proportion of government expenditure in the agricultural sector has declined by half from an annual average of 8% of total public expenditure during the pre-liberalisation period to an average of 4% during the liberalisation period (Table 5.1). In real terms, the total public

expenditure in agriculture has also declined and stagnated during the liberalisation period as shown in Figure 5.1.

Table 5.1 Public expenditure in agriculture sector as compared to total public expenditure in Kenya (million Ksh), 1984/85 to 1999/2000

Year	Agricultural Recurrent Expenditure	Agricultural Development Expenditure	Total Agricultural Expenditure	Total Public Expenditure	% Share of Agriculture*
Pre-reform period					
1984/85	1,808	780	2,588	30,420	8.5
1985/86	1,244	1,552	2,796	32,568	8.5
1986/87	2,454	1,994	4,448	41,262	10.7
1987/88	3,362	1,354	2,716	43,978	6.1
1988/89	6,200	1,832	8,032	62,038	12.9
1989/90	1,654	1,422	3,076	63,120	4.8
1990/91	772	804	1,576	56,314	2.8
Mean**	2,299	1,391	3,604	39,055	7.8
Reform period					
1991/92	266	98	376	98,534	0.4
1992/93	2,340	3,544	5,884	121,294	4.8
1993/94	3,212	6,058	9,270	180,154	5.2
1994/95	3,688	3,844	7,532	184,122	5.1
1995/96	4,320	3,410	7,732	183,408	4.1
1996/97	4,403	2,560	6,963	183,741	3.8
1997/98	4,269	3,488	7,757	313,430	2.5
1998/99	4,868	4,598	9,466	242,741	3.9
1999/2000***	4,422	5,316	9,738	287,839	3.4
Mean**	3,532	3,657	7,190	199,474	3.6

* Share of agriculture to total public expenditure. ** provisional figures. **Mean per period.

Source: Economic surveys (various)

As a result of the government's budget rationalisation program, agricultural development expenditure increased considerably in nominal terms during the reform period, surpassing in some years recurrent expenditure (see Table 5.1). Development expenditure appears erratic, a pattern that can be attributed to an over-reliance on donor funds³². Since 1991, donor funding has not only been in decline but has also been unstable (see Appendix 5.1). Declining levels of recurrent expenditure coupled with instability in development expenditure poses a major constraint to securing a sustainable, long-term strategy for agricultural development in Kenya. As the national agricultural development strategy in Kenya is centred on smallholder farming, and given the high dependency of smallholder farmers on services provided by the government, the results indicate that smallholder agriculture growth may have been severely hampered by these shifts in fiscal allocations.

³² Gross Overseas Development Assistance (ODA) inflows to Kenya increased from an annual average of US\$205 million (US\$ 15 per capita) in the 1970s to over US\$630 million (US\$34 per capita) in the 1980s, and slightly over US\$ 1 billion in 1990 – 1996 (US\$ 40 per capita). At the peak in 1990-91, net ODA inflows were equivalent to 14% of GDP and approximately 45% of total government expenditure (O'Brian & Ryan, 1999).

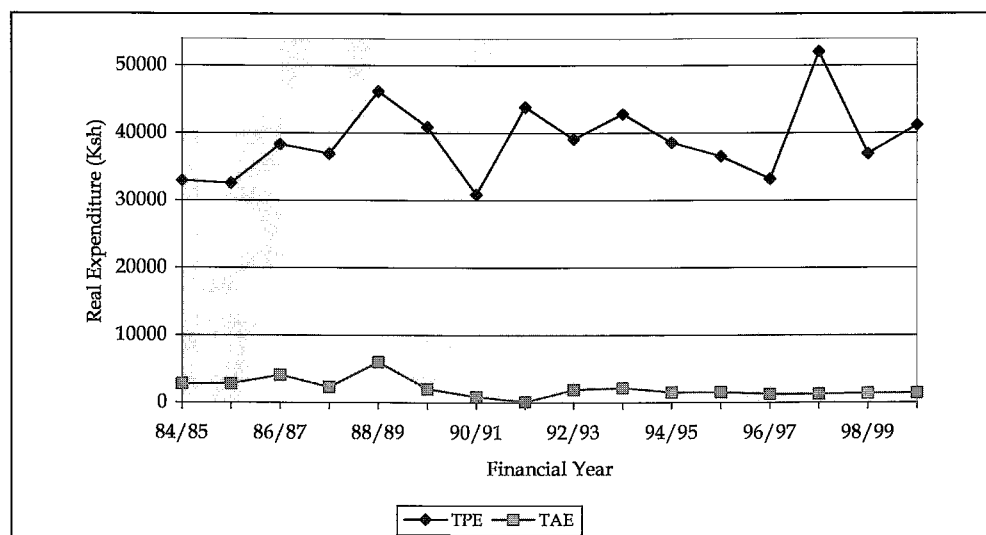


Figure 5.1 Real total public expenditure (TPE) and total public agricultural sector expenditure (TAE) in Kenya, 1984/85 to 1999/2000

A qualitative assessment of both access to and the quality of the various services offered to smallholder farmers in Kenya in the period 1982-1997, undertaken by Guatam (2000), confirms the results of the present study. As shown in Table 5.2, when farmers were asked to evaluate the changes that had occurred over the last 15 years, they identified improvements in both access to and the quality of private sector services. In contrast, access and quality of public sector services such as roads, health and extension were said to have deteriorated during the same period. As this timeframe corresponds with the pre- and post-reform period, the assessment reported in Table 5.2 also indicates that most public sector services deteriorated during the reform period.

Table 5.2 Smallholder farmer's evaluation of both access and quality of public and private service (1997 compared to 1982)

Service	% of total households							
	Access				Quality			
	Better	Worse	No change	Don't Know	Better	Worse	No change	Don't Know
<i>Private services</i>								
Seed dealer	34.6	1.0	63.9	0.5	51.7	6.2	37.5	4.7
Fertiliser-chemical store	31.5	1.0	66.4	1.0	48.7	3.7	40.2	7.4
Output market	14.5	1.3	84.0	0.2	53.3	10.6	34.3	1.8
Banking services	18.7	1.3	77.5	2.5	27.9	3.2	43.2	25.8
Other credit sources	10.6	1.4	78.5	9.5	22.5	8.9	40.6	28.0
Private health centre	62.0	0.6	34.8	2.6	54.2	4.9	26.7	14.2
Veterinary services	51.7	0.7	32.5	15.1	42.1	5.1	30.3	22.6
<i>Public services</i>								
Public health centre	23.7	1.9	74.3	0.2	30.8	48.2	20.2	0.9
Telephone facility	48.6	2.2	48.0	0.3	30.4	8.9	46.4	14.4
Piped water	33.7	18.0	59.4	3.8	11.9	20.4	46.7	21.0
Tarmac road	14.7	1.9	83.1	0.3	26.1	30.2	40.7	2.8
Dry season road access	6.5	3.3	90.0	0.2	22.9	50.3	26.5	0.4
Public transport	7.6	1.2	91.2	0.0	41.3	17.9	40.8	0.0
Public Veterinary services	17.2	2.4	77.3	3.1	16.0	27.3	42.8	13.9
Extension services	16.6	3.8	75.0	4.6	11.4	39.4	32.9	16.4

Note: The surveys in 1982 and 1997 on which these results are based, covered a total sample of about 700 households in six out of the seven rural Kenya provinces. The services covered in the surveys were 19 but those selected for their relevance to this study are 15.

Source: Adopted from Gautam (2000), p14.

Agricultural extension

Research and extension services continue to take the major share (about 70%) of agricultural expenditure. According to Gautam (2000) in 1996/97 extension alone accounted for 65% of Ministry of Agriculture's (MoA³³) development expenditure. Extension also accounted for about 45% of the ministry's total expenditure and more than half of its staff. Despite the high expenditure on extension services, the effectiveness of the service in the study region has been poor. This is attested by the low percentage of farmers who reported to have acquired farming information from government sources and also the low farmer to extension staff contacts as shown in Table 5.3a. Among the sampled households, only 11% had acquired technical farming information from government extension staff in 1999. About 21% of the households acquired their farming information from neighbours and local traders in 1999 (Table 5.3a). During the same year, majority of farmers (66%) had no contact with government extension staff. Even those who had a contact, this was mainly once in a year (Table 5.3b). These results are confirmed by a World Bank report that evaluated the impact of government agricultural extension services in Kenya (Gautam, 2000). According to the report the public extension services have achieved very little despite the continued usage of the Training and Visit (T&V) extension system since 1982. Appendix 5.2 summarises some of the major conclusions from the World Bank evaluation report.

³³ Due to regular changes in the name of the ministry in-charge of agriculture, the name Ministry of Agriculture (MoA) is used throughout this study for consistency.

Table 5.3 Sources of farming information, farmers contact with government extension staff in Central Kenya region, 1999

[a]		[b]	
Sources of information	% of Farmers	Farmer - Govt. Extension Contacts per year	% of Farmers
Government extension	11.4	none	67.5
Other public sources	18.9	one	16.7
Media	5.5	two	6.4
Neighbours/traders	20.8	three	4.4
No Access	43.6	> three	4.7
Total	100		100
n = 200			

Other public sources include attendance to field days and training courses organised by co-operatives and government parastatals.

Source: Household Survey, 1999/2000.

Agricultural extension services are also offered by government parastatals responsible for various commodities. The most notables in the study region were the Coffee Board of Kenya in coffee and Kenya Tea Development Authority (KTDA) in tea. The government has already off-loaded all smallholder tea extension services to KTDA which offers these services at a fee. Plans are also underway to off-load smallholder coffee extension services to farmers organisations. Limited extension services are also offered by co-operative societies, church organisations, private firms and other NGO's within their narrow areas of operations. There is however lack of clear policy and legal framework that can be relied upon in establishing these services. There is also lack of a clear assessment on the private sector institutional capacities and their degree of willingness in the provision of these services that are essentially public goods. Furthermore, as indicated in section 4.2 the deterioration of agricultural sector terms of trade offers a major economic constraint towards attraction of private sector investments in the sector.

Agricultural research

Agricultural research is carried out by the Kenya Agricultural Research Institute (KARI), the Coffee Research Foundation (CRF) and the Tea Research Foundation (TRF). KARI has responsibility for conducting agricultural research on all crops and livestock except coffee and tea. The institute is both government and donor funded. As shown in Appendix 5.3, research expenditure by KARI has been increasing in nominal terms in the last ten years. In 1997/98, KARI's budget accounted for 16% of total public agricultural expenditure or 0.87% of total agricultural GDP, which was also equivalent to 0.4% of total public expenditure. This is as compared to 2.8 % of total public agricultural expenditure (0.57% of agriculture GDP) equivalent to 0.5% of total public expenditure in 1987/88. This trend indicates that, the core budget for agricultural research as a proportion of agriculture GDP and total public expenditure has been declining over the last ten years. These levels of research funding are also well below the international set guidelines. The 1974 UN World Food conference had set research intensity³⁴ target of 0.5% to be reached by 1985, while the World Bank had aimed to achieve 2% intensity by 1990 (UN, 1974; World Bank, 1981).

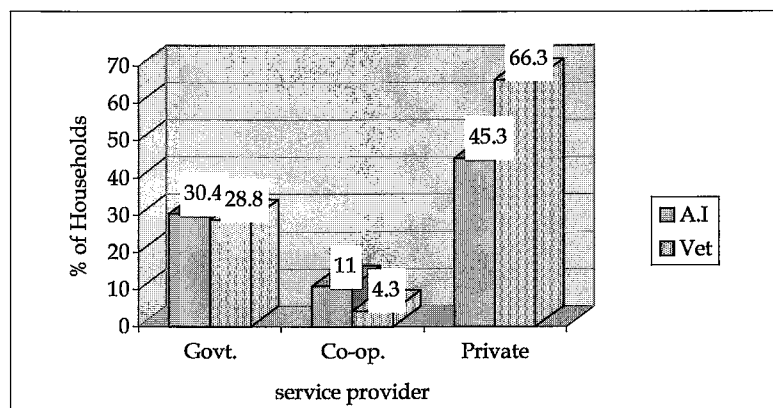
Coffee and tea research is undertaken by CRF and TRF, which are funded by farmers through a levy on all marketed coffee and tea. As also shown in Appendix 5.3, the research funding for these two commodities have been increasing in nominal terms in the recent past, fixed at around 2% of the marketed commodity value. Thus, the research funding levels for these two commodities has been close to the World Bank targets (World Bank, 1981). However, the research funding for these commodities have tended to fluctuate from year to

³⁴ Agricultural Research Intensity (ARI) is measured as a ratio between expenditures on public-sector agricultural research to agricultural GDP (Pardey *et al.*(eds.), 1991).

year due to volatility and general decline of commodity prices in the world markets as well as local production trends. Through representation, coffee and tea farmers are involved in research identification and prioritisation process unlike the other commodity producers who are not necessarily consulted in setting the research agenda at KARI. These research arrangements have been cited to create disparities in technology development in favour of tea and coffee.

Livestock services

Prior to 1993, the government was the sole provider of livestock services. These included veterinary and artificial insemination (A.I.) services and limited cattle dip services. Since then, most of these services have been fully or partially privatised. As shown in Figure 5.2, majority of the households in the study region obtained both A.I. and veterinary services from private providers. In 1999, the government provided livestock services to less than a third of the households while co-operatives played a minor role. In 1989, it was estimated that majority (65%) of smallholder households were using government A.I. services, while 20.3 % were using A.I. services from co-operatives (Karanja, 1990). The results therefore indicate that during the liberalisation period there has been a major shift from public sponsored livestock services towards private sector services.



Source: Household survey, 1999/2000

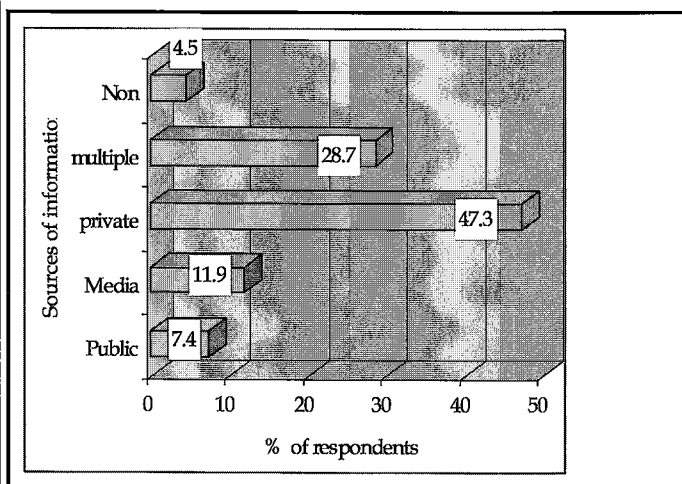
Figure 5.2 Providers of artificial insemination and veterinary services in Central Kenya region

Despite the low cost of services provided by the government, majority of the households interviewed expressed preference for the private and co-operative livestock services due to their reliability. The unreliability of government services may lead to higher transaction costs. Farmers might have to spend at least a day waiting for a government agent and, if the agent does not turn up, they face a host of implicit costs due, for example, to extended calving intervals with losses in milk production and possible animal deaths if animals are left unattended.³⁵ These risk perceptions about government livestock services may explain the high reliance on private A.I. and veterinary services by farmers in the region.

³⁵ By 1989, the transaction costs (implicit costs) per dairy cow pregnancy was estimated to be at least 71% higher for smallholder farmers using government AI services as compared to smallholder farmers using co-operative A.I. services (Karanja, 1990).

5.2.2 Smallholder farmers access to information and physical infrastructure

From a micro-economic point of view, access to relevant market information is an indispensable tool for an efficient marketing system as information facilitates rational decision making with regard to production, marketing and consumption. Information needs encompass not only gathering of facts concerning available technology and prevailing prices but also of information necessary for screening business partners. Indeed, the need to acquire information in order to do business can be said as one of the most important components of transaction costs. The households visited during the course of this study identified various sources of market information as shown in Figure 5.3.



Notes: Public refers to information acquired from government and co-operatives, media refers to both electronic and print media sources, private sources refers to information supplied by traders and neighbours, multiple refers to those farmers having access to more than one source of information while non refers to farmers having no access to market information.

Source: Household survey 1999/2000

Figure 5.3 Percentage of farmers using various sources of market information

The major type of information sought by most households concerns prices with little conscious effort being made to get information necessary for screening business partners. Most (47%) household got their market information from private traders and neighbours. Government agents, co-operative societies, print and electronic media played a minor role as sources of market information (Figure 5.3). As expected most traders will only give market information that is obviously asymmetrical in their favour. Thus, the results indicated that most of the households are disadvantaged as many of their sources of market information are rated as asymmetrically and not in their favour. Enhancement of public sources of market information could, therefore, go a long way to correct this asymmetry.

Access to physical infrastructure especially roads can enable farm households to access markets as well as reduce transaction costs that are transport related. Forty-eight percent of households in the study region accessed their local markets via ungraded roads that are often impassable during the rainy season. Only 28% of the households had access to an all weather (tarmac) road with another 23% having access via a graded road. Although the region could be said to have an advantage in terms of road accessibility when compared to other regions, the high proportion of households relying on un-graded roads had a direct effect on transport costs and produce losses. For example, although the average distance to the nearest market for most

of the households visited is 4 kilometres, the cost of transporting a bag of produce is Ksh 60 equivalent to Ksh 15 per kilometre. The poor state of roads is despite the fact that coffee and tea farmers who dominate the region pay a road cess of 1% of the value of these commodities to their respective local authorities. The cess is specifically meant for maintenance of rural access roads but this is rarely the case as the funds are diverted to other uses.

5.3 Institutional changes in the factor markets

5.3.1 Provision of agricultural credit

Various actors are involved in the rural financial markets (RFM) in Kenya and in the study region in particular. According to the broad definition of RFM given by Von Pische *et al* (1983) and Moll (1989), these include both formal and informal financial intermediaries. The main formal financial institutions are commercial banks, non-bank financial institutions (NBFIs), government, co-operative societies and the Agricultural Finance Corporation (AFC) which is a specialised farm-credit institution. Crop development institutions such as KTDA and CBK also give limited amounts of credit to farmers growing crops under their jurisdiction. Informal financial institutions such as professional moneylenders, farmers, and social and welfare groups are also active financial intermediaries in the research region. However, during the course of the study it was not possible to gather sufficient and comprehensive enough information to enable an analysis of the actual role of these informal financial intermediaries in the provision of credit.

Commercial banks and NBFIs have a dominant role in mobilisation of deposits and provision of credit in Kenya and in the study area. By the end of 1998, Kenya had a total of 57 operational commercial banks and 21 NBFIs as compared to 14 banks and 17 NBFIs in 1981 and 23 banks and 52 NBFIs in 1986. This significant increase in absolute numbers of operators in the financial markets (mainly banks) has occurred during the liberalisation period mainly as result of most NBFIs converting into banks to meet Central Bank regulations. The existing banks and NBFIs have a wide branch network but their activities remain concentrated in urban centres. As shown in Table 5.4 the amount of credit advanced to the agricultural sector from commercial banks and NBFIs has been increasing in absolute terms over the years. Nevertheless, the proportion of credit advanced to agriculture from the banks and NBFIs as a percentage of their total advances has declined steadily from an average of 15% and 7.8% during pre-liberalisation period to about 11% and 5%, respectively, during the liberalisation period as shown in Table 5.4

Table 5.4 Amount (Ksh billions) and proportion of agricultural credit advanced by commercial banks, NBFIs and the AFC, 1984/85 to 1998/99

Year	Agricultural Sector Credit from			Total credit	Agricultural Sector Credit as % of		
	Banks	NBFIs	AFC		Bank Credit	NBFI Credit	GDP
Pre-liberalisation period	(Ksh Billions)				(%)		
1984/85	2.96	1.48	0.38	4.82	12.8	12.0	5.1
1985/86	2.94	1.24	0.90	5.08	10.0	9.6	4.2
1986/87	4.09	1.18	0.75	6.02	15.1	6.5	5.3
1987/88	4.71	1.35	0.63	6.69	16.2	6.4	5.1
1988/89	6.03	1.53	0.34	7.90	18.4	6.1	5.3
1989/90	6.01	2.24	0.34	8.59	16.2	7.1	5.1
1990/91	7.19	2.49	0.38	10.06	15.5	6.8	4.8
Mean	4.85	1.64	0.53	7.02	14.9	7.8	4.9
Liberalisation period							
1991/92	8.24	2.79	0.52	11.49	13.8	6.5	4.7
1992/93	9.57	2.39	0.69	12.65	13.5	4.4	4.1
1993/94	11.89	2.10	0.76	14.75	12.7	5.6	3.8
1994/95	14.48	1.96	0.50	16.94	11.0	5.6	3.7
1995/96	14.86	1.78	0.30	16.94	9.1	4.3	3.2
1996/97	17.96	1.09	0.25	19.30	8.8	3.9	3.3
1997/98	21.93	1.02	0.17	23.12	9.4	3.2	3.9
1998/99	23.43	-	-	N/A	9.0	-	-
Mean	15.29	1.88	0.46	16.45	10.8	5.0	3.8

Source: Compiled from Central Bank of Kenya & AFC Statistical Bulletins (various)

The higher level of bank and NBFIs lending to agriculture during the pre-reform period was mainly due to a government policy that had established an agricultural portfolio ceiling of 17% of total credit. However, in most of the years this portfolio ceiling was not met as shown in Table 5.4. Moreover, the repeal of this portfolio ceiling and the deregulation of interest rates in 1993 seem to have contributed to the shrinking of agricultural credit from the banks and NBFIs. On the overall, agricultural credit has declined from 5% of total GDP during the pre-liberalisation period to 3.8% during the liberalisation period (Table 5.4). Equally, the total advances to the agricultural sector in real terms also declined substantially during the liberalisation era as shown in Figure 5.4. This decline of agricultural sector lending is despite the sector's contributions to total GDP that run at an average of 27% since 1985.

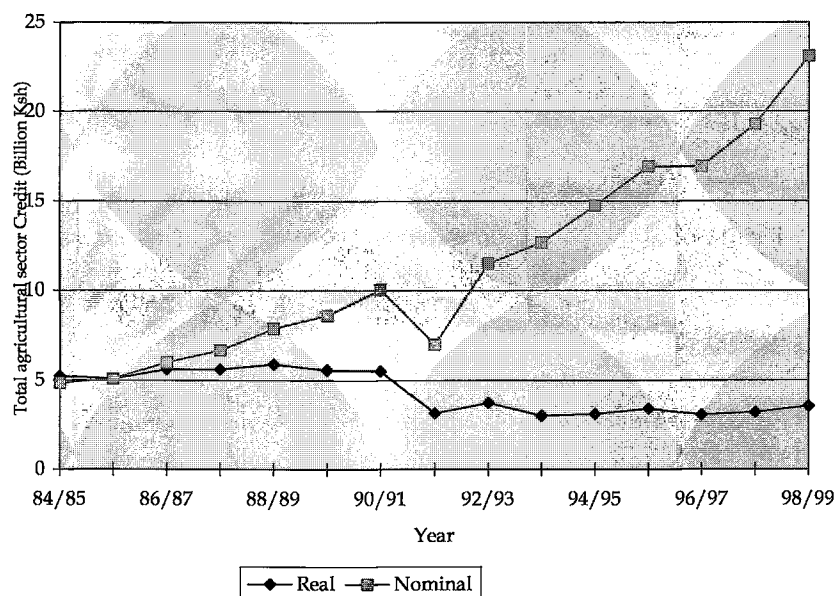
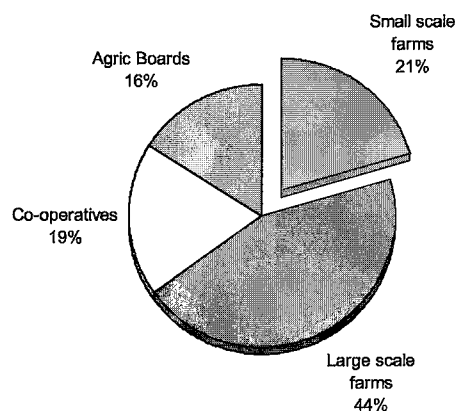


Figure 5.4 Total credit (nominal and real terms) advanced to the agricultural sector in Kenya by Banks, NBFIs and the AFC, 1984/85 to 1998/99

The Agricultural credit squeeze is even more severe to smallholder farmers who in the last fifteen years (1985 to 1998) have only been getting 21% of agricultural credit given by commercial banks as shown in Figure 5.5. Among the sampled farmers, only a mere 1.5% had access to bank credit as shown in Table 5.5. The bank credit is secured by land titles. Stringent collateral requirements, high interest rates and the repayment conditions imposed by most banks are cited as the main factors why farm households in this region borrow very little from banks. Even where special credit arrangements tailored to smallholder commodities systems are channelled through banks, they have been found unsuitable for smallholder farmers mainly because of the set sizes of the minimum loan, unfavourable repayment conditions and the collateral requirements (Karanja & Ndirangu, 2000)³⁶. This state of affairs upholds the view that rural agricultural households are generally outside the scope of commercial bank lending. Furthermore, the low level of land-secured loans in the study area may indicate that there is a weak relationship between land and credit markets. This result confirms earlier work done in this area and in other parts of Africa by Migot-Adholla *et al* (1993) and Pinckney and Kimuyu (1994).

³⁶ Such credit lines include, the small scale tea and coffee farmers loan scheme operated by the Kenya Commercial Bank, the Global Private Enterprise (GPE) loan program financed by the European Investment Bank and the OPEC fund for international development. For instance, the GPE loans are set at a minimum of ECU 50,000 or Ksh. 4 million, which in most cases is outside the capacity of small and medium farmers in Kenya.



Source: Compiled from Central Bank of Kenya Statistical Bulletins (various).

Figure 5.5 Percentage of commercial banks' agricultural credit advanced to different sub-sectors of agriculture, 1985 to 1999

Table 5.5 Sources of credit and percentage of smallholder farmers accessing credit in Central Kenya region

	Smallholder farmers n = 120	Commercial farmers n = 80	Average n = 200
<i>Producer & Marketing Co-operatives/companies</i>			
Farmers growing coffee with input loans (%)	28.3	N/A*	17.1
Milk producers with input loans (%)	8.3	7.2	7.8
Farmers growing tea with input loans (%)	78	80	80
Maize/beans producers with input loans (%)	7.5	3.6	5.6
<i>SACCOs</i>			
Membership (% of farmers)	28.2	14.6	22.8
Farmers with shares (%)	25.0	12.5	20.0
Farmers with loans (%)	5.8	9.7	4.3
Average value of shares (Ksh)	5,740	47,516	16,406
Average size of loan (Ksh)	15,720	5,416	13,143
<i>Banks</i>			
Farmers with loans (%)	1.6	1.2	1.5
Average size of loan (Ksh)	15,000	200,000	61,250
<i>Self-help groups</i>			
Membership (% of surveyed farmers)	34.6	19.5	28.1
Average size of loan (Ksh)	345	12,312	3,645

* Commercial farmers don't market their coffee through the co-operatives and are therefore not eligible loans from that source.

Source : Household Survey, 1999/2000

In an effort to improve farm household access to agricultural credit services, the government of Kenya started the Agricultural Finance Corporation (AFC) in 1963 to provide agricultural development and production credit. Like most other specialised farm credit institutions in developing countries, the performance of AFC has been below expectations. The amounts of loans advanced by AFC have been dwindling over the years and especially after 1994 as shown in Appendix 5.4. Furthermore, a scrutiny of the AFC loan portfolio indicates that small loans meant for smallholder farmers have been the most adversely affected by the

declining AFC lending as also shown in Appendix 5.4. AFC relies on government and donor supported credit lines that have not been forthcoming in the last couple of years. The corporation's lending policies that have tended to keep interest rates below the prevailing market rates³⁷ coupled with undue political interference on its lending and loan repayment, have over the years been attributed to its poor performance. It is therefore safe to assume that the non-significant role of AFC as a financier of smallholder agriculture will continue and there is a high likelihood that this situation will deteriorate further as government disengages as a key player in financing the agricultural sector.

The other formal sources of credit to smallholder farmers in the region are marketing and credit co-operatives and self-help groups as shown in Table 5.5. The milk and coffee marketing co-operatives are the most prominent while tea factories (companies) served tea farmers. Tea, coffee and milk producers, in that order, had the highest access to credit from their marketing companies or co-operatives (Table 5.5). A small percentage (5.6%) of food crop producers had access to input credit from co-operatives although the food crops are not marketed through this channel.

The marketing co-operatives and tea factories give their credit in form of farm inputs such as fertilisers and pesticides. The credit is secured through crop collateralization, in a typical inter-linked contract. However, due to market reforms that have eroded the monopoly status of milk and to some extent coffee marketing co-operatives, most of these co-operatives are not keen to give input loans due to the high default rate witnessed since mid-1993. This high default rate is a clear manifestation of contract enforcement problems arising from market reforms. Furthermore, the splitting of co-operatives into smaller units that has taken place since 1992 has eroded most societies' capital base required to secure credit for onward lending to their members. Even the tea factories reported some problems in loan repayment from farmers although at a lesser scale than the marketing co-operatives. The institutional changes in commodity marketing, therefore, seems to be jeopardising the confidence between parties involved thereby weakening the very fundamental requirement of any financial transaction.

In an effort to meet the credit demand unfulfilled by other formal financial institutions, Savings and Credit Co-operatives Societies (SACCOs) have mushroomed in the country and in the study region. For instance in 1985 there were 1,350 SACCOs in Kenya that had increased to over 3,800 in 1998 (Republic of Kenya, 1999). The number of SACCOs in the study region has also increased from 150 in 1985 to around 220 by the end of 1998. Majority of these SACCOs (90%) are, however, urban based. The rural SACCOs are mainly new institutions set up after 1992. Details on the rural SACCOs turnovers and loan portfolios are, however, not available. Nevertheless, during the course of the household surveys it was apparent that these organisations are yet to become important financial intermediaries in the study region. This is reflected by the small numbers of farmers who are members of SACCOs (Table 5.5). However, the potential of SACCOs as avenues for mobilising savings is clearly demonstrated by the share holding of the interviewed households that averaged Ksh 16,406. Equally, as shown in Table 5.5, the average loan size given to SACCO members is quite considerable, especially for smallholder farmers whose average loan size is about three times their share capital.

As most SACCOs relay on members' savings in form of shares, their interest rates are far below the market rates. As of 1999, most SACCOs in the region were lending at an interest rate of 15% per annum as compared to 26% per annum charged by commercial banks. However, the SACCOs do not pay interest on deposits but only pay dividends - averaging 5% in 1999 - at the end of the year whenever surpluses do occur. The other advantage of SACCOs is that loans are issued on the strength of each member shares backed by a guarantee of at least three other peers. This guarantee creates peer pressure that minimises the rate of default. Furthermore, unlike the marketing co-operatives that give only input credit, the

³⁷ For instance, during the period 1993 to 1998, AFC lending rate was pegged at 20% p.a. against commercial banks rates of about 30% p.a. over the same period.

SACCOs have a wider range of financial products ranging from school fees loans to development loans. Some of the SACCOs have even gone further to offer pseudo-banking facilities including processing of salaries and front-office banking facilities. Their affiliation and sharing of market and client information with marketing co-operatives and companies is another added advantage. However, most SACCOs in the study region derive between 50% to 80% of their core business from coffee payments thus implying a very high degree of co-integration with the sub-sector. This over-exposes most SACCOs to the price and general performance risks emanating from the coffee sub-sector. These risks have escalated in the recent past thereby adversely affecting SACCO performance.

Moreover, despite taking an increasingly bigger role in financial intermediation, the SACCOs operate within the co-operative legal framework, which curtails their business operational space as compared to other financial institutions that operate within the more liberal company framework. As a result the development of SACCOs as significant rural financial intermediaries is vulnerable to serious governance problems arising from the co-operative's egalitarian democracy that encourage high moral hazard and free riding. This mainly manifests itself through the co-operative ideals that allows each member one vote regardless of the number of shares held. Thus, one's shareholding is not in any way related to the control of SACCOs management, a situation that has allowed rent seekers to ascend to high managerial positions in these organisations.

Informal self-help groups also played a role as sources of credit as also shown in Table 5.5. The majorities of the self-help groups are, however, loose organisations whose main objective is identified as geared towards social security. This served to explain the limited credit-advancing role these groups played especially among the smallholder households. However, the groups seemed to play a bigger role as financial intermediaries among the larger commercial farmers.

5.3.2 Land and labour markets

Majority of smallholder farmers in the region has acquired their land through inheritance and has individual freehold land titles that gives them perpetual land ownership (Table 5.6). The farmers can therefore theoretically participate in land markets either through outright sales or through rentals. The land property rights in the region thus give the farmers incentives to use land efficiently and to invest in other long term land improvements. As land is a major resource constraint in the region, expectations are that a vibrant land market would prevail. However, the household survey data indicate that land markets are thin, as less than 12% (1.2% per year) of the sampled farmers had participated in land markets in the last ten years as shown in Table 5.6. This result is in line with an earlier study covering one of the Central Kenya districts (Murang'a) by Pinckney & Kimuyu (1991) that indicated that over the period 1963 to 1991, land purchases per annum was equivalent to 0.6% of total land owned.

Table 5.6 Features of land markets in Central Kenya region

	% of smallholder farmers n = 120	% of Commercial Farmers * n = 80	% of total sample n = 200
Method of land acquisition			
Inheritance	78.3	31.1	60.2
Purchase	10.4	40.0	23.0
Other Means	11.3	23.8	16.8
Ownership of freehold title			
With title	78.3	96.3	85.5
Without title	22.6	3.7	14.5
Participation in land markets (in the last 10 years)			Total
Buying Land	4.3	7.3	11.6
Hiring land	9.4	0.5	9.9
Leasing Land	3.9	0.6	4.5
Average Land prices			
	Ksh/acre	Ksh/acre	Ksh/acre
Purchase	113,500	132,000	125,600
Leasing/hiring (rent)	1,350	7,000	2,400

*Refers to coffee farmers who are non members of coffee co-operative who have their own coffee processing facilities

Source: Household survey data 1999/2000

The land value depended on location and quality of the land. The average land price is Ksh 125,600 per acre with no significant differences in prices between the two categories of farmers. Rental land markets also are present but to a limited extent with 10% of the farmers participating in this market as shown in Table 5.6. The smallholder farmers' participation in the rental land markets is relatively higher than that of commercial farmers. The severe land pressure among the smallholder farmers could be the reason for their higher participation in the rental land markets. Land rents per year are, however, five times more among the commercial farmers as compared to the smallholder farmers (Table 5.6). This could reflect differences in farm productivity across the two categories of farmers. A study done in 1987-88 in one of areas covered by the current survey had indicated that only 1.9% of smallholder households had rented land by then (Migot-Adholla *et al.*, 1993). This gives the indication that there have been improvements in rental land markets in the region since that time.

Cultural heritage considerations may also account to a certain extent the thin land markets in the region. Studies done elsewhere in Kenya (Okoth-Ogendo, 1980) indicate that although there is a weak land market in the country, the market is more severely restricted in former 'African reserves' -which include the study region - where the market operates mainly among members of the same ethnic group. However, most of these cultural heritage considerations are being discarded as more and more farm households engage in commercial agriculture.

The current government policies and regulations on land transactions can also be major factors behind the thin land markets. Land transfers are mainly controlled by village elders and provincial administration through the district land boards. This makes land transfers a long bureaucratic process that is conducive for rent seekers leading to high transaction costs. This bureaucratic process is officially justified as a safeguard to the likely dispossession of poor peasants by their richer neighbours.

Due to the high population density leading to a high labour:land ratio in the region, the labour markets are quite vibrant. Table 5.7 gives the salient features of the labour markets in

the study region. The smallholder farmers had a labour: land ratio that is about four times that of the commercial farmers. Majority (84%) of households reported hiring labour at different periods of the year with most of the hired labour being used in coffee and tea harvesting. The percentage of the small farmers hiring labour is lower (73%) as compared to 100% of the larger farmers who hired labour (Table 5.7). More than a third of the households also employed permanent workers of which the larger farmers constituted the majority as shown in Table 5.7. About 39% of the households had resident members employed outside the farm, with the larger farmers participating more in these off-farm labour markets. This gave the indication that the majority of small farmers are mainly engaged in full-time farming activities. There is, however, suspicion that the small farmers tend to downplay off-farm engagements as most of them are involved in short time jobs which they did not regard highly. Furthermore, most of the off-farm engagements could have been undertaken by women and children and could have been unreported by the household heads who are mainly men.

Table 5.7 Labour markets characteristics in Central Kenya region

	Smallholder farmers n = 120	Commercial farmers n = 80	Total sample n = 200
Labour:land ratio (MD/acre/yr)*	2,186(1,889)	545(462)	1,536(1697)
Farmers hiring labour (%)	72	100	84
Farmers having permanent workers (%)	13	65	34
Household having members engaged in off-farm work (%)	32	53	39
Av. Period worked by hired labourers(hrs/day)	6.5 (1.3)	6.4(1.3)	6.5(1.3)
Wage per day (Ksh)	78.10(14.9)	79.50(12.7)	78.7(14)
wage per Manday **(Ksh)	97.0(13.9)	100.3(13.9)	98.4(13.9)
Farmers offering inducements (%)	67.6	41.5	56

* Total family labour available for farm activities plus hired labour (permanent and casual) per year divided by farm size **One manday = 8 working hours; Figures in parenthesis indicate the standard deviations

Source: Household survey, 1999/2000

There are no major differences as far as the length of the working day for hired labour in both small and larger farms is concerned, with the average working day for hired labour being 6.5 hours. This is also the case for wages paid per day and its equivalent per manday (based on 8 hours per day) that averaged Ksh 78 and Ksh 98 respectively as shown in Table 5.7. Despite the uniformity in wages across the two farm categories, a higher proportion (67%) of small farmers as compared to 40% of the larger farmers reported that they offer inducements, mainly in form of meals, to their hired labourers. On this account, the smaller farmers could be said to face higher wages than the larger farms. Like any other farming situation labour shortages are said to occur during the peak seasons mainly in times of coffee picking.

5.4 Changes in market co-ordination and control of commodity systems

5.4.1 *Coffee market*

Before the onset of liberalisation all aspects of coffee production and processing were strongly vertically co-ordinated by the Coffee Board of Kenya (CBK). The CBK and its agents used to co-ordinate coffee planting, uprooting as well as designating coffee-growing zones. Legal and administrative provisions existed and still exist in the Coffee Act (Cap. 333 laws of Kenya³⁸) to ensure smallholder farmers abide by these requirements. In order to avoid adverse selection problems related to coffee cherry quality, the co-operative societies had field management committees that ensured smallholder farmers followed the laid-down production recommendations. With the onset of liberalisation, this vertical co-ordination in production has ceased as the field management committees no longer operate. This has given smallholder farmers greater control of coffee production but has enhanced both moral hazards (related to poor and good quality coffee cherries being pooled together) and adverse selection (quality not related to payments) problems in coffee marketed in the co-operative channel. As such, smallholder farmers are no longer keen to improve cherry quality as there are no incentives to do so.

To avoid the moral hazard problems in the co-operative marketing channel smallholder farmers in the study region and other areas have resulted to selling their coffee cherry to private traders thereby breaking the monopoly enjoyed by co-operative societies prior to liberalisation. Although this trade is considered illegal by CBK, it is reported to be rampant in the study region with 53% of the coffee growers either acknowledging to have participated in this parallel market or identifying active private coffee traders in their localities. As the private traders are not licensed, hence are operating outside the regulatory framework, their operations remain shrouded in secrecy but continue to undermine the vertical co-ordination of the coffee trade.

Despite the emergence of private coffee traders, the co-operative societies remain the main channel through which smallholder farmers undertake primary processing (pulp) of their coffee cherries. Prior to 1992, the government, through the Ministry of Co-operative Development, had wide ranging powers over the day to day management of co-operative societies. Those powers have been severely reduced through the revision of the Co-operative Act in 1998. Since then farmers have been given over-riding powers to decide on the management of co-operative societies. In exercising these powers, the farmers have demanded the splitting of co-operative societies into smaller units and as a result the number of coffee co-operative societies has increased by 62% from 207 in 1990 to 335 in 1999. Mismanagement and poor governance structures (see appendix 5.5 for an example) may also have fuelled the splitting of co-operatives. Although the splits may have brought decision making closer to smallholder farmers, the newly formed societies have a weak capital base that is hampering their ability to provide services such as supply of farm inputs to their members. This has further eroded the vertical integration of co-operative societies and their member as farmers no longer rely on them for provision of production services and credit.

As indicated earlier in chapter two, the coffee co-operative societies have been losing a sizeable number of their well-to-do members who have been licensed to become small independent estates. This resulted from reduction of the threshold coffee acreage a farmer needs to be licensed as an estate from 10 acres to 5 acres as part of coffee industry liberalisation. The exodus of these more commercially-oriented farmers from the co-operatives has created excess processing capacity in the co-operative factories and an increase in processing costs. The high co-operative processing and overhead costs have in turn increased the role of private coffee cherry dealers as smallholder farmers try to avoid these high costs.

³⁸ A new Coffee Act which repeals most of the old provisions in the old Act was passed by parliament in December, 2001 and is expected to become effective in April 2002.

The secondary coffee processing stage (milling³⁹) has also undergone changes that have affected the vertical co-ordination and control of the coffee marketing system. Prior to 1994 there was only one coffee miller- a farmer owned organisation - with a market share of almost 95%. Since then, three other milling companies have been licensed, thereby increasing the total installed milling capacity to over 230,000 metric tonnes against a production of around 80,000 metric tonnes. The licensing of more millers has reduced the vertical co-ordination of the coffee-marketing channel as the milling companies have tended to act independently based on their particular business interest. With the decline of the market share of the original farmer-owned milling organisation, the smallholder farmers have also lost a great deal of control over the coffee milling business. The competition in milling has, however, not resulted into any significant reduction in milling tariffs as envisaged.

After milling, coffee is offered in a central auction in Nairobi. The central coffee auction - the only means of selling coffee in Kenya - has remained well co-ordinated after liberalisation. The CBK controls the sales volumes, reserve price as well as making the payments to both co-operative and estate farmers. However, payments to the estate farmers are made directly into their bank accounts while those of smallholder farmers are passed-on to their respective co-operatives for on-ward payments to individual smallholders. The CBK also licenses the brokers and other participants in the auction. Nevertheless, the export trade, that accounts for over 95% of Kenya's coffee disappearance lacks co-ordinated promotion. Coffee dealers - exporters and roasters- numbering 85 in 1999 undertake the export trade with CBK having little or no information on the final buyer of the Kenyan coffee. This has created a major gap in market co-ordination as consumer preferences are not well linked with the production aspects. This means that smallholder farmers have weak control over the auctions, a venue that is supposed to bring together the producers and coffee exporters (Table 5.8).

³⁹ Coffee milling involves hulling (removal of parchment skin) and polishing of the coffee beans to end up with green (clean) coffee beans ready for marketing and roasting. The millers also perform the function of coffee grading based on the size, colour and density of coffee beans.

Table 5.8 Vertical co-ordination and farmers control of commodity markets before and during liberalisation

Commodity	Vertical co-ordination *		Smallholders farmers control **	
	pre-liberalisation	liberalisation	pre-liberalisation	liberalisation
Coffee				
Coffee Export trade	weak	weak	poor	poor
Central Auction	strong	strong	weak	weak
Secondary processing	strong	poor	weak	poor
Primary processing	strong	poor	weak	strong
Smallholder production	weak	poor	weak	strong
Overall	strong	weak	weak	weak
Tea				
tea exports	weak	weak	poor	poor
Auctions	strong	strong	weak	strong
Management of factories	strong	weak	weak	weak
Primary processing	strong	weak	weak	weak
Leaf collection	strong	weak	weak	weak
Smallholder production	strong	weak	weak	weak
Overall	strong	weak	weak	weak
Milk				
Milk & milk products sales	strong	poor	weak	strong
Processing	weak	weak	weak	poor
Milk collection	strong	weak	weak	strong
Smallholder production	weak	poor	weak	strong
Overall	weak	poor	weak	strong
Horticultural crops				
Export sales	weak	weak	poor	poor
local sales	weak	weak	weak	weak
processing & Packaging	weak	weak	poor	poor
Collection	poor	poor	weak	weak
Smallholder production	poor	poor	weak	weak
Overall	weak	weak	weak	weak
Food crops (maize & Beans)	strong	poor	strong	strong

* Refers to vertical co-ordination by the central authority either the government or a government agency. **control refers to smallholder farmer's control over various production (horizontal control) and processing and marketing (vertical control).

Source: Compiled by Author

In general, liberalisation has severely reduced the vertical co-ordination of coffee production, processing and marketing as shown in the subjective rating in Table 5.8. This weak co-ordination has created poor linkage between the smallholder producers and the exporters, thereby leading to serious asymmetries in information flow. Most smallholder farmers confessed during the household survey that apart from knowing when their coffee is ripe for harvesting, they have no idea of when and how their coffee is offered in the market. They are even more unsure of when they will receive their coffee payments from co-operatives. This was given as the main reason as to why they prefer cash payments from private traders. As the central focus for any exchange process is information with regard to preferences, products as

well as exchange of property rights, the liberalised coffee marketing and exchange process has not improved the flow of information. The weak smallholder farmers' control over the process aggravates the information asymmetry problems and their bargaining power. The weakening of smallholder marketing co-operatives in the advent of liberalisation coupled with lack of grassroots smallholder lobby groups have worsened the situation.

5.4.2 Tea market

The KTDA⁴⁰ is the main provider of services to smallholder tea growers in Kenya while the KTB is the sub-sector regulator. KTDA provides field services, tea factory management and marketing services. Unlike coffee, tea processing and marketing is centred around tea factories which are private limited liability companies owned by KTDA, the smallholder farmers and financing agencies. Prior to liberalisation, KTDA exercised considerable administrative and financial control over other parties in management of tea factories thereby making tea collection, processing, transportation and marketing a strongly vertically co-ordinated system as shown in Table 5.8. KTDA also provides smallholder farmers with extension services and farm inputs as well as processing farmers payments, all which increases its co-ordination in smallholder tea production. KTDA vertical-co-ordination is extended up the ladder to controlling tea market outlets either in Mombasa or London tea auctions as well as in domestic markets.

Liberalisation has reduced the vertical co-ordination role played by KTDA by reducing its administrative and financial control roles. Currently, KTDA's role has been reduced to that of a management agent with tea factory companies gaining greater degree of autonomy. In the new institutional arrangement, KTDA provides financial and administrative services to tea companies, in accordance to specific management agreements. KTDA together with tea factory companies still co-ordinate tea marketing as well as the provision of extension services and inputs. These institutional arrangements, although weak in comparison to the situation before liberalisation, are far better co-ordinated than in the coffee sub-sector.

With regard to smallholder farmers' control, the new institutional arrangements have given the farmers greater control in production and processing of their tea. At the production level, farmers have become more active through the formation of lobby groups to improve their bargaining power. In the study region, a group known as Kenya Union of Small Scale Tea Owners (KUSSTO) has been formed. Most farmers interviewed during the present study, were of the opinion that KUSSTO has been able to disclose to them information regarding market prices, the operational overheads of their tea factories and KTDA. Thus, the union has, to a certain extent, been able to bridge the information asymmetry that existed before liberalisation. A stockholders organisation known as Kenya Small scale Tea Growers Association (KSTGA) has also been formed to regulate tea cultivation, processing and marketing. To overcome delays in tea collection by KTDA and factory companies some farmers have also resulted to selling tea leaves to private factories or middlemen. The trade in tea leaves has increased in the recent past as it is seen as an alternative marketing window, especially for tea rejected by KTDA and tea factory managed buying centres. In this system, the farmers are paid cash-on-delivery without any other obligations. Despite the low prices paid to farmers, the cash-on-delivery system is said to ease the cash-flow constraint as well as reduce the transaction costs associated with tea leaves rejection at the KTDA/factory buying centres.

Under the new institutional arrangements, the smallholder tea farmers are expected to buy the equity held by KTDA in tea processing companies. This move is expected to enhance farmer's control on tea processing companies as they are supposed to elect the Board of Directors to these companies. The companies are expected to vertically co-ordinate and gain

⁴⁰ The Kenya Tea Development Authority (KTDA) changed its name to Kenya Tea Development Agency (KTDA) in June 2000 after amendment of the Tea Act.

control of the upstream marketing functions on behalf of their shareholders. However, the ownership of KTDA was not quite clear during the study period.

These institutional changes in the tea sub-sector seem therefore to have reduced KTDA's vertical co-ordination role while strengthening the smallholder tea farmer's control over the production and processing. Although the evidence at this stage is limited, there remain major issues of governance and management which farmers feel strongly about (see Appendix 5.6 for an example). The effects on these changes on smallholder tea sub-sector development in the study area and in Kenya are not yet clear, but there are high expectations that they will enhance tea production.

5.4.3 *Milk market co-ordination and control*

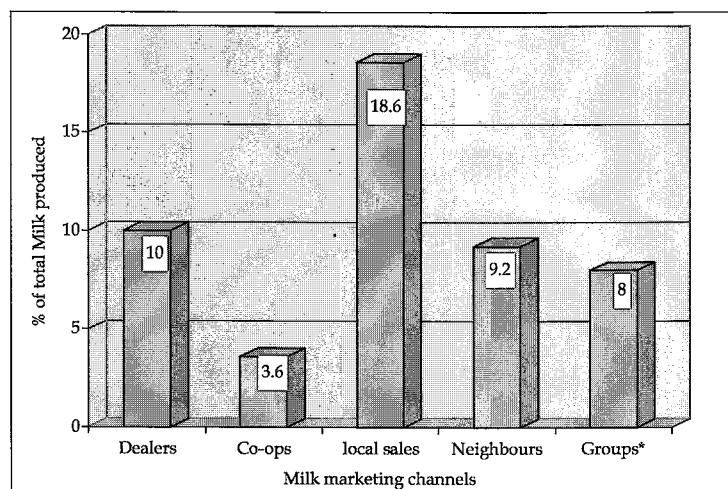
Unlike coffee and tea commodity systems, that had strong market co-ordination agencies before liberalisation, the milk commodity system was weakly co-ordinated even before the onset of liberalisation. The Kenya Dairy Board (KDB) has the mandate to regulate the milk commodity system. However, the KDB had vested most of its powers on its agent, the Kenya Co-operative Creameries (KCC). KCC mainly inter-linked with dairy co-operative societies as their main buyer of milk. The Co-operative in turn had direct co-ordination role in milk collection, quality control and supply of inputs to smallholder farmers. In addition KCC had a monopoly in milk processing and distribution.

Since the liberalisation of the dairy sector in 1992, new institutional arrangements in milk collection, processing and marketing have emerged. At the level of rural markets, informal marketing channels dominate with most farmers preferring to sell their milk through these channels as shown in Figure 5.6. The dominant sales channels are neighbours, business establishments like hotels, private milk dealers and a number of self-help groups. The dairy co-operatives that dominated in milk trade before liberalisation, are the least preferred milk-marketing channel. Indeed, most farmers treat dairy co-operative societies as milk marketing channels of last resort. The main reason given for this high preference for informal channel is their higher and prompt payment systems that assured farmers of daily, weekly or monthly incomes. This contrasts sharply with co-operatives that take at least 45 days to pay farmers. Equally, the informal channels are preferred due to their ability to collect milk directly from the farms and their facilitation in collection of evening milk, which the co-operatives are unable to do. In a bid to entice farmers, the societies have started to offer artificial insemination services as well as limited veterinary services. The provision of these services is inter-linked with the milk supply. One dairy co-operative in the region has also ventured into milk processing to compete with the KCC and other milk processing plants that have been started since 1992. The private and co-operative processing plants procure their milk from farmer organisations or directly from farmers. There is therefore stiff competition at the farm level in milk trade with limited vertical co-ordination.

Despite the multiplicity of milk marketing channels, only 49.6% of the total milk produced is marketed as shown in Figure 5.6. The rest is retained for domestic use and feeding calves while some goes to waste due to lack of appropriate milk storage facilities. Indeed, most households indicated that their major problem as far as milk production is concerned is the losses incurred due to milk spoilage especially the evening milk.

Unlike the coffee and tea smallholder farmer, dairy farmers have taken strong control of various marketing activities. There is strong horizontal control in dairy farming as farmers' control the procurement of inputs, artificial insemination and veterinary services through organisations such as co-operatives, and self-help groups. The farmers have also taken control of milk collection through their organisations or through making their own transport arrangements. However, the farmers have weak control of milk processing due to the fact that the market share of KCC, which is a public organisation, has been declining. As indicated in

section 3.3, KCC has been of late been facing serious financial problems that forced the company to close for some time in 1999 before winding-up in 2000. Farmers who were shareholder of the original KCC thus lost total control of the co-operative. Despite the loss in formal market control, farmers have a strong control at the raw market retaining level as they sell most of their milk direct to consumers.



* refer to self-help groups

Source: Household survey, 1999/2000

Figure 5.6 Smallholder farmers' milk marketing channels in Central Kenya.

The atomistic production and marketing activities in the milk commodity system have, therefore, reduced the co-ordination hitherto played by KCC. The rural milk markets and to some extent the urban markets have witnessed major institutional changes that have enhanced the dairy farmers control as well as changing the contractual arrangement and transaction costs. The institutional changes may call for regulatory mechanisms to enforce quality standards as well as in enforcement of trade contracts.

5.4.4 Horticultural crops markets co-ordination and control

The horticultural crops commodity system has remained mainly a private sector oriented system with minimal government presence, even before the onset of liberalisation. As such the horticultural commodity system has weak vertical co-ordination. The HCDA, which is vested with regulatory powers with regard to horticultural crops, has mainly concentrated on licensing of exporters and trader as well as maintenance of horticultural trade data. The organisation has little to do with smallholder production and marketing although it is supposed to provide them with seeds and market information.

Due to the weak vertical co-ordination offered by HCDA, some horticultural exporting companies have tried to co-ordinate their market activities with smallholder production through provision of inputs such as seeds within a loose contract farming arrangement. However, due to stiff competition among the exporters and lack of binding contracts, the incidences of smallholder farmers taking such inputs and not delivering the produce are widespread. This has discouraged most companies from the contract farming arrangements. As such, most smallholder producers organise production without consulting prospective buyers, hoping that

their produce will be bought when ready for harvest. This has led to a situation where horticultural crops are produced but not sold thereby increasing farmers' risks and transaction costs. The farmers are also not organised in either co-operatives or as self-help groups. Thus, various forms of middlemen who act as go-in-between the farmers, the exporters or the local market outlets, dominate horticultural production and marketing. These arrangements have led to a situation where smallholder farmers have a poor to weak control over many aspects of horticultural commodity system (see Table 5.8). The weak vertical and control in the system also has created serious information asymmetries especially with regard to export trade and quality. These factors have created major constraints to the development and growth of smallholder horticultural production.

5.4.5 Food crops markets co-ordination and control

The study area is a food deficit region in the country. As such, most households rely on local markets for their food supplies. There is, therefore, little or no vertical co-ordination in the maize and beans markets (Table 5.8). The farmers also grow the food crops for their subsistence requirements and only participate in the markets during harvest period at times when they need to purchase or sell. No inputs are provided by any agency and the farmers have full control of the production and marketing process. In times of surplus, maize and beans are sold to local traders who then transport the produce to urban centres. According to the household survey, 75% of the households are market participants and they buy maize most of the time. Due to the decentralised trade of food crops in the region, the market participating households have to incur the cost of transport as well as search for suitable buyers. The markets are dominated by cash-on-delivery transaction contracts. The frequency of trade is high as most household buy maize and beans in small quantities whenever they are needed.

5.5 Trade contracts and producer margins

This section documents the expected type of contractual arrangements at farm-gate level for the five commodities studied and the margins captured by smallholder farmers. The expected type of contractual arrangements is based on each commodity's characteristics, the frequency of transactions as well as asset specificity for each commodity. The expected contractual arrangements and producer margins are contrasted with those existing before and after liberalisation.

5.5.1 Product characteristics, frequency of trade and contractual forms

Table 5.9 provides a summary of the ratings for each product characteristics, frequency of trade and asset specificity for the five commodities under study. The five commodities produced by smallholder farmers in the region have various degrees of perishability with tea leaves and milk having a high level of perishability. Coffee cherries and French beans have a medium level of perishability as they can keep a fair quality for more than a week. Although ripe coffee cherries have to be picked at the right time, drying the cherries, which can later be sold as dry-processed coffee commonly referred to as buni, can arrest the loss of quality. This is, however, not the case with milk and tea which have to be processed or sold within the same day otherwise the farmer will incur a 100% loss. Dry maize and beans are rated to have the lowest perishability as most farmers have basic storage facilities and technologies to enable them to preserve these products even to a period of 3 months.

Table 5.9 Product characteristics and asset specificity of the five commodities

Commodity System	Perishability	Seasonality	Frequency of Transaction	Product Differentiation	Asset specificity
Coffee	Medium	Medium	Occasional	High	Idiosyncratic (high)
Tea*	High	Low	Continuous	Medium	Idiosyncratic (high)
Milk	High	Low	Continuous	Low	idiosyncratic (medium)
Horticulture (French Beans)	Medium	Medium	Occasional	Low	non-specific
Food Crops (maize & Beans)	Low	High	Occasional	None	non-specific

Notes:

*Tea refers to tealeaves Perishability:- based on the period a commodity can be maintained at good quality under the prevailing storage and processing technologies; high - period less than 3 days, medium - 4 to 10 days, low-more than 10 days. Seasonality:- high- product harvested with a period of one month, medium- product harvest period between 30 to 60 days, low-product harvest and trade period almost throughout the year. Frequency of Transaction:- based on Seasonality and the period smallholder farmers conduct trade transactions; occasional-product traded mainly during or immediately after harvest, continuous- product traded almost through out the year. Product differentiation:- based on number of grades after primary processing; high- more than 5 grades, medium - 3 to 5 grades, low- less than 3 grades, none- no grading. Asset specificity- based on asset specificity index described in section 2.3.2 (Table 2.1).

Source: compiled by author

Tea leaves and milk, which are high risk products as measured by their perishability also happen to have low level of seasonality as they are produced almost throughout the year. This implies that these products require a continuous trade relationship as indicated by the frequency of trade rating (Table 5.9). However, the two commodities differ in their level of grading in the market. Made (processed) tea is differentiated into five grades at the auction level (BP1, PF1, PD, D1, F1)⁴¹ with significant differences in prices. However, at the farm-gate level the farmer is paid an average price based on the weight of the tea leaves. This has been a major source of concern as it exposes farmers to adverse selection problems. Nevertheless, there is no known method of relating quality of tea leaves to the final product. Milk on the other hand is treated as a relatively homogenous product both at the consumer and at the farm level. Although there are minor differences in various brands of milk offered to consumers in terms of butterfat content, the farmers are only paid for their milk in terms of quantity alone. There is therefore less adverse selection problem in milk as compared to tea.

The similarity in product characteristics between coffee and French beans in terms of perishability, seasonality and frequency of transaction do not however transcend to product differentiation. French beans are graded into standard and premium grades at the export level while farmers are paid an average price based on standard grade. There are minor differences in the pricing system between these two grades. Coffee however is a highly differentiated product at the export level.

Due to the need to maintain the high quality standard for which Kenya coffee renowned world-wide, coffee is graded into seven grades that are further placed into 10 classes⁴². The

⁴¹ The grades are based on processed (black) tea physical and liquor characteristics.

⁴² The grades are AA, PB, E, AB, C, TT, and T while the classes are from 1 to 10. Grades AA, AB, PB and E are the premium grades which mainly constitute coffee in the top classes of 1 to 4 while the rest of the grades form the average quality commonly referred to as Fair Average Quality (FAQ) in coffee trade. FAQ coffee falls

grading is based on bean size while the classification is based on cup quality (taste, acidity). As shown in Table 5.10, the growers of premium classes (1 to 3) are expected to be paid around 20% and 60% higher price than those producing middle classes (3 to 6) and poor classes (7 to 10), respectively. Despite this elaborate grading and classification system, the smallholder farmers are only paid an average price based on the quantity of coffee cherry. This is as compared to plantation farmers who are paid in accordance to quantity in each class. The smallholder mode of payment is necessitated by the fact that coffee cherries are pooled together at the co-operative society level with little regard for quality. The average price system used by co-operatives therefore encourages and perpetuates severe adverse selection and moral hazard problems. Secondly, the high coffee differentiation and its high correlation with pricing indicates that the exchange of property rights is potentially more suited for vertically integrated channels rather than spot markets that do not take coffee differentiation and pricing patterns into account.

Table 5.10 Coffee realisation per quality class and % differences in price in Kenya for Selected years

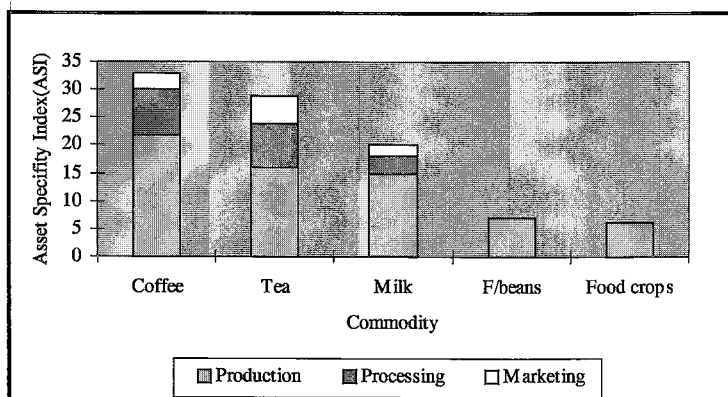
Quality class	1993/94	1995/96	1998/99
	US \$ per Kg of clean coffee		
Premium classes			
1	4.26	2.85	-
2	3.86	2.80	3.37
3	3.72	2.70	3.09
Mean (A)	3.95	2.78	3.23
Medium classes			
4	3.52	2.65	2.78
5	3.42	2.55	2.23
6	3.06	2.10	1.74
Mean (B)	3.33 (15.7%)	2.42 (12.6%)	2.25 (30.3%)
Poor classes			
7	2.76	1.70	1.32
8	3.31	1.15	0.91
9	2.06	0.80	0.60
10	1.61	0.55	0.37
Mean (C)	2.19 (44.5%)	1.05 (62.2%)	0.8 (75.2%)

Figures in parenthesis indicate % mean difference from mean (A)

Source: Coffee Board of Kenya market reports

Among five commodities, coffee and tea have high asset specificity that is idiosyncratic mainly associated with investments at production, processing and marketing level. This is as compared to milk which has medium asset specificity while French beans and food crops are associated with low asset specificity (Figure 5.7). Due to their perennial nature, coffee and tea farmers have to invest substantial amounts in establishment of these crops. They also need to have shares in co-operative societies and tea processing factories that process their produce. Most co-operative societies and tea processing factories also own shares in secondary processing and marketing agencies that are held in trust for the smallholder farmers. These vertically integrated activities make coffee and tea farmers to have relatively higher asset specificity and idiosyncratic investments as compared to producers of other commodities. Figure 5.7 gives the estimated relative indications of the magnitude and the components of the asset specificity index (ASI) in each commodity system as defined in section 2.3.3.

under classes 4 to 6 while classes 7 to 10 are considered as poor quality. Grading is based on bean size, colour and other physical characteristics of the bean. Classification is based on liquor attributes of taste, acidity and body of the liquor.



The ASI is based on an index of 60 points, 20 points each for production, processing and marketing.

Source: Authors estimation based on factors in Table 2.1 (section 2.3.3)

Figure 5.7 Estimated asset specificity at production, processing and marketing stages across the commodity systems

The expected types of contracts for each commodity system from a transaction costs perspective is shown in Table 5.11. Coffee and tea transactions are expected to be conducted within long term vertically integrated type of contracts that minimises risks associated with their high and idiosyncratic asset specificity, product differentiation and perishability. These types of contracts are also expected to ensure continuity in trade relationships. Milk trade is expected to be conducted within long term contracts which might not necessarily be vertically integrated to cover for the risks associated with milk perishability and a medium level of asset specificity. The French beans and food crops seem ideally suited for short-term, relational contracts and even spot markets as they have low risk levels and occasional trading patterns. In most of the commodity systems, the contracts are also expected to be inter-linked to inputs and other services.

These expectations in terms of contracts types have changed with market reforms despite little changes with regard to product characteristics, transaction frequency and asset specificity. Table 5.11 indicates the forms of contracts by which different commodities are transacted in the study region. The situation before reforms is compared to the post reform period. Major changes in types of contracts have been witnessed in coffee, tea and milk commodity systems. Food crops contracts have remained at the spot market level while the French beans contracts have been dominated by spot markets as was the case before liberalisation.

Table 5.11 Expected types of contracts as compared to existing trade contracts before and after market liberalisation

Commodity	Expected type of contract	Pre-reform types of contracts	Post-reform types of contracts
Coffee	<ul style="list-style-type: none"> • long-term vertically integrated and inter-linked 	<ul style="list-style-type: none"> • long-term vertically integrated and inter-linked 	<ul style="list-style-type: none"> • Long-term vertically integrated with few interlinkages [D] • Spot market
Tea	<ul style="list-style-type: none"> • long-term vertically integrated and inter-linked 	<ul style="list-style-type: none"> • long-term -vertically integrated and inter-linked 	<ul style="list-style-type: none"> • Long-term vertically integrated and inter-linked[D] • Spot market
Milk	<ul style="list-style-type: none"> • Long-term and inter-linked 	<ul style="list-style-type: none"> • Long-term vertically integrated and inter-linked [D] • short-term • Transaction specific 	<ul style="list-style-type: none"> • Short-term with no interlinkages [D] • Spot market [D] • Long-term vertically integrated with few interlinkages[M]
Horticulture(French beans)	<ul style="list-style-type: none"> • Short-term • Spot market • Transaction specific 	<ul style="list-style-type: none"> • Short-term • spot market 	<ul style="list-style-type: none"> • Spot markets [D] • short-term contracts[M]
Food crops (maize and beans)	<ul style="list-style-type: none"> • Spot market 	<ul style="list-style-type: none"> • Spot markets 	<ul style="list-style-type: none"> • Spot market

[D] -dominant contract form; [M] minor contract form

Source: Author compilation

The emerging spot market contractual arrangement across all commodities, and especially in tea and coffee, may be a manifestation of the dissatisfaction the smallholder farmers have on the otherwise potentially more efficient vertically integrated mode of organising trade. The dissatisfaction originates primarily from the high transaction costs associated with the vertically integrated marketing system. Limited development in suitable rural financial markets to cater for consumption smoothing also compels most smallholder farmers to result to spot markets in their effort to ease their cash flow constraints. Furthermore, the information asymmetries that prevails in the vertically integrated markets have the double effects of making farmers believe that they are being exploited, while at the same time enabling traders in the spot market to capitalise on the situation. Equally, the decline in interlinkages of trade contracts with input supply have in some cases increased transaction costs to both the traders and the farmers by increasing the searching costs. Inter-linkages in product and input contracts may also provide significant economies of scope in monitoring of trade partners. These economies have also been severely eroded by the low preference of inter-linked contracts. Furthermore, the farmers have lost the principle benefit of interlinkage - access to seasonal credit- that was being offered by co-operatives.

5.5.2 *Smallholder farmers' share of consumer prices*

The smallholder farmers' share (margin) of the price paid by the consumers across the four commodities before and after reforms are shown in Table 5.12. Among the food crops, maize producers receive the highest share of the price paid by consumers. This may be due to the fact that the whole grain maize trade involves little or no processing. The maize producer share increased slightly after market reforms from 73% in 1985 to 75% in 1998, thereby indicating marginal gains in marketing efficiency. By contrast, the milk producer share that averaged 50% before market reforms, decreased to around 42% by 1998. As the milk prices used in arriving

at the producer share are those prevailing in the formal marketing channel dominated by KCC, the reduction in producer share can only indicate deterioration of the efficiency of formal marketing channel after market reforms. This observation could help to explain why most farmers shun the formal channel in preference of the informal channel that has a higher margin. Equally, the low and declining producer margin before and after reforms indicates that milk processing and distribution - which takes the bulk of the price paid by consumer - is steeped with high costs, and may be an indication of inefficiency. Furthermore, due to its perishable nature, milk markets are highly dependent on road infrastructure, which as indicated earlier, has deteriorated in recent years. This may have increased transport costs which eventually increases the price wedge between consumers and producers.

Table 5.12 Producer share as a percentage of consumer or f.o.b. price across commodities for selected years

Year	Milk*	Maize	Coffee	Tea
1985	52	73	46	58
1990	50	73	58	84
1993	43	72	64	73
1996	44	76	67	70
1998	42	75	63	69

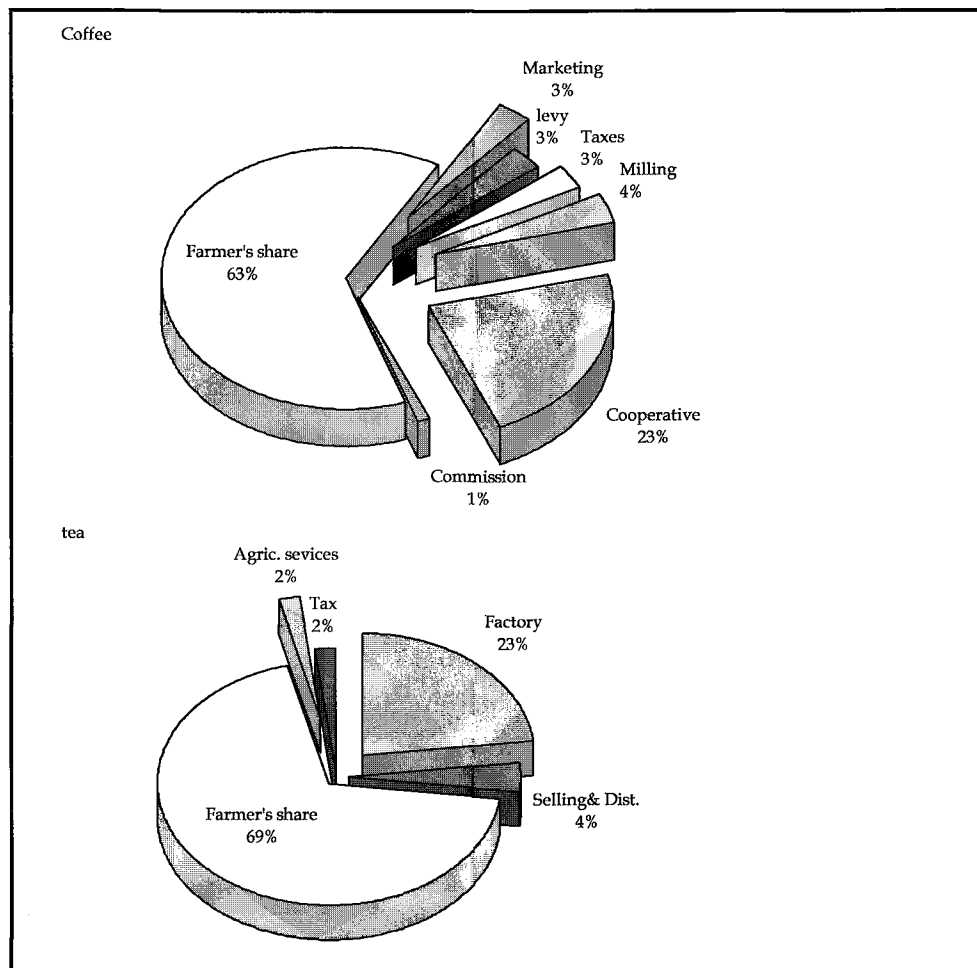
* Milk marketed through the co-operative channel

Source: Compiled by author

Among the export crops, the producer margins have increased after the market reforms with the coffee producer margin increasing by ten percentage points (Table 5.12 and Appendix 5.7). The same trend is repeated in tea with the producer margin increasing from 58% in 1985 to an average of 72% after market reforms as shown in Table 5.12. The increase in tea and coffee producer margins could be attributed to the changes in taxation. Prior to 1989, coffee and tea exports used to attract an export duty, which in 1985 was around 12% of export value. The duty was replaced in 1992 by a presumptive income tax that was originally pegged at 5%, but latter reduced to 2% in 1998. However, a further examination of the margins along coffee and tea marketing chains indicates that at the primary processing stage (dominated by coffee co-operatives and tea factories) the margins remain inordinately high⁴³ averaging 24% as shown in Figure 5.8. This could explain in a way why farmers are shunning these formal marketing channels in favour of the informal channels.

The trends in producer margins generally indicate that there have been marginal improvements during the reform period. Nevertheless, where such improvements have occurred they can be attributed to tax reform rather than reduction in transaction costs. Indeed most of the commodity systems are steeped by high transaction costs in processing and distribution as the cases of milk, coffee and tea margins clearly illustrates.

⁴³ The government guidelines based on the various efficiency studies in the two sub-sectors indicates that processing and other overhead costs should not exceed 15%.



Source: Compiled by Author

Figure 5.8 Distribution of coffee and tea trade margins among different agents, 1998

5.6 Conclusions

Through the use of the NIE approach and the exchange configurations analytical framework, the present study evaluates the characteristics of commodities traded, the actors involved and the institutional environment in which smallholder produce and exchange their goods and services. Results in this chapter show that during the market reform period, there have been major institutional changes in the environment in which smallholder farmers undertake their production and marketing activities. The decline in levels and share of public agricultural expenditure in Kenya has limited smallholder farmer access to agricultural production services especially in areas of technology development and its dissemination. The poor delivery of agricultural extension services in the study region especially by the government, therefore, means that smallholder farmers in the region have limited access to new production technologies. The on-going government rationalisation and down-sizing of Ministry of Agriculture (MoA) extension staff will also mean that farmers and their organisations will not

only incur higher extension costs but will also have to brace themselves for new institutional arrangements in agricultural information delivery. The anticipated private participation in the provision of these services seems not to have occurred. However, the study results indicate that the privatisation of livestock services (veterinary and artificial insemination), which have a lower level of public good component, has attracted a higher private sector participation.

The study also concludes that smallholder farmers in the study region had not only poor access to market information, but also that the available information is asymmetrical. As the degree of bounded rationality depend, *inter alia*, on levels of education and availability of market information, the indications are that smallholder farmers in the study region are bound to be disadvantaged in their production and marketing decisions by the prevailing information asymmetries. Furthermore, the prevailing information asymmetries can lead to development of opportunistic trading practices that can retard smallholder agricultural development. The study also showed that the farmers are not well served with access roads, a factor that increased their transport and information costs.

The factor markets are also shown to be in various stages of development and may in most cases impede smallholder agricultural development. Market reforms are further shown to have created a major agricultural credit squeeze that has particularly affected smallholder producers. This is shown to be particularly the case for the Agricultural Finance Corporation (AFC) which is the main agricultural credit organisation. Rural financial intermediaries in form of producer co-operatives and SACCOs were also adversely affected by market reforms thereby reducing their role as sources of formal credit of smallholder farmers.

Despite the revelation that most smallholder farmers in the study region had individual land titles, and also the high land pressure, the analysis indicates that the land markets are very thin. The low incidence of land collateralised formal credit in the region also indicates in a way that land titling has been not a sufficient condition for increased access to formal credit. The institutional arrangements in factor markets have therefore led to labour intensive production systems with reduced use of purchased inputs.

The analysis of the market actors through their market co-ordination and control roles indicates that market reforms have been associated with a general reduction of vertical co-ordination of the commodity markets. This may have created asymmetric information problems as the producers are not well linked with the various exchange configurations and more importantly to the ultimate consumers. However, although there are inter-commodity differences, the results indicate that smallholder farmers are gaining more control in production aspects, a case that is not repeated upstream in the various marketing institutions. This decreasing farmers' control on marketing functions may impact negatively on strategic decision making and the farmers' influence on pricing. Equally, institutional governance issues persist especially for the tea, coffee and dairy commodity systems and may be related to the decline in farmers marketing functions control and reduction in vertical co-ordination.

Evaluation of trade contracts before and after reforms resulted into the conclusion that the long-term vertically integrated types of contracts prevalent among most commodity systems are progressively been replaced by short-term relational contracts and spot market contracts. This is despite the indication from the study that long-term vertically integrated contracts are potentially more efficient mode of organising trade in smallholder, coffee, tea and to some extent the milk commodity systems. The emerging spot markets, especially in coffee and tea trades, are likely to have minimal long and medium term benefits to smallholder farmers given the product characteristics and asset specificity.

Lastly, the study results indicate that although it is difficult to compare the efficiency of the four commodity systems studied, it is however clear that there have been minimal if any improvements in efficiency based on the trends in producer share after market reforms. This situation is attributed to high transaction costs in processing, distribution and transport that have not been clearly targeted by the market reforms implemented so far.

CHAPTER 6

PRODUCTIVITY OF SMALLHOLDER FARMS UNDER CREDIT AND LAND CONSTRAINTS

6.1 Introduction

The evidence adduced in Chapter five indicates, *inter alia*, that institutional changes arising from market reforms in Kenya have induced a significant contraction of agricultural credit from formal institutions. This credit contraction has mainly affected smallholder farmers. Equally, agricultural production in the study region is also shown to take place under severe land constraints with poorly developed land markets. This chapter analyses the factors that determine household's demand for credit and land as well as farm productivity in the Central Kenya region within a liberalised market regime.

Economic theory suggests that farmers facing binding capital constraints would tend to use lower levels of inputs in their production activities as compared to those not constrained (Feder *et al.*, 1989; Bell, 1993). Improved access to credit can therefore facilitate optimal input use with a major impact on productivity. The productivity gains arising from enhanced availability of farm credit can be expected to be more pronounced in situations where land constraints necessitates intensified production systems that require continued and substantial use of external non-factor inputs.

Market liberalisation policies implemented in Kenya in the last decade have had both positive and negative impacts on the livelihood strategies of rural farm households. On the positive side, the contraction of state and parastatal control in agricultural production and marketing has greatly expanded opportunities for smallholder farmers mainly with regard to economic enterprises. The expanded opportunities have been witnessed in most Sub-Saharan Africa states that have embraced market reform policies. For instance, in a participatory study done in a cross section of Tanzanian villages, the villagers regarded the increased options for non-farm income generation as the single most significant change in their lives arising from the market reform policies (Booth *et al.*, 1993). A casual observation in rural Kenya leads one to the same conclusion as more and more farm households are engaging in off-farm activities mainly in form of micro-business ventures. The on-farm enterprise mix is also in a dynamic flux as resources are allocated to new enterprises, while some traditional farm enterprises are abandoned all together.

On the negative side, market liberalisation has been associated with higher market risks and uncertainties mainly arising from price risks as well as risks associated with uncertainties in the emerging institutional framework. Confronted with these risks and uncertainties, the risk averse farm households have adopted *ex ante* risk management strategies through income diversification measures, apart from engaging in *ex-post* risk coping strategies. Income diversification strategy is achieved through a choice of an enterprise portfolio (both on and off-farm) that has low covariant risks between its components. As expected, on-farm production and agricultural labour wage exhibit high correlation between risks associated with alternative income streams, thus offering limited risk protection to smallholder farmers. By contrast, diversification into non-farm income sources can lead to low risk correlation between income sources.

The need to take up new opportunities while minimising the risks arising from market reform policies have led most farm households to review their enterprise portfolios and the way they allocate resources to the chosen enterprises. Some households have been able to take up the opportunities opened up by market liberalisation while other have not. Studies across most

developing countries that had implemented SAPs, indicate that a big proportion of rural households, and especially the very poor, have indeed lost in welfare terms despite the new opportunities (Medelay, 1999). Major concerns have been raised about the erosion of food security and escalation of poverty levels in rural farm households. The cause of these differences in responses to the opportunities arising from market reforms across farm households is an important developmental issue, that need to be addressed in the formulation of agricultural development and poverty alleviation policies.

From a theoretical point of view, a number of factors, both endogenous and exogenous to the households, can be expected to influence their resource allocation decisions and hence their incomes. The household resource endowment, its demographic characteristics and the conditions of the physical, social and economic environment are expected to be prime conditions determining the resource allocation behaviour and household incomes. As postulated in the conceptual framework of this study (section 2.2), farm household decision making will be particularly influenced by each household's food trading condition, level of transaction costs and liquidity constraints. Thus, access to credit is a critical factor that can affect household's resource allocation and investment behaviour, which in turn affects their risk bearing ability and incomes.

Farm households in many developing countries have to cope not only with poverty but also with variable incomes in any one period. In most of these countries, rural insurance markets are totally lacking or incomplete, which makes saving and credit transactions to assume a special role of allowing households to smooth their consumption streams in the face of the random income streams. Thus, access to credit allows farm households to satisfy their cash needs induced by the agricultural production cycle and consumption requirements. In the absence of credit markets, farmers would have to maintain cash reserves or near liquid assets to facilitate production and consumption.

As Singh, Squire & Strauss (1986) have shown, when a producer has unlimited access to liquidity, production decisions will be independent of consumption decisions. However, due to asymmetric information and adverse selection prevalent in most rural credit markets, farmers are confronted with credit rationing that impinges upon their optimal behaviour (Carter, 1988). When credit is rationed, some borrowers cannot obtain the amount of credit they desire despite the level of interest rates. In such circumstances, liquidity can become a binding constraint in many farmers' operations. This leads to sub-optimal use of farm inputs. The marginal contribution of credit is therefore to bring input use closer to the optimal level thereby increasing output (Feder *et al.*, 1989).

In the context of agricultural policy, an important issue arising from the above arguments, is the magnitude of expected productivity gains arising from access to credit. The productivity gains from credit can be expected to differ between liquidity-constrained and non-constrained farm households as shown by Feder *et al* (1990) in Chinese agricultural settings. Carter & Weibe (1990) in an analysis of the productivity of smallholder farms in Kenya, indicated that despite the farmers' access to cheap labour, the potential of increasing small farms productivity was eventually overwhelmed by countervailing capital constraints. In a more recent study on smallholder dairy farms in East African highlands, Freeman *et al* (1998) also concluded that credit was likely to facilitate investments in cross-bred dairy cows by credit-constrained farms leading to a substantial increase in dairy productivity. It is therefore apparent that improved access to credit may have a significant impact on smallholder farmer's productivity.

Credit constraints also have an added effect of shaping production strategies by conditioning enterprise choices and subsequent allocation of household resources. The desire of risk-averse farm households to stabilise consumption in the face of uncertain income streams may lead to a situation where enterprises with a greater food security are chosen and allocated a bigger share of available resources. Thus, faced by consumption credit constraints, cash-flow

problems and volatility of food prices, a farm household may tend to adopt a safety-first kind of resource allocation behaviour. The household may also opt to diversify income sources as a risk management strategy.

The incentive for *ex ante* risk-reducing strategies such as diversification, can be lowered with the availability of effective mechanisms for dealing with these uncertainties *ex post*. Availability of credit, liquidation of assets, participation in labour markets and temporary migration serves as good examples of such *ex post* risk coping strategies. Even if labour and input credit is available across households, their enterprise choices and optimal resource allocation may differ depending on the availability of consumption credit.

Despite the evidence from the above-enumerated studies, which clearly verifies the importance of credit on farm productivity, there is nonetheless little empirical evidence on the simultaneous effects of credit and land constraints on farm productivity. This is despite a common observation in most farming environments that depicts a systematic inverse relationship between farm productivity as measured by physical yields and the size of farm holding (Feder, 1985; Barrett, 1996). The high land pressure in the study region coupled with rapid population growth as well as environmental sustainability concerns, precludes smallholder agricultural development strategy based on land expansion. Thus, intensification of production and commodity (enterprise) substitution remains the only viable option for agricultural growth. Intensification in small farm sizes requires widespread use of appropriate agricultural technologies that requires to be financed. Although, farmers can use and do use their savings to finance their farm operations, the low farm productivity, unemployment, high dependency ratios, cash-flow constraints as well as high cost of social services⁴⁴ such as education and health occasioned by market reforms severely limits their self-financing capacity. From a policy perspective, understanding how credit and land constraints interact to determine farm productivity can be of major importance. This cannot only aid in the formulation of effective credit policies but can also serve to illustrate the gains that such policies can achieve by enhancing complementarity between land and credit markets in rural areas.

It is in view of these considerations that this study hypothesised that, in a land constrained production system taken to be prevalent in Central Kenya region, smallholder farm productivity will significantly differ among credit constrained and non-constrained households. *A priori* expectation being that farmers faced by simultaneous credit and land constraints will have lower farm productivity regardless of the availability of labour. Secondly, the farmers' production strategies in terms of resource allocation will also vary depending on the land and credit constraints. As such resource allocation between cash crops such as tea and coffee, food crops, horticultural crops, dairy and participation in off-farm income generating activities will depend mainly on the prevailing land and credit constraints. To test for the above hypothesis a bivariate probit selectivity regression model is applied as detailed in section 2.3.4. The model distinguishes between credit and land constrained and non-constrained households that are used as the selection criteria.

Apart from this section, this chapter is organised into four sections. Section 6.2 describes the data and variables used in the analysis. Sections 6.3 and 6.4 details the results of the

⁴⁴ Economic reforms in the health sector included introduction of cost-sharing policy in 1989 where patients attending government health facilities pay a nominal fee. By 1996/97 the cost-sharing revenues amounted to Ksh 391 million or 15% of non-recurrent expenditures for the ministry of health. The figure was estimated to increase to 25% in 1999/2000 (Kimuyu eds., 1999). Equally, in 1988 the government withdrew financial support for teaching and learning materials in primary and secondary schools and introduced cost sharing in the education sector. Parents therefore meet the cost of textbooks and other learning materials while being responsible in putting up physical facilities including classrooms and workshops. Also fees payments have also been introduced at colleges and universities. As a result the cost of these services especially education have increased by more than ten times during the last decade.

analysis on factors affecting the households' constraint (land and credit) conditions and farm productivity, respectively. The final section draws inferences and conclusions from the results.

6.2 Data description and model estimation considerations

As detailed in section 2.3.4, the approach adopted in this study recognises that a disequilibrium exists in household's demand and supply of both credit and land. Thus, each household's land and credit demand and supply conditions are used as the first selection criteria in estimating a household selectivity model. The first-stage probit analysis involves joint estimation of the factors that determine smallholder farmer's credit and land demand. Nevertheless, the analysis takes recognition of the fact that there are differences in factors determining household's demand for land and credit. Credit demand is taken to be mainly related to each household's income level, savings, need for working capital as well as consumption patterns, whereas demand for land is taken to be mainly related to labour supply factors and the demand placed by the adopted on-farm enterprises.

The second stage analysis, that is closely related to the first, determines the effects of household's land and credit demand conditions on farm productivity. This is done through the use of separate regression equations to model the production behaviour of the farmers conditional on the selection criteria, i.e. whether the farmer is credit or land constrained. Households with low productivity may have more reason to indicate a higher demand for credit and land as compared to the more productive ones. This may create a possibility of endogenous credit and land demand dummy variables. However, as indicated in section 2.3.4, the Heckman procedure, that is applied in this second stage analysis, is hoped to adjust the estimates to take care of the endogenous constraint variables.

The household data used to estimate the bivariate selectivity model was collected through a household survey as described in section 2.4. The dependent variables in the first stage bivariate probit model are the farmers' credit and land constraint conditions. The credit (*Cr*) and Land (*L*) constraint variables take a value of 1 if a farmer is credit or land constrained, respectively and 0 otherwise. As also earlier defined in section 2.3.4, the constraints refer to household's responses to their situation with regard to credit and land demand conditions. Table 6.1 shows the distribution of the households in relation to their credit and land constraints.

Table 6.1 The distribution of households according to their land and credit demand conditions

Land and credit demand condition	Number of households	% of total sample (n=200)
Land and credit constrained (L=1, Cr=1)	80	40.0
Land constrained and no credit constrain (L=1, Cr=0)	21	10.5
Land non-constrained and credit constrained (L=0, Cr=1)	86	43.0
No land or credit constraint (L=0, Cr=0)	13	6.5
Total		
Land constrained (L=1)	101	50.5
Credit constrained (Cr=1)	166	83.0

Source: Household survey, 1999.

Among the total sample of 200 households, 13 (6.5%) of them are neither credit nor land constrained while another 21 (10.5%) are land constrained but not credit constrained. Eighty-six (43%) of the households are land non-constrained but credit constrained while the land and credit constrained households are 80 (40%). In total, 83% of the households are credit constrained while 50.5% are land constrained (Table 6.1). This indicates that credit constraints are more severe as compared to land constraints. These credit demand conditions corresponds to the results reported in section 5.3 that indicate significant contraction in credit supply mainly as a result of market reforms.

Table 6.2 shows the description of the variables used in the analysis and the descriptive statistics for the continuous variables. The household characteristics constitute the first set of independent variables. They include age, sex and education level of household head. The household resource endowment is represented by farm size and available family labour (related to household size). Where applicable, each households' land holding is adjusted for hired and leased land to arrive at the farm size. The total available family labour is based on the number of adults and children in each household and the number of hours spent by each member in the farm. To allow for differences in labour output across sex and age, females and children labour is weighted by a factor of 0.8 and 0.5, respectively. Direct estimation of labour spent on domestic and social activities is attempted but proved to be unreliable. As such, the available male and female labour is further weighted by a factor of 0.75 and 0.6, respectively to cater for these activities. The lower weighting of female labour is meant to account for the high labour demands for domestic activities.

Due to the need to analyse the effects of household resource allocation behaviour on their land constraint condition, the proportions of land allocated to food crops (maize and beans), perennial crops (coffee and tea) and horticultural crops is also included as independent variables. Land allocated to perennial crops is fixed both in the short and medium term, and can therefore be expected to increase household's land demand. The number of dairy animals per household is also included as a variable related to household resource allocation behaviour.

The household's off-farm income, expenditure patterns and credit availability are the main economic independent variables. Off-farm income from wages, salaries, remittances and trade is applied in both the land and credit models. The argument is that higher off-farm income can induce lower demand for credit by complementing farm incomes thereby offering households the much needed cash to finance farm inputs and consumption. Equally, engagement in off-farm income generating activities can reduce the demand for land as households have less labour dedicated to on-farm production.

Table 6.2 Description and descriptive statistics of the continuous variables.

Variable Code	Description	Mean	STD deviation
Dependent variables			
Cr	Household credit constraint condition, 1 for constrained households, 0 otherwise	0.83	-
L	Household land constraint condition, 1 for constrained households, 0 otherwise	0.53	-
Q	Value of total farm production (Ksh)	261,888	599,806
Independent variables			
1. Household characteristics			
SEX	sex of household head (hh), 1 if female, 2 if male	1.79	0.41
AGE	Age of household head (years)	59.40	14.05
EDU	Formal education level for hh, 1 = no formal education...,5 = college education	3.00	1.11
2. Household resources			
FSIZE	Farm size in acres	9.51	11.04
FLABOR	Total available family labour (MD*/ year)	5,445	3,004
3. Farm enterprises			
FOOD	% of farm allocated to food crops	20.31	16.37
CT	% of farm allocated to coffee and tea (perennials crops)	40.62	25.66
HORT	% of farm allocated to horticultural crops	2.95	5.13
COWS	Number of mature dairy animals	2.49	2.77
ENTERP	Number of farm enterprises (crop and livestock)	4.78	1.12
4. Household credit and expenditure			
CREDIT	Total available credit from all sources in 1999 (Ksh)	7,823	28,712
EXPVC	Total farm expenditure on purchased inputs (Ksh/year)	81,045	194,366
EXPDOM	Domestic expenditure (Ksh/year)	43,796	52,471
EXPSCFE	Total School fees expenditure per year (Ksh)	27,881	57,783
HIRED	Total hired labour (casual and permanent)- MD/year	1,506	2,075
5. Institutional factors			
EXT	Number of extension contacts per year	0.80	1.97
LMARKET	Household participation in land market, 1 for participants and 0, otherwise	0.12	-
FMARKET	Household participation in food market, 1 for participants, 0 otherwise	0.75	-
INFRAS	Distance to the nearest market X type of road (index)	-	-
COOP	Household marketing coffee through co-operatives, 1 for members, 0 otherwise	0.60	-
SACCO	Household membership to a credit saving co-operative society, 1 for members, 0 otherwise.	0.23	-
6. Location			
DISTRICTS	Truncated variable for district	-	-

* MD = Man Days equivalent to 8 working hours

Source: Household survey, 1999/2000

To incorporate the effects of expenditure levels on the demand for credit, the household's expenditure on purchased farm inputs, hired labour, domestic consumption (food and other consumable domestic items) and school fees are applied as independent variables in the credit constraint model. The domestic and school fees expenditures are considered special items as they normally take precedence over the other household expenditure items. As shown in Table 6.2 these two expenditure items take a major proportion (50%) of household's expenditures. Furthermore, as school fees are usually paid in three instalments in a year it tends to create major cash-flow constraints to households unlike domestic expenditure which is spread throughout the year. The amount of credit borrowed from all the available sources (co-

operatives, social groups, and banks) is also entered the credit model as an independent variable. As indicated earlier in section 5.3, most of the credit advanced to households is of short-term nature with a credit period of six to eight months (one season). In special cases where credit was advanced for a period longer than one year or less than six months, an adjustment is made to reflect the credit due in a year.

Several institutional factors are also used as independent variables in the land and credit constraint models. These include, household participation in the land and food markets, access to extension services, membership to a SACCO, access to a tarmac road and household membership to a coffee co-operative society. A household is considered as a land market participant if it has sold/purchased or hired/leased land in 1999 or in the preceding five year period. Equally, a household is considered a food market participant if it had purchased or sold maize (in all its forms) in 1999. Data from the household survey indicates that all those households selling maize are also buyers while the rest are non-participants. Finally, the district dummy is used to control for location effects.

The dependent variable in the second stage estimation of the selectivity model is the logarithm of the total value of farm production. Due to the multi-product nature of the farm households in the study region, the value of farm production is an aggregation of coffee, tea, dairy and horticultural crops production in the 1999 production year. The production is valued using the farm gate prices at the time of the household survey. Coffee, tea and French beans are produced entirely as cash crops and hence their farm gate prices are determined by the market forces. Equally, as most households in the study region are net milk sellers, the farm gate milk sales price that averaged Ksh 15 per litre in 1999 is used to value the milk produced per household.

With regard to maize the average price between selling and buying price is used to value production. As indicated earlier all those households selling maize are also buyers, albeit with a time difference. According to the survey results, the average price band between maize sales and purchase price is 15%, although the band tended to differ across households depending on the timing of sales and purchases. This indicates that averaging both sales and buying prices could give a close approximation of the household's decision prices rather than use of either price. The results also indicate that 75% of the households are food market participants. This result implies that 25% of the households have endogenous maize prices, as they are non-market participants. Nevertheless, no attempt is made in this study to estimate these endogenous prices. The assumption is that the endogeneity of a proportion of maize prices could not bias the estimates of the whole analysis as maize only formed as small proportion of the whole farm production. Furthermore, as shown by Janvry & Sadoulet (1994), the decision (shadow) price for self-sufficient household faced with credit and land constraints falls within the selling and buying prices of the food commodity in question. This is taken to be the case for the endogenous price for the maize self-sufficient households.

In the second stage analysis, all continuous explanatory variables are also expressed in logs. Logarithmic expression is meant to provide a dimension-less measures of responsiveness of farm production to changes in the considered variables. Since the coefficients of the regression equations are estimates of the partial farm production elasticity, then the larger the coefficients the higher the response of farm production to marginal changes to the respective variables, the vice-versa, being true.

The independent variables representing the household characteristics are identical to those used in the first stage bivariate probit estimation. On a *priori* basis, no clear-cut sign could be assigned to the household characteristics of age and sex. However, the expectation is that the educational level of household head could have a positive impact on the farm productivity.

The household endowment factors and expenditure patterns as represented by farm size, amount of family labour, total expenditure on variable inputs and credit available are applied in

estimating the productivity model. The *a priori* expectations are that these factors would have a positive influence on farm production. The household resource allocation behaviour is captured by the proportions of land allocated to perennials (coffee and tea) and food crops. The number of dairy animals is also included as an independent variable. The expectations are that the higher the proportion of land allocated to the high-value crops such as tea and coffee as well as dairy, the higher the farm productivity, the vice-versa being expected in relation to land allocated to food crops. Equally, the total number of farm enterprises is used as independent variable as a proxy for farm diversity, that in turn indicates the level of risk aversion. The expectations are that the higher the number of farm enterprises (diversity) the lower the farm productivity.

The institutional factors included in the production model are the household participation in food markets, the number of extension contracts per year and access to all weather road. As in the first stage probit model the household are categorised across districts and whether households marketed their coffee through a co-operative society or not.

The second stage regression does not include independent variables specifically related to the credit or land constraint models. These include membership to a SACCO, household participation in land market and expenditure on domestic and school fees. The maintained hypothesis is that these variables are unlikely to directly influence the level of farm output. Additionally, the exclusion of these variables served to identify the production model as shown by Maddala, (1983).

6.3 Estimates of factors affecting households land and credit demand (constraints) conditions

Table 6.3 shows the results of the full information maximum likelihood (FIML) estimates of the bivariate probit equations. The goodness of fit measures indicate that the estimated models fit the data reasonably well. The models correctly predict the household's credit and land constraints condition for 86% and 94% of the observations, respectively (Table 6.3). Of particular interest is also the fact that the estimated $\rho(\rho)$ is significantly different from zero, thereby indicating the suitability of the bivariate model estimates in constructing the selectivity term for consequent use in the second state regression.

Table 6.3 Bivariate probit model estimates for household's land and credit constraint conditions

Variable	FIML Bivariate Probit Estimates			
	Land constraint condition		Credit Constraint Condition	
	(n=200)		(n= 200)	
	Coefficient	Std. Error	Coefficient	Std. Error
CONSTANT	0.758	0.966*	1.079	1.281
AGE	-0.016	0.008*	0.003	0.012
SEX	0.061	0.268		
EDU	-0.108	0.109	-0.202	0.193
FSIZE	-0.077	0.028*	-0.008	0.033
CT	-0.085	0.477	0.235	0.765
FOOD	-1.314	0.768*	0.257	0.139
HORT	-0.296	2.262	-	-
COWS	0.053	0.051	0.021	0.097
FLABOR	0.004	0.005	-	-
HIRED	-0.009	0.008	-	-
OFFINCOME	0.111 x10 ⁻⁵	0.102 x10 ⁻⁵	0.320 x10 ⁻⁵	0.401 x 10 ⁻⁴
LMARKET	0.206	0.207	-	-
FOODM	0.624	0.254*	-1.181	0.621*
EXT	-0.101	0.061*	-	-
CREDIT	-	-	-0.345 x 10 ⁻⁴	0.128 x 10 ^{-4*}
SACCO	-	-	-0.945	0.411*
EXPVC	-	-	0.458 x 10 ⁻⁶	0.46 x 10 ⁻⁵
EXPDOM	-	-	-0.128 x 10 ⁻⁵	0.628 x 10 ⁻⁵
EXPSCFE	-	-	0.422 x 10 ⁻⁷	0.293 x 10 ⁻⁶
CO-OP	0.384	0.333	0.645	0.525
DISTRICT	0.484	0.077	0.186	0.211
Rho (1,2)			-0.254	(0.018)
% of correct predictions		86%		94%

* Indicates significance at 10% level or below.

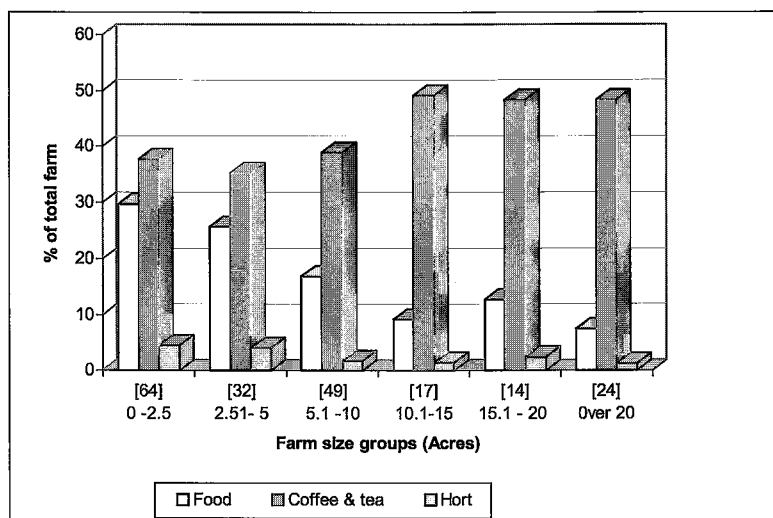
6.3.1 Factors determining household land demand

The age of the household head significantly decreases the household's land demand (Table 6.3). A plausible explanation is that older household heads tend to have larger land holdings unlike the younger heads who acquire smaller land sizes from their parents. Given the prevailing cultural practice of land inheritance where all the sons sub-divide their father's land, this result implies that land demand will grow with time. One of the ways of ameliorating this increase in land demand is to encourage a more vibrant land market. Although the household land market participation variable has the expected positive sign, it did not significantly affect the land constraint. This could be as a result of the low proportion of households that are participating in land markets during the considered period.

The farm size variable had a negative and significant effect on land demand. The variable has the expected theoretical expectation viz. that households with smaller farm sizes are expected to be more land constrained than those with bigger farms. This result reinforces the fact that, as land pressure continues to increase, land demand in the region will continue to increase.

Among the variables indicating household resource allocation decisions, only the proportion of land allocated to food crops had a significant effect on household land demand.

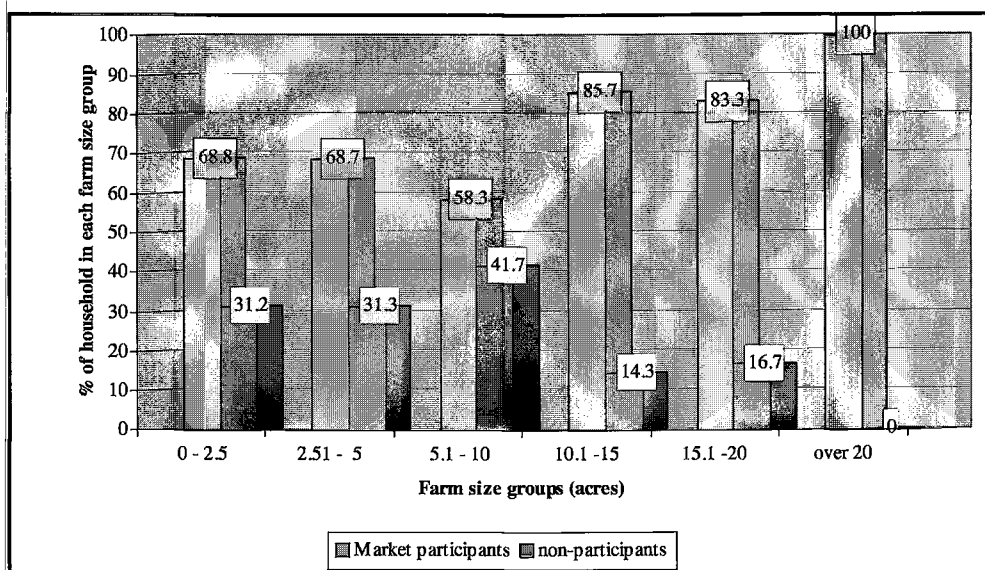
The *a priori* expectations that land allocated to permanent crops could reduce the household's land demand is found not to be the case. As can be seen in Figure 6.1, the proportion of land allocated to food crops decreases from around 30% to less than 10% with an increase in farm size. By contrast, the proportion of land allocated to the high-value perennial crops (coffee and tea) increases with farm size but with little variation among the farm size groups with the proportion allocated being around 40% across all farm sizes. The result is a clear indication that there are differences in resource allocation between the land constrained households and those not constrained, with the former group allocating more of their land to food crops.



Figures in square brackets represent the number of households in each group size
Source: Household survey, 1999/2000

Figure 6.1 Proportion of land (%) allocated to different crops across farm size groups in Central Kenya

The decision to participate in food markets as either a seller or a buyer also significantly increases the land constraint condition. Households that participate in food markets are mainly those with lower land demand (land non-constrained). As shown in Figure 6.2, the households' food market participation increases from 69% to 100% with increase with farm size. This indicates that the land non-constrained households rely more on the market for their food supply, a condition that enables them to allocate less of their land to food crops.



Source : Household survey, 1999

Figure 6.2 Household's level of food (maize) market participation in Central Kenya

According to Janvry & Sadoulet (1994), household's market participation can be determined by price bands that create a wedge between the sale and purchase price. When the price band is very large this can force the household to seek self-sufficiency in food production. This is found to be the case with households with small farm sizes in the study area as shown in Table 6.4. The results presented in Table 6.4 indicates that households with less than 5 acres of land tends to sell their maize early in the harvest season when prices are low and to buy later in the season when prices are high. Consequently, their price band between sale and purchase price is around 30% as compared to households with medium (5 to 20 acres) farms who face a price wedge of around 5%. The households with large farms are also shown to face a price band of around 17% as they tend to sell and buy maize in mid-season when prices are moderate. The differences in timing of market participation and hence the price bands could also be related to investment in storage facilities. Nevertheless, these results indicate that, as the land constraints increase in the future, it will be necessary to review the food marketing policies with a view of reducing the transaction costs in these markets. This will enable the land constrained households to get better access to food from these markets and possibly reallocate more of their land resources currently held by food crops to other more higher valued farm enterprises.

Table 6.4 Household's maize selling, buying prices and the price band

Household type by farm size (acres)	Selling price (Ksh/bag)	Buying price (Ksh/bag)	Price band* (%)
<i>Small</i>			
Less than 2.5	1254	1658	32.0
2.51 to 5	1151	1493	29.7
<i>Medium</i>			
5.1 to 10	1297	1367	5.4
10.1 to 15	1398	1479	5.8
<i>Large</i>			
15.1 to 20	1707	1800	5.4
over 20	1446	1678	17.2
Average	1376	1579	14.8

* Price band = [(selling price – buying price)/selling price]x100

Source: Household survey, 1999.

Among the other household resources, the amount of family labour is positively related to the land constraint condition, although not significantly. From a theoretical perspective, the available labour and particularly family labour can be expected to significantly increase the demand for land. Thus, this result is in line with the theoretical expectations. Nevertheless, the amount of hired labour has a non-significant negative relationship with land constraint condition. As also expected, off-farm income tended to decrease the demand for land although not significantly. This results indicates in a way that enhancement of off-farm income generating opportunities can be used to lower land demand in the region.

The land-constrained households have a more limited access to extension services than those without a land constraint. This may indicate that government extension agents tend to concentrate on the larger farms. Equally, the land-constrained households may also have little motivation to seek extension advice. The categorisation of farmers as co-operative and non co-operative member has no significant relationship with their land constraint condition. The same case applied for categorisation of farmers in terms of their districts. This may be an indication that there is limited locational effect on the sampled household. Overall, the estimates indicate that the probability of a household to be land constrained is mostly related to the size of the farm and the proportion of land allocated to food crops.

6.3.2 Factors determining credit demand

There is no significant relationship between the household's credit demand and the farm size. This is despite evidence elsewhere that indicates that the larger farm sizes tend to attract higher credit due to fixed costs of borrowing that are invariant to credit size (Binswanger & Siller, 1993). The non-significant relationship between the credit constraint condition and farm size in the study region could have arisen due to the low levels of land collateralized credit. As indicated earlier, high transaction costs in land markets as well as bureaucratic and cultural considerations, limit the use of land as credit collateral in the study region. This result therefore confirms the poor complementarity and inter-linkages between land and credit markets.

The proportion of each farm allocated to different enterprises and the number of dairy animals does not significantly affect the credit demand. The theoretical expectation is that activities that generate cash flow throughout the year, such as sale of milk and off-farm

employment, can serve to significantly reduce the credit constraint. Equally, farm enterprises like perennial crops (mainly coffee) which place high demand on credit could enhance the credit constraint. Thus, the positive but non-significant effect of area allocated to tea and coffee on credit constraint (Table 6.4) is counter the theoretical expectations. Results shown in Table 6.4 also indicate that the off-farm income tend to increase the probability of a household being credit constrained. No clear explanation is forthcoming for this unorthodox result, as the expectation is that off-farm income would ease the households credit demand.

The results also indicate that the probability of a household being credit constrained is not influenced significantly by the household head characteristics such as age and sex. However, the level of formal education of the household head has a negative correlation with the credit constraint. This may be an indication that the more formally educated households are able to identify credit sources that in turn reduce their credit constraint. Equally, the more formally educated household heads could be less risk averse than their less educated counterparts, a factor that enabled them to access higher levels of credit.

The amount of credit available per farm as well as farmer's membership to a SACCO, significantly decreases the credit demand condition. The significant relationship between the amount of credit and the household credit constraint condition provides evidence to support the non-ambiguity relationship between household borrowing status and credit constraint. This finding also serves to provide further support to the hypothesis that borrowers and non-borrowers are not homogenous with respect to their demand for credit. Indeed, this observation is consistent with the survey results where 10.2% of credit constraint household are found to be borrowers as compared to 73.5 % of credit non-constrained households who had loans. The average loan size for credit constrained households is Ksh 1,720 as compared to Ksh 37,620 for the non-constrained households. The significant SACCO membership variable on the credit constraint status is interesting from a policy point of view. It not only indicates the pivotal role these rural financial institutions can play in easing credit constraints but also shows that given a conducive environment farm households can be able to mobilise financial resources through savings and investments to ease their credit constraint.

Another closely related result indicates that farmers who market coffee through co-operative societies are less likely to be credit constrained. This is mainly due to the availability of input credit from these co-operatives. The household expenditure patterns in the form of variable inputs and domestic requirements are found not to significantly affect the credit constraint condition. However, expenditure on school fees has a significant effect on the credit constraint condition. The indications is that those households that have school fees obligations tend to have higher unmet credit demands. This may be due to the high demands school fees obligations places on the household incomes thereby compelling them to exhibit a higher demand for credit.

As in the land constraint equation, there is non-significant locational effect on the household credit constraint. This indicates that the perceived credit constraints affect the households equally across the various districts.

6.4 Estimation of factors affecting farm productivity

The two weighed least squares (WLS) estimates of the second stage selectivity regression models for farm output are shown in Table 6.5. Due to limitations in degrees of freedom, reliable model estimates for those households that are neither credit nor land constrained as well as those land constrained but not credit constrained could not be undertaken. Consequently, the model estimates reported in this section refer to households that are either land non-constrained and credit constrained or those that are land and credit constrained.

Among the land and credit constrained households, farm productivity is significantly influenced by the formal education level of the household head, the farm size, the number of dairy animals, amount of family labour, credit available and expenditure on purchased farm inputs as shown in Table 6.5. The number of dairy animals has the highest partial farm production elasticity. This may indicate the importance placed on dairy enterprise as a source of farm income. Furthermore, as zero-grazing is the predominant dairy production system, the results indicate that the land constrained households are using dairy as a production strategy aimed at relaxing the land constraint. Indeed, it is important to note that among the farm enterprises, only the number of dairy animals has a significant effect on farm production with area allocated to coffee and tea and horticultural crops having a positive but non-significant effect on value of farm production. Equally important is the negative and significant coefficient on land allocated to food crops that gives an indication that allocation of land resources to food crops seemed to depress farm productivity.

Among the land non-constrained and credit-constrained households, the number of dairy animals significantly increases the value of farm production. Also significant is land area allocated to coffee and tea, amount of family labour and hired labour. Thus, the relaxation of the land constraint seems to induce some differences in the factors that affect farm production. First, education, which is important in a land constrained condition, lost its importance. This may be due to the fact that the land-constrained households are mainly younger with higher formal education than the non-land constrained households who are mainly older generation of farmers. It therefore seems credible to associate higher farm productivity with higher formal education. This can be important policy intervention point.

Secondly, the size of the farm holdings positively and significantly influences farm productivity for the land and credit constrained household, but not in households where the land constraint is relaxed. Empirical evidence adduced elsewhere indicates a systematic inverse relationship between farm productivity and the farm size except for the smallest farms (Feder, 1985; Barrett, 1996; Benjamin, 1995; Newell & Symons, 1997). As such the positive and significant effect of farm size may appear as counter-intuitive. However, taking cognisance of the credit constraints, the food security concerns (higher land allocation to food crops), the low value of food crops and the high labour to land ratio of small land constrained households then the result can be well understood. As pointed out by Deininger & Binswanger (1999), imperfections in rural markets, such as capital and insurance markets, can severely erode the productivity advantages enjoyed by small farms. Indeed, Lele & Agarwal (1989) indicate that smallholder coffee, tea and tobacco farms in East and Central Africa exhibit lower farm productivity when compared to large farms despite their higher soil fertility. This is mainly attributed to inefficiencies in input markets and the smallholder household's risk taking behaviour. The current result therefore seems to confirm the Lele & Agarwal finding despite the market reforms undertaken in recent years, which should have corrected for these market distortions.

Table 6.5 Weighted Least Squares (WLS) estimated coefficients of the second stage selection model for farm output; Central Kenya region

Variable ¹	Land & credit constrained households (n = 80)	Land non-constrained - Credit constrained households (n = 86)
CONSTANT	8.378 (3.282)*	7.491 (2.656)*
AGE	-0.229(0.509)	0.185(0.430)
SEX	-0.284(0.254)	0.131(0.216)
EDU	0.467(0.255)*	0.043(0.226)
FSIZE	0.228(0.174)*	0.024(0.171)
CT	0.104(1.145)	0.165(0.076)*
FOOD	-0.127(0.019)*	-0.075(0.105)
HORT	0.020(0.055)	0.002(0.064)
COWS	0.480(0.102)*	0.257 (0.064)*
FLABOR	0.297(0.154)*	0.257(0.087)*
HIRED	0.01.0(0.052)	0.109(0.056)*
OFFINCOME	-0.006(0.019)	-0.012(0.019)
CREDIT	0.059(0.036)*	0.012(0.039)
EXPVC	0.182(0.112)*	0.064(0.094)
ENTERP	-0.441(0.555)	0.0304(0.536)
EXT	-0.063(0.119)	-0.027(0.049)
INFRAS	-0.073(0.086)	0.023(0.076)
FOODM	-0.045(0.027)	0.254(0.233)
COOP	0.106(0.334)	0.336(0.326)
DISTRICT	-0.013(0.072)	-0.061(0.067)
Selectivity Term (ζ) ² (a)	-0.066 (0.486)	0.422(0.415)
(b)	0.060(0.530)	0.049(0.629)
Adjusted R ²	63.0	64.6

¹/1- All continuous variables expressed in log

²/2 - Selectivity terms (a) and (b) refers to land and credit constraint conditions, respectively.

* - Statistical significance at 10% or below. Std errors in parenthesis

Thirdly, while the area allocated to food crops significantly affects farm productivity for land constrained households, the same is not the case for land non-constrained households. Instead, the area allocated to high-value perennial crops (coffee and tea) has a significant influence on value of farm production for the land non-constrained households. This result clearly indicates that the two categories of households have different resource allocation strategies that affect their farm productivity. The result also indicates that relaxing the land constraint tends to give households some degrees of freedom to seek internal ways of relaxing the credit constraint. This is especially the case where there is high labour to land ratio, a situation that can allow households to use more labour as a credit constraint relaxing strategy. Furthermore, the significance of land allocated to coffee and tea in enhancing farm productivity indicates that any development policy in the region that encourages promotion of these export crops has to address itself to the land constraints faced by a large proportion of farm households in the region.

Fourth, farm productivity in land constrained households is significantly influenced by availability of credit, which is not the case for land non-constrained households. This results indicates not only the importance of credit, but also the central role credit has to play towards increasing farm productivity, for households facing the land constraint condition. The land-

constrained households farm productivity is also significantly influenced by the value of variable inputs used (Table 6.5). The land non-constrained households may have relied more on extensive production using hired labour and family labour with minimal use of purchased inputs. Indeed, the credit coefficient in the land non-constrained household has a negative sign, giving an indication the available credit is negatively related to production. The other explanation for the non-significant impact of credit in land non-constrained farms is the amount of credit provided is too small to have any tangible impact on productivity.

In both models, the age and sex of household head did not significantly affect farm productivity. Nevertheless, the age and sex of household head seems to enhance productivity in credit constrained households while having a depressing effect in land constrained situation. Results in Table 6.5 also indicate that the area allocated to horticultural crops tended to enhance farm productivity, albeit insignificantly. This may be due to the fact that horticulture farming (mainly French beans) is usually confined to small plots that are intensively cultivated.

The level of off-farm income also tended to insignificantly decrease farm productivity in both land and credit constrained situations. This result indicates the effort and time taken to engage in off-farm activities tends to lower farm productivity despite the income enhancing benefits such activities may confer on households. However, a recent study by Woldehanna (2000) in Ethiopia indicates that off-farm income can be complementary to farm income if farms are borrowing constrained. The study also indicates that expenditure on farm inputs is more dependent on off-farm incomes due to capital markets constraints. Results from Table 6.5 also indicate that expenditure on variable inputs increases farm productivity. This is particularly the case where households faces both land and credit constraints. Furthermore, the result indicates that under credit and land constraints conditions, the partial production elasticity arising from use of inputs is 3 times higher than that of credit. The result therefore tends to indicate that, the effect of off-farm income and credit might have been embodied in the use of purchased inputs.

Equally, the available family labour significantly increases the value of farm production regardless of the constraint situation. In both constraint conditions, family labour has the second highest partial production elasticity after the dairy cows (Table 6.5). Based on these partial labour coefficients and the mean value of farm output indicated in Table 6.2, the shadow value for a unit (manday) of family labour is estimated to be Ksh 14.30 for the land and credit constrained households. For households with no land constraint, their labour shadow price is estimated to be Ksh 12.30, which is 14% lower than for the land constrained households. These labour shadow prices are only 10% of the prevailing nominal wage rate of about Ksh 120 per manday. These results gives two important indications. First, despite the high partial elasticity of farm production arising from use family labour, on-farm labour productivity is low. As such, farm households would be better off engaging in off-farm activities. The second indication is that, relaxing the land constraint offers small marginal gains to family labour productivity. This may be due to the credit constraints that limit the use of external productivity enhancing inputs such as fertilisers. Nevertheless, the result gives the indication that although the opportunity cost of family labour is low, it is nonetheless not equal to zero even an environment characterised by high labour to land ratio.

Among the institutional factors, the *a priori* expectation was that availability of extension services would enhance farm productivity. However, as shown in Table 6.5, availability of extension services tends to decrease farm productivity although not significantly. This result is somehow confirmed by the World Bank report that evaluated agricultural extension impact in Kenya (Gautam, 2000). The report indicates that between 1982 and 1997, crop productivity in the more productive regions in the country (including the study area) may have stagnated or declined. This is despite the consistent focus of extension services on these areas. The study

identifies the stagnation in dissemination of appropriate technologies as one of the main reasons behind the observed trends in productivity.

6.5 Conclusions

An increasing population pressure that is progressively reducing the available land per household confronts small farmers in the study region. They are also faced with market failures and institutional changes that generate binding farm level constraints in land and credit, among others. There is need therefore to evaluate the factors that can alleviate these farm level constraints with a view of increasing farm productivity. These issues are analysed in this chapter using a bivariate selectivity model.

This chapter provides evidence to the effect that the proportion of land allocated to food crops is a major factor that determines household's land demand. This is contrary to a *priori* expectations that the proportion of land allocated to perennial crops (such as coffee and tea) is the main factor determining land demand. The results further show that household's participation in food markets tends to alleviate the land constraint. Furthermore, the results show that the land constrained households face higher price bands in food markets that tends to limit their market participation. It is therefore apparent that policies that address the development of smallholder agriculture in the study region should focus on the issue of food security.

The study also shows that the land demand is also related to the size of the farm, with households having smaller farm sizes being more land constrained than those with larger land sizes. This result shows the development of a more vibrant land market could improve land allocation.

With regard to the households credit demand the study shows that there is an insignificant relationship between the credit constraint condition and the size of the farm. This is contrary to economic theory and empirical evidence from other similar farming situations. This result can be attributed to the low levels of formal credit secured through land collateralisation, despite most households having individualised land ownership in the region. The result therefore emphasises the potential for the development of an efficient land market that is inter-linked with the credit market.

The observed significant and negative relationship between a household credit constraint condition and its membership to a SACCO indicates the pivotal role these rural financial institutions can play in easing the credit constraint. The significant role of SACCOs in alleviating credit constraints also indicates the farm households' ability to save and invest. This indicates that policies to induce dependable saving opportunities through SACCOs and other financial intermediaries would ease the credit constraints. Results from this chapter study also show that some household expenditure items such as school fees are important factors that determine credit demand. This indicates that apart from investment credit, the household credit constraint condition also depends on the availability of consumption credit. As such the development of suitable and effective rural credit policies in the region ought to take into account the households needs for consumption credit.

This chapter also analyses the factors that determine productivity among households facing or not facing a land constraint given the prevailing credit constraint condition. The results indicate that the number of dairy animals significantly increases farm production of both land and land non-constrained households. Results also show that allocation of land resources to food crops tends to depress farm productivity regardless of the household's land constraint condition. However, the proportion of land allocated to food crops significantly depresses the value of farm production in land constrained households, but not in non-

constrained households. As households facing a land constraint condition tend to allocate a bigger proportion of their land to food crops, the results can be interpreted to indicate the need for encouraging households to move away from food crops to dairy and high value export crops that enhance farm productivity. Moreover, the factors that determine farm productivity are shown to differ among households facing land constraint and those not constrained. This indicates that land constraint condition is important in determining household's farm productivity and their resource allocation decisions.

From a policy point of view, the study results indicate that there are various interventions that can be applied to enhance the value of farm production in the study region. The results from the analysis of farm productivity also confirm earlier observations regarding the importance of deliberate policy interventions to address the food security concerns and enhancement of vibrant rural land markets. The latter intervention could go a long way in alleviating the land constraint faced by households in the region, a constraint which is bound to escalate as population pressure increases. For smallholder farmers to increase their farm productivity there is also need to address the imperfections in capital markets. The linking of land markets to capital markets will also allow the smallholder farmers in the study area to access formal credit. Furthermore, availability of credit can improve labour productivity, which is shown to be low.

CHAPTER 7

PRODUCTION (COST) EFFICIENCY OF SMALLHOLDER FARMERS

7.1 Introduction

One of the enduring themes in development economics over the last three decades has been Shultz (1964) -'poor but efficient' hypothesis. Under this hypothesis, peasant farmers in traditional agriculture settings are viewed as efficient in their resource allocation behaviour given their operating circumstances. There is no doubt that production efficiency of smallholder farms has important implications for development strategies adopted in most developing countries where the primary sector is still dominant. Although most developing countries' agriculture has evolved over time to an extent where it can no longer be termed as traditional, the scope of increasing its efficiency still remains great.

Economic reforms implemented in many developing countries during the last two decades have major implications for the dynamics of the socio-economic and institutional environments within which farmers operate. The reforms have been justified as a means through which farmers can enhance their economic efficiency thereby spurring higher agricultural productivity. However, in this unfolding process of agricultural and economic reforms, there has been a dearth of empirical studies documenting the level of agricultural production efficiency in Sub-Saharan Africa. Equally, the relationship between market indicators, household characteristics, institutional factors and production efficiency has not been well understood. An improvement in the understanding of the levels of production efficiency and its relationship with a host of farm level factors can greatly aid policy makers in creating efficiency-enhancing policies as well as in judging the efficacy of present and past reforms. For individual farms, gains in efficiency are particularly important in periods of financial and economic stress similar to the one being currently experienced in most Sub-Saharan Africa agricultural sectors. The efficient categories of farms are more likely to generate higher incomes and thus stand a better chance of surviving and prospering.

In recent years, there have also been important methodological developments in measuring economic efficiency that provide better empirical estimates of levels of efficiency. These new methodologies need to be tested in more diversified farming situations than currently is the case. A review of production efficiency literature indicates that most of the studies done to estimate farm inefficiencies have been undertaken in Asia (see Ali & Byerlee, 1991, Battese, 1992, Bravo-ureta & Pinheiro, 1993). Very few studies have been undertaken in Sub-Saharan Africa and none is reported to have been undertaken on coffee farms, despite the importance of the crop in world trade and economic development of less developed countries. Owing to major economic and institutional differences, efficiency evidence from Asia may not be directly applied in the formulation of agrarian policies in Sub-Saharan Africa. This chapter therefore hopes to contribute towards better understanding of smallholder farmers' economic efficiency in Sub-Saharan Africa while utilising the new methodological developments in measurement of economic efficiency.

As stated in the objectives' section of this study (section 1.5), this chapter analyses the economic efficiency levels of smallholder coffee farms in Central Kenya using a stochastic frontier approach. This framework is applied to measure cost efficiency of the smallholder households. The derived inefficiency index is then related to household demographic variables including institutional as well as economic factors. We start with a description of the variables used in estimating the model and the empirical estimation considerations in section 7.2. Sections 7.3 and 7.4 report the analytical results on estimation of cost efficiencies and their decomposition, respectively. Conclusions from this chapter are drawn in the last section.

7.2 Data description and empirical estimation considerations

To analyse the data, we developed a translog cost function as specified in section 2.3.5. The model is estimated by Maximum-Likelihood (ML) method using the LIMDEP[®] computer programme (Greene, 1995). For comparative purposes, three models are estimated differing in the assumed distribution of the efficiency term. The models are based on the half-normal, truncated and exponential distribution of the efficiency term. The log-likelihood functions of the three distributions are as given by Fried *et al* 1993; Aigner *et al* 1977.

Cross-sectional data for the sample of 200 households are used to estimate the model. The data collection methods are earlier described in section 2.4. Due to the multi-product nature of the farm households in the region, total costs are aggregated across the four commodities; coffee, tea, dairy and horticultural crops. The total production costs constitute the cost of purchased inputs, cost of manure and hired labour for each individual farm household.

The independent variables used in estimating the translog cost function include, the value of farm output (Q), the prices of fertilisers (f), pesticides (p), animal feed(a) and wage(w). Also included as independent variables are the fixed or quasi-fixed inputs in form of land size (L) and amount of family labour(H).

The value of farm output is aggregated over the four commodities and valued at the going farm-gate prices. The details of the considerations made in valuation of the farm output are as indicated in section 6.2. Due to the heterogeneity of fertilisers, pesticides and animal feeds used by the households, the prices of these inputs are arrived at as a weighted average price of the various brands used by each household. The wage rate for hired labour also varied with sex, with female labour being paid less per day. Where such cases are encountered a weighted wage rate per manday is used. Family labour and total cultivated land in acres are the fixed inputs entered in the model. Family labour is measured in man-hours after taking care of family labour hired out, as well as sex and age differences. The farm size in acres owned by each household represents the land size. The detailed descriptions and considerations made in measuring these variables are also indicated in section 6.2.

As indicated earlier, the constructed levels of cost inefficiencies (CI) per household are used as dependent variable in the second regression stage. Various factors are hypothesised as being responsible for the estimated farm-specific cost inefficiencies. Factors like land size, land tenure, credit availability, subsistence needs, extension, education level, age (experience), off-farm work have been shown to influence farm efficiency (Kaliranjan & Flinn, 1983; Ali & Flinn, 1989; Parikh *et al*, 1995). In the current, study cost inefficiency is related to various household, institutional and socio-economic factors. The estimated regression equation is defined as:

$$\begin{aligned}
 CI = & \alpha_0 + \alpha_1 AGE + \alpha_2 EDU + \alpha_3 HSIZE + \alpha_4 FSIZE + \alpha_5 FOOD + \alpha_6 CT \\
 & + \alpha_7 COWS + \alpha_8 Ext + \alpha_9 Fincome + \alpha_{10} Offincome + \alpha_{11} Enterp \\
 & + \alpha_{12} Foodm + \alpha_{13} Credit + \alpha_{14} Sacco + \alpha_{15} D + \varepsilon
 \end{aligned}
 \tag{7.1}$$

Where, AGE and EDU are the age and formal education level of the household head; HSIZE and FSIZE are the household and farm sizes, respectively; FOOD and CT are the proportion (%) of land allocated to food crops and coffee and tea; COWS is the number of dairy animals kept by each household, Ext is the number of extension visits made by government agents per household in 1999, Fincome and Offincome are the amounts of on-farm and off-farm income received per household in the 1999/2000 production year, Enterp is the number of farm enterprises; Foodm is a dummy variable indicating household participation in food markets; Credit is the amount of credit received per household; Sacco is a dummy

variable indicating a household membership in a credit co-operative. D is a dummy variable categorising households into those marketing their coffee through co-operatives and those who are non-members.

On a *priori* basis, the age and education level of the household head are expected to have a positive effect on level of efficiency as they embody experience and skills which can improve on economic efficiency. The household size determines to a great extent the available family labour. The size of the household can therefore be expected to improve efficiency especially in situations where labour is a constraint. Efficiency is however expected to decrease with farm size. This is in accordance with results from earlier studies that indicate higher relative efficiency of smaller farms (Yotopolous & Lau, 1973; Khan & Maki, 1979).

The *a priori* expectation is that the level of market integration would increase efficiency as it allows a household to acquire market information that enables it to have higher allocative efficiency. Furthermore, most inputs and production technologies are in most cases interlocked with cash crops. As such, the proportion of land allocated to coffee and tea (CT) and the number of cows are expected to be positively related with efficiency, while the contra is true for area allocated to food crops. The availability of extension, credit, membership to a SACCO and participation in food markets are expected to increase efficiency. Equally higher farm income is expected to enhance efficiency as it enables a household to apply the necessary inputs that enhance technical efficiency. However, no *a priori* expectation could be placed on off-farm income. Engagement in off-farm income generating activities can reduce the amount of labour available for on-farm production. Nevertheless, income from off-farm activities can be used to purchase inputs and hiring of labour thereby enhancing efficiency.

7.3 Estimation of levels of cost inefficiencies

Table 7.1 indicates the maximum likelihood estimates (MLEs) of the translog cost frontier models under the assumptions of half-normal and exponential distributions of the error term. As pointed out by Aigner, Lovell and Schmidt (1977), the parameter λ (ratio of standard deviations of the error terms) embodies the stochastic frontier model's level of inefficiency under the half-normal distribution assumption. As such the half-normal frontier model is parametrized in terms of λ and σ^2 (variance). Thus, the estimated value of λ equal to 2.79 indicates that the one-sided error term (u) dominates the systematic error (v) as shown in Table 7.1. This is further attested by the values of the variance terms, with the one-sided component variance (σ_u^2) being seven times larger than the systematic variance term (σ_v^2) as also shown in the lower panel of Table 7.1.

Table 7.1 Maximum likelihood estimates of the translog cost frontier

Name of variable	Parameter	Half-normal model		Exponential model	
		Coefficient	T-ratio	Coefficients	T-ratio
Constant	b_0	28.245	0.87	17.68	0.98
Output (Q)	b_Q	-0.596	-3.02*	-0.520	-4.17*
Fertiliser price (f)	b_f	6.959	0.99	-1.249	-0.31
Pesticide price (p)	b_p	3.171	1.33	-2.097	-1.59
Animal feeds price (a)	b_a	4.947	1.39	-1.659	-0.79
Wage (w)	b_w	5.282	0.90	0.250	0.07
Output X Output (QQ)	c_{QQ}	0.016	1.47	0.015	2.09*
Fertiliser X Fertiliser (ff)	c_{ff}	-0.201	-0.17	-0.406	-0.58
Pesticide X pesticide (pp)	c_{pp}	0.051	0.38	0.016	0.25
Feeds X feeds (aa)	c_{aa}	0.603	1.25	0.243	0.99
Wage X Wage (ww)	c_{ww}	1.438	1.91	0.203	0.35
Fertiliser X pesticides (fp)	c_{fp}	0.304	0.71	0.161	0.68
Fertiliser X feed (fa)	c_{fa}	0.223	0.56	0.099	0.38
Fertiliser X Wage (fw)	c_{fw}	0.606	0.77	-0.049	-0.10
Pesticide X feeds (pa)	c_{pa}	0.083	0.48	-0.028	-0.313
Pesticides X wage (pw)	c_{pw}	0.045	0.19	0.132	0.87
Feed X wage (aw)	c_{aw}	-0.084	-0.29	-0.018	-0.11
Land (L)	h_L	0.159	0.31	-0.010	-0.03
Family Labour (H)	h_H	-0.355	-0.27	-0.197	-0.27
Land X Land (LL)	h_{LL}	0.042	2.45*	0.026	2.08
Labour X Labour (HH)	h_{HH}	0.006	0.09	0.009	0.26
Land X Fertiliser (Lf)	h_{Lf}	0.080	0.97	0.065	1.14
Land X pesticides (Lp)	h_{Lp}	-0.048	-1.71	-0.024	-1.21
Land X Feeds (La)	h_{La}	0.005	0.14	-0.015	-0.64
Land X wage (Lw)	h_{Lw}	-0.102	-1.50	-0.069	-1.77
Labour X Fertiliser (Hf)	h_{Hf}	0.177	0.99	0.1279	1.15
Labour X pesticides (Hp)	h_{Hp}	0.157	2.23*	0.13	3.05*
Labour X Feeds (Ha)	h_{Ha}	0.064	1.09	0.023	0.62
Labour X Wage (Hw)	h_{Hw}	0.078	0.63	0.133	1.63
Land X Output (LQ)	h_{LQ}	0.027	2.53*	0.03	4.58*
Labour X Output (HQ)	h_{HQ}	-0.093	-6.04*	-0.083	-8.43*
Lambda	$\lambda = \sigma_v / \sigma_u$	2.7	0.39		
Sigma	$\delta = \sqrt{(\sigma_u^2, \sigma_v^2)}$	0.187	18.04*		
Theta	τ	-	-	9.84	9.48*
	τ_v			0.03	4.19*
	t_u^2		0.312		0.0103
	t_v^2		0.044		0.0013
Log likelihood			196.78		198.79

*significance at 5% level

The cost frontier model formulated under the assumption of exponential distribution of the disturbance term also gave equally good results as those of the half-normal model. The parameters of the exponential distribution (θ and θ_v) are both significant at 5% level (Table 7.1). The cost frontier model with truncated-normal assumption is also estimated for comparison purposes. However, the MLEs coefficient estimates are similar to those of the half-

normal model and the parameter μ is not statistically different from zero. As such the assumption of $\mu = 0$ seems warranted, and consequently the MLEs are not reported.

Based on the MLEs of the translog cost frontier, the mean of the cost inefficiency measure (u) is 8.5% and 7.9% for the half-normal and exponential distribution models, respectively (Table 7.2). As the difference between the observed cost and the frontier costs is attributed to both technical and allocative efficiency, the results indicate that on average 7.9% to 8.5% of the costs incurred by farm households could be avoided without any loss in total output. Table 7.2 and the corresponding bar chart in Figure 7.1 shows the frequency distribution of the estimated cost inefficiencies across the farm households. The frequency distributions of the farm-specific cost inefficiencies show a wide variation in the level of inefficiencies. The cost inefficiencies ranges from 1% to 66.3% with 91% of the households having inefficiencies below 15% (Table 7.2).

Table 7.2 Frequency distribution of farm-specific cost inefficiencies of the stochastic translog cost frontier models

Inefficiency index (%)	Half-normal model			Exponential model		
	No. of farms	% of farms	Cumulative %	No. of farms	% of farms	Cumulative %
0 - 5	70	35.0	35.0	86	43.0	43.0
5.1 - 10	58	29.0	64.0	63	31.5	74.5
10.1 - 15	54	27.0	91.0	30	15.0	89.5
15.1 - 20	5	2.5	93.5	7	3.5	93.0
20.1 - 30	8	4.0	97.5	7	3.5	96.5
30.1 - 40	2	1.0	98.5	5	2.5	99.0
40.1 - 50	1	0.5	99.5	1	0.5	99.5
above 50	1	0.5	100	1	0.5	100
Mean		8.57			7.87	
STD dev		7.82			8.32	
S.E. of mean		0.55			0.59	
Minimum		0.13%			0.02%	
Maximum		61.92%			66.30%	

Assuming that;

- i. The cost inefficiency levels in Table 7.2 also applies to coffee enterprise.
- ii. Smallholder coffee production in 1999 of 50,000 tonnes.
- iii. Average cost of coffee production of Ksh 60,000 per tonne in 1999 (CRF,1999).

This study estimates that if half the cost inefficiencies in coffee production are avoided, this might lead to smallholder coffee farmer's savings about Ksh 200 million per year. These cost savings would increase coffee enterprise profitability and hence the overall competitive advantage of the enterprise. The multiplier effect of cost savings in other farm enterprises can be expected to lead to marked improvements in farm incomes with no changes in production levels. Thus, although, the cost inefficiency levels may appear small they can translate into significant savings at the farm level.

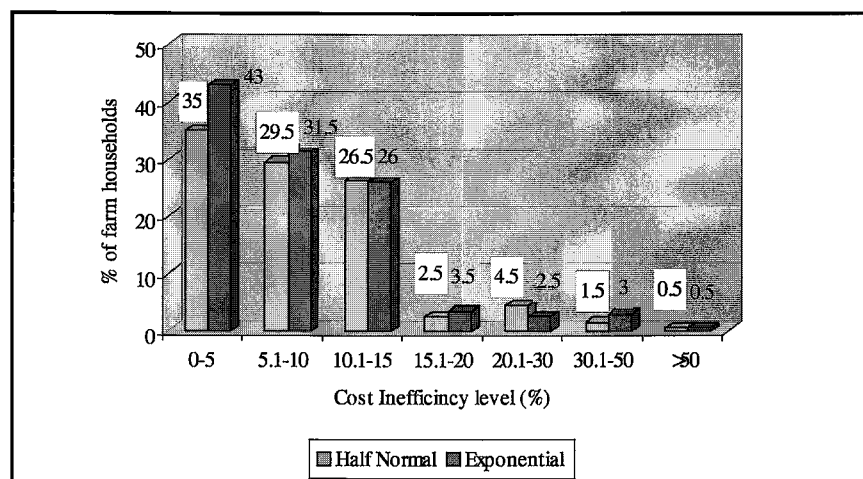


Figure 7.1 Frequency distribution of cost inefficiency index per stochastic model type

7.4 Factors determining the level of efficiency

The derived farm-specific cost inefficiency indices are used as dependent variable in estimation of regression equation 7.1. This analysis is mainly aimed at identifying the factors that influence the farmer's level of inefficiency. Table 7.3 shows the estimation coefficients and the other relevant parameters.

As shown in Table 7.3, both the estimated models based on the farm-specific cost inefficiencies under the assumptions of half-normal and exponential distributions of the error terms give almost similar results. The results indicate that the household size and the age of the household head coefficients have a negative sign, but not significant. This result seems plausible in that larger families can be expected to not only dedicate more labour to farm operations but also to ensure that operations are performed on time. As Parikh *et al* (1995) has shown for Pakistan, a larger family size can also offer a rational household head wider possibilities for matching jobs with the right person in terms of sex and age. Viewed from a broader context this result also indicates that, despite the high labour to land ratio prevalent in the study area, the opportunity cost of family labour is still positive.

The age of the household head can also be expected to have an efficiency enhancing effect as older household heads tend to be more experienced in farming, a factor that has been shown to enhance efficiency in many farming situations (Rougoor *et al.*, 1998). While experience in farming can enhance efficiency in farming due to prudent resource allocation decisions, age can also hinder adoption of new technologies due to higher risk aversion associated with older farmers.

Table 7.3 Relationship between farm-specific cost inefficiencies and household's demographic, economic and institutional factors

Variable	Model 1		Model 2	
	Coefficient	T-ratio	Coefficient	T-ratio
Constant	5.789	1.208	4.507	0.906
Hsize	-0.159	-1.041	-0.196	-1.239
Age	-0.908×10^{-2}	-0.215	-0.019	-0.456
Edu	0.669	1.197	0.498	0.858
Fsize	0.329	4.968*	0.372	5.416*
Food	0.128	0.034	0.388	0.100
CT	-0.889	-0.408	-1.187	-0.525
Cows	-0.245	-1.252	-0.211	-1.037
Ext	0.134	0.477	-0.012	-0.042
Fincome	-0.361×10^{-5}	-2.168*	-0.495×10^{-5}	-2.868*
Offincome	0.266×10^{-5}	0.571	0.585×10^{-5}	1.208
Enterp	-0.013	-0.026	0.105	0.204
Foodm	-1.399	-1.146	-1.712	-1.350
Credit	-0.263×10^{-4}	-2.352*	-0.239×10^{-4}	-2.881*
Sacco	-0.308	-0.233	-0.377	-0.289
Dummy	-1.148	-0.704	-0.343	-0.203
R ²	0.183		0.222	
F(15,184)	2.75		3.50	
D-W statistic	1.96		1.95	
Log -likelihood	674.47		681.93	

Model 1 and model 2 are based on the cost inefficiency estimates from the translog cost frontier under the half-normal and exponential distribution of the disturbance terms, respectively. * indicates significance at 5% level. D-W stands for Darbin Watson statistic.

The results also indicate that the level of formal education of the household head tends to increase inefficiency but not significantly. This result seems contrary to expectations and contradicting empirical evidence from other developing countries that supports the hypothesis that associates higher education with improved efficiency as reviewed by Bravo-Ureta & Pinheiro (1993); Phillips (1994) and Rougoor *et al* (1998).

Equally, the result from this study indicates no significant effect of extension on the level of farm inefficiency. Indeed, results from model 1 (Table 7.3) indicate a positive relationship between extension visits and level of cost inefficiency. Guatam (2000) also had found no significant relationship between supply of extension services and district-specific efficiency measures in Kenya⁴⁵. Moreover, these findings seems to confirm the earlier results reported in section 6.3.2 indicating that extension did not enhance farm productivity.

The farm size is found to have a significant effect on farm inefficiency. This means that larger farms are associated with higher levels of inefficiency. As shown in Table 7.4, the level of cost inefficiency increased with farm size among the sampled households. This result is also confirmed by Gautam (2000) who indicates that smaller farms in Kenya have higher cost and technical efficiency than the bigger farms.

⁴⁵ The study measured relative efficiency of households using data enveloping analysis (DEA). Technical, allocative and economic (cost) efficiencies were estimated using household data collected in 1997.

Table 7.4 Relationship between cost inefficiency and farm size.

Farm size group (acres)	half-normal model		Exponential model		
	mean	STD deviation	Mean	STD deviation	Number (N)
	<u>% cost inefficiency</u>				
0 - 2.5	6.19	4.63	5.35	3.91	64
2.51 - 5	6.26	4.16	5.16	4.97	32
5.1 - 10	9.13	7.08	8.07	6.98	48
10.1 - 15	8.08	8.54	8.16	8.45	17
15.1 - 20	12.38	7.31	10.94	7.94	15
20.1 - 30	12.01	10.95	11.89	11.72	10
30.1 - 50	16.08	17.13	17.57	19.04	11
over 50	19.96	7.02	21.33	12.91	3
Pop. Mean	8.56	7.83	7.87	8.32	200

The amounts of land allocated to food crops, coffee and tea, and the number of dairy animals are included as variables to test the relationship between household resource allocation behaviour and efficiency. These factors are, however, not significant in accounting for the level of cost inefficiency. Nevertheless, it is instructive to note that the proportion of land allocated to food crops tends to increase inefficiency while the proportion of land allocated to cash crops (coffee and tea) as well as number of dairy animals tends to reduce the level of inefficiency. Participation of households in food markets also tends to enhance efficiency level (Table 7.3). Participation in food markets can be expected to reduce the amount of land allocated for subsistence production thereby having a positive effect on efficiency.

The amount of on-farm income has a significant positive impact on the level of efficiency while the amount of off-farm income tends to increase the level of inefficiency, albeit not significantly. Allocation of more time and effort to off-farm activities may bring in extra cash that can ease the pressure for a household to seek credit, but it has the negative impact on the effort spent on farm activities. In contrast, more effort on on-farm activities has a positive impact on efficiency as clearly indicated by these results.

Availability of credit can shift the cash constraint outwards enabling farmers to not only purchase farm inputs, but also ensuring timely application of such inputs. These factors can be expected to enhance efficiency of production, a fact that is confirmed by the significant credit coefficient as shown in Table 7.3. Equally, those households who are members of a saving and credit co-operative society (SACCO) tend to have lower inefficiency levels, although not at a significant level.

7.5 Conclusions

This chapter uses cross-sectional data on input costs and aggregate farm output to measure farm-specific inefficiencies using stochastic cost frontier models. A translog cost frontier is used to estimate the cost efficiency levels of smallholder households in Kenya. Three such models based on half-normal, exponential and truncated-normal distributions of the error terms are estimated. Two of the models give quite similar results, except for the model based on truncated-normal assumption whose efficiency parameter is not significant. This result indicates that the estimates are not significantly affected by the stochastic assumptions albeit for the

truncated-normal assumption. It is therefore concluded that equally good results can be obtained from other stochastic assumptions without necessarily relying on the half-normal distribution assumption that has almost become the standard choice of most researchers.

The results show that the smallholder farmers in Central Kenya region are quite cost efficient. The average level of cost inefficiency is between 7.9% and 8.5% depending on the stochastic distribution assumption. We therefore conclude that there is still scope for improving production efficiency of smallholder agricultural producers in Kenya. Furthermore, given that most smallholder farmers are reasonably efficient, indications are that increases in productivity will require a development strategy that can shift the production frontier outwards through use of new inputs and technologies.

The estimated values of farm-specific cost inefficiencies are regressed on various household demographic, institutional, and economic variables with an aim of decomposing the levels of inefficiencies. The results indicate that cost inefficiencies increase significantly with farm size, while they decrease with the level of farm-incomes and amounts of credit available to each household. The result on the relationship between farm size and the level of inefficiency can be interpreted to indicate that small farms have higher efficiency than bigger ones. Thus, the results from this chapter may serve as an indicator that smallholder-based agricultural development policy is still relevant, and an efficient mode of organising production in Kenya and other contemporary developing countries.

The results further show that household demographic factors such as age and education level of the household head did not significantly affect the level of farm efficiency. Equally, the institutional factors such as availability of extension services, participation of households in food markets and membership to a credit co-operative society do affect the level of efficiency, but not significantly. However, availability of credit is shown to have a significant positive impact on efficiency. Household's resource allocation behaviour as proxied by land allocation to food and cash crops as well as the number of dairy animals are also found to be important but not significant variables. Thus, the study concludes that the opportunities for increasing smallholder farms productivity through more efficient use of the existing resources still exist although to a limited scale.

CHAPTER 8

DISCUSSION AND CONCLUSIONS

8.1 Introduction

The effects of market reforms on the agricultural sector, and smallholder coffee farms in Central Kenya in particular, is the theme of this study. These effects are analysed from a number of perspectives based on the specific research questions outlined in section 1.5.2. Smallholder-based agricultural systems offer formidable challenges especially as far as the organisation of market chains, the provision of public goods and services and the institutional requirements necessary for functioning factor and non-factor markets are concerned. Nevertheless, smallholder-based agricultural development strategy also offers opportunities for generating broad-based agricultural and economic growth. These opportunities and challenges are among the broader issues discussed in this chapter and are particularly important in the SSA context where smallholder agriculture is still dominant.

This chapter has been divided into five sections. The first four sections discuss the results from the present study. Each section focusing on a specific research question (s) in the order outlined in section 1.5.2. Section 8.2 discusses the impact of liberalised pricing and marketing policy on terms of trade in the agricultural sector, the general level of selected commodity prices and their price volatility. Section 8.3 discusses the effects of market reforms on smallholder market institutions with specific emphasis on farmer's access to production and marketing services as well as to factor markets. The impact of reforms on market structure and trade contracts is discussed in section 8.4. Section 8.5 discusses the factors determining smallholder farm productivity in a reforming environment characterised by credit constraints and thin factor (land) markets. This section also evaluates the factors determining farm-level efficiency and the policy measures that can be applied to enhance efficiency. The final section concludes and identifies various policy measures that can be applied to promote smallholder agricultural development in Kenya. Areas of possible further research are also highlighted in the last section.

8.2 Impact of market reforms on agricultural sector terms of trade and commodity prices

8.2.1 Agricultural sector terms of trade and implications to development

The results of this study indicate that during the period subsequent to macro-economic and agricultural sector reforms in Kenya, the agricultural sector terms of trade initially deteriorated and remained on average below the pre-liberalisation levels. Nevertheless, since 1997, the terms of trade have increased to pre-liberalisation levels. Thus, the general held view that market reforms enhance the agricultural sector terms of trade is found to be partially true for the Kenyan situation. The results further indicate that market reforms have arrested the declining trend in agricultural sector terms of trade. This may indicate that, in the long-term, the agricultural sector terms of trade can be enhanced if the momentum of reform is sustained. The deterioration of the agricultural terms of trade is shown to be the result of a decline in agricultural output prices against major price increases in manufactured consumer goods. The decline in agricultural output prices can be attributed to both domestic and international factors. On the domestic front, the results of this study indicate that market reforms have reduced the implicit tax burden placed on the agricultural sector through regulation, taxation

and local currency overvaluation. Nevertheless, high inflation rates, high transaction costs and poor macro-economic performance have had the double effect of reducing agricultural output prices while increasing the price of manufactured goods. Tax reforms such as the introduction of Value Added Tax (VAT) in 1992 may have also contributed to increasing the price of manufactured goods, thereby lowering the terms of trade in agriculture. However, the tight monetary policy that has been in place since 1997 has contained inflation rates to single digit levels while the VAT rate has been gradually reduced from an average of 18% in 1997 to around 15% in 1999. These developments coupled with better coffee and tea prices could explain recent improvements in agricultural terms of trade. Although further reforms in taxation and other macro-policies are needed to correct the historical policy bias against agriculture, special and further attention is also needed for reforms that can lower transaction costs. These kinds of policy reforms are not only necessary to improve the terms of agricultural trade, they are also needed to stimulate broad-based growth driven by the dominant agricultural sector.

Corbo and Fisher (1995) and Teranishi (1997) have shown that differences in levels of government investments - especially in rural infrastructure, technology, human capital and other support services - can be used to account for poor agricultural sector performance in most SSA countries. It can also help explain why the sustainable growth recorded in the region is below that of countries in Latin America and East Asia. While appreciating the role of the market, Stiglitz (1998) shares the same view by arguing that the market, left to itself, is likely to under-provide on human capital, research and development and other physical and social infrastructure necessary to enhance growth and development. Furthermore, recent work by Dollar and Kay (2000) also shows that economic growth is a key factor in poverty reduction, an issues that currently dominants in the development agenda. Moreover, according to Hanmer and Naschold (2000), the type of growth also matters in terms of the particular processes and sectors that generate growth. Various studies have shown that the agricultural sector is particularly important in generating the type of broad-based growth needed to secure a rapid poverty reduction (Lipton, 1977; Datt & Ravallion, 1998). Poverty reduction has been attributed to the growth of agricultural output and a growth in small-scale enterprises and services related to the rural economy but not to the movement of labour and capital out of agriculture (Thorbecke and Jung, 1996). Timmer (1997) and Bourgignon and Morrisson (1998) further indicate that growth in agriculture and basic services reduces poverty more than expanding industrial output. Thus, the lessons are clear, agricultural growth is important for both economic growth and poverty alleviation.

The global trading environment, and more specifically, the ability of LDCs to participate fully in the process of globalisation, is also a major factor that continues to contribute to low agricultural terms of trade and prospects for economic growth. Trade not only provides the opportunity for increasing export earnings, it also makes possible the transfer of technology and provides scope for enhancing economies of scale. However, agricultural producers in developing countries continue to confront high trade barriers that limit their market access and result in the deterioration of prices and terms of trade⁴⁶. According to World Bank estimates, for example, when the average poor person (producer) in a developing country participates in global trade he or she confronts market barriers that are roughly twice as high as those faced by a typical worker in a developed country (World Bank, 2001a). A case in point is the high subsidies and other support given to agricultural producers in developed countries,

⁴⁶ Preferential trade initiatives have been recently introduced such as the European Union (EU) 'everything but arms' initiative for LDCs, and the United States -Africa Growth and Opportunity Act (AGOA). There is however growing evidence to the effect that real benefits of concessional trade arrangements are limited. For instance, in the 25 year existence of the Lome Convention, African, Caribbean and Pacific (ACP) countries exports to EU have fallen from 7% to 3% in total (CFC, 2001). The limited success of preferential trade has been attributed to quota ceilings, non-linkage of market access and productive capacity, limitations on coverage and more recently limitations based on environmental, consumer and other concerns.

estimated to be US \$ 1 billion per day. Thus, it is also necessary to reshape the global trade environment, especially in agricultural trade, to enhance market access and promote pro-poor market based initiatives.

The results of this study can, therefore, serve to indicate that while there is still room for galvanising and solidifying the positive effects of the liberalisation measures taken so far in the Kenyan agricultural sector, increases in government expenditure are needed in technology development, extension and rural infrastructure. This will not only stem the flow of resources from the sector but will also help boost the declining supply response of agriculture producers. It is also likely to be an effective way of enhancing economic growth and reducing poverty.

8.2.2 Evolution of commodity prices

As indicated by Thorbecke (2000) and Kuyvenhoven *et al* (2000), evidence emerging from SSA indicates that liberalisation has largely been of the priciest type - "getting the prices right" - whose aim has been to rise real prices of agricultural commodities. However, there is a lot of empirical ambiguity about the actual effects of market reform policies on the general direction and magnitude of real price changes. Inter-commodity differences, inter-seasonal variations and international commodity price movement complicate predictions about both the direction and magnitude of real prices. Nevertheless, the general direction and magnitude of real commodity price changes continue to be of great importance as they determine, *inter alia*, the direction and magnitude of the supply response that can be expected from agricultural producers. As Mellor (1968) has pointed out, the output pricing system can be used to encourage investment and capital formation in agriculture. High farm prices relative to those in other sectors can therefore increase the rate of return to capital in agriculture and in this way encourage investment and growth in the sector. In developing countries most of the population is engaged in agriculture. Therefore, growth in this sector will translate into general growth in the macro-economy and will perform a major equity role as well.

The results of this study indicate that the average real crop and livestock commodity prices in Kenya in the period of liberalisation were below those in the pre-liberalisation period. There are, however, inter-commodity differences with the real producer prices of tea and maize registering a decline in the liberalisation period, and an increase in the prices for milk and coffee in the same period. Nevertheless, overall price movement of crops and livestock was positive in the reform period unlike the negative trend predominant in the pre-reform period. The results of this study confirm earlier findings by Karanja *et al.* (1998); Jayne & Kodhek (1997) and Staal *et al* (1998) who had indicated declines in maize prices and increases in milk prices during the reform period. Further results from this study show that the wedge between output and input prices widened in the period subsequent to the reforms as indicated by the declining ratio of output to input (O/I), only to recover during the last years of the period analysed. This indicates that the profitability of input use may have declined during the main part of the reform period. This is confirmed by analysis of the trends in relative prices that show a notable decline of commodity to fertiliser relative prices. This result contradicts that of Mbithi (2000), indicating that the fertiliser-maize price ratio decreased during the reform period in Kenya. A number of factors can be suggested to explain this mixed effects of market reforms on producer prices and the output to input ratio.

At the international level, real non-oil commodity prices have been declining for most of the twentieth century and particularly since the beginning of 1970s (CFC, 2001; World Bank, 2000c). One of the major factors in the decline of commodity prices, particularly in recent years is related to a steady growth in supply that has not been matched by growth in demand and which has lead to a high ratio of global stocks in relation to annual consumption. According to CFC (2001), for example, coffee stocks as a percentage of consumption in 2000 were estimated at 38% as compared to 40% for cocoa, 37% for cotton and 49% for sugar. This

scenario is reminiscent to the "fallacy of composition" which indicates that commodity producer countries as a group can hardly expect to boost their export revenues by merely increasing their production. Nevertheless, the global over-supply can in part be seen as a response to the economic reforms that have been implemented in most LDCs over the last two decades. These reforms, especially in the agricultural sector, have removed the bias against exports thereby improving the incentives for commodity producers to boost exports. Apart from the supply response by producers, there is also robust statistical evidence, both across commodities and countries, that supports the hypothesis that there is a growing disparity between producer and consumer prices. This factor could be responsible for the slow growth in commodity demand and hence the decline in prices (CFC, 2001). CFC (2001), for example, estimates that while the price of raw coffee declined by 18% on the world markets between 1975 and 1993, coffee consumer prices increased by 240% in the United States which is the largest consumer of coffee. Furthermore, it has been estimated that the constrained growth in demand may have cost commodity-exporting countries around US \$ 100 billion per year (CFC, 2001). Thus, the global trading environment, and the ability of LDCs to participate fully in the process of globalisation, is a major factor that might have contributed to the decline in producer prices despite the positive effects of market reforms. The challenge, therefore, remains of how to offer increased returns and opportunities (through wider access to global markets) to LDCs commodity producers.

For producer countries market reforms were expected to dampen the negative effects of global commodity markets. However, the results from this study clearly give the indication that market reforms did not immediately improve the producer prices received by smallholder farmers in Kenya. As such, there is unambiguous initial negative effect of market reforms on producer prices in Kenya. The smallholder supply response was negative as expected in a situation of declining prices. This is attested by the decline in the marketed agricultural production during the period under review as documented by Nyangito (1999) and Republic of Kenya (2000).

A literature review indicates that the Kenyan situation is similar to that documented by Valdés (1996) for eight Latin American countries where all major agricultural producer prices declined in real terms between 1986 and 1995. Similarly as in the eight Latin American countries studied by Valdés, the initial decline in real producer prices in Kenya could be attributed to half-hearted, intermittent market reforms which have been implemented in acrimony and sometimes seen as imposition from international development institutions. As Onjale (1995) and Swamy (1994) indicate the non-conducive environment, timing and sequencing of the liberalisation measures in Kenya may well have negated the benefits of what could have accrued from the reforms. Due timing and sequencing problems, some agricultural sector reforms preceded macro-economic reforms. In October 1992, for instance, the government stipulated that trade at the coffee and tea auctions in Nairobi and Mombasa should be conducted in US dollars as part of export commodity trade reform. However, coffee and tea farmers could not benefit from this trade reform as they could not transact their business in dollars due to foreign exchange controls, which were only amended in 1993. There are also glaring and costly timing and sequencing problems in the agricultural sector reform program. A particularly illustrative example can be found in the liberalisation of the agricultural inputs market in 1993 that included the abolition of fertiliser subsidies, while liberalisation of most output markets was delayed until the end of 1996. In fact coffee and tea output markets were still not fully liberalised in 1999. The liberalisation of interest rates coupled with the liberalisation of fertiliser and other input prices in 1993 was also not matched by any reform in rural credit markets, a situation that stifled the use of inputs and farm productivity. Thus, timing and sequencing problems, especially in the input and output markets, might account to some extent for the widening of the output to input price ratios during the reform period. As indicated by FAO (1994), it is generally advisable to liberalise the output markets before the

input markets in order to reduce the short-term structural problems that smallholder farmers face in procuring inputs from private channels.

However, the issue of the timing and sequencing of market reforms is not confined to Kenya and Latin American countries. It has also been reported in other SSA countries such as Malawi (Spooner & Smith, 1991; Kherallah & Govindan, 1999) and Tanzania (Booth, 1991). Experiences derived from these and other studies (see Duncan & Jones, 1993; FAO, 1994) indicate that before reducing government operations in agricultural markets, measures to decontrol all prices and to promote private sector participation should be in place. The studies also suggest that domestic financial market liberalisation should precede efforts to promote private sector participation as lack of access to finance is a major barrier to entry. A World Bank (1994) evaluation of SAPs in Africa also indicates that it is those countries that have undertaken and sustained policy reforms that have enjoyed some degree of economic as well as agricultural growth. This indicates that over and above timing and sequencing, there is a need for consistency in the reform process. In a wider context, the results of this study seem to vindicate the need for sustained and well-timed liberalisation measures as a necessary condition for reversals in agricultural prices and growth trends.

Apart from the lapses in the implementation of market reform policies, the initial decline in real producer prices in Kenya could also have been a result of the inefficiencies created along the marketing chain by retention of the monopoly power enjoyed by some marketing boards. Among the four commodities considered in this study, for example, only the real producer prices for milk and coffee increased during the liberalisation period. A closer look into the marketing channels of milk indicates that, unlike the other three commodities, stiff competition, multiplicity of marketing channels and strong private sector participation since the liberalisation of the dairy sub-sector in 1992, have lowered transactions costs in the fresh milk markets. This is in total contrast to the other sub-sectors where statutory marketing boards and local monopolies (e.g. co-operatives) still exercise considerable control in marketing and where there is limited private sector participation. As indicated by Booth (1991), delays in reforming marketing institutions in a liberalised trade environment can result in major distortions and high transaction costs that reduces farm gate prices and hence farm incomes.

However, it is important to point out that low food prices can be beneficial to both rural and urban consumers. In most situations the majority of smallholder producers are also net buyers of food as shown by Deaton (1989); Weber *et al* (1988), and Barrett & Dorosh (1996). Results from this study also point in the same direction. Thus, while it is important to address the issue of declining prices for cash crops like coffee and tea in order to enhance rural households' incomes, the same cannot be said about policies that are intended to raise food prices. Moreover, Fafchamps (1992); Jayne (1994), and Goetz (1993) have highlighted the fact that lowering food costs to food-deficient rural households can release resources that can be re-allocated to cash crops and off-farm activities with higher expected payoffs. In addition, as indicated by the results in chapter 6 of this thesis, farm productivity and resource allocation is highly dependent on a household's ability to participate in food markets. Although the need to lower consumer food prices while enhancing the level of producer prices may appear paradoxical, the two objectives can be achieved by enhancing both production and marketing efficiency. This requires policies specifically targeted to enhancing farm productivity and reducing transaction costs. Thus, further trade and institutional reforms aimed at promoting domestic investments, productivity and lower production and transaction costs would be beneficial.

8.2.3 Volatility of commodity prices

Pre-occupation with the presumed adverse effects of price instability has led many developing countries to establish a wide variety of mechanisms to stabilise prices for both internationally and domestically traded commodities. Volatility in commodity prices exposes producers, traders and consumers to price risks that, if unmitigated, can adversely affect incomes, trade margins and costs. In Kenya, prior to the introduction of liberalisation policies, one of the stated agricultural development policy objectives was to stabilise consumer and producer prices (Republic of Kenya, 1986; Pearson, 1995). This policy was aimed at reducing fluctuations in farm incomes while ensuring affordable food prices to consumers.

At the macro-economic level, commodity price volatility can cause fluctuations in macro-economic variables (such as exchange rate), the overall balance of payment position and the level of investment. In turn this can have an adverse affect on economic growth. Indeed, one frequently voiced claim is that instability in agricultural export earnings (arising from instability of production and prices or both) has a detrimental effect on the rate of economic growth and socio-political stability. Indeed, one of the voiced claims is that instability of agricultural export earnings (arising from instability of production and prices or both) has detrimental effect on the rate of economic growth and socio-political stability. Although some studies have contested this argument (MacBean, 1980), the weight of opinion seems to suggest that instability of agricultural export earnings has for various sample sets, data periods, statistical methods, and a host of independent variables, negative effects on economic growth, growth of exports and investments to GNP ratio in many developing countries (Adams & Berhrman, 1982; Sengupta, 1980; Deaton & Miller, 1996). A recent analysis of factors determining economic growth in Africa by Collier & Gunning (1999) indicates that minerals and agricultural commodities dominate the region's exports. This export concentration means that Africa's terms of trade are determined by commodity prices, a fact that has made the terms of trade extremely volatile and consequently has given rise to a reduction in economic growth. Another recent study from the World Bank using a historical perspective indicates that sustained periods of stable growth and income stability are more conducive to robust poverty reduction than periods characterised by cyclical patterns of 'boom and bust' (World Bank, 2000d). The lesson for LDCs and the international community is therefore clear: commodity price volatility is a source of instability that undermines prospects for steady economic growth and should therefore be addressed.

At the commodity trade level, companies involved in exports, stockholding and other related business activities are also affected by price volatility. Price volatility if not mitigated upon can eliminate profits and jeopardise business survival. Low trade volumes and limitations in accessing price insurance forces most companies in developing countries to raise their trade margins, a factor that reduces their competitiveness and increases the transaction costs in commodity chains. Thus, policies that enhance price risk management will be of great importance to trading houses in most developing countries. Nevertheless, price volatility can also be turned into business opportunities through stockholding and other inter-temporal supply management strategies. Results from this study, for example, indicate significant seasonal variations in maize prices. These variations can be utilised to induce inter-temporal supply management strategies both at the farm and trade level.

It has been further argued that high price volatility can reduce the welfare of the poor (such as smallholder farmers) who have limited price (income) risk management strategies. However, liberalisation policies have had a mixed effect on increased/lowered price volatility (Barrett, 1997). Results from this study indicate that the volatility of agricultural producer prices in Kenya increased during the period after liberalisation. This result when compared with earlier results from other studies (Shively (1996) in Ghana; Barrett (1997) in Madagascar and Badiane (2000) in Malawi may indicate that market reforms are generally associated with higher long-term price volatility. This means that price risk management policies in Sub-

Saharan Africa deserve higher priority than they are being given at the moment. According to Newbery (1996), crop insurance schemes aimed at stabilising producer incomes are plagued with moral hazards that limit their success. As such, most policy interventions designed to stabilise incomes are undertaken with the objective of stabilising producer prices. In the recent past, International Commodity Agreements (ICAs) have been used with a certain degree of success to stabilise producer prices in developing countries. The prevailing economic thinking that advocates increasing globalised free trade, however, consigns most ICAs to history. Indeed, obituary notices for ICAs have already been written (Gilbert, 1996). This means that developing countries have to take the onus of stabilising the commodity prices for their producers by using stabilisation funds/agricultural funds and to a more limited extent marketing boards regulation. The operation of these direct market interventionist programmes will, however, require a constant evaluation of the temporariness and trends of commodity prices. As it can be appreciated, forecasting the future path of commodity prices can be a notoriously difficult task. Moreover, market reforms in most developing countries have greatly limited the direct market intervention options by governments and agricultural marketing boards.

Rather than reacting to commodity price changes (which is the hallmark of price stabilisation funds), it is possible for Sub-Saharan countries to trade away much of the price risks by using modern market instruments such as futures, option and commodity swaps. However, this development requires a suitable legal and financial environment before it can become reality. The World Bank led International Task Force on commodity risk management (ITF) has already undertaken a study of the way these instruments are used. Pilot projects to test their use are being undertaken by the Common Fund for Commodities (CFC, 2001)⁴⁷. The ITF proposal identifies the need to strengthen smallholder producer associations and co-operatives to enable them to serve as a bridge between international price insurance markets and their members or what are termed as *Local Transmission Mechanisms* (LTMs). It is envisaged that LTMs will aggregate the volumes needed for purchasing price insurance. They are also expected to distribute the funds from the price insurance (in case of claim) and facilitate the provision of core services and technical assistance. However, before this scheme becomes a reality, major investments in capacity building and farmer education are needed. Equally, the producer associations have to learn to accept their new role in price risk management, a role that, before liberalisation, was largely borne by governments and marketing boards. Indeed, the transition from commodity production to future exchanges and market-based price risk management may seem far-fetched at the moment. However, given current global trends, farmers and their associations cannot simply limit themselves to commodity production and processing but must become actively involved in marketing and planning based on certain price expectations. Farmers associations therefore need to take a more active role in the promotion and use of market-based risk management and see it as an essential element of their forward-looking strategy.

In certain circumstances, parastatals involved in commodity marketing can also play a major role in risk management intermediation on behalf of farmers. The KTDA which, over the years, has offered smallholder tea farmers in Kenya a guaranteed monthly price (adjusted at the end of each year by a bonus payment) is a good example of such a parastatal. KTDA has the added advantage of dealing with the large trade volumes that are necessary for price insurance.

Gilbert (2001) has pointed out that the willingness of farmers' to pay commercial premiums for price insurance must also be considered. Most farmers tend to be self-insured either through diversification in the form a diversity of crop and livestock activities or by

⁴⁷ According to the Common Fund for Commodities (CFC), the first such project was approved in April 2000 and will assess the feasibility of using market based price risk management instruments in the cocoa sector in West Africa (CFC, 2001)

engaging in agricultural (farm) and non-agricultural (off-farm) income generating activities (Dearon, 1996; Rosenzweig & Binswanger, 1993). Results from this study indicate that in the study region about 68% of the households had a coffee income concentration of less than 50% (see section 4.7). Based on these income concentration ratios the cost of price volatility (the insurance premiums) for a smallholder farmer with a 42% coffee income concentration ratio is estimated to be about 0.28 % of total income. The more specialised farmer would incur a cost of about 1% of his or her income. While the cost may seem low it is, however, significant to farmers who are operating close to the poverty line. Nevertheless, these premiums can be reduced by public sector participation that promotes institutional frameworks and other social capital⁴⁸ that enable smallholder farmers to collectively deal with price risks.

There is also a need to create an enabling environment that allows farm households to overcome and manage price risks. As shown by Bevan *et al* (1989), agricultural producers are prudent managers of price volatility through participation in the financial markets if given the right policy environment. As one of the preliminary conclusions drawn by the ITF indicates, access to risk management instruments can also be an important means of enhancing smallholder credit (ITF, 1999). This is particularly so in the case for working capital as the purchase of price insurance would result in lower default rates of commodity related loans. As such, improved intermediation in commodity price risk management can be seen as way of enhancing rural credit.

According to Newbery and Stiglitz (1981) and Gilbert (1998), being able to forecast price is also an important element in a successful price risk management strategy. When price forecasting is improved, farmers and other agents are able to make prudent and timely decisions about the allocation of resources. Equally, most commodity producers in developing countries operate in markets that are far from perfect mainly because of information asymmetries and high transaction costs. This substantially reduces the gains producers can derive from the resource re-allocation postulated by Oi (1961). Therefore, governments and other agencies in Sub-Saharan Africa should try to improve commodity prices forecasting by putting market information programs in place. In this way farmers can keep in touch with current prices in local markets as well as the short-term price forecasts from international terminal markets. As shown by the simulation done for coffee farms in section 4.7 of this study, investments in market information programs can reduce the cost of price volatility to smallholder farmers. This is mainly the case for households with low (24%) coffee income concentration, whose costs can be reduced by a margin of 8% by investing and promoting policies and institutions that enhance the forecasting of coffee price by a 50% margin. Such investments would benefit the majority of farm households in Central Kenya as most of them had a coffee income concentration ratio below 40% (see section 4.7). Investments in public market information programmes and institutions can also act as a pre-requisite to market-based risk management policies as it tends to lower the insurance premiums.

Individual farmers can also be encouraged to diversify their production and sources of income. Results from this study indicate that the promotion of income diversification policies and programmes can be quite beneficial to smallholder farmers. Taking the case of coffee farmers in the study region, results indicate that the cost to farmers of price volatility can be reduced by up to 73% if their coffee income concentration is reduced by half. Nevertheless, income diversification can only be promoted as a long-term objective as it requires major investments in alternative income sources. Furthermore, on-farm diversification can be severely limited by natural factors that cannot be altered easily.

⁴⁸ Social capital has been defined as the norms and networks that enable people to act collectively. See Woolcock & Narayan (2000) on a recent review of social capital and its implications to development, research and policy.

8.3 Impact of liberalisation on smallholder farmers market institutions

8.3.1 *Agricultural production, marketing and service institutions*

Liberalisation policies implemented in Kenya and other developing countries have been shown to have a fundamental impact on the institutional arrangements within which smallholder farmers make production and trade decisions. One such change is the decline of institutional capacity of governments to provide public goods such as extension and research (Reardon *et al.*, 1996; Nuppenau & Badiane, 2000). This is mainly due to cuts in public expenditure on agricultural extension and other services including research. The cuts in public expenditure have compounded an already unfavourable situation characterised in the past by poor service delivery (Collier & Gunning, 1999). Results from this study confirm that this was also the situation in Kenya during the reform period. Results from this study show that government direct expenditure on agriculture services and programs declined from an average of 7.8% of total public expenditure during the pre-liberalisation period to only 3.6% during liberalisation. This is a clear case of what Lipton (1991) calls the 'state compression' phenomenon brought about by market reforms. Study results also indicate that cuts in public agricultural expenditure have severely limited smallholder farmers' access to extension services, market information and physical infrastructure. Furthermore, private participation in the provision of such services as extension and market information is also found to be non-existent in most cases and where such services do exist there is a fundamental asymmetry in information. These information asymmetries create room for opportunistic trading practices that hamper smallholder production and market participation, apart from increasing transactions costs. Indeed, a study undertaken by Gautam (2000) shows that most smallholder farmers in Kenya associate market reforms with a decline in both access to and the quality of public services.

Many agricultural services have a significant component of public good. Furthermore, agricultural producers, especially smallholder farmers, are geographically dispersed and poor. This may limit the willingness of the private sector to participate in the provision of agricultural services. Dorward *et al* (1998) have also argued that relatively little attention has been given to the capacity of the private sector to provide agricultural services. Neither has there been much discussion about what contribution the private sector could make in the provision of agricultural services given the economic, political and social conditions prevailing in most SSA states. Indeed, the disappointing response to market liberalisation can be attributed to the unduly optimistic view held by liberalisation enthusiasts about the potential of the privatisation in SSA settings. As far as they are concerned liberalisation can be equated to privatisation and government is ascribed a minimalist role (Stiglitz, 1999).

Given these facts, what role can the government and the private sector play in the provision of agricultural services (mainly technology development and dissemination) in a liberalised economy? The way forward is to build public, community and private institutions that enable smallholder farmers to enhance their productivity and market participation. Coincidentally, this is the focus of the World Bank's 2002 world development report - *building institutions for markets*.

Various studies have shown that public investments in agricultural technology development and information dissemination can yield high social rates of return. For instance, according to the World Bank (2001b) the sum of private and social returns on agricultural research and extension in Africa for the period 1953-1998 is around 34%. As indicated in chapters 6 and 7 of this study, smallholder productivity and efficiency in the study region would be enhanced through investments in technology development and dissemination. Nevertheless, results from this study also indicate (see section 5.2) that both public expenditure in agriculture and the agricultural research intensity ratios have declined in the last decade. There is a case, therefore for increasing public expenditure in agricultural technology development. However, increases in fiscal allocations alone might not enhance the

development of suitable agricultural technologies as past experiences have shown. Changes in fiscal allocations need to be accompanied by institutional reforms to cut down overhead costs, enhance the sharing of information in order to avoid duplication and to strengthen research-extension networks.

Attracting significant private sector investments in research and development is unlikely to occur in Kenya or other SSA countries in the near future. It is, however, necessary to create an environment that will attract private investments as supplement to public funding. One major institutional need will be in the area of intellectual property rights, which are currently not well defined and protected in Kenya or in other SSA states. Legislation might be in existence (as in Kenya) but mechanisms for enforcing these laws remain weak. Community-based funding of technology development has been used with some degree of success in the past and can be expanded even further. The funding of coffee and tea research by farmers (through a levy) has a long history in Kenya and offers a good example of involving farmers in research funding. However, farmer-funded research has come under pressure in the recent past due to the proliferation of marketing channels. Poor regulatory frameworks have made it possible for some market participants to devise methods of either not paying the research levy or under-invoicing the amounts due. Widening and enhancing farmer's involvement in research funding will, therefore, call for institutions that can maximise research levy collection from various marketing channels. More important it is necessary to increase farmers' social capital to ensure that they set the research agenda and maximise the direct benefits they can derive from the technologies developed.

As demonstrated by the results of this study and the evaluation done on Kenya's extension system (section 5.2), technology development without effective extension can be of little value to farmers. Extension enhances farm productivity through imparting knowledge that can enhance technical change and efficiency. Furthermore, as demonstrated by Feder & Slade (1995), the availability of public sponsored sources of agricultural information such as extension services, can lower the overall cost of information acquisition and in this way bring the allocation of resources closer to the social optimum. According to the World Bank (2001b) three main institutional reforms are necessary to ensure improvement in extension services. These include the options of decentralisation, privatisation and separating funding from execution. To some extent, as the results of this study show, there has been some form of decentralisation and privatisation of extension services taking place in Kenya. Tea and to some extent coffee and livestock services have been decentralised from government to various government agencies and community groups. These services (especially for dairy and tea) have attracted considerable private sector participation. What seems to be lacking is the institutional capacity of farmers' organisations such as co-operatives and farmer groups to participate more fully in offering extension services to their members. The main challenge to the privatisation of extension services, therefore, remains at the level of enhancing farmers' willingness to pay by demonstrating the positive effects of extension on productivity. Evaluations done by Gautam (2000) in Kenya indicate that smallholder farmers are ready and willing to pay for extension services either individually or as a group⁴⁹. This result indicates that there is a potential for charging farmers a fee to cover a part of the cost of extension services. The advantage of this type of cost recovery is that it provides appropriate incentives, budgetary respite, demand-driven and responsive service as well as encouraging alternative service providers. Such institutional arrangements remain largely unexplored in Kenya. Equally, the alternative of

⁴⁹ Paid extension service in Nicaragua has been cited as one of the success stories through its effects on improving service delivery, cost effectiveness and cost recovery (Dinar & Keynan, 2001)

providing extension services through private sector with public funding remains another unexploited option⁵⁰.

As highlighted in other sections of this study, institutional arrangements in market information, quality control and general market regulation are also needed in order to foster smallholder agricultural development. While the role of the private sector in the provision of most of these services can be expected to increase with time, the role of public institutions will be central both in the short and medium term. Community-based institutions can also play a vital role in the provision of most services but public investment in capacity building will be necessary.

8.3.2 Liberalisation and factor markets

Agricultural credit markets

Apart from their impacts on agricultural services institutions, market liberalisation is also shown to affect the structure and performance of factor markets. The results of this study indicate that agricultural credit from banks, NBFIs, and AFC declined from around 5% of GDP in the period before reforms were introduced in 1991 to a mere 3.8% during the reform period. The credit contraction mainly affected smallholders although credit from co-operatives and SACCOs was also affected. Results further indicate a weakening of crop collateralisation as loan security and a lack of institutional mechanisms capable of providing repayment incentives. These factors are shown to undermine and threaten the continuity of financial relationships in rural financial institutions and in co-operatives in particular. The poor performance and weak capital base of producer and credit co-operatives after liberalisation is also shown to constrain their role as important intermediaries in rural financial markets. Collier & Gunning (1999) have identified the decline of social capital in rural credit markets as one of the major factor that hampers the economic growth of rural households in Sub-Saharan Africa. As Dorward *et al* (1998) also report, market failures in farm input finance is a prevalent phenomenon characterising smallholder cash crop production systems across SSA and Asia. Credit market failures have become even more pronounced after market liberalisation mainly because of weakening of interlocking (inter-linkage between product and input markets) contracts. The reduction of interlocked credit coupled with sporadic and the uncoordinated nature of agricultural lending by banks, political interference and poor loan screening and enforcement have led to an escalation in the culture of 'strategic loan defaults' and borrower opportunism. Reliable and faithful borrowers have received little reward for their good faith and this has further exacerbated the serious incentive and enforcement problems that characterise rural financial markets. The challenge of creating the legal and economic environment necessary for thriving rural financial markets and institutions (or what Collier & Gunning, (1999) call financial depth) cannot therefore be over-emphasised.

The traditional assumptions of many policy makers regarding the capacity of farm households to invest and save and the performance of formal financial intermediaries have been questioned and generally found to be either weak or false (Moll, 1989). Cheap agricultural credit policies backed by government or donor credit schemes have not proved supportive of agricultural development especially in the emerging liberalised economic environments of developing countries (Adams *et al.*, 1983). Nyaribo and Young (1992) in their study of the impact of capital and land constraints on the livestock technologies adoption by smallholder farms in Kenya shared this view. They advocated private capital markets as a way of enhancing a demand for borrowing and lead to technology adoption. Cheap institutional

⁵⁰ According to Hanson & Just (2001), certain economic principals need to be considered when choosing between public and private extension services. Key among the considerations is the welfare and ability of poor farmers to pay so as to avoid exclusion.

credit schemes are subject to government budgetary constraints and political interference with lending and loan repayments and therefore lack sustainability. In addition they can result in credit rationing and distortions in financial markets. Evidence documented in this study, for example, indicates that the poor performance of the Agricultural Finance Corporation (AFC) - the main public agricultural credit organisation in Kenya - as financial intermediary was mainly due to political interference. It is for these reasons that various studies have advocated broader, more diversified rural financial markets (Von Pischke *et al.*, 1983; Moll, 1989). The fundamental feature in sound rural financial markets is that financial transactions between parties are based on confidence in their present and future ability and intentions (Moll, 1989). Farmer credit co-operative societies is one such rural financial market where confidence can be encouraged.

The survival of farmer credit co-operatives societies, however, depends on the farmers' ability to save and invest. Moll (1989) has reviewed literature on this topic and concluded that farmers' do have the ability to save and invest especially when the incentives to save are matched with secure and dependable opportunities to do so. This is illustrated by the example of coffee co-operative schemes in Kenya during the 1970s and 80s where the societies accumulated deposits in excess of volumes of loans (Von Pischke *et al.*, 1983). This success was, however, short-lived, as most of these societies collapsed in the early 1990s due to mismanagement, distortions in capital markets and from the effects of a rigid legal and socio-political environment.

Asset based lending is also increasingly being identified as a viable means through which commodity producers in developing countries can finance their operations as well as mitigate upon transaction and financial risks. Asset-based lending is premised on the notion that any commodity that is freely traded and tendered on the world markets is potentially good collateral. However, this potential can only be realised if such a commodity is located in an environment that allows a clear transfer of property rights. In pursuit of this idea, the CFC has proposed a commodity marketing, development and promotion project. The objective of the project is to increase the benefits from commodity production and marketing by developing a transparent and efficient marketing structures that promotes the use of warehouse receipts using commodities as collateral (CFC, 2001). For the system to be functional it is necessary to develop legal and institutional infrastructure that clearly defines the rights, liabilities and duties of each party involved. Capacity building in producer associations is also necessary if the system is to benefit smallholder farmers who have only a limited individual capacity to access such a financing system.

Land market

As noted by Feder and Feemy (1993), land transactions can increase efficiency of resource use as agents with potentially higher marginal land productivity acquire land from those with lower marginal productivity. Nevertheless, results from this study indicate very thin land markets in the study region. There is, therefore, a case for creating a conducive policy environment in the study region to support a robust land market.

The low incidence of land collateralised formal credit in the region also indicates that land titling has not been a sufficient condition for increasing access to formal credit. In order for land to be a useful collateral, uncertainties and asymmetric information with regard to property rights - and transfer rights in particular - have to be minimised or eliminated altogether. As indicated by Migot-Adholla *et al* (1993) and Pinckney and Kimuyu (1994) land as collateral can be of little value in some parts of Kenya and other Sub-Saharan Africa countries as land transfers to outsiders through sales (or fore-closure) are not always recognised as legitimate because of cultural and ethnic considerations. The bureaucratic and cultural considerations present in land markets in the study region may have created land transfer uncertainties and therefore need to be addressed to enable farmers to access more

formal credit. Such policy interventions need to identify the most important constraints hindering the development of functioning land markets while sequencing the removal of such constraints in a manner that does not jeopardise the social security of the poor. As Deininger and Binswanger (1999) have pointed out key areas of concern in formulating such a policy include: the clarification of property rights; the establishment of an institutional framework that guarantees the security of these rights; and increasing efficiency by facilitating the transferability of land rights in both rental and sales markets. Removing restrictions that affect the operation of the land sales market may, however, not be an urgent priority as far as increasing efficiency is concerned given the prevailing socio-political climate. Rather, priority should be given to measures that emphasise and facilitate a thriving land rental market that is well integrated into other rural factor markets such as credit. The same view is shared by Binswanger and Ronsenzweig (1986) and Collier and Gunning (1999) who identify land rentals as one of the main instruments through which production units can arrive at near optimal land to labour and capital ratios especially in a land-scarce environment.

Labour market

Unlike the capital and land markets, labour markets appear quite vibrant. Labour transaction costs are also low and relate mainly to supervision and such inducements as meals offered to hired-labour. Due to distortions in other factor markets, smallholder production systems in the study region are labour intensive with little use of purchased inputs that are a necessary prerequisites for improving productivity in a land-scarce environment.

8.4 Liberalisation and its impact on market structure and trade contacts

8.4.1 Market co-ordination and control

According to Thorbecke (2000) the impact of market liberalisation policies are expected to differ across exchange configurations depending on the products traded, actors involved, and other unique commodity characteristics. The organisation of the actors in an exchange configuration can be viewed as the market structure. An analysis of coffee, tea, milk, horticulture (French beans) and food crops (maize) exchange configurations revealed that although the five systems differ in terms of the number of market actors involved, the greatest impact of liberalisation has been to reduce the level of vertical co-ordination while having a differentiated effect on smallholder farmers market control. The reduction of vertical control mainly arose from lack of effective regulatory and information institutional frameworks, as government agencies (parastatals) have been reduced to spectators in their areas of jurisdiction after liberalisation. According to Jaffee and Morton (1995), the absence of an effective vertical co-ordination process in any commodity system can lead to resource mis-allocation, economic inefficiencies and an enhancement of production and marketing risks. Thus, the reduction of vertical co-ordination associated with liberalisation may have created poor linkage between smallholder producers and consumers, a situation that may lead to a mis-match of supply and demand conditions and a mis-allocation of resources. This is found to be particularly the case with coffee producers in the study region. This re-emphasises the need to have effective public and private market information systems with regard to pricing, quality and consumer preferences.

Concerning smallholder farmer's control of production and marketing aspects, this study finds that although there are inter-commodity differences, the farmers are progressively gaining horizontal control in production aspects after market liberalisation. However, these gains in control are negated by the loss of vertical control mainly in the areas of processing and marketing. Gains in horizontal control have enabled smallholder dairy, maize and to some

extent tea farmers to influence prices, incomes and other outcomes. Coffee and French bean farmers are, however, not as influential as other commodity producers when it comes to determining prices and other market outcomes. The loss of vertical control by smallholder farmers that came with liberalisation has eroded their strategic position as the most important group in an exchange configuration. Smallholder farmers, especially coffee, French bean and to some extent milk farmers, have not only lost the benefits associated with scale economies in processing and marketing but also seem vulnerable to opportunistic trading practices as they have weak lobby groups. The loss of vertical control may also not portend well for exchange of property rights especially for commodities like tea, coffee and French beans that require some form of post-harvest processing before sale and payments are effected.

8.4.2 Farm-level trade contracts

The study results indicate that liberalisation has also had an impact on the trade contracts made by smallholder farmers. It can be expected that product characteristics are important in determining which form these trade contracts will take. An analysis of the products indicates that products traded differ in their perishability, seasonality, differentiation, transaction frequency and associated levels of asset specificity. Trade contracts are shown to be in a process of evolution as a result of market reforms. The long-term, vertically integrated types of contracts prevalent among most commodity systems are progressively being replaced by short-term relational contracts and spot market contracts. This is despite the fact that the present study indicates that long-term, vertically-integrated contracts are likely to be the most efficient mode of organising trade in smallholder coffee, tea and (to some extent) milk commodity systems given their high and idiosyncratic asset specificity, high product differentiation, perishability and the need for continuous trade relationships. In contrast, the horticultural and food crops trade shows that it is better served by short-term, relational trade contracts and even spot contracts as they have low risk (low-asset specificity, perishability and differentiation) and occasional trade relationships. The emerging spot market contractual arrangement across all commodities and especially in tea and coffee may, therefore, be a manifestation of the dissatisfaction of smallholder farmers with the potentially more efficient, vertically-integrated mode of organising trade. Dissatisfaction mainly originates from the high transaction costs associated with the vertically integrated marketing system. These systems, especially for coffee, tea and to some extent horticultural crops, are characterised by adverse selection and moral hazard problems mainly due to a lack of a clear linkage between product differentiation and pricing.

Limited development in rural financial markets to cater for consumption smoothing credit also compel most smallholder farmers to resort to spot markets in their effort to ease their cash flow constraints. Furthermore, the asymmetrical information which prevails in vertically integrated markets has the double effects of making farmers believe they are being exploited while at the same time allowing traders in the spot market to capitalise on the situation. Equally, the decline in inter-linkages of trade contracts with input supply have in some cases increased transaction costs for both the traders and the farmers by increasing search costs. Inter-linkages in product and input contracts may also provide significant economies of scope in the monitoring of trade partners. These economies have also been severely eroded by the low preference of inter-linked contracts. Furthermore, farmers have lost the principle benefit of inter-linkage - that is access to the seasonal credit - that was being offered by co-operatives. This study, therefore, found that the transaction cost considerations of smallholder farmers are important determinants of their supply response and market participation. As pointed out by Williamson (1995); Jaffee and Morton (1995) and Dorward *et al* (1998), imperfect information influences the level of market participants 'bounded rationality' and also creates opportunism in trade relations. Trade opportunism, in turn, has increased the performance risks of producer organisations as some farmers have neglected their contractual

obligations. This has resulted in adverse consequences for all producers in the form of insufficient market volumes (in production and processing terms)⁵¹. These conditions seem to have escalated with market reforms and need to be addressed if smallholder agriculture is to remain the corner stone of development in Kenya.

8.5 Smallholder farmers productivity and efficiency in a reforming economy

8.5.1 *Farm productivity as affected by credit and land constraints*

The results of this study indicate that both farm productivity and resource allocation behaviour of smallholder coffee farmers in Central Kenya region are significantly influenced by the households' land and credit demand conditions. Households that face both land and credit constraints tend to allocate a significantly higher proportion of their farm to food crops, which in turn depresses farm productivity. As shown by Janvry *et al* (1991), the objective of most risk-averse farm households - to secure self-sufficiency in food - is one of the major factors effecting sub-optimal resource allocation behaviour. Although households in Central Kenya region do not suffer from chronic food insecurity, transitory food insecurity is prevalent just like in many other parts of rural Sub-Saharan Africa. The emerging liberalised food markets with reduced government food prices stabilisation role may compel most households to adopt a safety-first resource allocation behaviour aimed at addressing transitory food insecurities. Furthermore, as Janvry *et al* (1991) and Janvry and Sadoulet (1994) have indicated, imperfections in food markets can also cause a high degree of instability in food prices and family incomes as households are confronted with high transaction costs that imposes wide price bands between selling and buying prices. The results of the present study confirm this theoretical assertion. Households' participation in the food (maize) market is shown to depend on the size of the price band between selling and buying prices. The price band varied from 5% to 30%. Households in the smaller farm size category faced the highest price band and this reduced their capacity and willingness to participate in maize markets.

It has been argued that the long-term solution to food insecurity, especially transitory food insecurity, is to increase the level of farm productivity and household incomes (FAO, 1996) or what Sen (1990) calls the entitlements approach. One way of raising incomes (hence food entitlements) is to encourage higher production of high-value commodities such coffee, tea, and horticultural and dairy products. The encouragement of high-value enterprises especially cash crops have been shown to have the added advantage of making farm households more market integrated (Von Braun *et al.*, 1994). Market integration on its part has been shown to further reduce the need for self-food sufficiency (Fafchamps, 1992). Thus, the development and expansion of cash-crop production (mainly tea and coffee) in the Central Kenya region requires comprehensive policies that address the existing imperfections in food markets in order to allow smallholder farmers to allocate more resources to enterprises that enhance farm productivity, market integration and farm incomes.

Equally important is the result of this study that indicates that the availability of credit significantly enhances farm productivity in those households with high land demand (mainly with small farm sizes) but not those households where this is not the case. Furthermore, contrary to empirical evidence from similar farming situations, farm-size positively and significantly influences farm productivity for those households that are both land and credit constrained but not in those households where land constraints are relaxed. Apart from re-emphasising the importance of credit in enhancing the farm productivity of small farms, the

⁵¹ For instance, by not delivering coffee cherry to the co-operative society despite being advanced farm inputs and other services. This not only makes the faithful farmers bear a heavy debt burden but also creates over-capacity that is costly to maintain.

results of this study also indicate that the imperfections in rural factor markets in the region are severely eroding the productivity advantages usually enjoyed by small farms as indicated by Feder (1985); Barrett (1996); Newell and Symons (1997); Deininger and Binswanger (1999). Furthermore, the present study also indicate that although family labour is a significant input that enhances the value of farm production, its opportunity cost is only a tenth of the current agricultural wage rate. This is attributed to unemployment and credit constraints that limit the use of productivity enhancing inputs - conditions that lead to labour intensive production systems.

8.5.2 *Smallholder farmers efficiency*

The analysis put forward in chapter 7 shows that smallholder farmers in Kenya are quite cost efficient. The average level of cost inefficiency is between 7.9% and 8.5% depending on the stochastic distribution assumption. Inefficiency levels ranges from as little as 1% to as much as 66.3%. Such levels of inefficiency are comparable to those estimated for smallholder farmers in Asia and other developing countries as reviewed by Ali and Byerlee (1991); Battese (1992); Bravo-Ureta and Pinhiro (1993); Phillips(1994) and Rougoor *et al* (1998). Nevertheless, Gautam (2000) indicates that the level of cost efficiency of Kenyan smallholder farmers in 1997 was about 15%. However, this estimate was done for all the regions in the country. As might be expected there is a wide variation between the natural and economic productive potential of different regions in Kenya. Furthermore, the use of the data envelopment analysis (DEA) technique may have made the estimates more unreliable due to its sensitivity to extreme observations and non-composer of the error terms which are usually inherent problems in deterministic estimation techniques such as DEA.

We therefore conclude that there is still scope for improving the production efficiency of smallholder agricultural producers in Kenya. Although, the cost inefficiency levels may appear small they can, however, translate into significant savings at the farm level if they can be improved upon. For instance, this study estimated that if half the cost inefficiencies in coffee production are cut, this might lead to smallholder coffee farmers saving about Ksh 200 million. The cost savings would also increase coffee enterprise profitability and hence the overall competitive advantage of the enterprise. The multiplier effect of cost savings in other farm enterprises can be expected to lead to marked improvements in farm incomes with no changes in production levels.

Given that most smallholder farmers are reasonably efficient, indications are that increases in productivity will require a development strategy that can shift the production frontier outwards through the use of new inputs and technologies. Moreover, when these results are viewed in the context of the on-going market reforms they can lead to the conclusion that the reforms may have enabled the farm households to match resource allocation with prices. The shift in the production frontier will require investments and higher public expenditure on research and extension. This creates a dilemma as structural reforms have advocated fiscal austerity measures that have lead to a reduction the amount of public expenditure allocated to research and support services.

The analysis of factors affecting efficiency levels indicate that cost inefficiencies increase significantly with farm size, while they decrease with the amount of farm income and level of credit available to each household. The result of the analysis of the relationship between farm size and inefficiency levels can be interpreted to indicate that small farms have higher efficiency than bigger ones. This result confirms in a way earlier research findings by Lele and Agarwal (1989) who indicated that smallholder tea and coffee farmers in Kenya had a comparative advantage in terms of domestic resource costs as compared to large plantation producers. Deininger and Binswanger (1995) also came to the same conclusion in their comparative study of small and large farms in Kenya, Zimbabwe and South Africa. They did not, however, test for relative economic efficiencies between the farm categories studied.

Adesina and Djato (1996) in their comparison of small and large rice farms in Cote d'Ivoire found no differences in relative economic efficiency between the two farm types. Notwithstanding this finding in Cote d'Ivoire, evidence from India and Pakistan tends to confirm the existence of a relatively higher efficiency in smallholder farms (Yatopolous and Lau, 1973; Khan and Maki, 1979). Thus the results from this study coupled with evidence from other similar agricultural settings may serve as an indicator that smallholder-based agricultural development policy is at least relevant, and is possibly the most efficient mode of organising production in Kenya and other contemporary developing countries. The pursuit of a smallholder-based agricultural development policy may call for intensified removal of the production, credit and marketing policies that have tended to favour large farms in the past.

The significant effect of credit on improving farm efficiency highlights the need for enhancing agricultural credit and other policies that promote and deepen rural financial markets. According to Eswaran and Kotwal (1990), risk aversion is one of the factors that affect the efficiency of household resource allocation. Those farmers with greater access to credit for both consumption smoothing and investment purposes are better equipped to handle risk, which in turn improves their efficiency in resource allocation. This finding is confirmed by Carter (1989) who found that credit recipient smallholder farmers in Nicaragua exhibited significantly higher technical efficiency in production than their non-credit recipient colleagues. Binswanger & Sillers (1983) also came to the same conclusion. They found that the differential technology adoption behaviour of Indian farmers could be attributed to their differential risk preferences and this was largely due to differences in access to relevant credit institutions. Thus, the significant effect of credit on smallholder farmers efficiency in Central Kenya region only gives more impetus to the dire need of alleviating the severe credit squeeze facing smallholder farmers arising from market reforms as earlier results indicated.

8.6 Conclusions and policy implications

8.6.1 Conclusions

From a theoretical perspective, this study suggests that the neo-classical assumption of perfect competition is hardly met even after market liberalisation in Kenya. As such the NIE framework that relaxes this restrictive assumption is found to be better suited to analysing and understanding the economic performance and structures of agricultural markets in developing countries such as Kenya. Equally, the study finds the concept of 'exchange configurations' which categorises commodity systems into products, actors and their production and trade environment provides a useful analytical framework. Not only does it allow for flexibility but it also offers useful insight that can help to understand the intricacies of commodity markets within the broad NIE conceptual framework.

The analysis of the impact of liberalisation on agricultural markets in Kenya leads to the conclusion that liberalisation measures implemented in the country have been of the 'minimalist' type i.e. mainly concentrated on getting the prices right. As such the reforms have partly been able to halt declines in the terms of trade in the agricultural sector and real producer prices. Consequently, expected increases in supply response have not been forthcoming. The study also concludes that market reforms in Kenya have been associated with a higher volatility of commodity prices thereby exposing smallholder farmers to higher price risks. The study finds the intermittent nature of market reforms and their sequencing to be important factors that have contributed to negating some of the desirable effects of market reforms in the agricultural sector.

The results of this study also lead us to the conclusion that market liberalisation was accompanied by a significant reduction in public agricultural sector expenditure, which

severely constrains the provision of essential services needed to promote the productivity of smallholder farms. The study indicates that the expectation that the private sector would take on some of the roles left behind by government and its agencies has, for a complex variety of reasons, only been fulfilled to a very limited extent. This study, therefore, concludes that while there is a need for a consistent liberalisation programme, it is also necessary to reinforce the agricultural liberalisation policies already undertaken by increasing public expenditure on rural infrastructure, technology and human resources development and other agricultural support services.

This study also concludes that liberalisation policies implemented in Kenya have resulted in a major contraction of agricultural credit from banks and other rural financial institutions and that this has particularly effected smallholder farmers. The scarcity of credit has, in turn, had a negative impact on both productivity and the efficiency of production especially in the land-scarce environment that prevails in much of Central Kenya. Land markets (both rental and sales) are also shown to be characterised by high transaction costs and uncertainties, attributes the market reforms did not attempt to address. As a result land markets are thin and poorly integrated with capital markets despite the system of individual land tenure prevalent in Central Kenya. Due to distortions in factor markets, smallholder production systems in the study region are labour intensive with little use of purchased inputs that are a necessary pre-requisites for improved productivity and efficiency in a land-scarce environment.

Market reforms are also associated with major institutional changes that affect the environment within which smallholder farmers make their production and marketing decisions. After market reforms, the vertically co-ordinated marketing systems are in a state of dynamic flux towards a more decentralised system. This has created asymmetrical information that may lead to resource misallocation while enhancing production and marketing risks to smallholder farmers. This study also concludes that the control exercised by smallholder farmers' over production aspects may have increased with market reforms, nevertheless their control over marketing functions has generally declined. This may lead to a loss of their strategic bargaining position and encourage opportunistic trading practices. Another major effect of liberalisation can be seen in trade contracts that have generally moved from the vertically integrated contracts of the pre-reform period to relational and spot market contracts in the post-reform period. This study concludes that the shift from vertically integrated contracts is not in the best interest of smallholder producers, especially those involved in production of crops with high asset specificity and product differentiation such as coffee and tea. The spot market contracts are also not ideal for interlocking credit and products markets thereby constraining credits supply and hence supply response.

Based on the cost efficiency levels of smallholder coffee farms in Central Kenya, it is concluded that a smallholder-based agricultural development strategy is still relevant. It is also concluded that while there is still room for improving smallholder farmers levels of efficiency through better resource allocation and re-allocation, the highest source of growth is likely to come from technology development that shifts the production frontier outwards. The risk mitigation behaviour of smallholder farmers' risk mainly with regard to food security concerns is identified as a major factor determining their resource allocation behaviour. It is therefore the conclusion of this study that both food security and consumption smoothing concerns determine the resources allocated to high-value crops such as coffee and tea by smallholder farmers in Central Kenya region.

8.6.2 Policy issues for smallholder agricultural development

The conclusions reached by this study have led us to identify a number of policy issues that require attention. These directly affect smallholder-based agricultural development in Kenya

and Central Province in the present liberalised economic environment. We have divided these issues into seven clusters:

1. *Implementation of market reforms*

Market reform policies should be sequenced in a way that is self-reinforcing in order to maximise their intended positive impacts while minimising any deleterious effects. In this way general economic and agricultural sector growth will be fostered. This has been clearly demonstrated by the successes registered in South East Asian countries and even some of the consistent reform-orientated countries of SSA.

2. *Provision of services with high public goods component*

Improvement of agricultural terms of trade, real commodity prices and supply response will require the enhancement of public expenditure on rural infrastructure, technology development and dissemination, human resource development as well as other agricultural support services that have a high 'public good' component. This is particularly the case for smallholder farm which are more dependent on public services especially in areas where private sector participation is limited. Indeed, there is a strong case for using public expenditure as a lever to stimulate agricultural development even in a liberalised economic environment. Private sector participation in the provision of agricultural services with commercial appeal should also be encouraged and fostered by removing any existing barriers that hinder entry. This will not only lessen government involvement but will also enable the government to concentrate resources in areas where such resources can give the highest returns. Studies are, however, required to assess private sector capacity and the necessary incentives needed in the provision of agricultural services given the economic and social conditions prevailing in most developing countries and in SSA in particular.

3. *Institutional frameworks for risk management*

To counter the negative effects of high price volatility associated with market reforms and the global trends in commodity markets will require identification and implementation of suitable price risk management mechanisms backed by effective institutional capacity. Such mechanisms may include the use of market-based risk management instruments such as futures and options: the creation of reliable market information programmes: and the development of rural financial markets to enable farmers to smooth their incomes and expenditures. There is also a need to strengthen and enhance the capacity of producer organisations to enable them play a more central role in risk management for the benefit of their members. However, the formulation and implementation of these risk management policies should be preceded by studies to quantify smallholder farmers' price risk bearing ability and the roles rural financial markets and farmer organisations can play in this respect. Furthermore, such studies should also determine the effects of declining international commodity prices and the globalisation of trade on smallholder farmers market participation and welfare given their double roles as producers and consumers.

4. *Rural financial markets*

There is need to put into place discretionary policy measures aimed at improving smallholder farmers' access to production and consumption credit in order to boost farm

productivity and efficiency. Such policy measures should focus on creating a conducive policy environment for a vibrant rural financial markets and micro-financial institutions that are inter-linked with the evolving commodity market. Private and farmer-driven institutions such as credit co-operatives can play a crucial role in this respect. In addition there is a need to create appropriate legal and institutional infrastructure to enable commodity producers to access finance through the use of warehouse receipts and other commodity based collateral.

5. *Land Markets*

Policy interventions are also required to encourage the development of vibrant land markets that are well linked to rural financial markets. This is not the case in the Central Kenya region at the moment. The policy should aim at establishing an effective institutional framework that guarantees land security rights, facilitates the transferability of land rights and the reduction of transaction costs in both rental and sales markets. Priority should, however, be given to rental land markets, which have been shown to ease land constraints without necessarily jeopardising the social security of the poor.

6. *Regulatory framework*

There is need to strengthen the institutional framework within which smallholder farmers in Central Kenya and other parts of the country make production and marketing decisions. Such interventions are necessary in order to deal with the weak regulatory framework created by liberalisation and that is presently jeopardising smallholder farmers' co-ordination and control of production and marketing. Farmers' lobby groups and the creation of an effective public sponsored information system should be encouraged in order to increase farmers control in the marketing chain and address the information asymmetries prevalent in the current systems. It is essential to create a legal and policy environment that governs and enforces trade contracts to reduce opportunistic trade practices while at the same time ensuring regulation of quality standards to facilitate trade. Equally necessary are policies that address the governance problems that are beginning to appear in the management of farmer organisations – and in co-operatives in particular - which if not addressed may lead to the collapse of such organisations with severe consequences for both smallholder farmers production and market participation.

7. *Food security*

To boost cash crops - mainly export crop - production in Central Kenya smallholder farmers' food security concerns need to be directly addressed by creating thriving food markets and by minimising transaction costs in these markets. In this way the disproportionate amount of land and other resources currently allocated to food production can be re-allocated to cash crops and dairy production which have a higher market value consequently boosting farm incomes, investments and contribute to poverty reduction.

Most of the above policy fields focus on creating institutional frameworks necessary for reducing the transaction and production costs, increasing access to production resources and markets by smallholder farmers. This study considers this to be primary challenge facing Kenya in the new century if agricultural development and prosperity is to be achieved. The government has a major role to play in implementation of the policies identified above.

Paradoxically, this indicates that the government remains a major player in promoting agricultural development and particularly the development of smallholder agriculture even in a liberalised market. Implementation some of these policies will also require major public development expenditure both in the short and medium term. We believe such expenditures is justified and will bring dividends in the long term both to the government and the Kenyan economy as a whole. Furthermore, such expenditure should be seen as part of the ongoing development strategy has the alleviation of poverty as its ultimate goal.

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APPENDICES

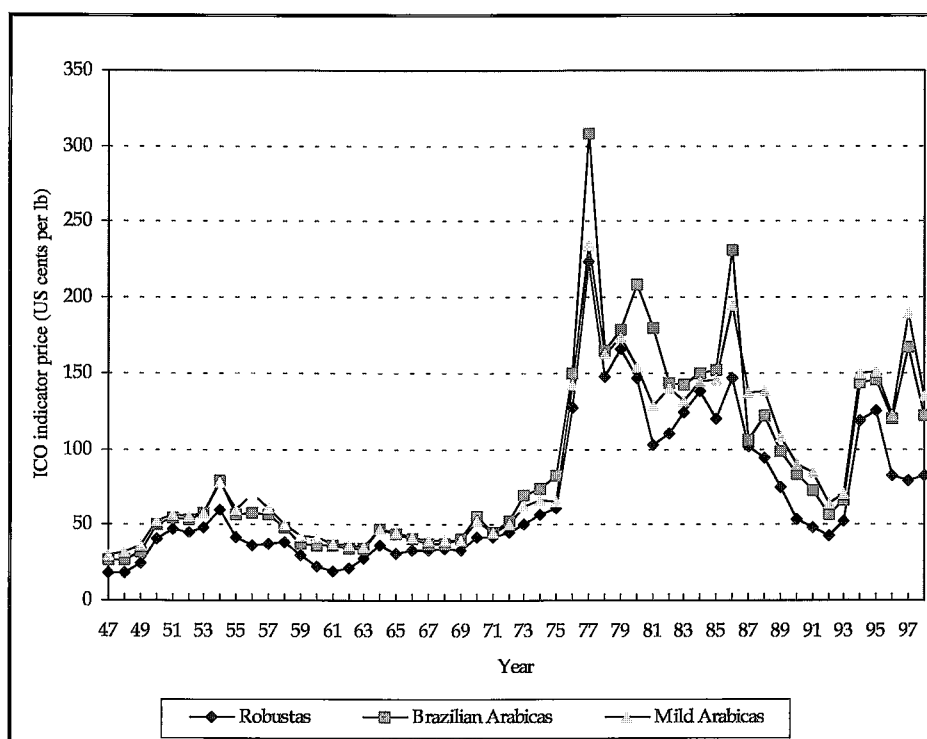
Appendix 1.1: *Commodity* export dependence greater than 50% for African countries, 1997*

Country	Commodities as % of merchandise exports		Leading Commodities	GNP per Capita		% of population living on less than one US \$ /day
	1980	1997 unless otherwise stated		US \$ 1997	Changes in % 1996-97	
Mauritania	99.6	99.9	iron ore, fishery	440	2.1	31.4
Chad	85.4	99.9	cotton, meat	230	3.5	..
Sao Tome & Principe		99.9	cocoa, copra, coffee	290	-2.0	..
Gabon	95.2	98.1	fuels, manganese ore, wood	4,120	3.3	..
Rwanda	99.6	97.7	coffee, tea, tin ore	210	-5.6	45.7
Niger	98.0	97.6	uranium, livestock	200	0.0	61.5
Congo, Rep	93.3	97.3	fuels, wood, sugar	670	-2.7	..
Sudan	99.7	97.2	cotton, animals, sesame seeds	290	4.2	..
Guinea-Bissau	91.8	95.8	nuts, fishery	230	4.4	88.2
Burundi	96.3	95.7	coffee, tea	140	-1.5	..
Somalia	..	95.5	live animals, fishery, bananas
Benin	96.6	95.4 (1996)	cotton, fuels	380	2.7	..
Gambia	93.2	92.8 (1996)	peanuts, fish, cotton, palm	340	2.1	..
Malawi	93.6	92.7	tobacco, tea, sugar	210	2.5	4.3
Ghana	99.1	92.3	cocoa, aluminium, wood	390	1.7	..
Cameroon	96.2	92.0	fuels, wood, coffee	620	1.7	..
Ethiopia	99.8	86.8	coffee	110	3.0	46.0
Zambia	84.0	68.5	copper, zinc	370	1.8	84.6
Mali	98.7	83.9	cotton, gold	260	3.5	..
Mozambique	61.8	83.3	fishery, nuts, cotton	140	10.5	..
Togo	89.4	80.5	phosphate, cotton, coffee	340	2.0	..
Tanzania	65.9	78.2 (1996)	coffee, cotton, cashew, minerals, tobacco, sisal	210	1.2	..
Kenya	87.9	74.7	tea, coffee, fuels	340	0.4	50.2
Burkina Faso	89.2	73.7	cotton	250	3.2	..
Madagascar	93.7	72.1	coffee, vanilla, cloves, fish, sugar	250	1.5	72.3
Uganda	99.3	70.7 (1996)	coffee, cotton	330	3.0	69.3
Zimbabwe	64.2	70.4	tobacco, nickel, cotton	720	0.1	41.0
Cote d'Ivoire	95.3	70.0	cocoa, fuels, wood	710	4.3	17.7
Namibia	..	69.2	minerals, fish, skins	2,110	-1.3	..
Sierra Leone	60.1	57.8 (1996)	minerals, cocoa, coffee, fish	160	-20.6	..
C. Africa Republic	73.8	57.4	wood, live animals, cotton	320	3.8	..
Senegal	84.9	50.2	fish, nuts, fuel, phosphates, cotton	540	2.5	54.0

* Excludes countries solely dependent on fuels

Source: Common Fund for Commodities (CFC,2000)

Appendix 1.2 International Coffee Organisation indicator prices for robustas, Brazilian arabicas and other mild arabicas, average annual prices 1947 to 1998



Source: Compiled from ICO coffee market reports (various)

Appendix 2.1: Autoregressive Conditional Heteroskedacity (ARCH-M) Estimation*

This appendix gives more econometric details of the ARCH estimation method introduced by Engle(1982). Bollerslev (1986) generalised the ARCH (GARSH) technique, so did Engle *et al*, (1987) by offering the ARCH-in- Mean (ARCH-M) refinement. The ARCH-M model that is used in this study permits the conditional variance (h_t) to affect the level of conditional mean (μ) i.e. providing for the expectation that the mean and variance move in the same direction. This condition can be expressed as:

$$\mu_t = \beta_0 + \delta g(h_t) \quad (1)$$

Where, β_0 is a constant and $g(h_t)$ is a monotonic function of the conditional variance (h_t). The term $\delta g(h_t)$ represents a risk premium i.e. the increase in expected rate of return due to an increase in the variance of the return. Bollerslev *et al*, (1992) and Bera & Higgins (1995) provide a good review of the ARCH literature.

In line with the general principles of the model, the price time series of each commodity (P_{it}) can be modelled in a linear ARCH-M form:

$$\Omega(L)P_{it} = \beta_0 + \beta_t T + \sum_{i=1}^c \beta_i X_{it} + \delta g(h_{it}) + u_{it} \quad (2)$$

$$u_{it} / \Psi_{t-1} \sim iid N(0, h_{it})$$

$$h_{it} = \alpha_0 + \alpha_t T + \sum_{j=1}^n \alpha_j u_{it}^2 + \sum_{k=1}^q \gamma_k Z_{kt} \quad (3)$$

$\Omega(L)$ is a polynomial lag operator, α_0 and β_0 are constants, and t is unit time index whose coefficient present a linear monthly trend (T). The residuals of the conditional mean equation (2) are normally distributed conditional on the information set, Ψ_{t-1} , being available. The function $g(h_{it})$ transforms the conditional variance as in equation (1). In the current model $g(h_{it}) = h_{it}^{1/2}$ is the risk premium with respect to conditional price(P_{it}) standard deviation. The X and Z vectors contain c and q exogenous variables affecting the mean and variance, respectively, as shown in the Table below.

* The theoretical part of this appendix is mainly based on Barrett (1997).

Independent variables in vector X and Z of the estimated model for each commodity time series.

Independent Variables	Unit	Maize	Milk	Coffee	Tea
Vector X (Variables in the mean equation)					
Lagged real price(P_{t-1})	Ksh	x	x	x	x
Time Trend (T) ⁱⁱ	-	x	x	x	x
Liberalisation Dummy (L) ⁱⁱⁱ	(0,1)	x	x	x	x
Production	Metric Tonnes	x	x	N/A	N/A
Seasonality Dummy (S) ^{iv}	(0,1)	x	x	N/A	N/A
Sales (S) ^v	Kg,bags, Lt,	x	x	x	x
Imports ^{vi}	90kg bags"	x	N/A	N/A	N/A
Real Exchange Rate (RER) ^{vii}	Index(1982=100)	x	x	x	x
Border Parity price (BP) ^{vii}	Index	N/A	N/A	x	x
ICA Dummy (ICA) ^{ix}	(0,1)	N/A	N/A	x	N/A
ARCH term (h_{t-1})		x	x	x	x
Vector Z (the variance equation)					

All the above variables except the arch term. The lagged variance (f_{t-1}) is also included in the variance equation.

Notes

- i) x - indicates inclusion of the variable in the model, N/A -indicates the variable is not included in the model.
- ii) The time trend is calculated as a simple regression of price against a time variable i.e. $P = f(t)$, where $t = 1, 2, \dots, n$ (years); P = nominal monthly price. The trend is calculated: $Trend = a + \beta p_t$, where, a is a constant estimated from the price regression equation, β is the trend coefficient and p_t is the price at period t .
- iii) $L = 0$, for the period January 1985 to December, 1991 (pre-liberalization period) and $L = 1$, for the period January 1992 to December 1999 to correspond with the liberalization period. Although specific market reforms in each sub-sector were implemented on different periods after 1991, for comparison purposes this study adopted 1992 as the liberalization year. The maintained hypothesis is that trade and other macro-economic reforms undertaken from 1992 had major impact that cut across all commodities and agricultural sector in general. As such the study did not attempt to have different dummy variables for particular periods in which specific reforms were undertaken in each of the commodity systems under consideration.
- iv) In the maize model, $S = 1$ in January, February, August, October and November of each year, which are the maize harvest months, $S = 0$, elsewhere. In the Milk model, $S = 1$ in the rainy months of April, May, June, October, November and December and $S = 0$, elsewhere for the dry months.
- v) In the maize model, sales refers to 90 kg bags sold by NCPB into the market, milk sales refers to litres of milk procured by the registered milk processing plants. Coffee and tea sales refers to bags and kg of clean coffee and made tea, respectively, offered in the weekly Nairobi coffee auctions and Mombasa tea auctions
- vi) Imports refer to maize imports by NCPB. Data on maize imports by private traders before and after maize market liberalisation are not available.
- vii) Real Exchange Rate (RER) is defined as the index of monthly average Ksh exchange rate adjusted by the ratio of Nairobi middle income consumer price index (CPI) to the U.S.A. wholesale price index (WPI) obtained from IMF international financial statistics.
- viii) The New York Coffee futures (2nd and 3rd) position price (US \$ per kg of green coffee) is used as the coffee parity price as it is used as a reference price at the Nairobi coffee auction. The

- ix) London tea auction prices(US\$ per kg of made(black) tea) are used as the parity price for tea. The border parity prices are expressed in US dollars rather than in Ksh equivalent to avoid multi-collinearity problem with the real exchange rate variable which is included in the model. In the coffee model, $ICA = 1$ for the periods, January 1985 to February 1986 and October 1987 to June 1987 when the ICA regulations were in place and $ICA = 0$, elsewhere.

Appendix 3.1: Major Horticultural Commodities in Kenya

Vegetables & tubers	Artichokes	Cauliflower	Lettuce
	Asparagus	Celery	Okra
	Baby marrows	Chillies	Onions
	Beetroot	Cucumbers	Potatoes
	Brinjals	Dudi	Radishes
	Brussels sprouts	Galka	Snake gourds
	Cabbages	Karela	Spinach
	Capsicums	Kohlrabi	Turia
	Carrots	Kale	Turnips
Fruits	Avocados	Limes	Plums
	Apples	Mangoes	Pomelos
	Bananas	Mulberries	Strawberries
	Cape gooseberries	Oranges	Sweet melons
	Figs	Papaya	Tangerines
	Grapes	Passion fruit	Tomatoes
	Guavas	Pears	Tree tomato
	Lemons	Pineapples	Watermelons
Cut-flowers	Alstoemerias	Lilies	Solidasters
	Ammi majus	Molucella	Spray carnations
	Arabicum	Orchids	Standard carnations
	Chrysanthemums	Ornithogalums	Statice
	Delphiniums	Roses	Tuberoses

Source: Dijkstra, T. (1997)

Appendix 4.1: Nominal and real, fertiliser prices and agricultural wages in Kenya, 1985-1999.

Year	Fertiliser price (Ksh/kg)		Wages Ksh/manday		Consumer Price Index (CPI)
	Nominal	real	nominal	Real	
1985	3.91	4.16	13.20	14.03	94.1
1986	3.90	3.86	13.30	13.17	101
1987	4.84	4.42	15.00	13.69	109.6
1988	6.07	4.94	16.35	13.33	122.7
1989	6.55	4.81	18.00	13.23	136.1
1990	7.03	4.00	24.15	13.74	175.8
1991	9.52	4.50	29.65	14.01	211.7
1992	11.38	4.44	35.05	13.66	256.6
1993	18.57	4.96	45.05	12.04	374.3
1994	20.96	4.38	52.10	10.88	478.8
1995	18.91	3.80	62.55	12.56	498
1996	22.35	4.12	75.00	13.81	542.9
1997	21.99	3.84	80.30	13.55	592.7
1998	21.96	3.39	93.00	14.35	647.9
1999	-	-	120.00	17.70	678

Notes

The Nairobi consumer price index (CPI) is used to deflate all nominal prices to arrive at real prices.

Fertilizer price based on a composite price of the most popular fertiliser brands in Kenya (CAN, DAP, UREA and N:P:K) which account for 88% of all fertilisers consumed in the country.

The agricultural wage refers to the casual worker wage rate negotiated by the Kenya Plantations Workers Union (KPAU), which is applicable to majority of plantation workers. As most smallholders' farmers compete with plantations for the available labour during peak periods, they are compelled to pay similar rates as those negotiated by KPAU. The government minimum agricultural wages, which are generally very low, are in most cases ignored.

Source: Compiled by Author

Appendix 4.2 : Types and quantity of fertilisers used in Kenya, 1985 to 1998

Year	Fertiliser type										Total
	DAP	MAP	CAN	UREA	20:20:0	23:23:0	25:5:5	20:10:10	17:17:17	All others	
	Metric Tonnes										
1985	47,338	5,052	21,479	12,001	16,998	0	21,000	13,476	4,195	-	141,539
1986	62,774	3,425	41,709	16,122	15,325	0	32,184	27,897	2,974	-	202,410
1987	63,500	1,000	48,000	8,750	18,000	0	36,175	23,000	4,500	-	202,925
1988	76,689	3,584	30,724	13,691	27,558	0	37,884	15,300	5,112	-	210,542
1989	81,351	2,532	39,449	16,377	22,580	1,740	51,675	12,373	5,498	-	233,575
1990	80,576	4,111	36,188	5,652	12,065	4,340	51,622	13,952	1,345	-	209,851
1991	73,343	8,367	21,792	18,779	9,971	1,932	41,373	23,237	4,855	25,066	228,715
1992	80,225	4,943	28,248	9,471	2,789	23,538	58,773	7,791	9,306	29,003	254,087
1993	65,845	11,512	31,680	14,926	7,449	8,882	54,937	7,514	10,664	19,486	232,895
1994	76,098	10,150	36,194	23,036	24,368	20,245	42,949	21,123	1,897	30,459	286,519
1995	82,346	16,898	38,733	20,716	10,595	11,394	51,332	7,359	8,751	33,098	281,222
1996	47,863	34,929	43,614	18,505	7,702	5,468	61,698	10,533	10,847	58,775	299,934
1997	52,067	14,393	32,842	14,020	13,577	14,441	65,629	11,709	12,671	31,352	262,701
1998	79,809	17,570	28,858	13,273	8,218	7,687	54,307	6,567	9,474	29,281	255,044

DAP = Diamonium Phosphate, MAP = Multiple Ammonium Phosphate, CAN = Calcium Ammonium Phosphate, The others represent compound fertilisers given in the ratios of Nitrogen (N): Potassium (P) : Phosphorus (K).

Source: Ministry of Agriculture database

Appendix 5.1 Total AID flows to Kenya, 1970–1996 (US\$ millions)

YEAR	TOTAL ODA	TOTAL EDA
1970	66.1	31.8
1971	80.0	49.6
1972	141.5	92.8
1973	141.2	84.5
1974	150.7	105.1
1975	187.6	109.2
1976	258.7	147.4
1977	253.6	148.4
1978	343.4	226.6
1979	432.0	297.0
1980	480.9	370.1
1981	535.8	396.0
1982	578.0	406.1
1983	519.6	354.3
1984	655.6	416.4
1985	526.5	397.8
1986	637.1	452.0
1987	752.6	515.8
1988	954.4	737.7
1989	1091.9	798.2
1990	1615.0	1442.2
1991	1102.1	863.1
1992	987.1	798.3
1993	869.7	749.3
1994	731.3	611.9
1995	1020.9	727.1
1996	743.3	575.0

Notes

All data in current prices. Total Official Development assistance (ODA) includes both concessional loans (those with a grant element of at least 25% according to Development Assistance Committee (DAC) definitions) and grants. Grants include both technical co-operation and debt relief on previous ODA loans. Loan data from World Bank debt reporting system; grant from OECD/DAC. Effective Development Assistance (EDA) from Chang, *et al* 'Measuring aid flows, A new approach'. EDA includes all grants plus the grant element of all development loans recalculated according to the methodology in Chang, *et al*.

Source: Adopted from O'Brien and Ryan (1999), p.43.

Appendix 5.2 World Bank Agricultural Extension Projects in Kenya (Impact Evaluation)

The Kenyan extension service adopted the training and visit (T&V) system of management in 1982 and has since been supported by the World Bank through the First and Second National Extension Projects (NEP-I and II). The projects had two objectives: institutional development of the extension service and sustained increases in agricultural productivity. The effectiveness of the extension approach adopted by the projects has been a subject of debate because of its perceived high cost and an apparent lack of impact on agricultural production. This debate is part of a broader disagreement on the effectiveness of the T&V approach to extension. The arguments have largely focussed on its efficacy relative to alternative mechanisms for delivering extension advice. While it is generally agreed that the T&V system is costly, the controversy centres on the returns to the high levels of investments by the borrowing countries, and hence on the impact on agricultural production. Despite the intensity of the debate and the high volume of lending by the Bank, there have been very few attempts to rigorously establish the impact of T&V projects. This evaluation adopted a theory-based approach to systematically gather a credible body of empirical evidence to establish the likely impact of the projects. Following a results-based management framework, the evaluation sought to relate the observed results in the farmers' fields to the projects' inputs. In addition, intermediate output and outcome indicators are measured to assess the performance of the extension system along the results chain to confirm the potential for impact.

Main findings and conclusions:

Institutional development: The institutional development impact of NEP-I and II has been limited. NEP-I introduced T&V as "first and foremost a management system." However, after fifteen years, there appears to have been no appreciable improvement in the effectiveness of the extension services; there is a lack of a strategic vision for the future development of the extension system; and the management continues to be weak, with virtually non-existent information systems. The prolonged ineffectiveness of the extension services has led to recent efforts by the Government of Kenya, with the help of other Bank projects and donors, to rationalize its extension services using alternative approaches. The projects established a national system organized along the T&V lines of management. The main benefits of the projects have been increased geographical coverage, improved research-extension linkages (albeit belated) and improved staff quality through training. The institutional design, reflecting the projects' objectives, has lacked a focus on the critical issue of farmer empowerment. As such, inappropriate incentives have resulted in a lack of accountability or responsiveness to the clients' needs. The hierarchical structure has been a disincentive for innovation, partnerships, and efficiency, and the extension system has been top-down, supply driven and non-participatory.

Sustainability:

- The system is neither financially sustainable nor cost-effective.
- The current system is significantly more costly, and no more efficient, than the one it replaced.
- Government allocations to extension, as for other public expenditures, continue to decline, and the system is heavily dependent on donor funds.
- An overwhelming proportion (80%) of the operational budget is consumed by staff salaries. As a result, many problems that limited the effectiveness of the previous system have persisted, and staff have reverted to the methods of dissemination that were used earlier.
- The approach taken—a high intensity of contact with a limited number of farmers—has been costly and unwarranted given the inadequate stock of messages for dissemination and the slow pace of new technology generation.

Relevance: A distinction is needed between the relevance of extension services *per se* and the relevance of project design. The rationale of providing extension services to smallholders is still relevant. However, several features of the projects' design proved to be inappropriate.

- There is an unmet demand for extension services, and the farmers value the access to such service enough to be willing to pay for it.
- There are still few alternatives to government-provided extension, although alternative providers are emerging.
- The relevance of the biweekly, or even a monthly, visit schedule is questionable considering that most farmers, including the contact farmers, do not want to meet the extension agent very often. The staff themselves are wary of the repetitiveness and ineffectiveness of the visits.
- A blanket cover of the majority of production areas using a single approach and standard messages proved to be inefficient and unproductive. The limited experience from some pilot initiatives under NEP-II confirms the potential usefulness of alternative and more responsive approaches.

Efficacy: The farmers did not have adequate access to extension advice in 1982, and appear not to have adequate access now. All methods using the available data indicate that the current institutional arrangements are ineffective in delivering the service. This reflects, in part, the poor enabling environment in which the extension service has operated in recent years. However, the poor performance is not entirely a function of external factors. Available evidence suggests that the current situation is not much different from that in 1990.

- Both the qualitative and quantitative assessments indicate that the relevance of the advice delivered has been

limited. The extension system has not been responsive to the types of information farmers want, and the relevance of the advice to the needs of a broad range of farmers is questionable.

- The focus of the extension service has remained on disseminating simple agronomic and maize-related messages. Extension activities under NEP-I and II have had little influence on the evolution of the patterns of awareness and adoption of recommendations.
- The failure to take advantage of the face-to-face extension approach to deliver more advanced and context-specific advice has reduced the cost-effectiveness of the project design. This is particularly true for NEP-II, at the start of which most farmers were known to have already adopted the simpler maize messages.
- A significant finding is that a very high proportion of those who are aware of the messages, on even the more complex practices, have adopted them. Thus, although non-extension related factors, including the often cited lack of financial resources or access to credit, may be important in preventing farmers from adopting certain complex practices (e.g. fertilizers and pesticides), it is evident that the lack of information continues to be an important constraint.
- The progress on gender issues has been mixed. The earlier bias against women farmers has been rectified, but some bias persists in the selection of contact farmers. The proportion of female field-extension agents has remained largely unchanged since 1982.
- Although the coverage has increased, access to existing services is limited, especially for the poor and the less educated. The availability of information and the quality of the services provided are reported by the farmers to have declined since the early 1980s.

The level of outreach is well below the anticipated levels, with only about 7% of the contact farmers (and 2% of all farmers) meeting with extension agents on a regular basis and in a setting prescribed by the project design.

Efficiency: Overall, a positive rate of return to the current expenditures on extension cannot be established. It is likely that NEP-I had some early beneficial impacts. However, these benefits appear to have been short-lived as the data do not indicate any significant impact even by 1990.

- There has been some improvement in the technical efficiency of farmers since 1982, but the overall efficiency continues to be low. Their low economic efficiency indicates the potential for farmers to achieve significant savings by simply moving to a more economical mix of inputs under current market conditions.
- The data show a very small positive impact of extension services on the level of technical efficiency, but the level of confidence in the result is low. The data also indicate that extension services have no discernible impact on the level of economic efficiency.
- A significant impact of the supply of extension on productivity at the farm level cannot be established from the current data.
- What can be established is that the allocation of extension resources has been inefficient. Extension services have been poorly targeted. The growth in agricultural production has been higher in the previously less productive areas, whereas the placement of extension staff has favoured the more productive areas. While extension possibly had an early positive impact in the spread of simple technological messages to the previously less productive and under-served areas, this impact cannot be conclusively established with the current data.
- A significant proportion of farmers are willing to pay for extension services. This reflects that the farmers value the advice when they receive it. The perceived benefit, as reflected in the amount that farmers are willing to pay, however, is well below what the government currently spends on extension services per farm.

Note: NEP I (1983-1991) and NEP II (1991-1998). The evaluation was conducted by OED based on data collected through 1982 rural household budget survey (RHBS), 990 household survey conducted by World Bank African technical department and 1997 household survey data collected by OED.

Adopted from Gautam, M. (2000). Agricultural Extension: The Kenyan Experience, an impact evaluation. World Bank Operations Evaluations Department (OED). Washington, D.C. 67p.

Appendix 5.3 (a) Agriculture research expenditures by KARI, TRF and CRF and expenditure shares, 1987/88 to 1997/88

YEAR	KARI	TRF	CRF	Total Expenditure (KARI +TRF+CRF)	Total Expenditure as % of Agr GDP
Expenditure in Ksh Millions				%	
1987/88	220 (0.57)	12.12	66.24	298.36	0.78
1988/89	231.12 (0.55)	11.76	73.46	316.34	0.75
1989/90	396.57 (0.88)	12.93	68.29	477.79	1.06
1990/91	402 (0.86)	14.9	81.54	498.44	1.07
1991/92	415.80 (0.77)	15.65	115.67	547.12	1.02
1992/93	534.28 (0.64)	18.22	106.08	658.58	0.79
1993/94	719.66 (0.67)	19	154.89	893.55	0.84
1994/95	830.45 (0.71)	25	172.89	1028.34	0.91
1995/96	1028.56 (0.82)	30	202.45	1261.01	1.01
1996/97	1041.47 (0.74)	40	232.86	1314.33	0.94
1997/98	1301.14 (0.87)	50	252.43	1603.57	1.07

Figures in parenthesis indicate KARI's expenditure as % of Agr GDP

Source: KARI, CRF, TBK annual reports and Author's calculations

Appendix 5.3 (b) Agricultural Research intensity Ratios (ARI) for various world regions, 1961 to 1985.

Simple Average (%)					
Country/Region	1961 - 1965	1966 - 70	1971 - 75	1976 - 80	1981- 85
Nigeria	0.11	0.21	0.29	0.48	0.35
Western Africa (15)	0.42	0.50	0.56	0.80	0.91
Central Africa (6)	0.51	0.61	0.51	0.55	0.77
Southern Africa (7)	0.71	1.09	1.00	1.08	2.04
Eastern Africa (7)	0.4	0.57	0.5	0.51	0.63
Sub-Saharan Africa (37)	0.49	0.65	0.63	0.75	1.06
China	0.41	0.31	0.39	0.47	0.39
Asia & Pacific, ex. China (15)	0.34	0.55	0.45	0.50	0.62
Latin America & Caribbean (26)	0.42	0.59	0.63	0.69	0.82
West Asia & North Africa (13)	0.60	0.71	0.93	1.05	1.27
Less-Developed Countries (92)	0.46	0.62	0.64	0.73	0.94
Developed Countries (18)	0.88	1.30	1.48	1.72	2.02

Agricultural research intensity (ARI) measured as agricultural research expenditure as percentage of AgrGDP

Figures in parenthesis represent the number of countries considered

Source: Pardey *et al.*, (eds.), 1991 p.36-37.

**Appendix 5.4 Agricultural Finance Corporation (AFC) Loan Disbursements per Loan Category,
1984/85 to 1997/98**

Year	Loan Category*			Total
	Large scale**	Small scale	Seasonal	
		Ksh '000'		
1984/85	183,016	46,165	153,872	383,653
1985/86	188,573	135,476	580,211	904,260
1986/87	218,448	108,474	418,108	745,030
1987/88	164,972	84,501	380,451	629,924
1988/89	123,886	50,136	164,661	338,683
1989/90	84,340	94,880	163,480	342,700
1990/91	133,270	34,350	207,415	375,035
1991/92	128,460	93,440	294,620	576,520
1992/93	258,160	63,420	372,360	693,940
1993/94	165,510	115,398	481,955	762,863
1994/95	159,322	236,671	104,504	500,497
1995/96	191,127	4,931	104,826	300,497
1996/97	208,219	21,246	20,173	249,638
1997/98	78,408	32,450	62,119	172,975

Notes

*AFC offers four facilities:

Large-scale loans – all farm development loans worth more than Ksh 100,000

Small-scale loans – all farm development loans worth less than Ksh 100,000

Ranch loans – loans granted for development of ranches for meat production.

Seasonal credit loans – Loans under special loan scheme for maize and wheat production
(mainly given to large scale farmers)

** Includes both large and ranch loans

Source: AFC statistical digests, 1994 and 1998

Appendix 5.5

PEASANT REVOLT

Festus Murathe is a bitter man. He has already sold four of his five sheep and one of his two cows in a desperate effort to raise money. But his youngest son is idling at home after being expelled from school because of unpaid fees. His two other children face a similar fate. His smallholding of coffee, formerly his main source of cash, now seems like a curse. 'They are killing me and my family also,' Festus says, glowering at his neat rows of once-prized coffee plants stretching down the hillside. 'I feel as if I'm dead already. I don't have fees, my children are just at home, what am I to do?' The focus of his anger is the management of the local Mukurwei-ini Coffee Farmers Co-operative Society of which he is a member. Festus planted 600 coffee bushes in 1976 when coffee industry in Kenya was experiencing a mini-boom, with Kenyan coffee beans fetching high prices on world markets. He joined the Co-operative, which gave small growers a chance to do what had hitherto been done only by white settlers farming coffee on a large scale.

The system worked well and Festus earned a good enough living with an expensive roof of iron sheets up on the hill beside his plantation. He would take his beans - 'black gold' as they call it - down the steep muddy track to Mutitu coffee factory in the valley. At the factory, run by the Co-operative, the beans would be washed then spread on mesh racks to dry in the sun. From the factory the beans would be taken to the millers for removal of the outer shell, then transported to the Coffee Board of Kenya for grading and selling at auction. The Co-operative paid the farmers according to the profits made and ensured delivery of the pesticides and fertilisers needed to produce a healthy crop. But the heyday did not last long. The high profits attracted unscrupulous operators who took advantage of the simple farmers' inexperience in business. Local barons wormed their way into positions of influence within the Co-operative by manipulating the management elections. They colluded with 'elected' officials to win contracts for the delivery of farm inputs and other services, and again with manufacturers and distributors to further inflate their profits. The Co-operative sagged under the weight of corruption, mismanagement and inefficiency. The farmers bore the brunt. Sometimes their coffee plants were blighted by insects because the pesticide they were sold was diluted with chalk. Yields fell as they fertilisers they had paid for were poor quality - and sometimes were not even delivered.

Today, Mukurwei-ini Co-operative's 22,000 members may earn as little as 10 per cent of the price ultimately realised for their coffee. The other 90 per cent is siphoned off by various commissioning agents and shadowy bureaucracies. In some years, the farmers have not been paid at all - the Co-operative claimed its profits had been used to pay off debts or overdrafts. Reduced to poverty, Festus Murathe took up his hoe and machete a few months ago and joined other farmers in taking over Mutitu factory and declaring independence from the Co-operative. They dug trenches and felled trees to block the roads and fought off police who tried to evict them from the factory. Tired of the corruption and inefficiency of the Co-operative management, they determined to run their own affairs and reap the true reward of their own labour. The rebellion spread fast through the coffee-growing region of highland Central Province. Older people were reminded of the last violent struggle that gripped the area: the Mau Mau revolt against the British colonialists more than 40 years ago. The whole coffee sub-sector is now in chaos. Farmers are using their agricultural tools to fight the police and rival groups of farmers opposed to splitting up the Co-operatives. Factories and other property have been burnt and some farmers have uprooted their coffee plants in defiance of the law.

Source: BBC Focus On Africa Jan-March, 2000 Issue

**Mukurwei-ini coffee farmers co-operative is located in Nyeri District (one of the study districts)*

Appendix 5.6

STORM BREWING

Josephine Muthoni Thigori has been harvesting tea in the village of Meeri for the past fifteen years. With the hot sun beating down, she works all day from seven in the morning with a large basket strapped to her head, plucking tea leaves. Working at a ferocious pace, bending and straightening her back, she gathers until her baskets are full. Then she awaits the lorry from the buying centre. The wait for the bus is just about the only respite Josephine gets during her back-breaking day. 'I usually work about seven hours,' she says. 'But if the lorry doesn't come, we go on until six in the evening. Often they don't come on time'. Sometimes the lorries don't come at all. The roads to the plantations are rocky and stony and often impassable during the rainy season. The farmers pay an annual levy for the maintenance and repair of roads. But they have never seen any work carried out on them.

Josephine, like the others, harvests between 30 and 40kg of tea leaves a day, which is all thrown into the basket resting on the backbone. 'I'm tired all the time because I work hard from Monday to Saturdays,' she complains. 'But we don't make enough money. Josephine's eldest son is eighteen, but doesn't go to school because she can't afford the fees. His younger brother is very bright and has passed all his exams, but there's no money to send him to Secondary school. More and more, tea plantation workers and farmers like Josephine are blaming their plight hard work for not enough return- on the parastatal Kenyan Tea Development Authority, the KTDA. Farmers have been saying for some time that much of the profit from tea is being pocketed by corrupt officials.

Tea farmers are calling for tighter controls on the KTDA and greater autonomy from what they see as a corrupt government. Wanjema Wanjogla, spokesperson of the Association of Farmers in Meeri, said that members of the board who are supposed to represent farmers' interests are not elected by them, but are appointed by the government. According to Wanjema, until the small farmers have the power to elect their own representatives to the KTDA board, they will be continually exploited. Following the example of the coffee farmers (see Focus on Africa Magazine Jan - March 2000), tea farmers have embarked on a campaign of protests. Josephine was herself arrested after a demonstration in Uhuru Park in downtown Nairobi. She said her night in the cells will not deter her from fighting for her rights and going on another march. A few kilometres from the plantation, down a bumpy road, lies the Theta tea factory. Here, the hundreds of basket of tea are off-loaded, sorted, withered and then bagged, ready to be driven down to the tea auction in Mombasa. The assistant factory manager is Stephen Mugweka who was quick to refute the farmers' allegations that they don't get a fair price for their crop and are being exploited by the KTDA and the factories. 'The price of tea in Kenya is one of the fairest in the World,' he said. 'Prices are determined by market forces of supply and demand have nothing to do with the factories

According to him, most of the noise made by the farmers has been caused by misinformation. Yet he could not explain who those who do the hard work don't have enough money to support their families and have never seen the profits trickling down. The definitive explanation came in a landmark report published by the Ministry of Agriculture in February. The report shows the KTDA has for the past decade been beset by dishonesty, inefficiency and fraud: billions of Kenyan shillings have gone missing from the KTDA coffers; managers have undersold farmers' tea; numerous irregular contracts have been issued for the purchase of fertilisers and other goods and services. The report also cites evidence that some board members and even farmers have been bribed into silence. Other farmers have been bribed not to join those agitating for change.

Appendix 5.7 Commissions, taxes and deductions made along the coffee marketing chain in Kenya, 1984/85 to 1998/99

Year	Marketing charges	Non-marketing levy	Export duty	Presumptive Income Tax (PIT)	Milling charges	County Council cess	Commission agent fee	Co-operative deductions	Total deductions	Producer margin
Pre-reform period										
% of coffee price at the Nairobi Auction										
84/85	2.06	8.82	8.33	0.00	3.00	3.00	1.00	26.00	52.21	47.79
85/86	1.08	10.21	11.99	0.00	3.00	1.00	1.00	26.00	54.28	45.72
86/87	3.18	6.72	5.74	0.00	3.00	1.00	1.00	25.00	45.64	54.36
87/88	4.38	9.83	8.89	0.00	3.00	1.00	1.00	25.00	53.10	46.90
88/89	9.49	2.74	1.70	0.00	3.20	1.00	1.00	27.00	46.13	53.87
89/90	5.96	0.99	0.00	0.00	4.00	1.00	1.00	29.00	41.95	58.05
90/91	4.69	2.01	0.00	0.00	3.20	1.00	1.00	30.00	41.90	58.10
mean	4.41	5.90	5.24	0.00	3.20	1.29	1.00	26.86	47.89	52.11
Reform period										
91/92	6.90	2.10	0.00	0.00	6.70	1.00	1.00	27.00	44.70	55.30
92/93	3.14	1.70	0.00	0.00	2.40	1.00	1.00	27.00	36.24	63.76
93/94	2.16	1.40	0.00	2.00	2.10	1.00	1.00	25.00	34.66	65.34
94/95	3.41	2.00	0.00	2.00	3.10	1.00	1.20	25.00	37.71	62.29
95/96	3.05	2.90	0.00	0.00	2.90	1.00	1.20	22.00	33.05	66.95
96/97	1.68	2.80	0.00	0.00	2.80	1.00	1.20	23.00	32.48	67.52
97/98	3.00	3.00	0.00	2.00	2.50	1.00	1.20	24.00	36.70	63.30
98/99	3.00	3.00	0.00	2.00	2.50	1.00	1.50	25.00	38.00	62.00
Mean	3.29	2.36	0.00	1.00	3.13	1.00	1.16	24.75	36.69	63.31

Notes

Marketing charge levied by Coffee Board of Kenya to cover marketing costs, Non-marketing levy caters for non-marketing costs of CBK and research costs, Milling charges are levied by millers for secondary processing, the country council cess is levied by local authorities for "improvement" of rural access roads, commission agents fees is to cater for "professional" services offered by the agents while Co-operative deductions caters for society operational costs and other overheads.

Source: Coffee Board of Kenya annual reports and Author's calculations

SUMMARY

In most least developed countries (LDCs), and Sub-Saharan Africa (SSA) countries in particular, agriculture remains the dominant sector accounting for a large proportion of GNP, employment and export revenues. Equally, in most SSA states, agricultural development policies have for various economic, social and political reasons centred on smallholder farms unlike in the developed countries where large family farms are the preferred mode of organising agricultural production. The smallholder based agricultural systems however offer formidable challenges mainly with regard to organisation of the market chains, provision of public goods and services, as well as the institutional requirements necessary for functioning factor and non-factor markets.

The performance of the agricultural sector and particularly the small farms in SSA countries has not been impressive in the last two decades. This is despite the implementation of wide-ranging liberalisation policy measures under the structural adjustment programmes (SAPs). For agriculture, the SAPs contained fundamental policy changes meant to correct the extensive and pervasive government interventions in the sector that were associated with slow agricultural sector and economic growth in the region. Despite the differences in specific policy measures implemented across SSA countries the overriding objective has been to improve internal terms of trade for the agricultural sector, promotion of agricultural exports and to increase both productivity (supply response) and efficiency in the agricultural sector. The obvious question is the extent to which these liberalisation objectives have been achieved and especially their impact to smallholder agricultural production and marketing. This is the broad issue addressed in this study with particular reference to Kenyan situation in general and the smallholder coffee farms in Central Kenya province.

Like most of other developing countries, Kenya's economy is agriculturally based with 80% of the population living in rural areas mainly engaged in agriculture related activities. The main agricultural development strategy in independent Kenya has been based on promotion of smallholder farming. Initial attempts to liberalise the Kenyan economy and the agricultural sector in particular were made as far back as 1981, but these initial reform attempts were not implemented due to various reasons. It was only after 1991 that consistent implementation of SAPs began in Kenya. Despite the implementation of wide ranging market reforms, the volume of marketed agricultural production has not increased as expected while smallholder market participation has also declined.

Central Province, which is the study area, is one of the provinces with high agricultural potential in the country. The province is highly populated with land holdings averaging 1.5 ha per household. Smallholder farmers in the region mainly practice intensive farming systems characterised by a diversity of crop and livestock enterprises. Thus, although this study focuses on smallholder coffee farmers, these farmers also have other farm enterprises with coffee being the *main common* farm enterprise.

Study objectives and methodology

The study has three objectives: (1) Determination of the effects of market reforms on the agricultural sector terms of trade, evolution of smallholder farmers' commodity prices and price volatility in Kenya. (2) Assessment of the institutional changes brought about by market reforms and their impact on smallholder farmers' transaction costs, access to factors of production and inputs and the attendant changes in market co-ordination and control in various commodity systems. (3) Assessment of the effects of economic, institutional and household factors on smallholder farmers resource allocation decisions and their subsequent effects on farm productivity and efficiency in a liberalised economy. The period 1985 to 1990 is taken as the pre-liberalisation period while the 1991 to 1999 period represents the reform period. Five

commodities systems that are the major smallholder enterprises in the study region namely; coffee, tea, maize, horticultural crops (French beans) and milk are analysed in fulfilment of the above stated objectives. The study uses both time series and cross sectional data sets. The cross sectional data was collected between December, 1999 and April, 2000 covering a total of 200 households in the study region.

Four separate but related analytical models are formulated and applied in this study, details of which are presented in **chapter two**. The first model analyses the effects of market reforms on agricultural terms of trade, commodity price evolution and volatility in Kenya for the period 1985 to 1999. The second model is based on *exchange configuration analytical framework* that is rooted in the New Institutional Economics (NIE). The model analyses the institutional changes occasioned by market reforms as they affect smallholder farmers' level of transaction costs and their access to markets and services. The model also analyses changes in trade contracts and farmers control and co-ordination roles in the emerging market institutions. A bivariate probit selectivity model is applied as the third model that relates households' credit and land constraints with farm productivity. Finally, a stochastic frontier model based on a translog cost function is used to measure the cost efficiency of smallholder farmers' in the study region and the explanatory factors to the estimated inefficiency levels.

The application of the analytical models is, however, preceded by a review of the agricultural development policies in Kenya as documented in **chapter three**. The review aims at appraising the agricultural development and pricing policies pursued by the Kenyan government while elucidating on the nature of market reforms undertaken in the country. The review indicates that during the both pre- and post-reform periods there has been a mixed performance of the agricultural sector in Kenya. The review also gave the indication that during the considered liberalisation period, smallholder agricultural production in the majority of the commodities was generally declining despite the expected increases in supply response expected in such an environment.

Terms of trade, price evolution and volatility

The results of the analysis undertaken to determine the effects of market reforms on agricultural sector terms of trade, commodity price evolution and their volatility is documented in **chapter four**. Market reforms are shown to be of the 'minimalist' type, mainly concentrated on getting the prices right. Results indicate that during the period directly after macro-economic and agricultural sector reforms in Kenya, the agricultural terms of trade generally deteriorated, but that they increased towards the end of the period of analysis. During the same period, there was a general increase in both nominal output and input prices. The real producer prices show substantial differences, with the producer prices for tea and maize registering a decline, and those for milk and coffee an increase in the liberalisation period. The wedge between output and input prices first widened as indicated by declining output to input price ratio, but recovered at the end of the period of analysis. Results also indicate that market reforms in Kenya significantly increased volatility of coffee, tea and maize prices thereby exposing smallholder farmers to higher price risks. However, there is a non-significant decrease in the volatility of milk prices during the same period.

Institutional changes

Market reforms are also associated with major institutional changes that affects the environment within which smallholder farmers makes their production and marketing decisions as detailed in **chapter five**. Market reforms are shown to have induced significant reduction in public agricultural sector expenditure that severely constrained the provision of essential services needed in promoting productivity of smallholder farms. The envisaged entry of the private sector to take up some of the roles left behind by the government and its agencies occurred only to a limited extent due to a myriad of reasons. Market reforms are also associated

with major contraction of agricultural credit from banks and other rural financial institutions that has mainly affected smallholder farmers. Scarcity of credit has in turn impacted negatively on both productivity and efficiency of production especially for the land-scarce environment prevalent in Central Kenya region. Land markets (both rental and sales) are shown to be characterised by high transaction costs and uncertainties, attributes the market reforms did not attempt to address. As a results land markets are thin and poorly integrated with capital markets despite the individual land tenure system prevalent in Central Kenya region. Due to the distortions in factor markets, smallholder production systems in the study region are labour intensive with little use of purchased inputs that are necessary pre-requisites for improved productivity and efficiency in a land-scarce environment.

Furthermore, due to changes brought about by market reforms, the prevalent vertically co-ordinated marketing systems are shown to be in a dynamic flux towards more decentralised systems after market reforms. This has created asymmetrical information that may lead to resource mis-allocation while enhancing production and marketing risks to smallholder farmers. Equally, the results indicate that smallholder farmer's control of production aspects may have increased with market reforms. However, their control on marketing functions have generally declined, which leads to situation that may lead to loss of their strategic bargaining position while encouraging opportunistic trading practices. The results also indicates that trade contracts have generally moved from vertically integrated contracts before reforms to relational and spot market contracts after reforms. The shift from vertically integrated contracts may not be in the best interest of smallholder producers, especially those involved in production of crops with high asset specificity and product differentiation such as coffee and tea. The spot market contracts are also not ideal for interlocking credit and products markets thereby constraining credit supply and hence supply response.

Farm productivity

Chapter six documents the results of the analysis of the economic, institutional and household factors affecting farm productivity in an environment characterised by credit and land constraints. Results indicate that both farm productivity and resource allocation behaviour of smallholder coffee farmers in the study region are significantly influenced by each household's land and credit demand conditions. Those households facing both land and credit constraints tends to allocate a significantly higher proportion of their farm to food crops which in turn depresses their farm productivity. This leads to the conclusion that smallholder farmers' risk mitigating behaviour with regard to food security is a major factor that determines resource allocation to high-value crops such as coffee and tea. Equally important is the result from this study indicating that availability of credit significantly enhances farm productivity in those households with high land demand (mainly with small farm sizes) but not in households that are not. Furthermore, contrary to empirical evidence from similar farming situations, the farm size positively and significantly influence farm productivity for those households that are both land and credit constrained but not in those households where the land constraint is relaxed. Apart from re-emphasising the importance of credit in enhancing farm productivity of small farms, the results indicate that the imperfections in rural factor markets in the region are severely eroding the productivity advantages usually enjoyed by small farms.

Cost efficiency

Estimates of the cost efficiency of smallholder coffee farmers in Central Kenya using a stochastic cost frontier model are reported in **chapter seven**. The result indicates that farmers in the region are cost efficient with a mean cost inefficiency level of 8%. There are, however, wide dispersions of the farm-specific inefficiency levels, which ranges from 1% to 66%. Levels of farm-specific cost inefficiencies are significantly influenced by farm size, amounts of farm incomes and availability of credit. Other household demographic factors such as age,

household size and education level as well as institutional/economic factors such as availability of extension services or off-farm employment did not significantly affect the levels of inefficiency. The study concludes that while there is still room for improving smallholder farmers levels of efficiency through better resource allocation and re-allocation, the highest source of growth is likely to come from technology development that shifts the production frontier outwards. Generally, the results also indicates that smallholder based agricultural development policy is still relevant, and an efficient mode of organising production in Kenya even after the major institutional and economic changes brought about by liberalisation.

Policy implications

In **chapter eight**, general discussions and conclusions of the results from the previous chapters are made mainly with respect to the policy implications to the agricultural sector and smallholder farming both in Kenya and in the wider context of SSA region. The study further identifies a number of policy issues that deserve attention as they directly affect smallholder based agricultural development in Kenya and Central Province in particular in a liberalised economic environment. These issues are grouped into seven fields related to; sequencing and implementation of market reforms, the role of the government and private sector in provision of public goods, creation of the necessary institutional framework for risk management, improvement of rural financial markets, development of land markets and their linkage to financial markets, strengthening of regulatory framework and promotion of high-value commodities by addressing food security issues. Most of these policy fields focuses on creating institutional frameworks necessary for reducing the transaction and production costs, increasing access to production resources and markets by smallholder farmers. This study views this as the main challenge to be tackled in the new century for agricultural development and prosperity in Kenya.

The government is identified as a key player in implementation of most of the policies despite the diminished role of government as a market player in a reformed economy. Furthermore, we note that the implementation of majority of the policies will call for increased public expenditure that can be justified by long-term benefits to the general economy and enhancement of household incomes. Moreover, such expenditure should be seen as part of the ongoing development strategy that focuses on alleviation of poverty.

SAMENVATTING

In veel ontwikkelingslanden, in het bijzonder de landen in Afrika ten zuiden van de Sahara, blijft landbouw de belangrijkste sector die een grote bijdrage levert aan het bruto nationaal product, de werkgelegenheid en de export. In de meeste landen ten zuiden van de Sahara heeft het landbouwonontwikkelingsbeleid zich vanwege economische, sociale en politieke redenen geconcentreerd op kleine landbouwbedrijven, in tegenstelling tot de situatie in ontwikkelde landen waar landbouwproductie overwegend in grote familiebedrijven georganiseerd is. Landbouwsystemen die op kleine bedrijven gebaseerd zijn roepen uitdagingen op voor de organisatie van de marktketens, de voorziening van publieke goederen en diensten, en de institutionele voorzieningen die nodig zijn voor het functioneren van factor en niet-factor markten.

De prestaties van de landbouwsector in Afrika ten zuiden van de Sahara, en in het bijzonder de prestaties van de kleine bedrijven, zijn de afgelopen twee decennia niet indrukwekkend geweest. Dit ondanks de uitvoering van verstrekkende liberalisatie maatregelen binnen structurele aanpassingsprogramma's. Voor de landbouw bevatten deze aanpassingsprogramma's fundamentele beleidswijzigingen bedoeld ter correctie van het uitgebreide overheidsingrijpen dat verantwoordelijk gesteld werd voor de langzame groei van de landbouw sector en de economie in de regio. Ondanks verschillen in beleid tussen de landen ten zuiden van de Sahara waren de algemene doelstellingen de verbetering van de interne ruilverhouding tussen de landbouw en de rest van de economie, stimulering van de landbouwexport, en de verhoging van productiviteit en doelmatigheid in de landbouwsector. Een voor de hand liggend vraag betreft de mate waarin deze doelstellingen zijn bereikt, in het bijzonder de effecten op de productie en marketing van kleine bedrijven. Dit onderwerp wordt in deze studie behandeld met speciale aandacht voor de situatie in Kenia en de kleine koffiebedrijven in de *Central Province*.

Zoals in de meeste ontwikkelingslanden is de economie van Kenia gebaseerd op de landbouw en 80% van de rurale bevolking is betrokken bij landbouw gerelateerde ondernemingen. De belangrijkste landbouwonontwikkelingsstrategie in Kenia na de onafhankelijkheid is steeds gebaseerd geweest op de stimulering van landbouw door kleine bedrijven. De eerste aanzetten tot liberalisatie van de Keniaanse economie en de landbouw sector in het bijzonder dateren van 1981, maar deze eerste pogingen tot hervorming werden om verschillende redenen niet uitgevoerd. Pas na 1991 werd in Kenia een begin gemaakt met de systematische uitvoering van aanpassingsprogramma's. Ondanks de invoering van uitgebreide markthervormingen is het volume van de op de markt gebrachte landbouwproductie niet toegenomen, terwijl de deelname van de kleine boeren afgenomen is.

Central Province, het studiegebied, is één van de provincies met een hoog landbouwkundig potentieel. De provincie is dichtbevolkt en de bedrijven hebben een gemiddelde grootte van 1,5 hectare per huishouding. Deze kleine boeren hebben een intensief landbouwsysteem bestaande uit verschillende gewassen en diersoorten. Dus, hoewel deze studie gericht is op kleine boeren die koffie produceren als één van hun belangrijke activiteiten worden ook de andere activiteiten in beschouwing genomen.

Studie doeleinden en methodologie

De studie heeft drie doeleinden: (1) Vaststellen van de effecten van markthervormingen op de ruilverhouding van de landbouwsector; de ontwikkeling van prijzen en prijschommelingen geldend voor de kleine boeren in Kenia. (2) Beoordelen van institutionele veranderingen veroorzaakt door de markt hervormingen met de gevolgen voor de transactiekosten van de boeren; de toegang tot productiefactoren en productiemiddelen met de veranderingen in

marktstructuur in een aantal productketens. (3) Beoordeling van de gevolgen van economische, institutionele- en huishoudfactoren op de bedrijfsbeslissingen van boeren met de gevolgen voor productiviteit en doelmatigheid binnen een geliberaliseerde economie. De periode van 1985 tot en met 1990 is genomen als de periode vòòr de liberalisatie, terwijl de periode van 1991 tot en met 1999 geldt als de periode van de hervormingen. Vijf productsystemen die van belang zijn voor de kleine boeren in het onderzoeksgebied, namelijk koffie, thee, maïs, tuinbouwproducten (sperziebonen) en melk, zijn geanalyseerd om de gestelde studiedoelinden te bereiken. De studie gebruikt zowel secundaire data als primaire data. De primaire data betreffende 200 huishoudens in het onderzoeksgebied zijn verzameld tussen december 1999 en april 2000.

Vier verschillende, maar samenhangende analytische modellen zijn geformuleerd en toegepast in de studie, de details staan vermeld in **hoofdstuk 2**. Het eerste model analyseert de effecten van markthervormingen op de ruilverhoudingen in de landbouw en het verloop van de prijzen en prijschommelingen in Kenia voor de periode van 1985 tot en met 1999. Het tweede model is gebaseerd op het *exchange configuration analytical framework* dat is gegrondvest in de nieuwe institutionele economie. Het model analyseert de institutionele veranderingen als gevolg van markthervormingen en de gevolgen op de transactiekosten en toegang tot markten en diensten van kleine boeren. Het model analyseert ook veranderingen in contracten en de controle en coördinatie van boeren in de nieuw opkomende instituties. Een *bivariate probit selectivity model* is toegepast als derde model om de beperkingen van huishoudens op het gebied van krediet en land te relateren aan de productiviteit. Tenslotte is een *stochastic frontier model* gebaseerd op een *translog cost function* gebruikt voor het meten van de kosten efficiëntie van de kleine bedrijven in het onderzoeksgebied en voor de verklarende factoren in de geschatte inefficiëntie niveaus.

De toepassing van de analytische modellen wordt voorafgegaan door een overzicht van het landbouwonwikkelingsbeleid in Kenia in **hoofdstuk drie**. Het overzicht bespreekt het landbouwonwikkelings- en prijsbeleid van de Keniaanse overheid waarbij de aard van de markthervormingen duidelijk gemaakt wordt. Het overzicht toont dat gedurende de onderzochte liberalisatie periode de landbouwproductie door kleine boeren terugliep ondanks de verwachte positieve aanbotsreactie in een dergelijke situatie.

Ruilverhoudingen, prijsontwikkeling en prijschommelingen

De resultaten van de analyse van de gevolgen van markthervormingen op de ruilverhoudingen in de landbouw, productprijzen en prijschommelingen wordt beschreven in **hoofdstuk vier**. Markthervormingen blijken 'minimalistisch', voornamelijk betrekking hebbend op de prijzen. De resultaten laten zien dat gedurende de periode na de macro-economische en landbouwsector hervormingen in Kenia de ruilverhouding in de landbouw aanvankelijk verslechterde, maar verbeterde in de laatste jaren van de geanalyseerde periode. Gedurende dezelfde periode was er een algemene nominale prijsverhoging van producten en productiemiddelen. De reële prijzen vertoonden grote verschillen, waarbij de producentenprijzen voor thee en maïs daalden, en die van melk en koffie stegen in de periode van liberalisatie. De verschillen tussen productprijzen en de prijzen van productiemiddelen werden aanvankelijk groter, maar verkleinden aan het eind van de liberalisatieperiode. De markthervormingen leidden tot grotere prijschommelingen voor koffie, thee en maïs waardoor kleine boeren hogere prijsrisico's liepen. In dezelfde periode was er een niet significante daling van schommelingen van de melkprijs.

Institutionele veranderingen

Markthervormingen zijn ook gekoppeld aan institutionele veranderingen die de omgeving beïnvloeden waarin kleine boeren beslissen over productie en verkoop, **hoofdstuk vijf**. Markthervormingen hebben duidelijk geleid tot een aanzienlijke vermindering van het overheidsbudget ten behoeve van de landbouw. Het gevolg was een aanzienlijke inkrimping

van diensten die nodig zijn voor de verhoging van de productiviteit op kleine bedrijven. De voorziene opkomst van de private sector in taken die door de overheid werden afgestoten heeft om vele redenen slechts gedeeltelijk plaats gevonden. Markthervormingen worden ook in verband gebracht met de inkrimping van landbouwkredietverlening door banken en andere rurale financiële instituties die voornamelijk kleine boeren getroffen heeft. Schaarste aan krediet heeft een negatief effect gehad op de productiviteit en de doelmatigheid, in het bijzonder in de situatie van landschaarste in centraal Kenia. De landmarkt, betreffende zowel het verkopen als het huren van land, blijkt hoge transactiekosten te hebben die niet onderkend zijn bij de markthervormingen. Het gevolg is dat de landmarkt een beperkte omvang heeft en nauwelijks geïntegreerd is met de kapitaalmarkt, ondanks het individuele landbezit in centraal Kenia. Als het gevolg van de verstoringen in de factormarkten zijn de productiesystemen van de kleine boeren arbeidsintensief met een gering gebruik van gekochte productiemiddelen die nodig zijn voor een hogere productiviteit en doelmatigheid in een situatie waar land de beperkende factor is.

Als gevolg van markthervormingen blijkt de bestaande verticale coördinatie in de marktketen te verminderen met een tendens naar een meer decentraal systeem. Dit heeft geleid tot asymmetrische informatie die kan leiden tot onjuiste allocatie van productiefactoren waarbij productie- en marktrisico's van boeren groter worden. De resultaten laten echter ook zien dat de controle van boeren over de productie toegenomen zou zijn als gevolg van de markthervormingen. De controle over marktfuncties is in het algemeen afgenomen wat leidt tot een slechtere onderhandelingspositie en een stimulering van opportunistische handelspraktijken. De resultaten laten ook zien dat contracten verschuiven van overwegend vertikaal geïntegreerde contracten vóór de hervormingen naar contracten op lokale markten ná de hervormingen. De verschuiving van de vertikaal geïntegreerde contracten is mogelijk niet in het voordeel van de kleine boer, speciaal niet voor diegenen die producten verbouwen als koffie en thee die investeringen vergen en duidelijk kwaliteitskenmerken hebben. De contracten op lokale markten zijn eveneens niet ideaal voor het combineren van krediet en producten waardoor de kredietverlening beperkt wordt en daarmee de productie.

Bedrijfsproductiviteit

Hoofdstuk zes geeft de resultaten van de economische, institutionele en huishoudfactoren die de productiviteit beïnvloeden in een omgeving die gekenmerkt wordt door beperkingen in krediet en land. De resultaten geven aan dat zowel de bedrijfsproductiviteit als het gebruik van productiefactoren door kleine koffieboeren significant beïnvloed wordt door de individuele situatie betreffende de vraag naar krediet en land. De huishoudingen die beperkingen kennen in zowel land als krediet hebben de neiging een groter deel van hun bedrijf te gebruiken voor voedselgewassen, hetgeen hun totale productiviteit doet afnemen. Dit leidt tot de conclusie dat het risicogedrag van boeren met betrekking tot voedselzekerheid een belangrijke factor is bij de beslissing betreffende het gebruik van productiefactoren voor gewassen met een hoge waarde zoals koffie en thee. Van gelijk belang is het resultaat dat aangeeft dat de beschikbaarheid van krediet de productiviteit significant verhoogt op bedrijven met een substantiële onbeantwoorde vraag naar land (merendeels kleine bedrijven), maar niet bij bedrijven die geen gebrek aan land hebben. Vervolgens, en tegengesteld aan bevindingen in vergelijkbare situaties, heeft de bedrijfsgrootte een positieve en significante invloed op de bedrijfsproductiviteit bij die bedrijven die een gebrek hebben aan zowel land als kapitaal, maar niet bij bedrijven waar de landbeperkingen in mindere mate aanwezig zijn. Naast het benadrukken van het belang van krediet als ondersteuning voor de productiviteit op kleine bedrijven geven de resultaten ook weer dat imperfecties in de regionale rurale factor markten de productiviteitsvoordelen uithollen die kleine bedrijven gewoonlijk genieten.

Kostenefficiëntie

Schattingen betreffende de kostenefficiëntie van kleine koffieboeren in centraal Kenia met behulp van het *stochastic cost frontier model* worden gegeven in **hoofdstuk zeven**. De resultaten geven weer dat de boeren in de regio kosten efficiënt zijn met een gemiddeld inefficiëntie niveau van 8%. Er zijn echter grote verschillen tussen de bedrijven met een inefficiëntie variërend van 1% tot 66%. De niveaus van bedrijf specifieke inefficiënties worden significant beïnvloed door bedrijfsgrootte, grootte van het bedrijfsinkomen en de beschikbaarheid van krediet. Andere demografische factoren van de huishouding zoals leeftijd, omvang van de huishouding, en opleidingsniveau en institutionele en economische factoren als de aanwezigheid van een voorlichtingsdienst of externe werkgelegenheid beïnvloeden de inefficiëntie niet significant. De studie concludeert dat er weliswaar een mogelijkheid is tot efficiëntieverhoging bij kleine boeren door betere toedeling van productiefactoren, maar dat de grootste groei waarschijnlijk dient te komen van technologieontwikkeling die de productiemogelijkheden structureel verandert. In het algemeen geven de resultaten aan dat een landbouwontwikkelingsbeleid gericht op kleine boeren nog steeds zinvol is, omdat het een mogelijkheid biedt tot efficiënte organisatie van de productie in Kenia, zelfs na de ingrijpende institutionele en economische veranderingen als gevolg van de liberalisatie.

Gevolgen voor het beleid

In **hoofdstuk acht** worden de discussies en conclusies betreffende de resultaten van voorgaande hoofdstukken doorgetrokken naar de gevolgen voor het beleid ten aanzien van landbouw en kleine boeren zowel in Kenia als in de bredere context van de regio ten zuiden van de Sahara. De studie identificeert een aantal beleidskwesties die aandacht vereisen omdat zij rechtstreeks betrekking hebben op de landbouwontwikkeling via kleine bedrijven in Kenia, en de *Central Province* in het bijzonder, binnen een geliberaliseerde economische omgeving. Deze kwesties zijn ondergebracht in zeven aandachtsvelden gerelateerd aan: de opeenvolging en uitvoering van markthervormingen; de rol van de overheid en het bedrijfsleven in de voorziening van publieke goederen; de opbouw van een institutioneel kader voor risico beheersing; verbetering van rurale financiële markten; ontwikkeling van landmarkten met verbindingen naar financiële markten; bevordering van de teelt van gewassen met hoge productiewaarde door aandacht te schenken aan voedselzekerheid. In de meeste van deze aandachtsvelden gaat het om het ontwikkelen van institutionele kaders die noodzakelijk voor het reduceren van transactie- en productiekosten, en het verbeteren van de toegang tot productiemiddelen en productiefactoren door kleine boeren. Deze studie onderkent dit als de belangrijkste uitdaging voor landbouwontwikkeling en welvaart in Kenia in deze nieuwe eeuw.

De overheid wordt aangewezen als een centrale partij in de uitvoering van het beleid ondanks de afgenomen rol van de overheid als deelnemer in markten in een geliberaliseerde economie. Daarnaast stellen we vast dat voor de uitvoering van het merendeel van de beleidsmaatregelen een verhoging van openbare uitgaven nodig is. Dit kan gerechtvaardigd worden door de voordelen op de lange termijn voor de nationale economie en de verbetering van de inkomens van de huishoudens. Bovendien dienen dergelijke uitgave gezien te worden als een onderdeel van een ontwikkelingsbeleid dat de nadruk legt op armoedebestrijding.

Curriculum Vitae

Andrew Mwihia Karanja was born in April 26, 1962 in Kiambu, Kenya. After primary and high school, Andrew joined the University of Nairobi in 1984 and graduated in 1987 with a B.Sc. degree (honors) in agriculture. He worked briefly with the Ministry of Agriculture before re-joining the same University in 1987. He graduated with an Msc. in agricultural economics in 1991. His MSc. thesis was entitled, 'The economics of dairy cattle breeding by small scale farmers: a case study of Kiambu District'. Between 1989 and 1991 he worked with the Ministry of Agriculture as a planning officer before joining Coffee Research Foundation in September 1991 as a research officer.

In January 1994, Andrew attended the International Course in Research in Agriculture (ICRA) at Wageningen, Netherlands. It was during this time that he developed a keen interest in joining Wageningen University to pursue a Ph.D. This was achieved in October, 1998 when he joined the Department of Development Economics to start his studies, which culminate to this dissertation. Andrew is married and has three children.

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