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# **Effects of Market Price Volatility on Production Patterns and Apparent Retreat into Subsistence Farming by Kenyan Smallholders**

**By Hezron Nyangito, Walter Odhiambo, Samuel Mwakubo  
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### **Introduction**

Many farmers in developing economies face wide variations in the price of agricultural commodities they produce and have devised ways of coping with market risks arising from producer price variations. In the absence of government interventions or stabilizing market institutions for producer prices, farmers may rely on self-insurance and income diversification. These latter mechanisms have the disadvantage of having a high potential of driving households into poverty - households may self-insure through sale of productive assets thus undermining future incomes or/and may diversify and thus reduce incomes by inhibiting potentially profitable specialization. Diversification into subsistence crops may also imply shortfalls in revenue from cash crops, which may perpetuate poverty. This Policy Brief presents findings of a study that examined the changing maize marketing systems following market reforms and the household strategies for coping with arising market risk.

This Policy Brief is organized as follows: The first section presents an overview of policy reforms in the food sub sector and links to price variability as well as the farmer responses to income risks. The second section presents the evidence on price and income variations and farmers' responses to income risks in Kakamega District of Kenya.

### **Food Markets Policy Reforms and Links to Producer Price Variations and Income Risks**

Kenya started to implement market policy reforms in the food sub sector as from the early 1980s. The key focus in the policy reforms for the food sub sector

was to liberalize markets, which hitherto were government controlled. This included price decontrol with the major objective of providing incentives (stable and higher prices) to farmers through open market operations for increased production. However, despite the policy reforms, agricultural production, and food production in particular, has been on the decline (Nyangito, 1999). Food production levels are currently below what was achieved in the 1980s. Fluctuations in volumes of marketed outputs through formal markets for the main food commodities (maize, wheat, sugar, rice and milk) have also been observed while price volatility is also a common feature in the markets. It appears that although government controlled marketing systems did not work for the benefit of producers, post-liberalization marketing systems do not seem to be working any better.

The observed fluctuations in marketed output volumes of the main food commodities and price volatility have serious implications for poverty, risk and vulnerability in the rural areas. They may result in the poor not being able to produce enough food to meet their domestic needs, generate enough income to purchase food and meet other basic needs, or have means of dealing with natural calamities such as droughts. However, the extent to which market structure and price volatility have impacted on food production and shifts in agricultural production among the small farmers is not known. The study upon which this Policy Brief is based was undertaken to fill this gap using evidence from Kakamega District in Kenya.

### **Why Price Variability**

Price adjustments in agriculture do not behave as the neoclassical economic theory would predict for a

perfect market where convergence of supply and demand occurs to establish an equilibrium price. This is because of existence of an inelastic demand for agricultural products and inelastic short-run supply response of agricultural outputs. Gabre-Madhin et al, (2003) point out that price inelasticity of demand is a principal factor underlying food price variability and its effect is made worse if marketing margins are high, a possible scenario in regions with high transaction costs. In such circumstances, marketing margins are likely to be unresponsive in the short-run to changes in retail price. This implies that a fall in the later reduces more than proportionally producer prices.

The inelasticity of the supply is attributed to several factors: (i) labour, capital and land are considered fixed-costs and are fully employed (ii) factors of production are not highly mobile in response to factor price changes (iii) producers are entrenched in agriculture as a way of life. The arising price variability from both the demand and supply side is manifested in seasonal and inter-annual fluctuations in price levels both of which have welfare consequences. Seasonal variation has the potential to produce income shocks especially for households with low asset base. Liquidity constraints may force producers to sell cheaply after a harvest only to buy expensively later in the year. On the other hand, inter-annual fluctuations produce uncertainty making planning difficult. This study focuses on market risks arising from maize price variation and how households cope with it.

### **Farmers Response to Income Risks**

Farmers' decisions as to what enterprise mix to produce is influenced by the available resources, productivity of various enterprises at different scales of production and various risks faced as the farmer strives to raise household income and food security. After incurring losses through low and or uncertain prices, low yields, among other factors, farmers associate different levels of risk with different enterprises, and this affects the amount they are willing to invest. Relative to short run decisions, like seasonal farm planning, it is only product prices and yields that are uncertain and thus most important in determining risk (McConnell and Dillon, 1997). In the context of long term planning decisions, all yield, price and cost variables are likely to be uncertain. In this study, the focus was on farmers' response to price risks. The risk attitude held by the farmer influences the enterprise mix depending on the risk management strategies the farmer employs. Individuals react to risk in different ways; one could be a risk taker, risk neutral or risk averse. However various empirical studies, (e.g. reported by Hazel and Norton, 1986), have demonstrated that farmers typically behave in risk averse ways. Farmers as such often prefer farm

plans that provide satisfactory level of security even if this means sacrificing income on average. In general, many small-scale farmers cope with price uncertainty through diversification. This study focuses on the diversification strategies farmers have used to respond to maize price fluctuations in Kakamega district.

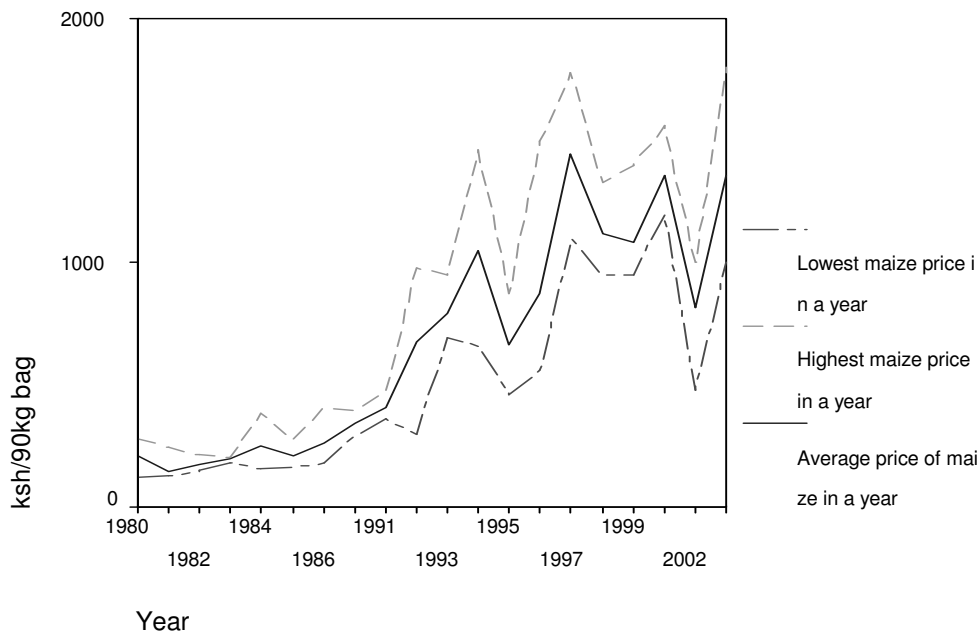
### **Evidence on Price Variability and Farmer Responses**

Kakamega is one of the most densely populated and most agriculturally productive districts in Kenya. The district lies in the Western region of the country and produces a significant amount of maize. However in the recent past, the district has been reported to experience a decline in maize production. Kakamega district has a diverse range of farm enterprises, which include production of maize, beans bananas, sweet potatoes, millets, Kales, tea and sugar cane. With respect to food crops, maize still dominates in both area allocation and production although there is a decline in the post reform period. There is some evidence of diversification in food crop production. Beans and sweat potatoes have emerged as important marketable food crops in the late 1990s. Significant production has occurred for sweet potatoes in 2000 where hardly any level of production was recorded in the pre-reform. In general, although overall food production increased after 1998, there has been a decline since year 2000. The decline in bean production is especially noticeable. The changes in enterprises mix could be a reflection of farmers' reaction in response to various enterprise risks, market or otherwise.

### **Price Volatility and Crop Production Patterns**

The maize price trends (Figure 1) were compared using inter-annual price variations of the highest, lowest and average maize prices in the district for the period 1980 to 2002. The comparison reveals large differences in both the mean and variances for maize with some years having the highest price being more than twice the lowest. The high variation between the highest and lowest prices is explained by price fluctuations between the harvests. Prices generally decline immediately after harvest and are at their lowest around December to February. Around this period, liquidity constraints may force farmers to dispose off their produce at low prices to meet cash needs associated with school and festival demands. The prices then gradually increase from March and are at peak between May and July.

**Fig. 1: Movement in Kakamega Market Maize Price: 1980-2003**



Greater intra-annual differences were observed in the period just after reforms but the fluctuations became less in late 1990s, which could signal farmers' investment in storage, diversification to other crop enterprises and involvement in off-farm activities. However, the fluctuations have been on the increase in recent years and prices have generally been lower than the harvest month. This is due to 'distress' food sales arising from increased poverty levels, lower market participation because of decline in purchasing power and uncertainty resulting from price volatility, and maize imports from neighbouring countries.

Movement in real crop producer prices indicates that there has been a slight decline in real producer prices of all the crops in the region. Apart from the decline, all commodity prices have generally been volatile with the exception of maize and tea that have been rather stable<sup>1</sup>. Bean prices have been the most volatile followed by maize. Areas under the two crops follow a similar trend. The area under maize and beans has declined by about 20%, since 1980. The Pearson's correlation coefficient of negative 0.5 exists between seasonal maize price movement and area allocation for years 1980-2003. This implies that as the price volatility increases, farmers reduce the amount of land put under maize, which is a rational response to risk.

<sup>1</sup> This may explain the gradual increase in area under sugarcane

A combination of declining real prices and production has led to a reduction in real crop incomes for smallholder farmers in the study region. There has been high volatility in crop revenues too (Table 1). Sugarcane revenues are the least volatile with a coefficient of variation of about 15%. All the other crops apart from bananas show quite high volatilities with beans recording the highest fluctuations with a coefficient of variation of 78%. The higher volatility in the other crops' revenues may also be arising from fluctuations in yields shown also in the table compounding price variability.

However, maize yields are only moderately volatile despite high fluctuations in prices possibly due to quick reaction by farmers. Unlike the revenue from beans, maize revenues per hectare are quite low. The higher bean revenues per unit area may explain the higher land allocation for beans over time. However, real market prices have declined in late 1990s and by 2003, they were about 50% of the pre-liberalization level. This coupled with the fluctuations may have meant reduced bean intensification and the apparent decline in yields in recent years. Although hecterage has remained fairly stable since 1998, output has declined over the period.

**Table 1: Crop Revenue Means, Standard Deviation and Coefficient of Variation**

Crop	Mean		Standard deviation		Coefficient of variation (%)	
	Revenue (Ksh/ton)	Yield	Revenue (Ksh/ton)	Yield	Revenue (Ksh/ton)	Yield
Sugarcane	70369.2	43.1	10467.3	4.0	14.9	9.2
Tea	70024.8	4.6	21118.8	1.0	30.2	22.5
Maize	2264.0	2.1	610.1	0.3	26.9	15.6
Beans	2197.4	1.1	1642.1	0.9	74.7	83.1
Sweet Potatoes	5064.2	9.2	1528.2	2.1	30.2	23.0
Banana		10.4		0.5		4.5

**Costs of Crop roduction and Farm Incomes**

Crop production was found to be labour intensive with limited use of capital, except for the sugarcane enterprise in the Mumias Sugar zone, where the sugar company supplies inputs for production on credit. Intermediate input use was also low, and mechanization limited to land preparation. Even with land preparation, farmers use a combination of draft animal and casual labour.

Qualitative responses from farmers show less usage of fertilizers and pesticides as well as credit compared to pre-reform period. More farmers have used less of these inputs in 2003 than period before 1990. While many farmers use fertilizer and other improved technologies, the amount of fertilizer used is low as a result of high prices. Manure use, however, has been fairly stable which is consistent with efforts towards risk management.

The level of input usage is related to problems that farmers have been facing post reform. Some of these problems include lack of operating capital, and costly inputs arising from removal of subsidies by the government. Market decontrol did not result in lower prices as envisaged.

The magnitude of total cost notably costs of seeds, fertilizer, manure, equipment and labour has implications on entry to enterprises for households. The analysis of cost of production showed that total production costs were generally high for dairy, maize and maize/bean enterprises. The cost per unit area for dairy, maize and sugarcane were estimated at Kshs. 13,300, 4,700 and 4,300, respectively. The lowest unit costs were for cassava (Kshs 462) and bananas (Kshs 927). Dairy, maize and sugar cane have relatively higher capital requirements, which may constrain poorer households. However, these are also the enterprises with the highest returns. Sugarcane ranks first in terms of gross margin per acre in the whole sample contributing about 63.6% and is followed by the dairy

enterprise (27.4%). Maize/bean intercrop ranks third with 15%.

On returns to investments, apart from bananas and sweet potatoes, which hardly use inputs, sugarcane ranks highest in terms of returns to labour, land and capital per shilling invested. The high return on sweat potatoes may explain the rise in production. Other crops worth noting are Kale and millet. Although not considered as major crops, returns per shilling invested are high compared to maize and beans.

**Alternative Off Farm Jobs and Income Opportunities**

Smallholder farmers often rely on off-farm activities as part of their diversification strategies (Ellis, 1998; Barrett et al, 2001). Diversification patterns therefore reflect what households consider to be their most attractive options and provide insights on policies that optimize use of the poor’s assets given the risks they face.

The proportion of households involved in off-farm activities indicated that over half of the sampled households are involved in off-farm activities. The results show that households with high farm gross margins had more family members in off- farm businesses, thereby suggesting a close relationship between farm incomes and off-farm business. Poorer households find it difficult to engage in off-farm businesses due to lack of lack start up capital.

More households with low farm incomes were involved in formal employment. This applied more to those households with small farm sizes. Thus land scarcity may be a push factor to off-farm employment.

**Conclusions and Policy Implications**

This paper has examined market price volatility arising from market liberalization and decontrol and how households cope with the market risk. The study found that farmers are sensitive to price fluctuations as

shown by increase in area allocation to crops like sugarcane which show stability in prices over time. This indicates that while farmers may be withdrawing from the market in some food crops such as maize, there is expansion in cash crop production.

Weakness in input markets compounded by the problem of price volatility (product market risk) is largely responsible for the lack of desired response from market reforms in the maize industry. There is evidence of market failures in credit market, which in turn may affect purchased input use. Access to extension services is low following reduction of government budgets in extension. Policy reforms need to consider such constraints that may hinder attractive options for households. Also important is to address factors that may hinder expansion of food crop enterprises such as kale and millet that have high returns and also offer greater opportunities for poverty reduction. Addressing market and infrastructure constraints could assist in expansion of these enterprises.

But price volatility is bound to have negative impacts on supply response whatever options may exist for farmers. So should the government attempt to stabilize prices? History has shown that government stabilization is costly and stock release can at times be unpredictable making private agents reluctant to hold stocks. If the government is to encourage greater private sector participation to induce competition there is need for addressing storage costs such as reduction of interest rates. Another issue of concern in long term price stabilization is the interventions in times of deficits. They have the potential to lower prices and thus reduce incentives for private agents. Furthermore, the concentration with maize in such interventions reduces diversification in consumption that may lead to a reduction in production of other crops such as millet. Given that food deficit episodes recur frequently nowadays in Kenya, a possible option is for the government and relief agencies to buy food from the domestic market since this not only supports domestic production but also supports private agents and improves their capacity to trade.

Since one of the major factors contributing to price variability is poverty, which forces producers to use out-put as quasi-credit (selling low and buying high) a broad based growth strategy that seeks to address the purchasing power of rural areas is called for. This means increasing the producer's production levels and productivity through strategies such as improved infrastructure to open up the market, improve access to credit, research and extension.

## About the Authors

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*Strategies and Analysis for Growth and Access (SAGA) is a project of Cornell and Clark Atlanta Universities, funded by cooperative agreement #HFM A 00 01 00132 00 with the United States Agency for International Development. In Kenya, SAGA is implemented through a collaboration among Cornell and Clark Atlanta Universities, the Institute of Policy Analysis and Research, the Kenya Institute for Public Policy Research and Analysis, Tegemeo Institute of Agricultural Policy and Development, and the University of Nairobi Department of Agricultural Economics. All views, interpretations, recommendations, and conclusions expressed in this paper are those of the authors and not necessarily those of the supporting or cooperating organizations.*



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