

## The impact of price and market liberalization policies on Uganda's coffee supply response

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### Abstract

Econometric modelling using time series data on production and yields for the period 1970-93 was used to evaluate farmers' supply response shown by price elasticities. The findings of the study revealed that pre- and post-liberalisation short-run output supply elasticities(SRE) for Robusta coffee at 0.189 and 0.201 respectively, were not significantly different. Post-liberalisation SRE at 0.644 was significantly higher than the pre-liberalisation SRE at 0.465 for Arabica coffee. Pre- and post-liberalisation long-run elasticities(LRE) were 0.526 and 0.541 for Robusta coffee, and 0.722 and 0.988 for Arabica coffee, respectively. There were no statistically significant differences between elasticities before and after the liberalisation policies based on yield data of both Robusta and Arabica coffee. The policies had a positive and significant impact on Arabica coffee output. It was recommended that the price and market liberalisation policies be upheld. Yield and area LRE revealed that yield rather than area will increase Uganda's future coffee supply. Therefore appropriate mechanisms for adoption of improved coffee production technologies should be put in place by concerted efforts of Ministries and Organisations involved in the industry.

**Key words:** Econometric modelling, liberalisation, price elasticities

### Introduction

Coffee, Uganda's major export crop, provides over 60 percent of the country's foreign exchange earnings (World Bank, 1993).

The coffee industry was seriously plagued by domestic and international economic crises since the early 1970s. Low real producer prices, fixed and overvalued exchange rate regimes, inefficient marketing systems and high rates of inflation aggravated its terms of trade compared to the non-traded food crops with liberalised prices. Coffee plantations were abandoned, yields and marketed output sharply declined from about 3.2 million bags in the early 1970s to 2.01 million bags in 1992/93; Bibangambah, 1989; Government of Uganda, 1993). Coffee quality and output further declined owing to the old age of the coffee trees and the collapse of the International Coffee Agreement in July, 1989, which caused world coffee prices to fall. This led to a situation where Uganda's export earnings could no longer support the import bill. Coffee exports accounting for 50 and 95 percent of Uganda's exports in 1970 and 1986/87, respectively, still remained Uganda's main export

even as production incentives were declining largely due to the collapse of other exports (World Bank, 1988).

To salvage the coffee industry, government in 1990/91 coffee season initiated the sectoral policy for institutional reforms. This involved price and market liberalisation which entailed decontrol of producer prices, dismantling of domestic trade, export marketing and transport monopolies and removal of exchange rate and export taxes. During the same period, the Coffee Marketing Board Act was repealed and Coffee Marketing Board, a government export monopoly, was made a limited company; the Coffee Marketing Board Limited. Competition was permitted in the coffee export market between this company and private firms. The foreign exchange system was also liberalised. In 1991, the regulatory and supervisory functions of the Coffee Marketing Board, were shifted to Uganda Coffee Development Authority.

This study assessed the impact of the shift from government tight control to extreme liberalisation of the industry on the viability of the industry as indicated by farmers' supply response. The objectives of the Study were to examine farmer's output and yield supply response in light of the liberalisation policy framework.



**Methodology**

**The coffee supply functions.** Econometric modelling using multiple regression analysis of time series data for the period 1970 to 1993 was adopted to estimate specified supply functions. The Ordinary Least Squares(OLS) technique was employed in the analysis. The Nerlovian long-run equilibrium supply, partial(stock) adjustment and naive price expectations schemes were considered in the model. Due to technological constraints, farmers lag their response, hence the dynamics of supply were considered in the supply functions(Nerlove, 1958; Ssemogerere, 1990; Otim, and Ngategize, 1993). Serial correlation was corrected for by the Prais-Winsten iterative procedure.

The Ministry of Agriculture(Planning division) was the major source of data on yields and prices. Other sources were Bank of Uganda (Agricultural Secretariat) and the Ministry of Finance and Economic Planning. Owing to data limitations, procurement figures were used to estimate farm output. Output was specified as a measure of farm supply. Since coffee production is a set of biological processes in which growth is expected to form exponential and cyclical curves, output and yield functions were specified in log-linear functional forms (Gujarati, 1988; Ellis, 1992) as follows:

*(i) Coffee output supply functions.* The coffee output supply functions were specified as follows:

$$\ln Q_t = \beta_0 + \beta_1 \ln Q_{t-1} + \beta_2 \ln P_t + \beta_3 \ln D_2 P_t + \beta_4 \ln P_{c,t-1} + \beta_5 D_2 + \beta_6 D_3 + \beta_7 \ln Wages + U_{i1} \dots \dots \dots (1)$$

where  $Q_t$  = quantity(QR/QA) of Robusta/Arabica coffee produced in the current year in metric tons;  $Q_{t-1}$  = quantity of coffee produced the previous year in metric tons;  $P_t$  = Real (PR/PA) Robusta/Arabica coffee producer price in shillings per metric ton lagged by one year;  $P_{c,t-1}$  = real market price of competing crops in shillings per metric ton lagged by one year;  $P_c$  = PMZ for maize, PSP for sweet potatoes and PBN for beans - the crops in the coffee based farming systems which bore significant cross-price elasticities. Nominal producer prices were deflated using the Kampala low income group consumer price index.

$D_2$  = the price and market liberalisation dummy, that takes on value 1 for 1990-1993 (the liberalisation period) and 0 otherwise; the multiplicative dummy-policy interaction affects the slope of the supply function and hence the elasticities. The additive dummy coefficient is an intercept(supply) shifter.  $D_3$  = a dummy variable to capture the effect of the 1978/79 civil war, an economic shock in farm production; wages = a proxy for all coffee production inputs given that labour represents an overwhelming proportion of production inputs;  $U_i$  = The error term;  $i$  = Robusta or Arabica.

$\beta_2$  and  $\beta_4$  are pre-liberalisation,  $(\beta_2 + \beta_3)$  and  $\beta_4$  are post-liberalisation short-run own-price and cross price elasticities. The corresponding long-run elasticities are  $\beta_2/\lambda$ ,  $\beta_4/\lambda$  and  $(\beta_2 + \beta_3)/\lambda$  where  $\lambda = (1 - \beta_1)$  and  $\beta_1$  is the coefficient of the lagged dependent variable.

*ii) Coffee yield supply functions.* The coffee yield supply functions were specified as follows:

$$Y_i = \lambda_0 + \lambda_1 \ln Y_i + \lambda_2 \ln P_i + \lambda_3 D_2 + \lambda_4 \text{Trend} + \lambda_5 \ln D_2 P_i + \lambda_6 \ln P_{c,t-1} + U_{i2} \dots \dots \dots (2)$$

Where: Trend = a linear term that takes into account factors that affect yield over time. Other variables are defined as in the output equation with  $Y_i$  referring to yield.

**Results and discussion**

**Coffee output and yield supply functions.** The results of the econometric analysis are presented in Table 1. They indicate that all regressors are signed as hypothesised and that farmers responded to price signals. The liberalisation dummy variable and its interaction with the producer prices is positive and statistically significant for Arabica coffee output but statistically insignificant though positive for Robusta coffee output and yields of both coffees. This could be due to the old and run-down traditional coffee robusta trees. Clonal Robusta coffee shambas currently contribute a small proportion of the total output. Most clonal coffee plantations are either not yet in production or are yet to attain their maximum

**Table 1. Regression results of coffee supply and yield response in Uganda (1970-1993)**

Variable	Estimated coefficient		t-Value	
	Arabic	Robusta	Arabic	Robusta
Lagged supply/yield	0.354(0.669)	0.732(0.347)	2.298**(3.350***)	4.551***(1.415 <sup>NS</sup> )
Lagged own price	0.465(0.233)	0.189(0.169)	3.312***(1.920*)	3.154***(1.792*)
Price of maize	0.644(0.198)	-(0.104)	-4.445***(-1.5.2 <sup>NS</sup> )	- (-0.936 <sup>NS</sup> )
Price of beans	-	0.240	-	-1.884*
Price of potatoes	0.478	0.142	-2.358**	-1.867*
Wage price	0.282	-	-3.242***	-
$D_2$	1.145	0.071	5.842***	1.088 <sup>NS</sup>
$D_2$ own price	0.169(0.018)	0.012(0.027)	5.892*** (0.629 <sup>NS</sup> )	1.150 <sup>NS</sup> (1.010 <sup>NS</sup> )
$D_3$	0.394	-	-1.831 <sup>NS</sup>	-
Trend	(0.019)	(0.128)	(2.114*)	(1.359 <sup>NS</sup> )

Note: Figures in parenthesis \*\*\*, \*\*, and \* denote significance at 1, 5 and 10 percent respectively. NS= not significant



production potential. The non-price policy attributes like improved marketing, prompt payments and the price incentives have therefore so far only significantly stimulated Arabica coffee supply. The anticipated adoption of clonal coffee and its higher producer prices could make Robusta coffee responsive as well.

**Results of the price elasticities.** Short-run and long-run elasticities prior to and after liberalisation periods are presented in Table 2. Both Arabica coffee output and yields were more responsive to price signals than the Robusta. Short-run output elasticity in the post-liberalisation period at 0.644 was significantly higher than that before liberalisation at 0.465 in case of Arabica. The two were statistically not significantly different at 0.201 and 0.189 respectively, for the pre- and post-liberalisation periods in case of Robusta coffee. Corresponding short-run yield elasticities of 0.251 and 0.233 for Arabica; 0.196 and 0.169 for Robusta coffees respectively, were both not significantly different prior to and after liberalisation. Results of area and yield elasticities indicate that in future, increase in Uganda's coffee supply will depend more on its yields than on area. The policy options of replacing old run down Robusta coffee trees with high yielding clones and adoption of improved practices for Arabica are therefore justifiable. Long-run area elasticities were 0.230 and 0.241 for Robusta and Arabica, respectively compared to corresponding yield responses of 0.300 and 0.758.

Cross-price short-run elasticities of competing crops presented in Table 3 indicate that maize is a stronger competitor for Arabica farmers' resources than sweet potatoes. There is a high demand for maize in the major Arabica coffee producing areas in eastern Uganda from both Ugandan and Kenyan consumers. Possibly for similar reasons, beans compete more than maize for Robusta coffee farmers' resources. Beans constitute a regular ingredient in many Ugandan menus. Besides, large quantities are exported across the borders to neighbouring countries.

**Table 2. Estimates of coffee own-price elasticities**

	Pre-liberalisation		Post-liberalisation	
	SRE	LRE	SRE	LRE
<b>Crop output response</b>				
Arabica	0.465	0.722	0.644	0.998
Robusta	0.189	0.526	0.201	0.541
<b>Yield response</b>				
Arabica	0.233	0.704	0.251	0.758
Robusta	0.169	0.259	0.196	0.300
<b>Area response<sup>d</sup></b>				
Robusta	-	-	-	0.230
Arabica	-	-	-	0.241

d = Derived from the estimated output and yield elasticities.

**Table 3. Estimates of coffee output cross-price elasticities**

	SRE		LRE	
	Arabica	Robusta	Arabica	Robusta
Maize	-0.648	-0.143	-1.009	-0.511
Beans	-	-0.240	-	-0.436
S.Potatoes	-0.505	-	-0.781	-

These avenues provide a good market and hence a competitive price to beans compared to Robusta coffee.

### Conclusions and policy implications

Based on the findings of the study, Ugandan coffee farmers were found to be responsive to price incentives. Results also show that increase in coffee supply will largely be a result of increase in coffee yields, rather than area, in the long-run. Considering the fact that arable land is gradually decreasing, the current government policy option of encouraging adoption of higher yielding clonal Robusta coffee and yield enhancing improved practices for Arabica coffee is valid. It is recommended that: (i) appropriate mechanisms for adoption of improved coffee production technologies be executed by concerted efforts of Ministries and organisations involved in the coffee sub-sector, (ii) price and market liberalisation policies should be upheld so as to maintain the associated positive stimuli.

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### References

- Bibangambah, J.R., 1989. Agricultural market intervention and pricing policies in Africa. In: *Food and Agricultural Organisation of the United Nations, Paper No. 88*, Rome, 1989.
- Ellis, F., 1992. *Agricultural Policies for Developing Countries*. Cambridge University Press.
- Government of Uganda, 1993. *Background to the Budget 1993/94*. Ministry of Finance and Economic Planning (MFEP). June 1993
- Gujarati, D.N., 1988. *Basic Econometrics*. McGraw-Hill Book Company, 2nd edition, New York.
- Kanakulya, W.J., 1985. The need to improve on the present marketing system of coffee on the World market. Paper presented in the first national workshop on the coffee industry organised by UNCA, Kampala.
- Nerlove, M., 1958. Distributed lags and estimation of long-run supply and demand elasticities: Theoretical considerations. *Journal of Farm Economics*, 40: 301 - 314.
- Otim, S. and Ngategize, S.K., 1993. Uganda coffee supply response and export demand: An econometric analysis. *African Crop Science Journal*, 1: 175-182.

Ssemogerere, G., 1990. Structural adjustment programmes and the coffee sub-sector in Uganda, 1981-1987.

African Economic Research Consortium(AERC) Research paper No.1, 1990.

World Bank, 1988. *Uganda, Towards Stabilisation and*

*Economic Recovery*. Report No. 7439-UG, Washington D.C, USA.

World Bank, 1993. *Uganda: A World Bank Country Study on Agriculture*. Washington D.C, USA.