JOURNAL OF ECONOMIC DEVELOPMENT
Volume 18, Number 1, June 1993

Rationality of the Peasant Farmer:
Response to Changing Policies

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This paper uses time series data from Ghanaian cocoa production to investigate the rationality of the peasant farmer in production decision making. In particular, we investigate whether cocoa farmers incorporate the additional information contained in pricing and other policy changes into their production decision making. We find that farmers consider not only the information contained in the policy changes but also all relevant information available to them in their decision making. In this regard the peasant farmer is a rational decision maker.

I. Introduction

Economic rationality of the peasant farmer has long been questioned by popular opinion in the developed world. This has prevailed in spite of Hill's (1956) excellent work on rural agricultural capitalism in Africa and seems to have influenced post-colonial African economic policy makers especially in the 1960s and 1970s, when agricultural monopsonies were set up to forcibly transfer resources from agriculture to industry and government. However, poor agricultural performance in post-colonial Africa has, in recent years, forced policy makers to rethink their policies as a means of increasing agricultural output. In the process, the rationality of the peasant farmer is being reexamined.

Are peasant farmers rational decision makers in the sense that they respond to economic incentives? Is the behavior of these farmers consistent with profit maximization? If farmers are rational, then the quantities of crops they offer for sale will be positively related to the producer prices of

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Ghanaian cocoa industry still remain as it was put in place in 1961. At best, all policy changes made since 1961, are intended to make the 1961 system work better rather than an attempt to replace it with a new one.

In view of recent government efforts to revive the sagging cocoa industry through price incentives and other reforms, it is important to understand how farmers will respond to price as well as other policy changes. Studies of farmer rationality are important parts of such efforts at understanding farmers' reaction to policy changes since success or failure of the new policy depends in part on farmers' response to these policies. The results obtained here could be of help to policy makers charged with rehabilitating the cocoa industry in Ghana. In addition, the results obtained in studies such as this one will provide yet another evidence of economic rationality or otherwise of the peasant farmer.

Researchers, employing Nerlove's stock adjustment model have estimated supply response of farmers to price changes in Less Developed Countries (LDCs). A crop whose supply response has been greatly studied is Ghanaian cocoa (Ady (1968), Bateman (1974), (1968), Behrman (1968), Rourke (1974), and Franco (1981)). Bateman (1968, 1974) using regional data for the 1946-1962 period find short run supply elasticities ranging from .14 to .53 for different production regions of Ghana. Behrman (1968), using aggregate production data from 1932 to 1968 finds the long run supply response elasticity of Ghanaian cocoa to be .71. Ady (1968) finds supply response elasticities of Ghanaian cocoa production that are large relative to the short run supply elasticities found by Bateman.

The results of these studies do not reflect the effects of policy changes — pricing, marketing, payment schedules, input availability, and availability of consumer goods — introduced by post-colonial government of Ghana in the early 1960s and 1980s. This means that earlier researchers were not able to assess the response of Ghanaian cocoa farmers to these policy changes. Second, these researchers have assumed that coffee is the alternate crop to cocoa in Ghanaian agriculture. However, in Ghana, local food crops, rather than coffee, are the alternatives to cocoa. These food crops are also grown along commercial lines like cocoa and other cash crops. Thirdly, these authors did not investigate the effects of producer pricing policies on smuggling and hence on the quantity of cocoa sold to the Ghana Cocoa Marketing Board. These studies, therefore, did not consider all of the important variables that enter the Ghanaian cocoa farmer's decision making process.

Theoretically, a farmer can shift from cocoa production to the production of one of many food crops; hence one should consider the possibilities of substitution among food crops in investigating rational

The rest of the paper is organized as follows. Section II gives a brief summary of recent history of the Ghanaian cocoa industry. Section III discusses the model and data while Seciton IV presents and discusses the statistical results. Section V summarizes and concludes the paper.

II. Recent History of Cocoa Policy

Cocoa plays a dominant role in Ghana's economy. It accounts for 11% of GDP, 64% of all export earnings, and a sizable proportion of government revenues. The fortunes of the Ghanaian economy rise and fall with that of the cocoa sector. The industry has, however, fallen on hard times recently. From its introduction to Ghana in the late 19th century, cocoa output increased consistently, reaching a peak output of 549,000 tons in 1964/65 — accounting for 31% of the world's supply of cocoa beans. Since the 1960s, Ghana has gone from a position of dominance in world cocoa production to a distant third. Output reached a low of 180,000 tons in 1982/83, accounting for only 16% of the world's supply of the crop. Accompanying the output changes have been equally dramatic changes in real producer price of cocoa. Real producer price of cocoa rose from £74.30 per ton in 1932/33 to a high of £217.00 per ton in 1953; it stayed around £200.00 till the attainment of independence in 1957. Price then declined consistently until by 1982/83, the real producer price had fallen to £15.88 per ton.[3] Producer prices began to recover in 1984 with the ERP, and with it, ouput has also began to recover.

Besides the decrease in the absolute producer price of cocoa, the price of cocoa decreased relative to the price of ther crops that can be grown with similar production technology within the same ecological environment. Killick (1978) shows that profitability of food crop farming relative to cocoa farming increased by 116% between 1961 and 1971. Rourke (1974) reports similar figures for the Eastern Region of Ghana in the late 1960s and early 1970s.[4] The deterioration of the cocoa farmer's position in Ghana continued to the 1970s and early 1980s. While the current producer price of cocoa increased 13.4 times between 1970 and 1980, current producer prices of local food crops increased 37.3 times.[5]

The relative decline in the producer price of cocoa was the result of conscious government effort to transfer cocoa incomes to industry and

3 See Bateman (1968) and World bAnk (1983).
4 See Killick (1978) and Rourke (1974).
5 See World Bank (1983).

services to the farmers compensated for the lack of price competition.

In 1961, the lincences of all LBAs were revoked, and one of them, the Cocoa Purchasing Company, was placed under the United Ghana Farmers Council (UGFC) and made the monopsony LBA in Ghana. The UGFC was itself made a wing of the ruling Convention People's Party (CPP).[10] The monopsony LBA system remains in place today with the Cocoa Purchasing Company, now renamed the Produce Buying Agency, given more monopsony powers over the purchase of coffee and shea nuts in addition to cocoa. The new policy did not provide a mechanism for supplying consumer goods to farmers to replace the LBA sources.

This change in the marketing of cocoa affected cocoa farmers in many ways. First, all the services provided by the LBAs to the farmers vanished with the new structure. Second, the government was now in a position to extract more taxes from cocoa farmers without risking their wrath. This was possible because the UGFC was supposed to be a farmers' cooperative, and hence its executive council could be used as a front for the forced resource transfer.[11] Ghanaian governments have used this strategy to levy high taxes on the cocoa farmer since the 1960s. Third, the new system introduced the "chit system." The "chits" were IOUs issued by the purchasing agent to the cocoa farmer at the time of purchase to be presented for redemption at a later date when cash became available. Purchases with IOUs therefore replaced cash purchases under the new system. Since waiting periods were long, cocoa farmers faced severe liquidity problems. It was possible to lose all cocoa income if a farmer happen to lose his "chit" before the purchasing agent was ready to make payment — an occurrence that was very common. The chit system also encouraged corruption in the purchasing system. Since the purchasing agent could now purchase cocoa with an IOU, he never paid the farmer at the time of purchase even when the GCMB provided the money; he bought the cocoa with an

10 The UGFC was abolished after the 1966 coup d'etat that overthrew the Nkrumah government. The monopoly buying power still remained with the Cocoa Purchasing Company later renamed the Produce Buying Agency.

11 There is a lot of evidence to suggest that the executive of the UGFC was working for the party in power and for themselves rather than for the interest of farmers. For example, in 1960, the executive of the UGFC announced that cocoa farmers were making a "voluntary contribution" amounting to 10% of the producer price of cocoa to the second development plan. In 1961, the executive announced a further "compulsory savings" equal to 15% of the producer price of cocoa bought by the council. Since the UGFC was now the only buyer of cocoa, it meant every cocoa farmer was forced to "save." Later in the same year, the executive of the UGFC announced that the proceeds from the "compulsory savings" had been given to the government as a gift from farmers. Of course no farmer at the grassroots took part in all these decisions.

tion each year making cocoa production relatively attractive again. In place of the "chit" system, the government introduced the "Akuafo Check" system under which cocoa is purchased with checks drawn on the central treasury. This ensured that farmers were paid promptly and their checks were safe. Other reforms, such as foreign trade and exchange liberalization made it possible for the private sector to supply imported inputs and consumer goods to the farmer more efficiently. Cocoa output has began a moderate recovery in response to these reforms.

III. Model and Data

The decision to plant cocoa trees can be viewed as an investment decision with a long gestation period. Cocoa trees are considereed as capital assets from which the farmer derives income over a period of about thirty years. In making this investment decision, farmers also consider the net earnings as well as the stability and safety of such earnings.[14] Bateman (1968) uses a modified Nerlove stock adjustment model that accounts for the peculiar yield structure of cocoa trees to study cocoa production in Ghana.[15] The farmer chooses acreage of cocoa that maximizes the present value of net revenues from cocoa over the life of the cocoa trees, subject to resource constraints and hence the opportunity cost of cocoa farming. This explains the investment decision. Production is linked to acreage of cocoa through a vintage model production function. From this, Bateman derived his estimated equation as:

$$(1) \qquad \Delta Q = \alpha_1 + \alpha P_{t-8} + \alpha_2 P_{t-12} + \alpha_3 \Delta H_{t-1} + \alpha_4 \Delta R_{t-1} + \alpha_5 C_{t-8} + \alpha_6 C_{t-12} + e_t$$

where Q_t is cocoa output, P_t is producer price of cocoa, H is soil humidity, R is rainfall, C_t is real producer price of coffee.

We adopt a variant of Bateman's 1974 model as expanded upon by Stryker et al (Stryker *et al* (1990)). The supply function of cocoa is derived from a three stage process. In the first stage, the farmer chooses the optimal acreage of cocoa to plant based on cocoa price and the cost of planting. Normal or capacity output (NQ) is obtained by multiplying the yield by the available acreage of each vintage of cocoa trees after adjusting

14 The general feeling among cocoa farmers is that since cocoa has an assured market and since it involves very little maintenance cost after the trees start bearing fruits, investment in cocoa is less risky than other forms of investments available to them.

15 See Bateman (1968) for details of the model.

producer price of cocoa in Ghana, price of food crops, rainfall, acreage under cocoa trees (proxied by NQ), among other things. Formally:

$$(2) \qquad Q^* = f(P, FP, R, NQ)$$

where FP is the price of food crops and all other variables are as defined in the text above. The quantity of cocoa sold to the GCMB, hence the observable output, is related to Q^* in the following way:

$$(3) \qquad Q = h(PW/P)*Q^*, \quad h' < 0$$

where PW is the producer price of cocoa in neighboring countries and all other variables are as defined above. An increase in the producer price of cocoa in neighboring countries relative that of Ghana induces Ghanaian cocoa farmers to smuggle part of their output to these countries, thus resulting in a decrease in a decrease in the quantity sold to the GCMB. Substituting (2) into (3) gives us the relationship between observed output and the explanatory variables. Formally:

$$(4) \qquad Q = q(PW/P, FP, R, NQ)$$

where all variables are as defined above. We assume a log linear relationship between Q and the explanatory variables in (4).

We proxy the effects the police changes in 1961 and 1984 by two dummy variables, D and ERP respectively. D takes the value of unity for years for which the 1961 policy changes were in effect, zero otherwise while ERP is unity after 1984 zero otherwise. We allow D to affect the price coefficient as well as the intercept term for the reason that it will affect the degree to which farmers take care of the stock of cocoa trees as well the decision to invest in cocoa trees. While we allow for both differential intercept and slope for the 1961 policy changes, we only allow for differential price effects for the ERP reforms. Besides the degrees of freedom problems (only 5 years), this formulation is consistent with the nature of cocoa farming since in this relatively short period, increased supply can only come from improved husbandry and harvesting rather than from increased acreage. To estimate the effects of price and other policy changes on the supply of cocoa, we follow Stryker *et al* (1990) and estimate on autoregressive cocoa supply equation. The estimated equation is:

$$(5) \qquad Q_t = \beta_0 + \beta_1 Q_{t-1} + \beta_2 NQ_t + \beta_3 R_t + \beta_4 PW_{t-1} + \beta_5 FP_t + \beta_6 D + \beta_7 P_t + \beta_8 D*P_t + \beta_9 ERP*P_t + \varepsilon_t$$

Table 1

SUMMARY STATISTICS OF DATA 1947 TO 1988

Variable	Mean	Standard Deviation	Coefficient of Variation
Quantity (000 tons)	289.48	87.99	29.69
Real Producer Price (£s/ton)*	100.92	73.87	66.91
Real World Price (£s/ton)	183.62	122.03	70.60
Rain (inches)	22.23	6.71	32.08
ERP	.167	.4228	253.17
P/Pw	.483	1.432	296.48
D	.589	.504	95.22
Price Index (1963 = 100)	3,723.97	10,628.15	328.12
NQ	344.58	107.73	32.20
FPrice Index	6,655.03	18,002.21	270.51
Number of Observations	42		

* Until 1965, Ghana's currency was the Ghana pound which had a par value equal to and fully convertible to the pound sterling. The exchange rate between the pound and $ was £.357 = 1.00. The pound was devaluated to £.416 = $1.00 in 1967, an average value it held until the breakdown of the Bretton Wood system. Ghana introduced a new currency, the Cedi, in 1965. The official exchange rate between the Cedi and the dollar as well as the pound was fixed even though there were three devaluations during the period under review.

cocoa in Ghana and the world price of cocoa and the large dispersion of the producer price of cocoa in Ghana. Most of this dispersion can be attributed to the large price changes after 1961. Also of interest is the high rates of inflation, especially in the latter part of the sample period leading to further erosion of the purchasing power of the already low producer prices of cocoa.

Table 2

COEFFICIENT ESTIMATES OF SUPPLY RESPONSE FUNCTION, 1947-1988

Variable	Parameter (2a)	Estimate (2b)
CONSTANT	0.577	.6417
	(0.772)*	(0.592)
P_t	.1688	.1487
	(2.321)	(1.447)
Q_{t-1}	.5296	.5566
	(5.692)	(4.043)
D	−.6912	−.4656
	(2.099)	(1.685)
$D*P_t$	−.1401	−.081
	(1.888)	(1.442)
R_t	.2041	.1860
	(3.323)	(2.803)
FP_t	−.218	−.1975
	(1.549)	(2.147)
PW_t	−.1206	—
	(2.595)	
$(PW/P)_{t-1}$	—	−.0277
		(1.611)
NQ_t	.2671	.2586
	(2.415)	(2.170)
$EXP*P_t$	.049	.021
	(2.225)	(1.904)
N	42	42
F	33.148	26.608
R^2	.9053	.8729
H	0.4912	1.281
RHO	.028	.042
PRESS	.539	.613

* Absolute value of t statistics in parentheses.

Note: Cutoffs: DFFITS = .975, RSTUDENT = 2, HAT = .476, W: NORMAL = .929

creased dramatically in the mid 1970s and 1980s.

The coefficients of the structural dummy variables suggest that the structure of cocoa supply function changed after the 1961 and 1984 policy changes. In addition to the statistical significance of the coefficients of the structural dummy variables, a Chow test to test the hypothesis of no structural change in the cocoa supply function produce F statistics of 4.961 and 4.332 for (5a) and (5b) respectively. With 7 and 32 degrees of freedom, we reject the null hypothesis of no structural change in the supply function at $\alpha = .01$.

An alternative way of checking for structural changes in the supply response function after the policy changes is to estimate a cocoa supply function without the structural dummy variables and compare the resulting estimates from such a "restricted" model to the estimates from the full model. This is intended to test whether farmers considered the policy changes in making production decisions. If cocoa farmers do not consider the added information contained in the policy changes in making production decisions, there will be no difference between the "restricted" model and the unrestricted model, otherwise there will be a difference between the two. Coefficient estimates for these models are presented in Table 3. The explanatory power of the restricted model falls far short of that of the full model. One also observes that the coefficients from the restricted models are different from those of the full model. In addition, there is the presence of severe autocorrelation, and the coefficient estimates are imprecise. All these lead one to conclude that the restricted model is misspecified because of omitted variables. Calculated F statistics to test the null hypothesis of equality of the full and restricted models are 6.160 and 3.86 for (a) and (b) respectively. With 3 and 32 degrees of freedom, we reject the null hypothesis and conclude that the two sets of equations are different.

Are Ghanaian cocoa farmers rational decision makers in the sense that they respond to economic incentives and use all available relevant information in making production decisions? The econommetric results provide in an indication that Ghanaian cocoa farmers behave in a rational way when making production decisions. Rational behavior can be inferred from the asymmetric behavior of the producer price coefficients as well as the negative coefficients on FP and PW. As argued above, in the short run, so long as the producer price of cocoa exceeds the operating cost, it is rational for farmers to continue to produce cocoa even when the producer price does not cover the total cost of production in times of decreasing producer prices. However, when producer prices increase, farmers will increase their husbandry and harvesting efforts as well increase the use of

farmers do not only consider the producer price of cocoa in Ghana in their production decision making, they also the profitability of food crop production relative to cocoa production in their decision making. The negative and significant coefficient of FP implies that Ghanaian cocoa farmers decrease cocoa output when food farming became more profitable than cocoa farming. Also important to rational decision making is the fact that Ghanaian cocoa farmers smuggled part of their output by The Ivory Coast and Togo in response to producer price differential in these countries and Ghana. The proportion of Ghana's cocoa that was smuggled to these countries increased as the producer prices in these countries increased relative to that paid in Ghana (May 1985)). The roportion smuggled decreased after 1984 when government policies decreased the producer price differential between the Ivory Coast and Togo on the one hand, and Ghana on the other. These estimates are therefore consistent with economic rationality in the sense that cocoa farmers consider all the available relevant information in their decision making — information that is used to make decisions that are consistent with profit maximiation.

In the long run, we expect producers to make decisions about acreage under cocoa production. As the opportunity cost of cocoa production increases, one expects cocoa farmers to convert their farms to food crops. The timing of conversion of cocoa farms to food crop farms indicates that cocoa farmers in Ghana are rational decision makers. Though the conversion and abandonment of cocoa farms were in response to the 1961 policy changes, large scale conversion and abandonment did not take place until the 1970s and 1980s. As indicated, cocoa trees once planted, continue to bear fruits for about thirty years with minimal maintenance. The opportunity cost of immediate conversion, given that the cocoa trees are young with high yields, would be very high to farmers. So long as the marginal cost of maintaining the cocoa farms was lower than the marginal benefit, it was not economically rational to convert the farms. As the trees got older and yields declined, the opportunity cost of maintenance exceeded the benefits from keeping the farms, hence it was economically sensible to convert cocoa farms and in some cases abandon them. The increased responsiveness of cocoa farmers to increased producer prices, certainty of payment, and the availability of inputs and consumer goods associated with the ERP reforms of the 1980s also shows that the cocoa farmer is a rational decision maker. It appears therefore that Ghanaian cocoa farmers display sophisticated cost benefit analysis in their production decision making.

There is another sense in which farmers' response to the policy changes reflect rationality. Berthelemy and Gagey (1987) have argued that when consumer goods are in short supply and farmers are rationed out, even a

the supply elasticity after 1961. These changes in the supply response function were farmers' rational response to changes in the institutional structure for buying and marketing cocoa that influenced the profitability of cocoa farming. We also find that farmers incorporated all information embodied in the policy changes in their production decision making. A statistical test of rationality also indicate that cocoa farmers are indeed rational decision makers. The results obtained in this study is another evidence that, given the right market incentive, the African peasant farmer will increase production. It shows that the agricultural crisis in Subsaharan Africa is not the result of the peasant's unwillingness to produce for the market but the result of bad economic policies pursued by African governments.

Since cocoa farmers in Ghana are sensitive not only to cocoa price but also to food price changes and the price of cocoa in neighboring countries, increasing producer prices in Ghana will not be enough to drastically change production. To elicit the right response, producer price of cocoa should be increased relative to the prices of domestic food crops. To reduce cocoa smuggling, the differential between producer price in Ghana and those of neighboring countries should, at least, be eliminated since that is the only sure way to stop smuggling of cocoa.

One of the services farmers lost with the aboltion of the LBA system is the direct sales of inputs and consumer goods to farmers. The government could consider the complete privatization of input supplies to cocoa farmers. Still, a better policy may be the reintroduction of the LBA system or even the return to the pre-1947 system where there was no state monopsony and independent buyers completed for the farmer's crop. The GCMB could be relegated to a supervisory or coordinating role. It appears that the supply of cocoa is also sensitive to the availability of consumer goods to farmers. Any package of incentives to increase cocoa output in Ghana should therefore include the availability of consumer goods to the farmer.

It appears that current policies point in the right direction. Recent developments in the Ghanaian government's overall economic policy leads to an optimistic view. The government has vigorously pushed a wide ranging structural adjustment and trade liberalization policy. Inflation has decreased from a high of about 180% in 1983 to about 13% in 1988. At the same time, the government continues to increase the producer price of cocoa and assures prompt payment while trade and exchange liberalization have made it possible for the private sector to provide much needed inputs and consumer goods. The results of this study shows that market forces should be given more chance to work in Africa in order to solve the food crisis on that continent.

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