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Supply Response of Export Crops in Zambia: The Case of Coffee

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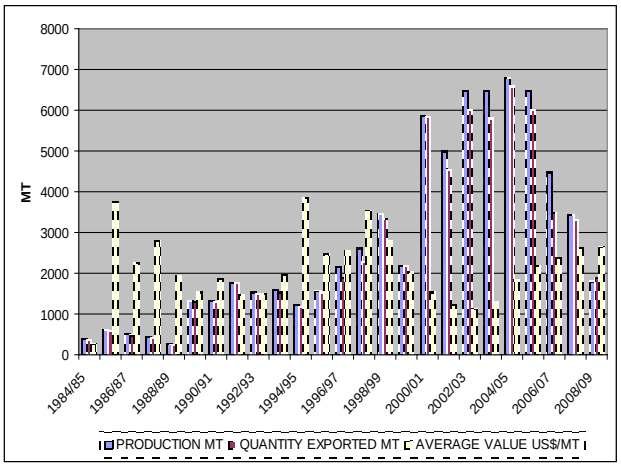
Key Points/Summary

1) Export diversification has long been at the centre of Zambia's economic diversification policies. This article focuses on the coffee sector as a potentially important source of export diversification and examines its supply response to changes in various incentives.
2) Zambian coffee exhibits asymmetric short-run supply adjustments to long-run equilibrium such that production rises significantly after prices rise while changing little after prices fall.
3) The fact that coffee in Zambia is mainly grown for export, the changes in real exchange have the most significant effect on supply in that a depreciation in the Zambian Kwacha leads to an increase in coffee supply.
4) In addition, the economic reforms which were initiated in Zambia in 1998 have had a positive effect on coffee supply.
5) Overall, coffee supply exhibits threshold adjustments whereby supply tends not to adjust immediately, and does so only when the price shocks in the various incentives (either positive or negative) reach a certain threshold.

INTRODUCTION: High and sustainable export growth, mainly driven by agricultural productivity, is critical for Zambia to reduce poverty and foster economic development. Despite the fact that, Zambia's economic policies have for a long time emphasised export diversification, copper remains the main export commodity for Zambia. Coffee, an essential export commodity in most eastern African countries, has suffered declining levels of production amidst declining and unstable world prices[1]. Zambia, in particular, experienced a drastic decline in coffee production from about 6800 metric tonnes (mt) in 2005 to less than 2000 metric tonne in 2009 (Figure 1).

Factors that determine the supply of coffee in Zambia have not been investigated although several reports attribute the recent decline to the fall in coffee producer prices in the last decade.

Figure 1. Coffee Production in Zambia



Source: Author's design using data from Zambia Coffee Growers Association.

[1] International Coffee Organization (ICO) price data. www.ico.org

Supply response studies become relevant in providing empirical evidence for policy makers to identify key variables that are important in determining agricultural commodity supply. Basically, agricultural supply response explains the degree to which output adjusts to various policy and other production incentives. As such, the extent to which farm production decisions respond to information on various incentives should be central in policy planning (Rao 1989).

OBJECTIVES: The aim of this study is to examine supply response of coffee to various incentives in an asymmetric auto-regression model. The incentives include coffee prices, prices of competitive crops (specifically maize), the real exchange rate (given that coffee is grown specifically for export), and the economic reforms implemented in the 1990s leading to a liberalised economy. In addition, the study compares results from two models. The first model ignores aspects of asymmetric response while the second model takes into account the possibility of coffee supply responding asymmetrically to changes in production incentives.

MODEL ESTIMATION: To examine the supply response of coffee, we capture the elasticity response of coffee supply to various incentives. Elasticity coefficients are examined from two models. The first model is the Engle and Granger (1987) cointegration model which assumes a linear or symmetric adjustment to long-run equilibrium. Several researchers including Abdulai and Rieder (1995), McKay (1999), and Thiele (2000) have applied cointegration and ECM in supply response analysis in different commodities. Second, we employ a threshold auto-regression (TAR) model to assess asymmetric adjustments of supply. Building on the works of Enders (2004), a multivariate threshold error correction specification is developed in this study to assess possible asymmetries of short-run supply adjustments to its long-run equilibrium based on changes in coffee prices, maize prices, real exchange rates, and economic reforms.

DATA: Annual series data covering the period 1983 to 2008 is used for the empirical analysis. The variables include annual coffee production in metric tonnes, coffee producer prices in US cents per pound (lb.),[2] real maize prices in Zambian Kwacha (ZMK) per kg, and real exchange rate for the Kwacha currency. Coffee production data were obtained from the Zamia Coffee Growers Association (ZCGA) while coffee price data were obtained from the International Coffee organisation (ICO). Unlike in most African countries where coffee farmers are small scale and receive their earnings in the local currency, most Zambian coffee farmers are large scale who export directly and are paid in Unites States Dollars (USD). Data on real exchange rates and maize prices were obtained from the Bank of Zambia (BOZ). A dummy variable identifying economic reforms is included to control for a potential structural break. This structural break was determined endogenously using the Lee and Stazicich (2003) structural break unit root tests in the real exchange rates variable. We choose to use the exchange rate variable to determine economic reform because currency liberalization took a central stage during the economic reforms. All the variables are expressed in natural logarithms to reduce the variation.

RESULTS: In the first stage of the Engle and Granger model, we establish the long-run relationships between coffee supply and the explanatory variables (coffee producer prices, maize prices, the real exchange rate, and economic reforms). In the second stage, we test for stationarity of the residuals from the regression results in the first stage. The results of the first stage regression model (with t-statistics obtained from Augmented Dickey Fuller (ADF) distribution in parentheses) are as follows:

$$Q_t = \underset{(8.910)}{5.154} - \underset{(-0.317)}{0.0421}P^c_{t-1} + \underset{(0.086)}{0.010}P^m_{t-1} + \underset{(9.031)}{0.331}RER_{t-1} + \underset{2.373)}{0.795}RF$$

The variables are described in table 1.

[2] Lb. is the abbreviation for Libra which is the Roman word for pound. One pound is 0.45 kilograms (kgs).

Table 1. Description of the Variables

σ_t	Quantity of Coffee supplied in year t
P_{t-1}^{c}	Price of Coffee in the previous year
P_{t-1}^{m}	Price of maize in the previous year
RER	Real exchange rate
RF	Economic reforms

The equation above shows that the exchange rate is the most important variable in determining coffee supply. A positive coefficient of the exchange rate means that when the Zambian Kwacha weakens against the dollar (a depreciation of the local exchange rate) coffee supply increases. Given that in Zambia coffee is mainly grown for export, a strong currency makes the commodity less competitive, hence unattractive for farmers to plant more or invest more in the already growing trees. A one unit depreciation of the Kwacha leads to 0.33 percent increase in coffee supply in the long-run.

Additionally, the results show that economic reforms, which occurred in 1998 (according to a structural break in the real exchange rate), have had a positive and statistically significant impact on coffee production. The coefficient is positive, an indication that coffee production increased following the economic reforms. By contrast, the effect of local coffee prices on coffee production in Zambia in the long-run is negative and not significant from this model. Similarly, price for maize, the competing crop with coffee, has no significant impact on coffee supply. An explanation for this outcome is that land may not be a factor for the large scale farmers, who produce 99% of coffee. In that case, maize is not grown as an alternative crop, but as complementary to coffee.

The results discussed above do not differentiate between effects of positive and negative shocks on supply response. Due to a possibility of asymmetric supply movement, threshold log-run relationship between coffee supply and the various incentives was examined using a TAR model. The results show that there is a long-run relationship between coffee supply and the various incentives. However adjustment towards this long-run relationship depends on whether a deviation is above a threshold of $0.23 or below. Also the short-run movements towards this long-run relationship are that positive shocks and negative shocks to the incentives have different impacts on coffee supply. For the changes in coffee prices, while the Engle and Granger model showed no significant impact of coffee prices on coffee supply, the asymmetric model has shown that there is increase of 0.26% in coffee production when the price gets above a threshold of $0.23 per pound. Below this threshold, there is no significant impact on coffee supply in the country. However, just like the results from the first model, changes in maize prices do not have any significant effect on coffee supply in the long run, whether the system is above or below the threshold. Concerning the real exchange rate, as expected, threshold short-run adjustment results show that whenever the Zambian Kwacha depreciates by one unit above the threshold, coffee supply increases by 19%. This demonstrates that farmers find exporting profitable when the Zambian Kwacha depreciates against the US Dollar.

CONCLUSIONS: Coffee supply in Zambia, despite its potential contribution toward achieving the country's export diversification goals, has not received much attention among researchers and policy makers. This study has shown that there are various factors that may otherwise be overlooked, that have significant effect on coffee supply in the country. The liberalisation of the Zambia kwacha has significant long term implications on coffee supply. The response tends to be asymmetric in that positive shocks, such as increases in the exchange rate, have more impact on coffee production than the negative shocks.

Overall, the theory that supply adjusts to price incentives may not apply to export commodities where farmers receive their incomes in a foreign currency. In that case the motivation to expand or contract production depends more on the exchange rate in relation to locally consumed goods and wages. In that

case policies should focus on increasing non-price incentives and creating an environment for a stable exchange rate.

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