Market Liberalization and Agricultural Intensification in Kenya (1992-2002)

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Abstract

This study analyses the impact of the liberalization on the intensification of maize production in Kenya. It first analyses the impact of liberalization on input and output prices, followed by an analysis of farmer practices comparing two major farmer surveys, from 1992 and 2002. The results show that liberalization has had a general positive impact on the evolution of prices, with a decrease of input/output price ratios. However, fluctuations of maize prices has become very high and, combined with a decrease of marketing by the marketing board, has increased the uncertainty in maize production. The liberalization has also resulted in a decrease in extension services. Fortunately, farmers have an increased access to credit services.

The combined effect of prices and access to services has resulted in little change in the number of farmers using new maize technologies, in particular improved varieties and fertilizer. The dose of fertilizer per ha has, however, decreased. As a result, yields have not increased. The analysis also showed that credit and extension have a major effect on adoption and, indirectly, on yield.

The results indicate that an effort is needed to improve extension access. While the improved access to credit is encouraging, more than half the farmers still miss this essential service. Finally, the increased price fluctuation and market uncertainty should be addressed through improved use of price buffer mechanisms. Market access can also substantially be improved through investment in infrastructure.

Keywords: liberalization, intensification, adoption, maize, Africa

1. Introduction

Africa is the only region in the world in which both the number and proportion of malnourished children is rising (Rosegrant et al. 2001). Kenya is a typical example, where food production per capita had been steadily decreasing over the last 20 years. Yields of the major food crop, maize, grew from 1 to 1.5 tons in the late 1970s and early 1980s, but have been stagnant since. In combination with the rapidly increasing population, this has led to a substantial reduction in maize production per capita. Similarly, in East and Southern Africa, the once praised intensification of maize production (Byerlee and Heisey 1997) has clearly stalled (Smale and Jayne 2003).

Heavy government involvement was long seen as necessary to intensify agriculture, in particular for research, extension, credit and marketing. In the 1980s, however, came the realization that many of these programs were not sustainable and, moreover, hampered market development and the participation of the private sector. As a result, market liberalization was introduced in many countries, including Kenya (Wangia, Wangia, and De Groote 2004).

Unfortunately, market liberalization has had limited effect on food production in Africa. What went wrong? Some studies claim the liberalization has gone too far, others think it did not go far enough. Most of these studies are based on macroeconomic data and literature review, but lack the microeconomic information to explain the trends.

In this paper, therefore, we analyze the trends in agricultural intensification in Kenya, using both macroeconomic and microeconomic data. On the macroeconomic level, we analyze the policies of the liberalization and its effect on institutions and prices, in particular the major inputs (seed, fertilizers and labor) and on the maize output. On the microeconomic level, we

compare two major farm surveys conducted in Kenya, in 1992 and 2002, with representative samples in all major agro ecological zones.

2. Agricultural policies and their effect on prices in Kenya

The agricultural liberalization in Kenya has been difficult and unsteady, but has lead to a liberalization of the seed and fertilizer sectors (Wangia, Wangia, and De Groote 2004). These evolutions have lead to an increase in number of participants, particularly from the private sector, but also to a decrease in institutional support, in particular for research, extension, credit, and marketing (De Groote et al. 2005).

Due to government control and market interventions, maize prices stayed fairly stable in the 1970s and 1980s. However, after the initiation of market liberalization the nominal price rose very quickly (Figure 1). Still, after adjusting for inflation, the trend is less clear. What emerges clearly is the strong fluctuation of maize prices in the 1990s. After adjusting for inflation, seed and fertilizer prices have also decreased, but the real parameters of interest are the input/output price ratios. Because of the high fluctuation of the maize price, these ratios also fluctuate substantially (Figure 2). In 1992 there was an increase in seed and labor prices, but these were compensated by the maize price rise of 1993. There was a further decrease in the input/output price ratios in the rest of the 1990s. The maize price drop in 2002 brought the ratios up for a short time, but they went down again after that. In the long run, a downwards trend can be observed. The upheaval in the early 1990s, however, in combination with high maize price fluctuations, has disturbed many maize producers and created a high level of uncertainty. As we will see in the following sections, the effect on input use by farmers is mixed.

3. Survey methodology

In the next sections, the results of two representative farmer surveys, covering all major agro ecological zones in Kenya, are compared. The first survey was conducted in 1992 by the International Maize and Wheat Improvement Centre (CIMMYT) and the Kenya Agricultural Research Institute (KARI) in the major agro-ecological zones of Kenya (Hassan, 1998). This study redefined these zones into six major agro ecological zones for maize production (Figure 3). Starting from the coast and going inland, the Lowland Tropics can be distinguished, followed by the Dry Mid-altitudes and Dry Transitional zones. These three zones are characterized by low yields, below 1.5 tons/ha (according to official agricultural statistics, that is). Although these zones cover 29% of Kenya's maize area, they only produce 11% of the maize. Central and Western Kenya are dominated by the Highland Tropics (HT), bordered at the West and East by the Moist Transitional (MT) zone, which is between mid-altitude and highland. These zones have high yields (more than 2.5 tons/ha) and produce 80% of Kenya's maize on 30% of Kenya's maize area (Figure 3).

Both surveys use stratified, two stage random sampling and a structured questionnaire covering most aspects of maize production. The first survey was conducted in 1992 and covered 79 clusters, selected from the sampling frame of the Central Bureau of statistics, and 1407 farmers (Hassan, Lynam, and Okoth 1998). The second survey covered 185 sublocations, randomly selected from the 1999 census report (CBS 2001), and 1800 farmers (Table 2).

4. Evolution of maize production in Kenya 1992-2002

Both surveys included the basic characteristics of the household head (age, gender, schooling), the farm (if maize was sold, farm size), the institutional environment (access to credit and

extension), maize inputs (improved seed and fertilizer) and maize production (area, production, yield). The description of the variables used and their descriptive characteristics are presented in Table 2.

The analysis, however, is more interesting at the level of the agro ecological zones. Where most farmers, especially in the high potential areas, had good access to extension services in 1992, this was reduced substantially in 2002 (Figure 4). This clearly reflects the decreased resources available to the agricultural extension services. A bit surprisingly, the proportion of farmers with access to credit has actually increased, especially in the high-potential areas (Figure 5). This indicates an increased role of micro-finance institutions and farmer cooperatives, as compared to the old formal agricultural credit, which has basically collapsed.

But what was the effect of this changing institutional environment, combined with the price changes, on input use? Generally, there is little change in the percentage of farmers using improved maize seed (Figure 6) except for the lowland tropics. This likely reflects the increased effort of the Kenya Seed Company to develop new varieties for that zone, in particular hybrids. Similarly, there has been little change in the percentage of farmers using fertilizer on maize (Figure 7), except for the lowland tropics. The percentage of farmers using improved seed stays very low in the low potential areas, however (less than 15% in the dry mid-altitudes and the coast), while reaching more than 80% in the high-potential areas. The major difference between the two surveys, however, is on the dose of fertilizer used (Figure 8). While there is little change in the highlands (a dose more than 70 kg/ha on average), the reduction is substantial in the moist-transitional zone (from 135 to 89 kg/ha). Farmers in the low-potential, finally, use very small doses of fertilizer.

The effect of all these changes on maize yields is, again, mixed. Yields in the highlands has stayed constant around 1200 kg/ha, but yields in the moist-transitional zone have decreased to a similar level (Figure 9). In the other, low-potential areas, yields have substantially increased, although only reaching the 1000 kg/ha in the moist-mid-altitudes. These results also indicate that the official statistics overestimate the maize yield in Kenya.

5. Factors influencing adoption of maize technologies and yield

Combining the data from both surveys also allow an analysis of the factors influencing adoption of new maize technologies. Therefore, a logistic model was estimated using adoption of improved maize varieties and fertilizer as dependent variables (Table 3). A dummy was added for the year of the survey to allow potential differences. However, after taking into account the other factors, the proportion of farmers using improved varieties has not changed, but there is a positive tendency for the proportion of farmers using fertilizer. This is in line with the results of the previous section. Some individual characteristics are influential: the proportion of farmers using improved varieties or fertilizer decreases with age, an unfortunate trend. Fortunately, the effect of schooling is positive. Gender of the household head, on the other hand, has no significant effect on adoption. Farm characteristics such as farm size, or commercializing maize, did not have significant effects on adoption.

Institutional factors play, however, a very important role. Both access to credit and access to extension have large and significant effects on adoption, both of improved varieties and fertilizer. But the largest effects found, by far, come from the agro ecological zones. In line with the adoption proportions in Figures 6 and 7, situation in a particular zone determines to a large

extent the adoption levels. This indicate that, apart from the above differences, access to inputs varies widely among regions.

Finally, we analyze the effect of the new technologies and other factors on the major indicator of agricultural intensification, yield, using a multiple linear regression model (Table 4). Both fertilizer and improved maize varieties have a significant impact, although the effect of fertilizer is low: one extra kg of maize for every extra kg of fertilizer. The effect of improved varieties, however, is estimated at 227 kg/ha. Keeping all other factors constant, there is no difference between the two surveys. Of the individual and farm characteristics, only the gender has an influence, and yields decrease by 290 kg/ha for female-headed households. This indicate that other factors than those included in the regression play a role and should be identified.

The access to credit and extension are not significant here, indicating that their major effect is through an increased use of fertilizer and improved varieties, which were included separately. Finally, the effect of agro ecological zone is clearly felt, reflecting the better conditions in the high-potential areas.

6. Conclusions

We conclude that the liberalization has had a general positive impact on the evolution of prices, with a decrease of input/output price ratios. However, fluctuations of maize prices has become very high and, combined with a decrease of marketing by the marketing board, has increased the uncertainty in maize production. The liberalization has also resulted in a decrease in extension services. Fortunately, farmers have an increased access to credit services.

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Finally, the increased price fluctuation and market uncertainty should be addressed through improved use of price buffer mechanisms. Market access can also substantially be improved through investment in infrastructure.

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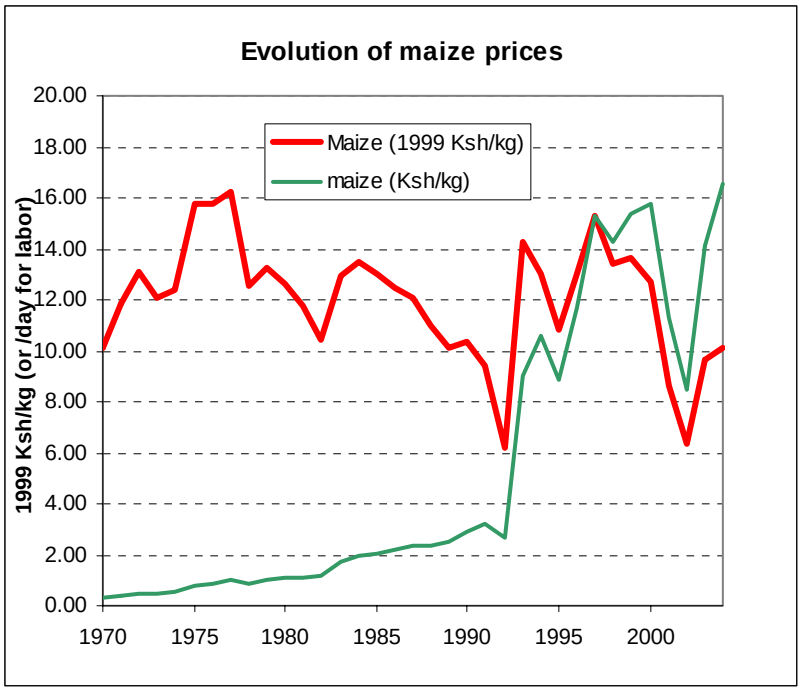

Figure 1. Evolution of maize prices.

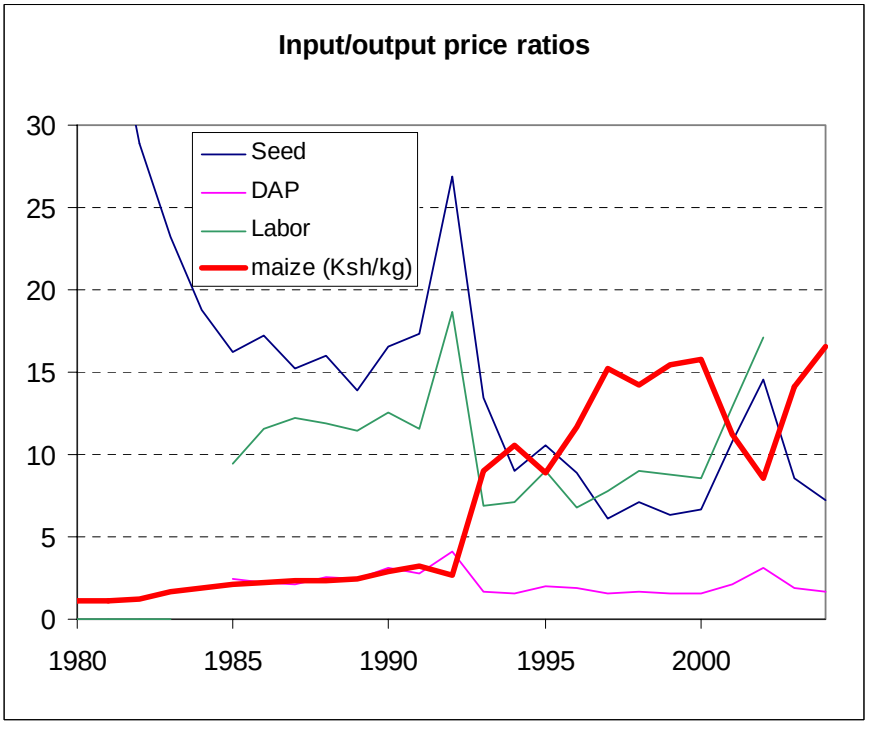

Figure 2. Evolution of the input/output price ratios in Kenya

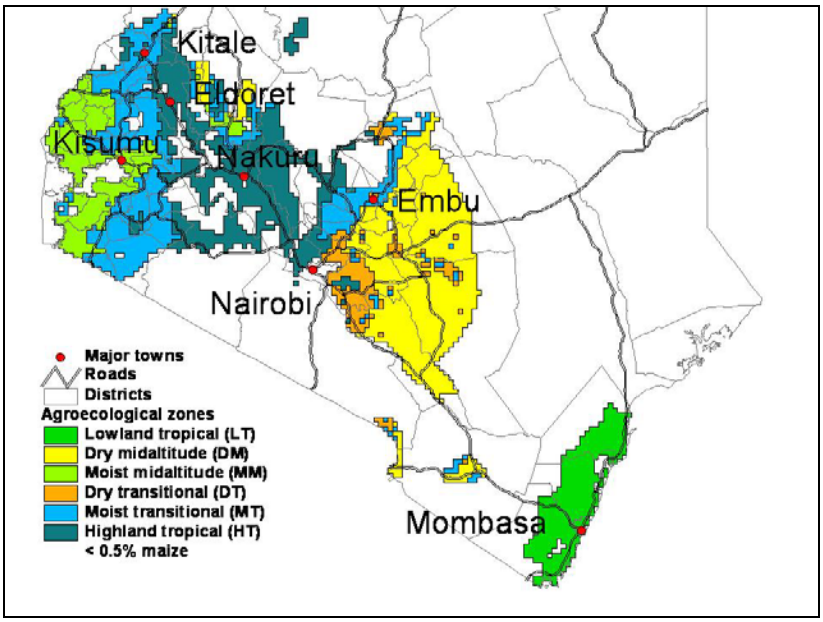

Figure 3. Maize agroecological zones of Kenya

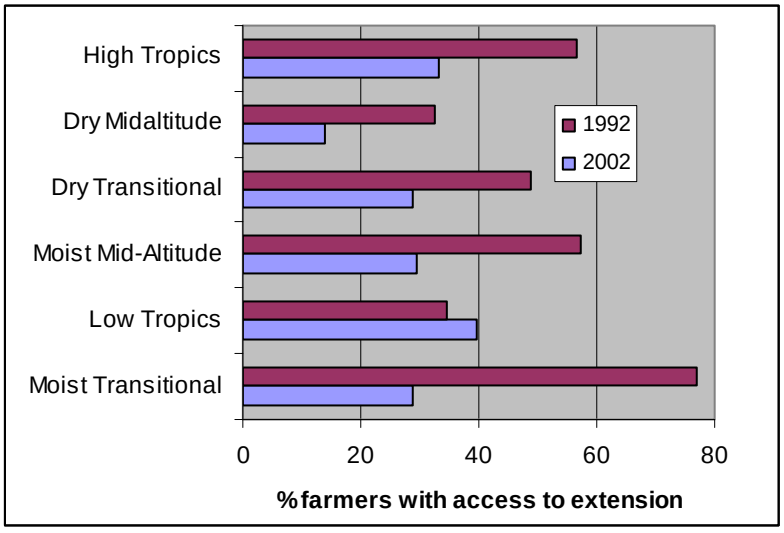

Figure 4. Proportion of farmers having access to extension services.

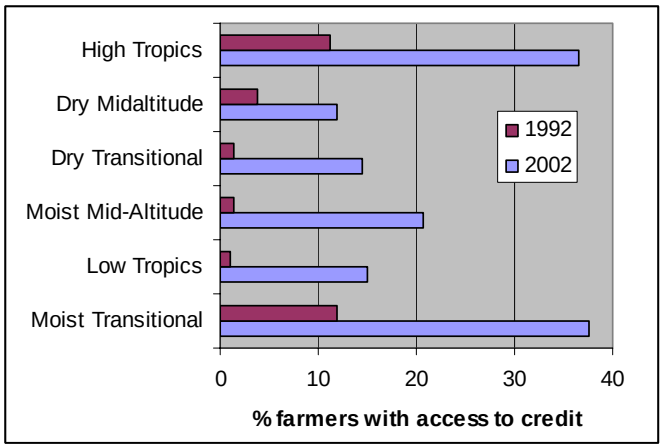

Figure 5. Proportion of farmers having access to credit services.

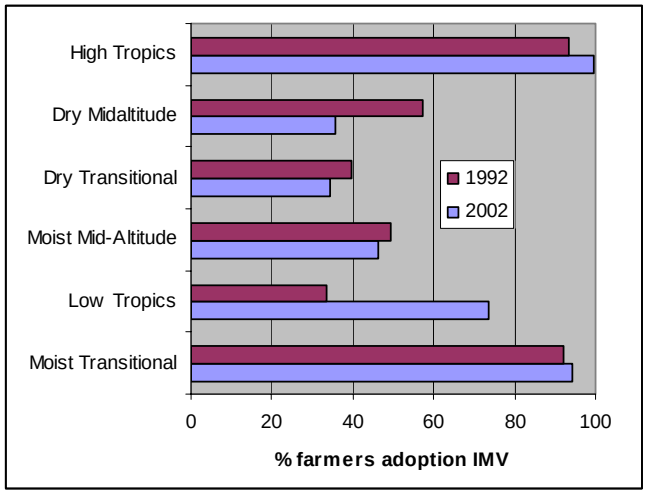

Figure 6. Percentage of farmers using improved maize varieties

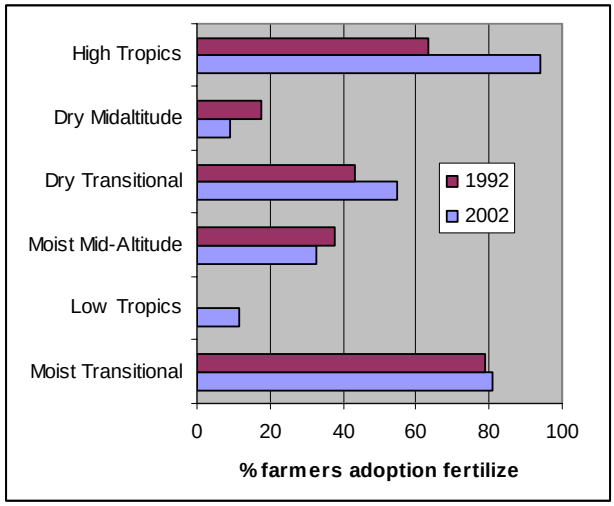

Figure 7. Percentage of farmers using fertilizer on miaze

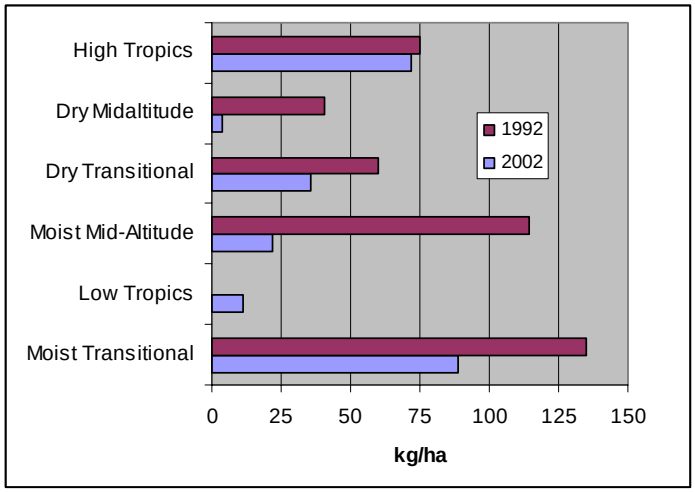

Figure 8. Average dose of fertilizer used on maize (kg/ha)

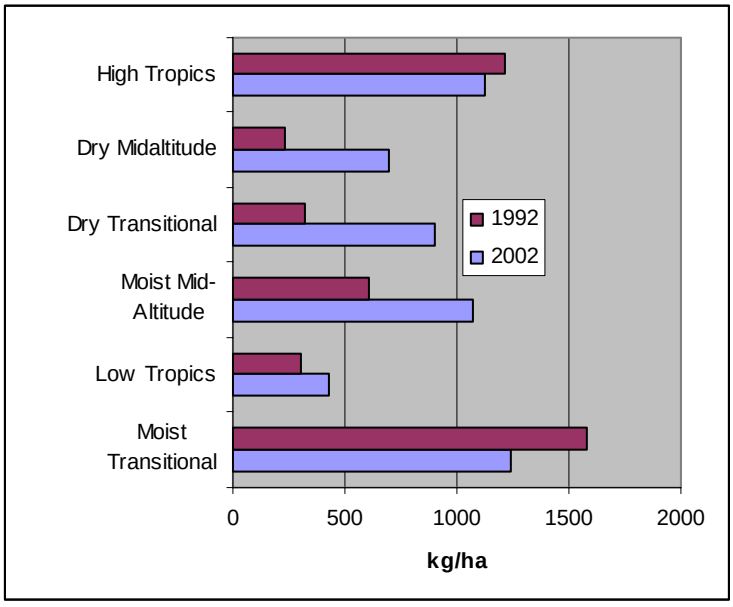

Figure 9. Average yield of maize, by agroecological zone.

Table 1. Sample details of both surveys.

	1992			2002		
Agroecological zone	# clusters	# farmers /cluster	# farmers	# sublocations	# farmers /sublocation	# farmers
Low tropics	5	20	100	20	15	300
Dry mid-altitude	10	18	181	25	8	200
Dry transitional	4	20	80	20	5	100
Moist mid-altitude	9	20	183	25	10	250
Moist transitional	23	18	412	55	10	550
High tropics	28	16	451	40	10	400
total	79		1407	185		1800

Table 2. Descriptive statistics of variables in maize intensification study.

		1992		2002	
	units	Mean	Std. Dev.	Mean	Std. Dev.
Age head of household	years	45.95	15.92	49.19	14.52
Head has at least some schooling	dummy (1 = yes, 0 = no)	0.59	0.49	0.87	0.34
Female headed household	dummy (1 = yes, 0 = no)	0.40	0.49	0.12	0.32
Household sold maize	dummy (1 = yes, 0 = no)	0.11	0.31	0.39	0.49
Farm size	hectare (ha)	24.52	266.11	2.68	13.49
Access to extension	dummy (1 = yes, 0 = no)	0.58	0.49	0.30	0.46
Access to credit	dummy (1 = yes, 0 = no)	0.08	0.27	0.27	0.45
Use of improved maize varieties	dummy (1 = yes, 0 = no)	0.76	0.43	0.72	0.45
Uses of fertilizer on maize	dummy (1 = yes, 0 = no)	0.54	0.50	0.51	0.50
Fertilizer dose on maize	kg/ha	88.02	263.10	46.70	113.82
Maize area	ha/farm	3.07	16.08	2.03	7.09
Maize production	kg/household	9232	83085	2604	21163
Maize yield	kg/ha	1014	2056	952	1723
N		1157		1250	

Table 3. Factors influencing the adoption of new maize varieties and fertilizer.

		Use of improved varieties			Use of fertilizer on maize		
		Coefficient	Std. err.		Coefficient	Standard error	
Time	Year (1992=0, 2002=1)	0.093	0.139		0.292	0.139	**
Head of hh	Age	-0.009	0.004	**	-0.006	0.004	*
	Some schooling	0.392	0.146	***	0.365	0.136	***
	Female headed	-0.013	0.144		0.1	0.13	
Farm	Farm sold maize	0.206	0.134		-0.018	0.134	
	Farm size (ha)	0	0		0	0	
Institutional	Access to extension	0.76	0.122	***	0.454	0.112	***
	Access to credit	0.548	0.185	***	1.085	0.163	***
Zones	Dry Mid-Altitudes	-0.843	0.183	***	0.382	0.275	
	Dry Transitional	-1.197	0.221	***	2.334	0.262	***
	Moist Mid-Altitudes	-0.856	0.171	***	1.614	0.226	***
	Moist Transitional	1.717	0.202	***	3.59	0.223	***
	Highland Tropics	2.356	0.252	***	3.37	0.229	***
	Constant	0.394	0.269		-2.794	0.306	***
Goodness-of-fit	% Correctly predicted	78			76.5		
	-2 Log likelihood	1964.629			2230.336		
	Cox & Snell R Square	0.27			0.33		
	Nagelkerke R Square	0.389			0.441		
	N	2265			2264		

***, **, * Coefficient significantly different from zero (at 1%, 5%, or 10%),

Table 4. Factors influencing maize yield.

type	Variable	Coefficient	Standard error	
	(Constant)	154.14	216.713	
Inputs	fertilizer dose on maize (kg/ha)	1.028	0.206	***
	use of improved maize varieties	227.08	106.587	**
Time	Year (1992=0, 2002=1)	-12.562	100.839	
Head of hh	Age	0.729	2.836	
	Some schooling	136.793	104.639	
	Female headed	-291.222	101.048	***
Farm	Farm size (ha)	1.112	0.215	
Institutional	Access to extension	86.315	87.71	
	Access to credit	127.622	115.43	
Agroecological zone	Moist Transitional	802.428	141.779	***
	Moist Mid-Altitudes	453.367	151.783	***
	Dry Transitional	287.802	199.677	
	Dry Mid-Altitudes	64.233	162.293	
	Highland Tropics	612.664	148.02	***
Goodness-of-fit	R2	0.27		
	N	2249		

***, **, * Coefficient significantly different from zero (at 1%, 5%, or 10%),