

**Final Report ESCOR Project 8078:  
COPING WITH MARKET REFORMS: WINNERS AND LOSERS AMONG GHANAIAN COCOA  
FARMERS**

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## **1. Background and research objectives**

The success of agricultural market reforms in countries producing cash crop commodities is frequently questioned on the grounds that the incentives from liberalisation policies have a limited impact in improving the production conditions of smallholders. This is partly due to the failure of the reforms to account for the complex institutional framework in which peasant households operate. Increasing the farmgate price given to the farmers – a measure frequently promoted under market liberalisation - is a necessary but not sufficient condition to affect rural livelihoods. Bottlenecks in credit availability, imperfections in the labour and non-labour input markets, land tenancy contracts (which often limit access to land and constrain investments to improve land productivity) are among the different problems faced by farmers in the developing world which are left to the margin of market reforms packages.

Ghana's cocoa sector is an important case study of how agricultural market reforms affected farmers' livelihoods. Ghana is the second largest producer of cocoa in the world after Ivory Coast but the only one among its West African neighbours who has yet to fully liberalise the marketing of the cash crop. Its extensive experience with liberalisation policies makes it possible to analyse the changes which have occurred over time. In the 1990s two major steps were taken towards a full deregulation of the sector. The removal of internal controls on cocoa purchases at the farmgate through the introduction of a number of private buying companies (1992), and the introduction of export licenses which in principle allowed some private companies to export directly the cash crop in the world markets (2000). These two steps were expected to encourage a more efficient marketing system by introducing an element of competition. Moreover, in 1996/97 all subsidies on chemicals were removed generating a greater availability of fertiliser and insecticides to cocoa growers, although at a considerably higher cost.

This study analyses the changes occurred to the cocoa sector since the early 1990s by posing four related research questions:

1. How much has cocoa production increased in the 1990s, and how does the macro evidence on the aggregate changes to the sector compare to the microeconomic changes observed at the farm level?
2. Are cocoa smallholders using more inputs (labour and chemicals) as a result of the reforms and have these changes in inputs been associated with changes in land or labour productivity?

3. Are contractual arrangements over land rights a useful dimension to investigate differentials in farmers' productivity levels? If so is this informative of possible ways to improve the incentives given to the farmers for a more efficient allocation of inputs in cocoa production?
4. Most fundamentally of all, is there any evidence of increases in total factor productivity?

The objective of the project was to identify winners and losers from market reforms. We can use our answers to these four questions to say in general terms who have been the major beneficiaries of the changes which have occurred. We also highlight the serious outstanding problems that remain for the sector.

The methodology adopted in the study is empirical and consists of an econometric analysis of two separate data sources. Firstly, we look at two cross sections of the nationally representative Ghana Living Standard Survey (GLSS hereafter) covering the period 1991-98. Secondly, we use a new data set of 497 cocoa farmers collected in 2002 under the present project. The objective of collecting new and original data on cocoa farmers was twofold: 1) to test the consistency of our earlier findings based on the GLSS data, 2) to study in greater detailed issues pertaining to farm-level characteristics, and marketing preferences under the new partly liberalised system. These are under-researched aspects in cocoa farming studies, and ones that should be taken into account for a rigorous assessment of the status of the sector 15 years into the reforms.

The rest of the report is organised as follows. Section 2 explains the context relevant to the research questions we pose. Section 3 explains the methodology and data sources upon which our analysis is based. Section 4 discusses the findings from the empirical analysis drawing on two separate data sources. The first is the Ghana Living Standards Surveys, the second was data collected as part of this project which has enabled to investigate the problems of the cocoa farmers in greater depth. The perceptions of farmers, as to the effects of liberalisation, are considered in section 5 by drawing on the new data. The work carried out to disseminate the findings from the research are reported in section 6. Section 7 provides conclusions in the form of highlights and a summary.

## **2. The political and economic context**

As the country's single most important agricultural export commodity, and the major source of income for circa 700,000 smallholder farmers, the performance of Ghana's cocoa sector has always been at the centre of the country's economic policy and academic debates. From the early 1970s until the mid 1980s Ghana's cocoa output fell due to the combination of an overvalued exchange rate and the heavy taxation of cocoa effected by means of a monopsonistic marketing board (see Figure 1). From the mid 1980s a series of interventions have gradually liberalised markets. First a substantial

devaluation of the nominal exchange rate had by the early 1990s largely eliminated the black market premium. Real prices to producer rose and input subsidies were reduced so that the real prices of inputs inflated far faster than the Consumer Price Index.

In 1992 an element of competition was also introduced in the internal marketing of the cash crop when 18 licensed private buying companies progressively entered the domestic sector as competitors to the Cocoa Marketing Board for the internal purchase of the crop. The emergence and operation of these private traders (unlike in the neighbouring Côte d'Ivoire, Nigeria and Cameroon) was limited to the domestic market. These agents cannot yet access credit and working capital from abroad, and thus are not in a position to truly compete with the Producing Buying Company (PBC)<sup>1</sup>. Moreover, the monopsonistic price setting by the Cocoa Board is de facto still enforced pan-territorially. Although in principle these companies are entitled to offer farmers a higher price to attract the selling of cocoa bags, data from the survey conducted under this project show that among the cocoa farmers selling to private buying companies 99% reported receiving by their chosen buyers the same price set by the cocoa marketing board. However, as will be discussed further below, the entry of these companies in the domestic supply chain of cocoa has enhanced farmers' ability to market the cash crop at better conditions under different non-price criteria.

Cocoa exports continued to remain the exclusive monopoly of the Cocobod throughout the 1990s, and only recently (officially from October 2000) have some of these licensed buying companies been allowed to export up to 30 percent of their purchases if they satisfy specific quality criteria<sup>2</sup>.

As aggregate production levels are now approaching those of the early 1970s, important questions are being raised on the kind of policy interventions required to sustain this recovery and to ensure the continued growth of the cocoa sector. The approach adopted in this project is to answer these questions by looking at cocoa farmers' production throughout the period of reforms. We do so by analysing three related aspects. 1) Whether the micro survey data for cocoa farming households show a rise in output consistent with the aggregate macro data. 2) How this rise in household production was effected by identifying the sources of growth at the production level in the years following the sector's rehabilitation. 3) Finally, we address the issue of land productivity and of the efficiency of resource allocation to identify which cocoa farmers are better placed to benefit from the reform incentives. The logic of the three aspects outlined above is to offer a comprehensive understanding of

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<sup>1</sup> The purchasing arm of the state-owned marketing board recently been privatised though the board maintains a large share of capital in it.

<sup>2</sup> A Company wishing to engage in the external marketing of cocoa must: (i) be a Licensed Buying Company (LBC) and must have participated in the internal marketing of cocoa for a minimum period of two cocoa crop years, (ii) have purchased a minimum of 10,000 tonnes of cocoa per year over the immediately preceding two consecutive crop years, (iii) have personnel who possess the relevant technical know-how and experience in external marketing or can demonstrate it has access to the requisite human resources, (iv) must demonstrate that it has access to adequate financial resources (Ministry of Finance, 2000).

the changes occurred to the sector in the 1990s to suggest a clear vision of where the sector's performance stands at a time of much policy debate on the desirability of a full liberalisation: will this enhance farmers' incentives to raise land productivity or are the constraints to higher yields to be sought elsewhere in the present system?

### **3. Methodology and Data Sources**

This project uses an empirical approach to address the research questions set out in the introduction. We first estimate production function equations across two data cross sections to investigate the sources of household-level growth in the 1990s. This analysis is complemented with instrumental variable estimations which enable to control for possible sources of endogeneity in the right hand side variables. Secondly, we estimate detailed yield equations using different controls for land tenancy rights to look at the issue of land productivity and allocative efficiency of input use. This second analysis will be based on the 2002 cross sectional data.

Throughout the following analysis we make use of two different datasets on cocoa farming: 1) two cross sections of the Ghana Living Standards Survey covering the period 1991/92 – 1998/99, 2) one cross section for the crop year 2001/2002 collected under this project. The rest of this section overviews the key features of both these datasets.

#### **3.1 The Ghana Living Standards Survey – 1990/91 to 1997/98**

The nationally representative Ghana Living Standards Survey was collected in four rounds between 1987 and 1998. The present study uses the last two cross sections of the data covering the crop years 1991/92 and 1998/99. These represent two important points in time since they fall respectively one year prior to the domestic liberalisation of the cocoa sector and five years into the implementation of marketing reforms. In this study cocoa production refers to the crop years 1990/91 and 1997/98.

The GLSS data covers detailed information on households' agricultural production with details on the crops grown and harvested, the costs incurred, and various aspects on agricultural assets such as households' land holdings and tenancy arrangements, farm equipment and livestock. Out of the 3253 (1991) and 4277 (1998) households originally surveyed, we identified respectively 503 and 789 cocoa observations. However, these numbers were further reduced to 372 and 679 observations when compiling the data due to some inconsistency in different parts of the questionnaire. One additional limitation of the data is that it does not have a panel component. Although the Statistical Office in Ghana has released to the author detailed information of the villages sampled (which would have allowed the construction of a pseudo-panel dataset), only 13 of the 1991/92 villages were resurveyed

in 1998/99, precluding any sensible econometric use of the panel component across the two years. Therefore the present analysis is based on pooling the observations across the two years where statistically possible, and highlighting – when relevant – regional difference that matter in understanding the evolution of cocoa production. Table 1 presents some characteristics of the GLSS sample data. The general picture shows the dominant presence of male-headed cocoa-farming households, with household heads being on average 50 years old. The data show that in absolute terms the level of education of household heads has increased between 1991 and 1998 from just above five to nearly six years of education, a rise of 11 per cent. The average size of cocoa farms has not changed significantly, while the percentage of hired labour increased by 7 percentage points (the only statistically significant change occurred over the period analysed). The data also show a high percentage of revenue from cocoa-sales in cocoa-households' income. Although this proportion has not increased considerably in the 1990s, the sampled percentage has remained stable around 50% suggesting that cocoa production remains the major source of income for those farmers that are still in the sector.

### **3.2 The Ghana Cocoa Farmers Survey - 2002**

The second source of data used in this project is the Ghana Cocoa Farmers Survey. These data were collected between July and September 2002 in three cocoa growing regions of the forest zone of southern Ghana: Ashanti, Brong Ahafo, and Western. These regions cover the cocoa growing areas in the country where the crop is predominantly cultivated (79% of total purchases from the entire cocoa belt come from these areas according to Cocobod statistics). These regions are diverse with respect to some important characteristics and hence apt to capture the diverse profile of cocoa farming. Ashanti represents a relatively traditional cocoa growing area, Brong Ahafo has a higher concentration of tenant farmers working on landholdings of absentee landlords. It is also the region that has been most severely hit by pests and diseases causing the reduction of land productivity over the last ten years, and the continuous progression of the savannah from the north. Finally, the Western region is the highest cocoa yielding area in the country. Here the possibility of clearing up virgin forestland to new cocoa cultivation is still an option despite the striking absence of adequate (in same case any) road infrastructure, and it is here that the smuggling activities across the Ivorian border take place. Figure 2 and figure 3 illustrate the geographical coverage of the survey. The survey instruments were grouped into 8 different sections of the questionnaire, each one covering several aspects of cocoa production and sales, details of which can be found in the appendix to this report.

## **4. Cocoa production and productivity: the macro and micro data**

We begin with the macro data. Table 2 looks at three key agricultural macroeconomic indicators: land harvested, production levels and cocoa yields. These data, obtained from FAO's official statistics,

show that an increase in both total area under cocoa cultivation (73%) and in the level of production (37%) occurred between 1990/91 and 1997/98.

The production increase is largely a result of the expansion of the area cultivated to cocoa, namely the westward movements towards unoccupied virgin forests of Western and southern Brong Ahafo regions (Gerken, et al., 2001; Ministry of Finance, 1999). However this macro data implies a substantial drop of 21% in land productivity. Is the micro evidence consistent with this macro picture? Two figures are needed to carry out this exercise. The first, which is derived from the GLSS data, is the change in the average amount of cocoa harvested at the household level. The second is the change in the cocoa farmers' population.

The top half of table 4 shows these data obtained from the census on Ghana's household population by region. The number of households in Ghana's six cocoa growing regions has increased by 29.7% between 1991 and 1998. Over the same period the total proportion of cocoa farming household has remained stable, accounting for 16% of the total number of households in each year. It is estimated that in 1998 there were about 700,000 cocoa farmers in Ghana (Commodity Risk Task Force, 2000; EC, 2000; Wallis, 2000a, b). The GLSS data for the same year indicates an estimated number of 496,000 cocoa growing households. This number is consistent with the 700,000 figure if one considers that each household typically accounts for more than one cocoa farmer allowing for spouses and family member selling out their labour to non family owned farms. Therefore, combining the estimated increase in household population (29.7%) with the average increase in the level of household cocoa production (6%), we get a 37% rate of cocoa production growth - exactly the number given by the macro data. While the micro data is wholly consistent with the macro for the increase in output there is no evidence from the micro data of any fall in yields (i.e. output per hectare) and there is strong evidence that labour productivity has risen. The source of this rise is investigated in the next section.

#### **4.1 Cocoa Production Functions**

Having established that the micro data on supply response is consistent with the macro figures we now turn to consider the factors that underlie the increase in output by estimating cocoa production functions. In the following analysis we have dropped all observations from the Volta region due to the insufficient number of observations for individual years. With this exclusion the focus of the econometric analysis is restricted to those areas where cocoa has been predominant in Ghana for the last twenty years.

In addition to the basic agricultural production inputs such as land, labour, and non-labour inputs, a number of household and non-household characteristics are expected to have important effects on the level of cocoa production. Accordingly the basic specification to be estimated is as follows:

$$\ln(\text{cocoa}) = \beta_1 + \beta_2 \ln(\text{farm size}) + \beta_3 \ln(\text{Input}) + \beta_4 \ln(\text{Labour}) + \beta_5 \frac{L_H}{L_T} + \beta_6 \ln(\text{farm value}) + \beta_7 \text{hhh edu} + \beta_8 \text{hhh edu}^2 + \beta_9 \text{hhh sex} + \beta_{10} \ln(\text{rain}) + \gamma T \quad (1)$$

Where:

cocoa	=	kilos of cocoa produced
farm size	=	total hectares of cocoa farms cultivated by each household
input	=	amount of non labour input use
labour	=	Man-days of labour (both household and hired)
$L_H/L_T$	=	% of hired labour in total labour
hhh sex	=	dummy =1 if household head is male
hhh edu	=	Level of household head education
farm value	=	value of all land holdings owned/operated by the household on which any cocoa is growing
rain	=	regional amount of rainfall
T	=	time trend = 1 if year==1997, the measure of TFP

The above equation explicitly accounts for the effect of the percentage of hired labour. Why is this important? Total labour used in production is a function of hired and household labour but might not be correctly measured by adding up the two components if these have different productivity levels. The dual labour-market model hypothesises that small family-owned farms, which characterise most cocoa farms in Ghana, are endowed with a relatively large supply of family labour which they tend to employ beyond the point at which marginal productivity equals the prevailing market wage rate. Therefore, when analysing cocoa production functions, it is important to allow the effect of hired labour to be identified separately, as this is equivalent to testing the different productivity of the labour components.

Three aspects are of primary relevance to our econometric investigation: a) the contribution of land, non-labour and labour inputs and the relative importance of the hired labour component, b) whether there are significant regional differences, and c) if there is any evidence of technological progress between the 1990/91 and 1997/98.

The OLS findings in table 5 can be summarised as follows:



- The data suggest a very substantial rise in the use of non-labour inputs. This is consistent with liberalisation having provided a framework by which inputs, although no longer subsidised, are used because they are now available.
- This increase in non-labour input occurred with a very substantial decline in household labour. While offset to some extent by a rise in hired labour use, the net effect was a decline of 24 per cent in labour input. This large fall implies that the major change which has occurred in the Ghana cocoa sector over this period was a very substantial rise in labour productivity.
- Hired labour used on cocoa farms has distinctly increased, however our analysis shows no evidence of any productivity differential between hired and household labour. These two aspects suggest that labour, while remaining a key input in cocoa production, has not provided any significant contribution to the cash crop's growth. Labour productivity was increased in part due to the expansion on non-labour inputs and land but mainly due to the large declines in labour input
- There has been no change in either land productivity or TFP. The lack of innovation in new crop technologies may be due to the fact that they are labour using and land saving whereas it is labour that is scarce to the household.
- Finally, and most unambiguously as far as the GLSS data shows, we show that output growth was almost entirely due to the traditional method of expanding output by means of additional land. Of the 37 per cent increase in output over this period only 6 per cent was due to increased output per household, the rest was due to the expansion of the number of households.

## **4.2 Land productivity in cocoa farming**

The first part of this study concluded that in the 1990s cocoa production increased marginally at the household level, with the aggregate increase taking place essentially through land expansion and population growth. We also found suggestive evidence of an increase in both labour productivity and (chemical) input use, while land productivity (i.e. yields) stagnated throughout the decade at just over 300 kg/ha. These values are about one third of the levels found in other countries, and one tenth of those achieved on experimental farms in Ghana. As total factor productivity defines the future sustainability of the cocoa sector growth, serious concerns arise to understand the reasons underlying the absence of any technological change and the resulting low productivity levels in cocoa farming.

To further investigate this problem, the authors collected in 2002 a new dataset based on both farm and farmer-level data. One objective of the survey was to gather more accurate farm-level data, particularly with reference to the land area under full bearing cocoa trees, as well as the tenancy rights prevailing on every farm operated by each producer. A second research objective was to take a more rigorous account of the allocation of labour (both household and hired) used for the various cocoa-farming tasks. The findings from the GLSS data suggested three important features of labour use in cocoa farming in the 1990s: both the percentage of hired labour and labour productivity have increased, whereas no evidence was found of a productivity differential between the two different types of labour force employed. A third task of the survey was to assess cocoa farmers' perception of the new marketing arrangements that took place in the 1990s. Has there been any appreciation of greater competition with the introduction of private licensed companies? If so, in what terms has this enhanced competitive setup affected cocoa farmers? The next session examines in turn each of the issues outlined above.

### **4.2.1 Reviewing the effects of inputs in cocoa production**

A preliminary task when using different data sets is to establish the degree of consistency in the relationship among and in the size of the key variables to be analysed across the different data sources. Accordingly, our first concern in using the new data collected under this project was to verify the reliability of some earlier findings based on the analysis of the GLSS data. Tables 6a, 6b and 6c describe some features of the new data which can be summarised as follows:

1. cocoa yields remain low at just under 300kg./ha, therefore justifying the need to further look into the causes for low total factor productivity,
2. the percentage of hired labour is significantly higher than what we previously found in the GLSS data. Table 6b shows the composition of labour use on cocoa farms derived from the

new survey instruments with a task-level breakdown and a categorisation per type of labour. Interestingly household labour is shown to be systematically lower than hired labour. Within the hired labour groups, more annual labourers (which are known to be relatively cheaper to the farmers) are found in clearing land and harvesting, the two most strenuous farming tasks. In contrast, contracted labour is used more intensively for weeding. This is a more costly option for the farmers who tend to use daily waged labour in addition to household inputs to increase seasonally the work force needed to maintain cocoa trees in good order. This task is found to absorb overwhelmingly the highest share of total labour supply (i.e. both at household and hired levels).

3. Non-labour inputs now measure exclusively the quantities of insecticide and fertiliser applied by the farmers to their landholdings. Table 6c reports data on the use of these chemicals in the 2002 data and for comparative purposes in the crop years 1990/91 and 1997/98 (calculated from the GLSS data). The numbers show a dramatic increase in the quantities and in the percentages of farmers using insecticides. On the contrary the figures on fertiliser use remain low with the percentage of quantities used by the farmers decreasing in all surveyed regions compared to the 1997/98 figures.

To further probe if the new data produced results consistent with our earlier findings we re-estimated the cocoa production function based on equation 1.

Some key similarities from this analysis can be summarised as follows:

1. The regression analysis shows a very similar contribution of labour supply to cocoa production to what we have found in the GLSS data (with the elasticity being 14%).
2. There continues to be no evidence of a productivity differential between the two components of labour. Given the greater accuracy of the new survey labour instruments this is an important finding which confirms what we previously inferred about the composition and contribution of labour inputs to cocoa production.
3. The production function also confirms the importance of insecticide with a highly significant point estimate of 0.1<sup>3</sup>. We also experimented a regression including only a dummy to control for the effect of fertiliser adoption<sup>4</sup>. The results of this estimation (not reported in the present report but available from the authors) show that cocoa production would increase by 30% on farms presently not using fertiliser. This implies a net revenue increase of 17% in producers'

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<sup>3</sup> A study on cocoa farming conducted in 1997 (Masdar, 1998) reviews the process of input subsidy removal in Ghana. This was first discussed in 1988 with the beginning of the Cocoa Rehabilitation Project but came to effect only in 1997. The Masdar study shows that cocoa farmers - despite the unwarranted increase in the cost of chemicals - have welcomed the greater availability of chemicals implying a *strong latent demand for inputs that would be revealed in the event of better financing* (Masdar Socio-Economic Study, pg. 47). Padi (2000) also reports that despite the substantial rise in the cost of insecticides, the removal of subsidies improved dramatically the domestic supply of these chemicals, especially as these inputs were previously smuggled across to Nigeria and Ivory Coast given their relatively cheap prices.

<sup>4</sup> Table 6c shows how very few farmers have used any fertiliser at all throughout the reform period.

revenue from cocoa sales, which is indeed suggestive of the potential yield gains that could derive from a more widespread application of these chemicals. This is consistent with other findings in the economic literature of fertiliser use associated with a 21% increase in cocoa yields (Edwin et al., 2003).

To sum up, the preliminary inspection of the new data confirms the key features of cocoa production in Ghana which were discussed in the first part of this study; a very strong contribution of land and non labour inputs to production levels, the relatively low production elasticity to labour inputs, with hired labour showing no underlying productivity differential from household labour.

#### **4.2.2 Land size and factor productivity: are small cocoa farmers more productive than large ones?**

To understand the problem of low land productivity levels in cocoa farming we first analyse yield regressions to compare cocoa produced on each unit of land to the average size of landholding and to the intensity of factor use (i.e. using as right hand side variables inputs per unit of land). This relationship is often used in agricultural economics to test for the existence of allocative inefficiency in input use among rural producers. The theoretical hypothesis underlying this specification states that in an economic context characterised by multiple market imperfections (which could for example arise in the labour, credit and/or insurance markets) higher levels of land productivity may emerge on small landholdings. An inverse relationship (IR) could emerge because small landholdings tend to use more intensively household labour which is relatively cheaper to the farmer. This implicitly creates a distortion in input allocation whereby household labour is employed beyond the point where its marginal productivity equals the prevailing wage rate. Table 8 shows three different outcomes of yield regression estimations. We start by estimating a basic equation of the type:

$$\ln(\text{cocoa yield})_i = \alpha_1 + \alpha_2 \ln(\text{farm size}) + v_i \quad (2)$$

Column [1] shows evidence of a strong negative and statistically significant relationship between cocoa yields and farms size. This relationship is often interpreted as evidence that small farms are more efficient than larger ones. However it is clear that this is simply a representation of the production function in which we omit inputs. It shows that smaller farms do have a higher land productivity than large farms due to the higher non-land inputs per unit of land on smaller farms. Small farms have lower labour productivity than large farms and we have shown that this does not appear to be due to hired labour being more efficient. Thus there is no simple link from farm size to productivity. As we would anticipate given the results in Table 7 after accounting for input use the inverse relationship disappears. In Table 8 we show that the percentage of the farm affected by black pod disease reduces by one percent the level of land productivity.

### 4.2.3 Sharecropping

Another line of investigation pursued in this study looks at the existence of productivity differentials among farmers operating under different land tenancy arrangements. Share contracts are a common feature of the forest zone of Ghana. According to Takane (2000) all land under cocoa cultivation is under customary land ownership. Tenure agreements have been evolving towards individualised ownership over time. With the disappearance of virgin forest, and with hired labour becoming more costly to the farmers, land tenancy contracts have adapted to accommodate the need to access land and to access labour at the cost of partly conceding rights to owned land. Clearly this represents a key dimension to evaluate which farmers are more productive as well as the nature of obstacles to land productivity increases faced by the landless.

Before 1950 share contracts they were synonymous with the *abusa* system, but during the 1950s the *abunu* system came into existence as land became scarcer. Abunu and abusa systems have been transformed from a relationship between migrant labourers and landowning citizens into a relationship between land owning citizens, landless youth, and land-owning family elders (Amanor et al., 2001).

Although there is a wide degree of geographical variation in the specific aspects of these two contracts, it is possible to summarise their basic features as follows.

- Abunu entitles a 50% division of the harvest (or of the land in full bearing) between the owner and the tenant, where the latter has previously contributed to clear a new farm to cocoa.
- Abusa entitles the tenant to retain one-third of the harvest and to give two-thirds to the owner in exchange for weeding, harvesting, and marketing the crop.

In the data used for the present analysis we also consider the category of *caretakers*<sup>5</sup>, who are simple labourers, often members of the farmer's household looking after the farm in the absence of or in aid of the person in charge of the main operations. They do not get a share of the crop (or land) as such, but they are often compensated with food products or occasional monetary payments.

What does the new survey show on the productivity of different tenancy arrangements? The data employed was collected taking the farmer/operator as the primary unit of observation, whereas the information on land tenancy status was collected at the farm level. Each respondent could report information on up to nine farms operated under different tenure arrangements. In order to define an

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<sup>5</sup> The term caretaker in Ghana cocoa farming is subject to different interpretations among academics and agricultural experts. Many associate this notion to that of abusa farmers. This study considers it as a separate category from sharecroppers based on respondents classifying themselves as caretakers but not sharecroppers and based on numerous discussions held on this subject with several academic experts on the subject (K. Amanor, L. Awanyo, C. Okali, and F. Ruf).

owner, an abunu or an abusa cocoa farmer we have considered the respondent's status on the largest landholding operated (or on the majority of farmed land on which the same land rights was exercised). Table 9 shows a breakdown of cocoa farming characteristics by tenancy status. The Abusa farmers are described as the youngest, more uneducated category, but also as those farmers with corresponding higher cocoa yields. Moreover they appear to receive more than 80% of their income from cocoa, and are the second category after farmers-owners using highest levels of non-labour inputs.

To test the existence of productivity differentials across different tenancy types, we re-estimated in table 10 yield regressions controlling for tenancy status. The findings from this analysis show that the abusa farmers have up to 41% higher yields than owner farmers. This result is robust to different checks. We first controlled for the possible endogeneity of tenancy status to cocoa yields by instrumenting in column [2] the tenancy dummies with the predicted values from a multinomial logit regression (on the determinants of land rights). Secondly, we restricted our sample to those individuals operating only one cocoa farm to make the regression equivalent to a farm level analysis (column [3]). Both these tests show the abusa farmers to be consistently more productive than the other categories. While the scope of this study does not allow a further investigation of this result, we hold our findings on the abusa farmer to be significant news. Contrary to the common belief of the allocative inefficiency associated with sharecropping contracts, we found suggestive evidence of the opposite to be true: abusa farmers are by far more productive than both owner-farmers and abunu-farmers.

## **5. The marketing system**

The 2002 survey also collected information on farmers' opinion over the present partly liberalised marketing arrangements. This section describes the relevant findings showing to what extent farmers are aware of the international price and how they value the prospect of a full liberalisation of the sector.

Table 11 shows information on pricing. The data shows that while only 7% of the respondents are aware of the movements in the international price of cocoa, 20% of the respondents know the selling price of cocoa across the border in the Ivory Coast, with the highest percentage of positive answers concentrated in Brong Ahafo and in the two sub-regions of Western.

Since it was not possible to measure directly farmers' participation in smuggling activities, we asked farmers to discuss their opinions on cocoa pricing in the neighbouring Ivory Coast. We asked the respondents if they knew of individuals in the same village selling cocoa to Ivorians, and if so

whether they *knew of* the trading price offered to Ghanaians for their cocoa bags (columns [4] to [7]). As expected, given the high sense of community bond prevailing in rural areas, we had a rather low rate of response to questions about people *smuggling* on either sides of the border. Yet two aspects are worthwhile noticing. Firstly, both areas in the Western region show a higher percentage of awareness about cross border trading. Secondly, making the reasonable assumption that the selling price to Ivory Coast is a good indicator of the smuggling price, it is remarkable how – as one would expect – in both Western regions farmers reported a higher price. This would suggest the important role of vicinity in increasing the bargaining power of the trading parties. The figures reported in column [6] reflect the price reported for the major crop season (October/December 2001). In Ghana this price (fixed pan territorially by the marketing board) was 274,000Cedis per bag. The figures therefore imply that at a Ghanaian farmer based in Ashanti was getting only just over half of the smuggled price, while farmers in the Western region were receiving about 40 per cent of the price available from smuggling. Part of this differential may reflect the costs of illegal smuggling but the figures also suggest the extent of the price differential existing between Ghana’s fixed farmgate price and the market price prevailing in liberalised Ivory Coast.

We further investigated the farmers’ perspective of the possible full liberalisation of the sector, featuring private traders entering the exporting segment of cocoa marketing.

Among the 30% farmers who reported that they would be affected by the policy, there was an equal division between those favourable and those against the reform. Those in favour were overwhelmingly attracted by the prospect of receiving higher farmgate prices, whereas among the sceptical ones the two major concerns reported were the prospect of lower government revenue, and the fear of being cheated by traders.

We finally asked the reasons for choosing to sell to any particular buying company. We first note that 60% of farmers used the Producer Buying Company (i.e. the ex-state owned purchasing arm of the marketing board which most farmers still associate with the State). Figures 6 and 7 illustrate the information reported.

Clearly PBC remains the preferred outlet for sales with 37% of sampled farmers saying that “accountability and trust” was the first reason for their selling choice, followed by the promise of a prompt cash payment. Immediate payment was also the main reason reported for choosing to sell to any other buying company (47%).

In conclusion, the data collected on farmers' opinions about the prevailing marketing arrangements show that farmers have not been receiving different farmgate prices by selling to private traders<sup>6</sup>. What emerged instead was a situation of general unawareness of the cocoa price in the international markets mixed with a degree of knowledge of the price received across the border for illegal trade. Moreover our data suggest the persistent preference of farmers' to sell to the former state owned buying company, with prompt cash payments being the main reason to choose private traders.

## **6. Dissemination**

The preliminary results of this study have been presented to the Cocoa Marketing Board in Ghana in a workshop held in Accra on 12 November 2003 in collaboration with Mr Haruna Maamah (the Ghanaian collaborator to the project). The discussion of these findings was well received by the Marketing Board Officials who are now waiting the final results of the study to be presented in a second workshop in Accra in July 2004.

A research summary of the project findings has been posted on the Centre for the Study of African Economies (CSAE) web page and can be found at the following link: (<http://www.csae.ox.ac.uk/resprogs/coco/default.html>).

The authors have presented the first working paper of the project "Production changes in Ghana cocoa farming households under market reforms" at CSAE's annual conference *Growth, poverty reduction and human development in Africa* in March 2004. An updated version of this paper will be presented in Accra in July 2004 at the conference *Ghana's Economy at the Half Century* jointly organised by Cornell University and the Institute of Statistical, Social and Economic Research (University of Ghana). A second working paper reporting on the sources of productivity differentials across farm and tenancy type is under preparation.

The findings are being fed into a World Bank study being undertaken on understanding incentives for exports from Ghana. The authors are in contact with policy makers in the Ghana Trade Ministry which is conducting a wide review of trade policy options. We intend to make the final version of this study available to them.

Finally, the authors plan to participate in a range of seminars to discuss academic and policy issues raised by the study's findings.

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<sup>6</sup> 99% of the respondents had been paid the price announced by the marketing board.



## 7. Highlights

Ghana's cocoa sector is an important case study of how agricultural market reforms affect farmers' livelihoods. Cocoa remains the country's most important agricultural export commodity and the major source of income for about 700,000 smallholder farmers. Following a sharp decline in the 1970s, output levels have now recovered to the levels of the 1960s. This study has analysed the changes in the cocoa sector since the early 1990s by posing four related questions:

- How much has cocoa production increased in the 1990s, and how does the macro evidence on the aggregate changes to the sector compare to the microeconomic changes observed at the farm level?
- Are cocoa smallholders using more inputs (labour and chemicals) as a result of the reforms and have these changes in inputs been associated with changes in land or labour productivity?
- Are contractual arrangements over land rights a useful dimension to investigate differentials in farmers' productivity levels? If so is this informative of possible ways to improve the incentives given to the farmers for a more efficient allocation/use of inputs in cocoa production?
- Most fundamentally of all, is there any evidence of increases in total factor productivity?

The methodology adopted is empirical consisting of an econometric analysis of two different datasets:

- Two cross-sections drawn from the nationally representative Ghana Living Standard Survey covering the period 1991-98.
- A new survey of 497 cocoa farmers conducted in 2002 in the three regions of the forest zone of southern Ghana producing 79% of the total crop: Ashanti, Brong Ahafo, and Western.

The findings from the study can be summarised as follows:

- Cocoa production grew by 37 per cent between 1990/91 and 1997/98. Of this increase only 6 per cent was a rise in output per household, 31 per cent was due to the traditional method of land expansion and population growth.
- There has been a very substantial rise in the use of insecticide use. This is consistent with liberalisation having provided greater availability of inputs which, although no longer subsidised, are now used. In contrast fertiliser use remains marginal, although our data suggest that when used it may increase output by as much as 30 per cent.
- The major change over the reform period has been a very substantial rise in labour productivity occurring through the expansion of non-labour inputs relative to labour. In absolute terms labour input has declined substantially. Within the labour total the proportion

of hired labour has increased. We have found no evidence of a productivity differential between hired and household labour.

- Our data suggest significantly higher levels of land productivity on sharecropped farms. The traditional category of *abusa* farmers outperforms both owner-farmers and the more favourably compensated *abunu* sharecroppers.
- Finally, both land productivity and total factor productivity have not changed. The lack of innovation in new cocoa technologies may be due to the fact that they are labour using and land saving whereas it is labour that is scarce for the household.

Four policy-relevant conclusions follow from the study:

- In general there are no clear winners from Ghana's cocoa market reforms as total factor productivity - which is the key to general and widespread gains - has failed to increase.
- Labour productivity is higher on relatively larger farms and these will have benefited most from the rise in labour productivity.
- Fertilisers use has a substantial impact on yields but its use remains minimal.
- Total factor productivity is higher on sharecropped land suggesting the right incentives can improve underlying productivity.
- The factors limiting growth of total factor productivity remain to be more fully investigated.

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**TABLE 1**  
**GLSS DATA<sup>a</sup>: CHARACTERISTICS OF COCOA-FARMING HOUSEHOLDS**

Characteristics	1991/1992	1998/1999	Difference (98 – 91)	<u>No of Observed Households<sup>b</sup></u>	
				1991/1992	1998/1999
<b>HH head Gender (% male)</b>	72% (0.03)	74% (0.03)	0.02	371	673
<b>HH head Age</b>	47 (0.88)	49 (0.93)	2	371	673
<b>If hh head attended school (% yes)</b>	12% (0.02)	14% (0.01)	0.02	371	673
<b>School years completed by HH Head</b>	5.24 (0.27)	5.84 (0.29)	0.60	371	673
<b>Household size</b>	5 (0.15)	5 (0.14)	0	371	673
<b>Farm size (hectares)<sup>c</sup></b>	1.65 -	2.02 -	0.37 -	371	673
<b>% Of hired labour</b>	22% (0.02)	29% (0.02)	0.07***	371	673
<b>Revenue from cocoa<sup>d</sup></b> (‘000 Cedis)	112.48 (13122.52)	129.01 (13598.53)	16.53	371	673
<b>Revenue from all crops</b> (‘000 Cedis)	210.86 (20008.22)	228.54 (21747.37)	17.68	371	673
<b>% Revenue from cocoa</b>	53%	56%	0.03	371	673
<b>Producer Price Changes<sup>e</sup> (Cedis/Kg.)</b>					
<b>Producer Prices (nominal)</b>	251,2	1800,00		467	718
<b>Producer Prices (real)</b>	251,2	266,02		467	718

**Notes:** a) Figures – unless noted otherwise - are mean values, standard errors are in parentheses. T-test of difference between means.  $H_0$ : mean(1998/99) - mean(1991/92) = 0. b) The figures were calculated using non-missing observations for all variables with the exception of producer prices. The latter were computed using the values of any cocoa sale reported, to get the most accurate representative figure to reconcile the micro with the macro data. c) Median values are reported in place of the mean to control for the skewness of these variables in levels. d) Constant 1991/92 prices. e) These are median unit values obtained by dividing the value of cocoa sales by the amount sold, and perfectly match the macro figures from the Cocobod statistics. These figures were computed using the values of any cocoa sale reported to the get most accurate figures to reconcile the micro with the micro data.

**TABLE 2**  
**COCOA PRODUCTION, YIELD AND AREA HARVESTED (a)**

Crop Year	Area Harv (‘000 ha)	Yield (Kg/Ha)	Production (‘000 Kg)
1990/91	707	379	268
1991/92	721	384	277
1992/93	711	398	283
1993/94	694	391	271
1994/95	843	412	346
1995/96	1025	394	403
1996/97	1062	342	363
1997/98	1220	300	366
<b>Changes over the period as a whole (%)</b>			
	73	-21	37

Source: FAOSTAT Database

**TABLE 3**  
**REGIONAL MEANS OF COCOA PRODUCTION VARIABLES**

		<u>Data in levels</u>						
		Western	Central	Eastern	Volta	Ashanti	B. Ahafo	Total
No. Households	1990/91	137	71	100	14	112	71	505
	1997/98	227	130	123	16	132	54	682
Cocoa farming hh (as % of total pop.)	1990/91	29%	14%	15%	3%	15%	16%	16%
	1997/98	34%	22%	16%	3%	12%	9%	16%
	Change	0.05	0.08	0.01	0.00	-0.03	-0.07	<b>0.00</b>
Cocoa harvested (kg)	1990/91	628	483	433	128	334	623	489
	1997/98	922	395	266	128	441	1353	626
	% change	47%	-18%	-39%	0%	32%	117%	<b>28%</b>
Cocoa farm size (ha) <sup>a</sup>	1990/91	1.97	1.65	1.21	1.35	2.43	2.83	1.65
	1997/98	2.48	1.65	1.21	0.22	1.62	2.63	2.02
	% change	26%	0%	0%	-84%	-33%	-7%	<b>23%</b>
Cocoa yield (kg/ha)	1990/91	355	230	442	158	217	504	340
	1997/98	493	231	331	216	263	287	353
	% change	39%	0%	-25%	87%	21%	-43%	<b>4%</b>
Non-lab. Real input exp (constant 1991-92 prices) (‘000 Cedis)	1990/91	13.04	12.34	8.05	3.30	16.10	10.47	12.03
	1997/98	32.29	11.94	8.08	3.04	17.68	11.50	18.89
	% change	148%	-3%	0%	-8%	10%	10%	<b>57%</b>
Tot lab days (Yearly man/days)	1990/91	132	118	101	129	160	158	134
	1997/98	108	82	83	102	118	118	101
	% change	-18%	-31%	-18%	-21%	-26%	-25%	<b>-24%</b>
Household labour (Yearly man/days)	1990/91	103	88	74	114	120	133	103
	1997/98	69	57	65	76	68	68	66
	% change	-33%	-35%	-12%	-33%	-43%	-49%	<b>-36%</b>
% Of hired labour (Man/days)	1990/91	0.20	0.22	0.26	0.12	0.25	0.18	0.22
	1997/98	0.28	0.31	0.23	0.29	0.31	0.35	0.29
	change	8%	9%	-3%	19%	6%	19%	<b>7%</b>
Labour productivity (kg cocoa/man-days)	1990/91	6.46	4.51	6.05	1.24	3.34	5.93	5.19
	1997/98	11.40	6.32	4.11	1.45	5.43	19.49	8.37
	% change	77%	40%	-32%	17%	62%	229%	<b>61%</b>
Real input exp./ha (‘000 Cedis)	1990/91	7.62	5.62	8.39	2.97	12.26	5.43	8.31
	1997/98	18.17	6.24	11.75	8.35	12.83	4.27	12.71
	% change	138%	11%	40%	181%	5%	-21%	<b>53%</b>
Man-days lab./ha	1990/91	97	109	165	99	128	73	118
	1997/98	81	65	190	433	102	49	103
	% change	-17%	-41%	15%	337%	-20%	-33%	<b>-13%</b>

		<u>Data in Logarithmic</u>						
		Western	Central	Eastern	Volta	Ashanti	B. Ahafo	Total
Cocoa harvested (kg)	1990/91	5.91	5.48	5.35	4.59	4.87	5.70	5.44
	1997/98	6.05	5.27	4.83	4.04	5.31	6.13	5.50
	% change <sup>b</sup>	15%	-19%	-41%	-42%	55%	54%	<b>6%</b>
Cocoa farm size (ha)	1990/91	0.71	0.40	0.06	0.44	0.65	0.84	0.52
	1997/98	0.89	0.57	0.02	-0.94	0.42	1.08	0.58
	% change	20%	19%	-4%	-75%	-20%	27%	<b>5%</b>
Cocoa yield (kg/ha)	1990/91	5.20	5.08	5.29	4.15	4.22	4.86	4.92
	1997/98	5.16	4.7	4.81	4.98	4.89	5.05	4.92
	% change	-4%	-32%	-38%	129%	95%	21%	<b>0%</b>
Labour productivity (kg cocoa/man-days)	1990/91	1.27	0.87	1.00	-0.16	0.02	0.85	0.78
	1997/98	1.58	1.01	0.60	-0.38	0.87	1.55	1.11
	% change	36%	15%	-33%	-20%	134%	103%	<b>39%</b>
Non-lab. real input exp	1990/91	8.92	8.77	8.36	7.85	9.18	8.77	8.80
	1997/98	9.32	8.90	8.29	7.83	8.99	8.83	8.92
	% change	48%	14%	-7%	-2%	-17%	6%	<b>14%</b>
Tot lab days (Yearly man/days)	1990/91	4.67	4.63	4.37	4.75	4.85	4.86	4.67
	1997/98	4.48	4.27	4.24	4.43	4.43	4.58	4.39
	% change	-17%	-30%	-12%	-27%	-34%	-24%	<b>-24%</b>

Source: Author's calculation based on GLSS3 and GLSS4. a) Median values. The data on farm size, yields and inputs per hectare are based on a smaller sample excluding all the observations that did not report the size of the land holdings on which cocoa production occurred. b) The percentage of log-differences in the bottom half of the table is computed using the formula:  $\text{Exp}(\log\text{-difference})-1$

**TABLE 4**  
**MATCHING THE MACRO AND MICRO DATA ON COCOA PRODUCTION GROWTH**

~ PROJECTIONS FROM CENSUS ('000) ~							
<u>Year</u>	<u>Western</u>	<u>Central</u>	<u>Eastern</u>	<u>Volta</u>	<u>Ashanti</u>	<u>B. Ahafo</u>	<u>Total</u>
<i>1. All Households</i>							
1991	350	380	480	310	540	330	2,390
1998	420	540	570	380	740	450	3,100
<i>2. Percentage Change in Total Number of Households</i>							
%Δ	20.00%	42.11%	18.75%	22.58%	37.04%	36.36%	<b>29.71%</b>
~ GLSS POPULATION ESTIMATES ~							
<u>Year</u>	<u>Western</u>	<u>Central</u>	<u>Eastern</u>	<u>Volta</u>	<u>Ashanti</u>	<u>B. Ahafo</u>	<u>Total</u>
<i>3. All Households</i>							
1991	483	515	659	409	733	454	3,253
1998	664	604	738	607	1,083	581	4,277
<i>4. Cocoa Farming Households</i>							
1991	137	71	100	14	112	71	505
1998	227	130	123	16	132	54	682
<i>5. Percentage of cocoa farming households in the GLSS<sup>a</sup></i>							
1991	28%	14%	15%	3%	15%	16%	16% (0.006)
1998	34%	22%	17%	3%	12%	9%	16% (0.006)
<i>6. Estimates of Cocoa Farmers' Household Population ('000) (applying 5. to 1.)</i>							
1991	98	53	72	9	81	53	382
1998	143	119	97	11	89	41	496
% Δ	<b>1.46</b>	<b>2.24</b>	<b>1.35</b>	<b>1.22</b>	<b>1.22</b>	<b>0.77</b>	<b>1.30</b>
<i>7. Log of household average cocoa production (kilos)</i>							
1991	5.91	5.48	5.35	4.59	4.87	5.70	5.44
1998	6.05	5.27	4.83	4.04	5.31	6.13	5.50
<i>8. Proportional Change in Cocoa Production</i>							
%Δ	<b>1.15</b>	<b>0.81</b>	<b>0.59</b>	<b>0.58</b>	<b>1.55</b>	<b>1.54</b>	<b>1.06</b>
<i>Estimate of Cocoa Production Growth (combining the total %Δ in 6. and 8.)</i>							
	<b>68%</b>	<b>81%</b>	<b>-20%</b>	<b>-29%</b>	<b>89%</b>	<b>19%</b>	<b>38%</b>

Source: Projections from Census from documentation to GLSS data, and author's calculations from GLSS data.

Notes: a) These figures are derived counting all cocoa growing households who harvested any positive quantity of cocoa in each given crop year.

**TABLE 5**  
**ESTIMATING HOUSEHOLD COCOA PRODUCTION AT THE REGIONAL AND AGGREGATE LEVEL**

	(1)						(2)	(3)
	OLS						2SLS All	2SLS Labour
	Western	Central	Eastern	Ashanti	B. Ahafo	Pooled	Pooled	Pooled
<b>Dependent variable is Log (cocoa harvested)</b>								
Log of cocoa plot size	0.273*** (0.066)	0.364*** (0.088)	0.299*** (0.084)	0.431*** (0.090)	0.267 (0.172)	0.332*** (0.041)	0.353*** (0.074)	0.318*** (0.043)
Log of labour input	0.176* (0.090)	0.385* (0.209)	0.040 (0.150)	0.117 (0.189)	-0.049 (0.332)	0.117 (0.073)	0.473* (0.252)	0.243* (0.146)
Percentage of hired labour	0.686*** (0.227)	0.224 (0.443)	-0.449 (0.440)	0.353 (0.389)	1.030* (0.522)	0.270 (0.176)	1.678 (1.300)	0.581 (0.859)
Log of input expenditure (constant prices)	0.207*** (0.054)	0.335*** (0.098)	0.302*** (0.082)	0.140* (0.074)	0.262* (0.154)	0.246*** (0.036)	-0.098 (0.272)	0.206*** (0.068)
Log (plot value+1)	0.052*** (0.011)	0.024** (0.012)	0.004 (0.014)	0.011 (0.014)	-0.009 (0.026)	0.025*** (0.006)	0.029*** (0.009)	0.024*** (0.006)
Dummy = 1 if hh head is male	0.320** (0.153)	0.186 (0.188)	0.348* (0.203)	0.114 (0.199)	0.004 (0.328)	0.336*** (0.092)	0.457*** (0.145)	0.336*** (0.115)
Years of schooling of household head	0.051 (0.031)	-0.090* (0.047)	-0.091* (0.047)	0.118** (0.054)	0.040 (0.129)	0.010 (0.022)	0.029 (0.029)	0.013 (0.025)
(Years of schooling of household head) <sup>2</sup>	-0.007*** (0.002)	0.004 (0.004)	0.006* (0.003)	-0.010** (0.004)	-0.005 (0.011)	-0.003 (0.002)	-0.005 (0.003)	-0.003 (0.002)
Log of total annual rainfall per region	0.012 (0.118)					0.102 (0.231)	0.134 (0.258)	0.100 (0.238)
Y98		-0.005 (0.185)	-0.525*** (0.167)	0.421** (0.183)	-0.144 (0.289)	-0.031 (0.096)	0.033 (0.134)	-0.007 (0.109)
Constant	2.242*** (0.522)	0.392 (1.283)	2.716*** (0.670)	2.593*** (0.984)	3.608** (1.644)	1.791* (1.057)	2.572 (1.777)	1.506 (1.098)
Observations	292	173	184	237	84	970	968	970
R-squared	0.43	0.38	0.32	0.22	0.22	0.31	0.19	0.31
<b>Sargan test (over identification test of all instruments):</b>							4.10	9.898
<i>p-value</i>							0.25	0.195
<b>Hausman Test: H<sub>0</sub> OLS efficient against IV (col. 2)</b>							2.92***	
<i>p-value</i>							0.98	
<b>CRS: H<sub>0</sub>: <math>\beta_{Land} + \beta_{Lab} + \beta_{Non-Lab\ input} + \beta_{farm\ value} = 1</math></b>								
<b>F test</b>	8.07	0.19***	6.43	2.89	2.20***	13.82		
<i>p-value</i>	0.005	0.66	0.01	0.09	0.14	0.00		
<b>Wald test [<math>X^2(1)</math>]</b>							3.53*	2.01***
<i>p-value</i>							0.06	0.16

Notes: Robust standard errors in parentheses. For coefficient estimates the following notation holds: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. For diagnostic tests, \*, \*\*, \*\*\* denote non-rejection of the null hypothesis at respectively 10%, 5% and 1%. Table A3 in the appendix shows the first stage regression of the IV estimates as well as the different instruments used for the labour input variables.

**TABLE 6A**  
**DESCRIPTIVE STATISTICS ON GHANA COCOA FARMERS SURVEY (CROP YEAR 2001/2002)**  
**MEANS OF PRODUCTION INDICATORS**

<b>DATA IN LEVELS</b>				
	<b>Ashanti</b>	<b>B. Ahafo</b>	<b>Western</b>	<b>Total</b>
No. Farmers	<i>122</i> (25%)	<i>111</i> (22%)	<i>264</i> (53%)	<b>497</b>
Cocoa produced (kg)	1040	1049	1442	<b>1255</b>
Cocoa farm size (ha)*	3.64	4.05	5.26	<b>4.45</b>
Individual cocoa farm size (ha)*	2.02	2.43	2.02	<b>2.02</b>
Number of cocoa farms cultivated	1.63	1.49	2.27	<b>1.94</b>
Cocoa yield (kg/ha)*	181	174	182	<b>181</b>
Cocoa yield (kg/ha)	259	235	248	<b>248</b>
Insecticide (litres)	5.76	14.47	12.20	<b>11.13</b>
Fertiliser (50kg. Bags)	0.31	0.18	0.65	<b>0.46</b>
Total labour (person-days)	234	268	267	<b>259</b>
Household labour	68	77	73	<b>72</b>
% Of hired labour	0.58	0.48	0.62	<b>0.58</b>
Labour productivity (Kg cocoa/person-days)	8.60	11.02	10.57	<b>10.19</b>
<b>DATA IN LOGS</b>				
Cocoa sold (kg)	6.47	6.48	6.82	<b>6.66</b>
Cocoa farm size (ha)	1.28	1.38	1.63	<b>1.49</b>
Individual cocoa farm size (ha)	0.76	0.95	0.72	<b>0.77</b>
Cocoa yield (kg/ha)	5.19	5.1	5.19	<b>5.17</b>
Total labour	4.83	4.86	4.94	<b>4.89</b>
Labour productivity	1.65	1.62	1.88	<b>1.77</b>
Insecticide	2.01	2.32	2.39	<b>2.29</b>
Fertiliser	4.94	3.95	4.80	<b>4.66</b>

Note: \*These are median values to control for the effect of few dominant outliers in the distribution of the variable.



**TABLE 6B**  
**THE ALLOCATION OF LABOUR TO COCOA FARMING TASKS**

	HOUSEHOLD PERSON-DAYS				HIRED PERSON-DAYS			
	Men	Women	Children	Tot. hhold	Contract	Annual	Nnoboa	Total hired
<i>FARM TASKS</i>								
<b>INVESTMENT*</b>								
Land Preparation	24.87 (60)	25.30 (33)	8.50 (2)	<b>4.72</b>	87.83 (94)	255.33 (18)	15.67 (9)	<b>26.14</b>
Planting	26.61 (119)	26.03 (152)	24.58 (24)	<b>15.52</b>	68.83 (35)	62.86 (21)	10.78 (9)	<b>7.70</b>
<b>PRODUCTION</b>								
Maintenance (Weeding)	45.78 (232)	38.38 (248)	40.22 (50)	<b>44.57</b>	156.30 (372)	118.56 (73)	59.94 (102)	<b>146.70</b>
Applying inputs	7.75 (125)	5.69 (160)	4.96 (23)	<b>4.01</b>	12.37 (215)	20.29 (34)	14.76 (17)	<b>7.24</b>
Harvesting	19.50 (229)	16.68 (345)	13.35 (110)	<b>23.52</b>	30.84 (194)	40.93 (59)	53.99 (149)	<b>33.08</b>

Note: The figures in parentheses show the number of farmers using any given labour category. \*The two investment categories were not included in the regression analysis.

**TABLE 6C**  
**CHANGES IN QUANTITIES OF INSECTICIDE AND FERTILISER APPLIED: 1990/91 –2001/2002**

Year	Ashanti	Brong Ahafo	Eastern	Total
<b>No of farmers</b>				
<b>1991</b>	112	71	137	320
<b>1998</b>	132	54	227	413
<b>2001</b>	122	111	264	497
<b>Fertiliser (50kg bags)</b>				
<b>1991</b>	0.65	0.24	0.04	0.30
(% of farmers using)	(23%)	(11%)	(7%)	(14%)
<b>1998</b>	0.31	0.07	2.66	1.57
(% of farmers using)	(17%)	(15%)	(24%)	(21%)
<b>2001</b>	0.31	0.18	0.65	0.46
(% of farmers using)	(5%)	(7%)	(11%)	(8%)
<b>Insecticide (litres)</b>				
<b>1991</b>	2.19	0.62	1.88	1.71
(% of farmers using)	(59%)	(14%)	(44%)	(42%)
<b>1998</b>	1.66	0.98	3.76	2.73
(% of farmers using)	(39%)	(25%)	(64%)	(51%)
<b>2001</b>	5.76	14.47	12.20	11.13
(% of farmers using)	(63%)	(63%)	(78%)	(71%)

**TABLE 7**  
**PRODUCTION FUNCTION: 2002 GHANA COCOA FARMERS SURVEY**

OLS	
<i>Dependent variable is ln (kg cocoa sold)</i>	
Log (full bearing cocoa farm size)	0.558*** (0.045)
Log (labour)	0.140*** (0.046)
% of hired labour	-0.081 (0.109)
Log (lit. insecticides applied +1)	0.115* (0.061)
Dummy = 1 if no insecticides was applied	0.228 (0.178)
Log (kg. fertiliser applied +1)	0.030 (0.090)
Dummy = 1 if no fertiliser was applied	-0.143 (0.478)
Log (value agr. equipment + 1)	0.108*** (0.028)
% of farm destroyed by Black Pod	-0.007*** (0.001)
hh head years of schooling	-0.008 (0.020)
(hh head years of schooling) <sup>2</sup>	-0.000 (0.002)
sex of hh head	0.200** (0.084)
region==Ashanti	-0.113 (0.111)
region==Brong Ahafo	0.475*** (0.139)
region==Western Sefwi	0.547*** (0.137)
Ln (rainfall)	1.225*** (0.216)
Constant	-1.685 (1.149)
Observations	497
R-squared	0.56
Wald test: Ho CRS	0.27***
<i>p-value</i>	0.61

Note: Robust standard errors in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**TABLE 8**  
**YIELD REGRESSIONS: 2002 GHANA COCOA FARMERS SURVEY**

	(1)	(2)	(3)
	Basic model	With production inputs	2SLS (instrumenting land)
<i>Dependent variable is ln (yields)</i>			
Log (full bearing cocoa farm size)	-0.27*** (0.05)	-0.08 (0.09)	0.00 (0.47)
Log (labour/ha)		0.14*** (0.05)	0.14*** (0.05)
% hired labour/ha		-0.13 (0.13)	-0.10 (0.18)
Log (lit. insecticides applied/ha)		0.12* (0.07)	0.13 (0.11)
Dummy = 1 if no insecticides was applied		0.24 (0.18)	0.28 (0.28)
Log (kg. fertiliser applied/ha)		0.03 (0.09)	0.08 (0.31)
Dummy = 1 if no fertiliser was applied		-0.13 (0.48)	0.11 (1.48)
Log (agr. equip. expend/ha)		0.11*** (0.03)	0.11*** (0.03)
Percentage of farm destroyed by black pod disease		-0.01*** (0.00)	-0.01*** (0.00)
hh head years of schooling		-0.01 (0.02)	-0.01 (0.02)
(hh head years of schooling) <sup>2</sup>		-0.00 (0.00)	-0.00 (0.00)
sex of hh head		0.20** (0.08)	0.18* (0.11)
Ln (rainfall)	1.38*** (0.23)	1.20*** (0.22)	1.18*** (0.22)
region==Ashanti	0.00 (0.10)	-0.12 (0.11)	-0.13 (0.12)
region==Brong Ahafo	0.49*** (0.14)	0.47*** (0.14)	0.46*** (0.15)
region==Western Sefwi	0.46*** (0.14)	0.54*** (0.14)	0.53*** (0.14)
Constant	-0.60 (1.10)	-1.57 (1.16)	-1.74 (2.03)
Observations	497	497	497
R-squared	0.15	0.32	0.32
Sargan test - Chi-sq(3)			1.23***
<i>p-value</i>			0.54
Test of excluded instruments [F( 3, 474) ]			4.31***
<i>p-value</i>			0.00

Note: Robust standard errors in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Instruments used were the log of household size, a dummy = 1 if land was virgin forest before cocoa cultivation started, and a dummy = 1 if the farmers owns a spraying machine.

**TABLE 9**  
**MEAN VALUES OF COCOA PRODUCTION RELATED VARIABLES BY TENANCY STATUS**

	OWNER	ABUNU	ABUSA	CARETAKER/KIN	TOTAL	
No. Farmers*	<b>GCFS - 2001</b>	413	25	34	25	497
	<i>% of tot sample</i>	<i>(83%)</i>	<i>(5%)</i>	<i>(7%)</i>	<i>(5%)</i>	
<i>PROFILE OF FARMERS</i>						
Age respondent		52	49	45	43	51
Gender (% males)		0.80	0.92	0.94	0.96	0.83
Years of education		6.85	5.84	3.21	7.40	6.58
Number of <i>all</i> ** cocoa farms operated		1.96	1.92	1.65	1.92	1.94
<b>LOG TRANSFORMED VARIABLES</b>						
Cocoa sold (kg)		6.67	6.43	6.99	6.31	6.66
Total ha cultivated under cocoa		1.50	1.65	1.39	1.32	1.49
Cocoa yield (kg/ha)		5.17	4.78	5.61	4.99	5.17
Total labour		5.12	5.03	4.46	4.38	5.04
Labour productivity (Kg sold per unit of labour)		1.54	1.40	2.54	1.93	1.62
<b>LEVEL VARIABLES</b>						
Household labour (Person-days)		98	95	55	57	93
% Hired labour		58%	51%	46%	52%	56%
% Income from cocoa		75%	71%	84%	71%	75%
Litres of insecticide applied		12,4	5,5	6,3	2,5	11,1
Kilos of fertiliser applied		25,9	6	15,3	0,4	22,9
% Invested in replanting (last 5 years)		51%	48%	32%	32%	49%
% Invested in expansion (last 5 years)		50%	52%	29%	49%	47%

\*Shown in parentheses percentage in the sample. \*\* The tenancy status of each farmer is defined by the tenure rights prevailing on the largest landholding operated (or on the majority of farmed land on which the same land rights was exercised). However each respondent typically operated more than one farm, often with different individual tenure rights. This row reports the total number of farms operated by each respondent regardless of the tenure status on each single landholding.

**TABLE 10**  
**THE EFFECT OF TENANCY CONTRACTS: 2002 GHANA COCOA FARMERS SURVEY**

	(1)	(2)	(3)
	OLS	2SLS (instrumenting tenancy <sup>†</sup> )	one farm-one farmer sample
<i>Dependent variable is ln (yields)</i>			
Log (full bearing cocoa farm size)	-0.19* (0.10)	-0.18* (0.10)	-0.16 (0.13)
Log (labour/ha)	0.14*** (0.05)	0.13*** (0.05)	
% hired labour/ha	-0.07 (0.11)	-0.04 (0.11)	
Log (lit. insecticides applied/ha)	0.12 (0.07)	0.12 (0.07)	0.12 (0.09)
Dummy = 1 if no insecticides was applied	0.22 (0.18)	0.24 (0.18)	0.14 (0.25)
Log (kg. fertiliser applied/ha)	0.04 (0.09)	0.04 (0.08)	-0.05 (0.11)
Dummy = 1 if no fertiliser was applied	-0.11 (0.48)	-0.10 (0.43)	-0.63 (0.52)
Log (agr. equip. expend/ha)	0.11*** (0.03)	0.11*** (0.03)	0.04 (0.04)
% of farm destroyed by BP	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
Status==abunu	-0.15 (0.17)	-0.41 (0.37)	-0.43 (0.26)
Status==abusa	0.34*** (0.12)	0.73*** (0.26)	0.31* (0.16)
Status==caretaker/kin	0.05 (0.16)	-0.59 (0.39)	0.02 (0.15)
hh head years of schooling	-0.00 (0.02)	0.01 (0.02)	-0.02 (0.03)
(hh head years of schooling) <sup>2</sup>	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
sex of hh head	0.18** (0.09)	0.16* (0.09)	0.32** (0.13)
Ln (rainfall)	1.10*** (0.22)	0.84*** (0.25)	1.21*** (0.30)
Region==Ashanti	-0.12 (0.11)	-0.06 (0.12)	-0.07 (0.17)
Region==Brong Ahafo	0.35** (0.14)	0.19 (0.17)	0.36* (0.21)
Region==Western Sefwi	0.49*** (0.14)	0.40*** (0.15)	0.59*** (0.22)
Constant			0.18** (0.08)
Observations	497	481	226
R-squared	0.29	0.26	0.33
Sargan test: Chi-sq(1)		2.13***	
<i>p-value</i>		0.14	

Note: Robust standard errors in parentheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. † The instruments used for tenancy status were the predicted values of a multinomial logit on the determinants of land rights.

**TABLE 11**  
**FARMERS' PERCEPTION OF INTERNATIONAL PRICES**

Region	(1) No Obs.	(2) Are you aware of the int. price of cocoa?	(3) Do you know the price paid in I.C.?	(4) Do people come to buy cocoa here from IC?	(5) Do you know that some farmers sell their cocoa in IC?	(6) Do you know for what price* they sell?	(7) Do you know anyone selling at this price?
<b>Ashanti</b>	122	5%	7%	3%	3%	525,000	8%
<b>Brong Ahafo</b>	111	6%	23%	2%	25%	601,563	13%
<b>Western Sefwi</b>	121	11%	31%	8%	39%	659,189	35%
<b>Western Wassa</b>	143	6%	20%	5%	29%	656,522	42%
<b>Total</b>	<b>497</b>	<b>7%</b>	<b>20%</b>	<b>5%</b>	<b>24%</b>	<b>640,188</b>	<b>24%</b>

\*Cedis/bag, with 1 bag  $\approx$  kg. 62,5

**FIGURE 1**  
**GHANA'S COCOA PRODUCTION (MT) AND PRODUCER PRICES (CONSTANT 1987 USD)**

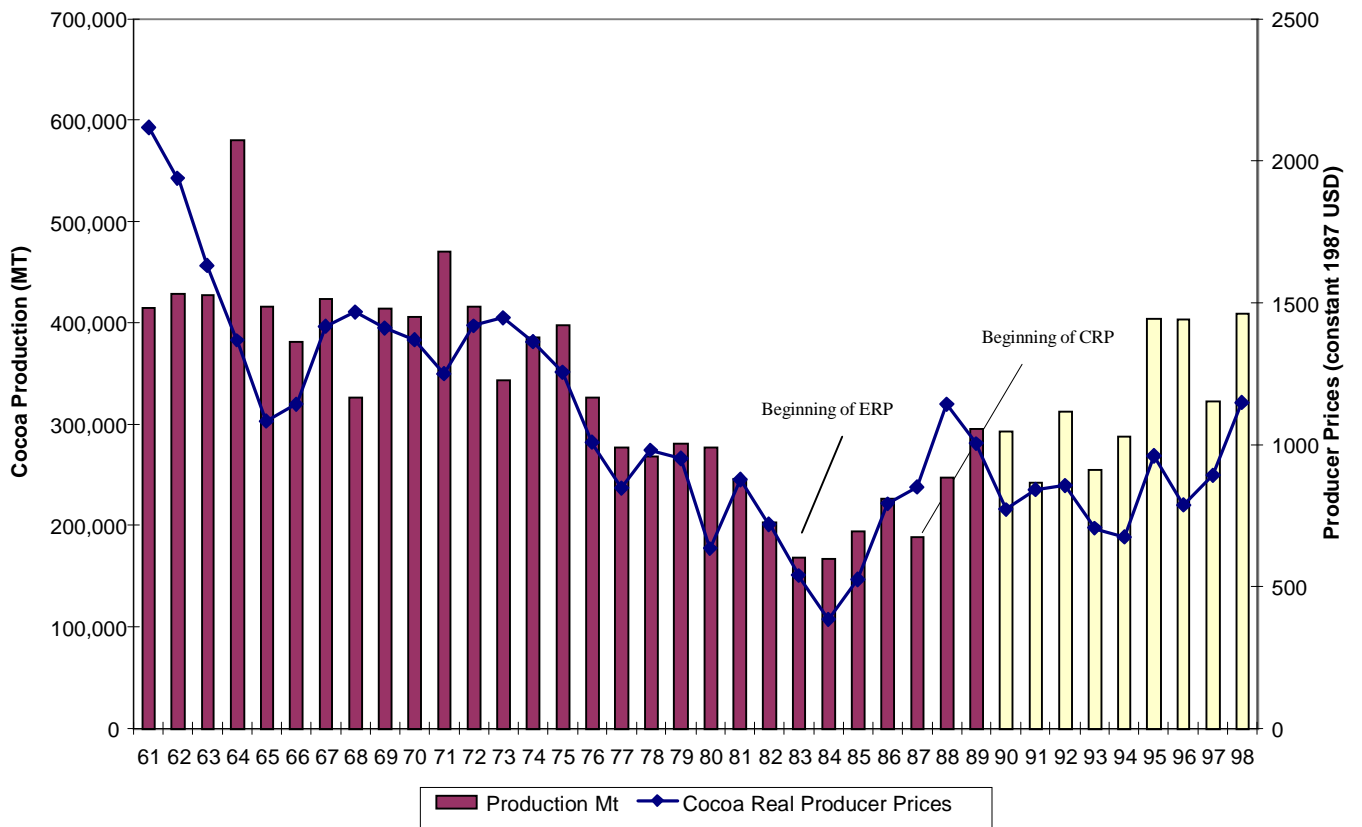
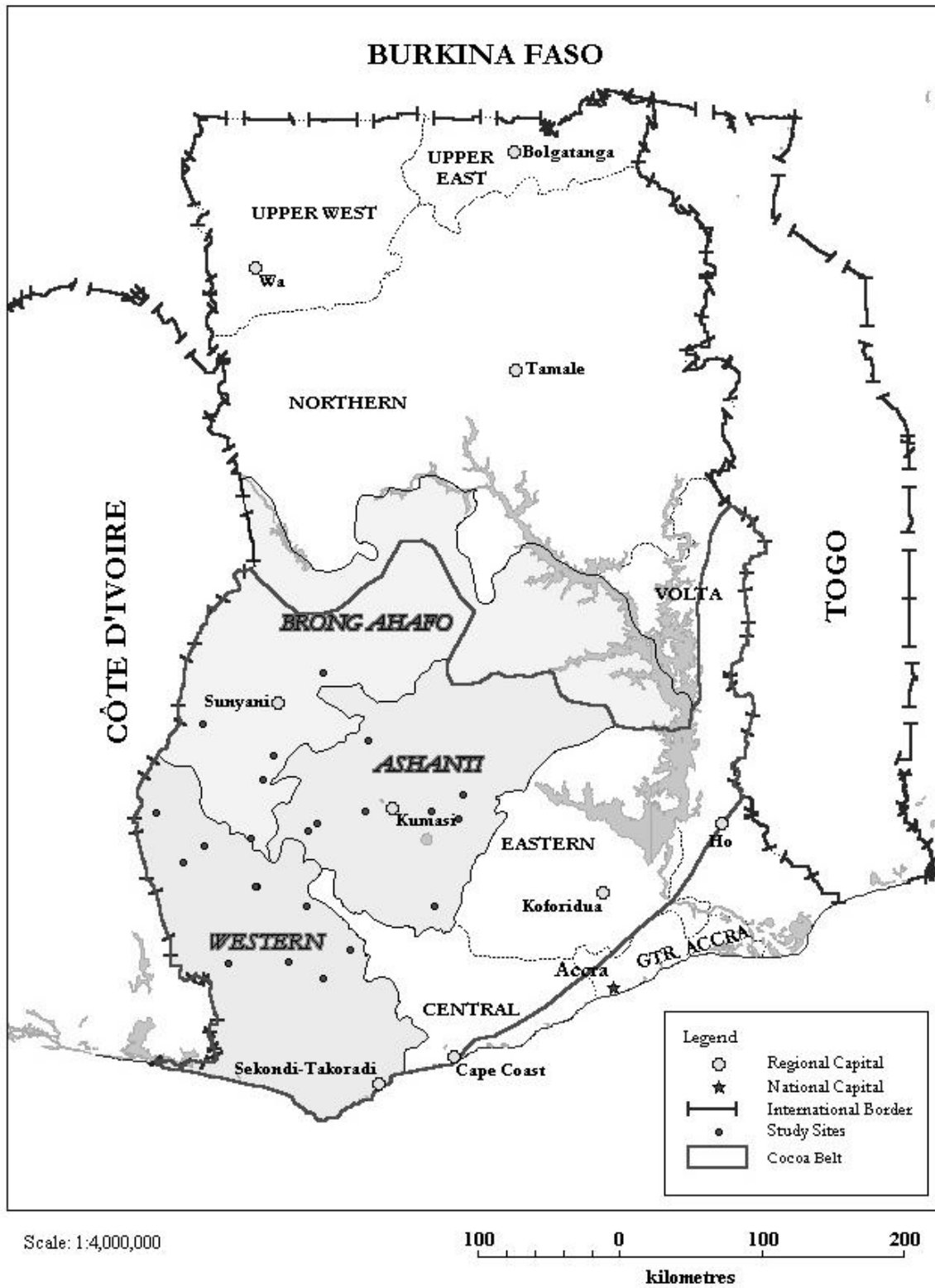
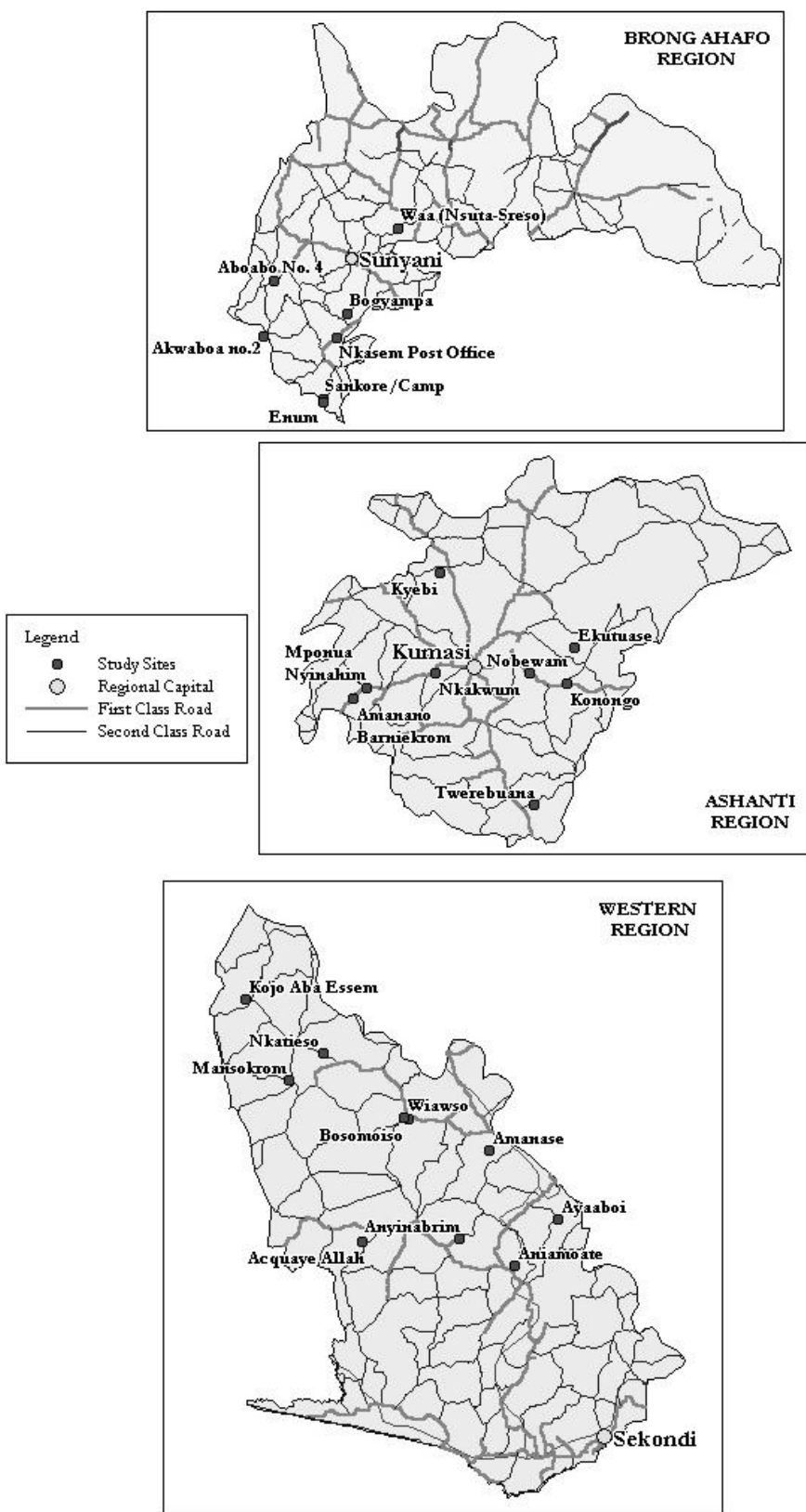


FIGURE 2  
OVERALL VIEW OF SURVEY AREA

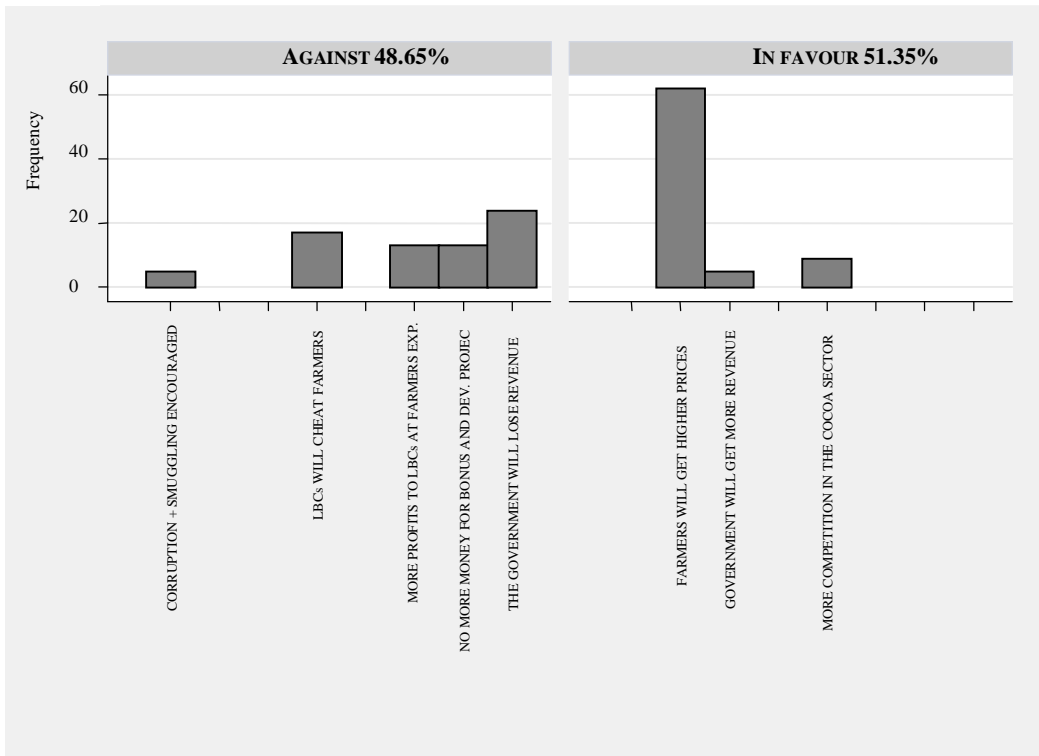




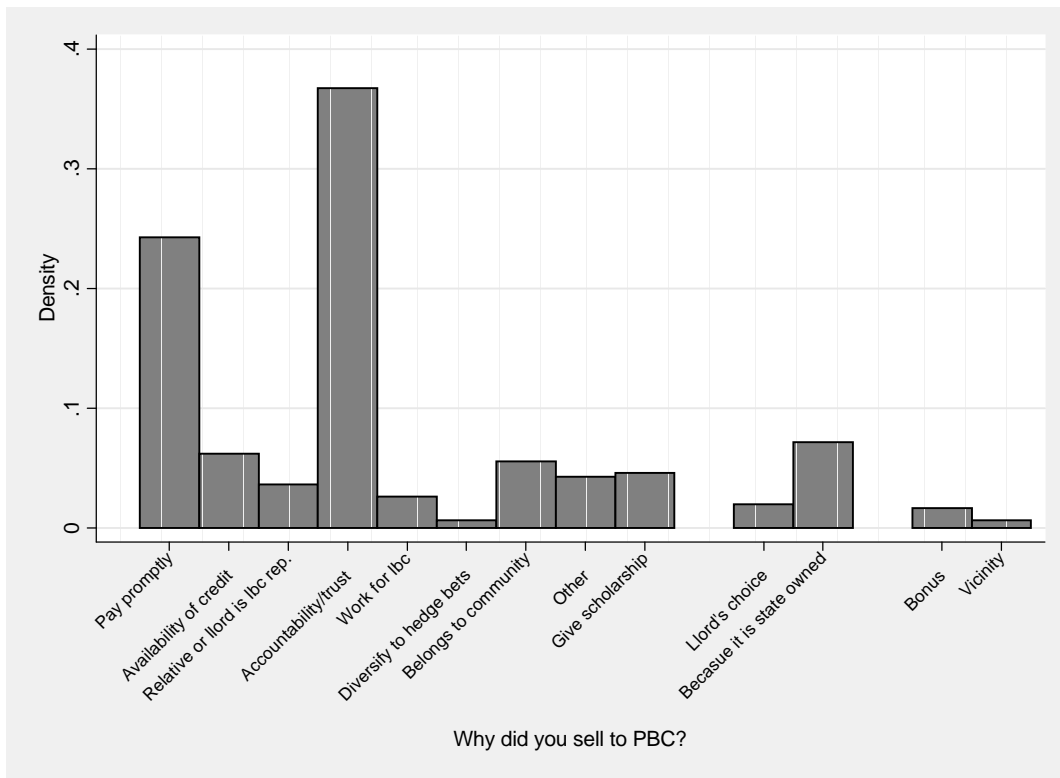
**FIGURE 3**  
**REGIONAL DETAILS OF STUDY SITES**



**FIGURE 4**  
**HOW WOULD FULL LIBERALISATION AFFECT FARMERS**



**FIGURE 5**  
**REASONS FOR SELLING TO THE PRODUCE BUYING COMPANY**



**FIGURE 6**  
**REASONS FOR SELLING TO ANY OTHER BUYING COMPANY**

