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Farm Level Impacts of Food-for-Work in a Semi-Arid Region of Kenya

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Abstract

Food-for-work (FFW) was conceived in the mid-1970s as both a short-run assistance programme for meeting basic food needs of low income households, and as a long-run developmental tool for building infrastructure and for providing income to ease capital constraints on farm production. However, it was feared that FFW might divert labour from own farm production and reduce the level of locally produced foods crops. This paper empirically examines these hypotheses in the Ewalel and Marigat locations of Baringo District, Kenya. A representative sample of 300 households were randomly selected in Marigat and Ewalel locations. Of these, 100 were found to be participants in the FFW project supported by UN/FAO World Food Programme. Food items provided to the programme in the study area are maize, beans, and vegetable oil. A two-year linear programming model is developed for both participant and non-participant households to compare levels of production activities, employment and income with and without the FFW programme. The results reveal that FFW in the study area augments own farm output by contributing to the minimum nutrient requirement, eases the capital constraint by the second year of participation, increases the marketable surplus from both own-crop and livestock production, increases hired labour in farm production, causes a shift from maize to millet production, and increases savings. As a result, the net income for the representative farm households with FFW is 52 per cent higher than those without FFW. Thus, the existence of a disincentive effects on own-farm employment and output were not found in this study.

Introduction

Food-for-work (FFW) strategies were conceived in the mid-1970s as a means of achieving twin objectives: (1) meeting food needs of targeted, low-income families; and (2) utilizing 'surplus' labour to build rural infrastructure. The underlying rationale was that the 'free' labour resource would create productive capital capable of yielding permanently higher income streams to the targeted community.

Ideally, such programmes would simultaneously achieve the objectives of increased agricultural output and a more equitable distribution of income (Austin and Wallerstein 1979, Deaton 1980, Maxwell and Singer 1979, Schuh 1981). However, it was feared that FFW may divert labour from own-farm production and reduce the level of locally produced food crops. Although FFW can be managed to avoid depressing local food prices and thereby creating producer disincentives, this labour reallocation could be detrimental to local food production.

There has been almost no empirical research to test these theoretical effects. An appropriate model for testing the labour-displacing impacts of FFW at a farm level would have to be sufficiently comprehensive to account for: (1) increased income earning opportunities provided by FFW, and (2) increases in own-farm production brought about by the greater capital availability in subsequent production periods resulting from earnings from FFW.

The purpose of this paper is to analyse the impacts of the FFW Programme on farm households in the Baringo District, Rift Valley Province, Kenya. The hypothesis to be tested is that the rural farm households who participate in the FFW Programme divert labour from own-production to FFW projects with deleterious effect on their own level of production and farm earnings.

The developmental consequences of international food assistance will remain cloudy until an appropriate analytical framework is developed that incorporates production, consumption, employment, and distribution effects of peasant household behavior in an economic environment influenced by food aid imports (Bezuneh, Deaton and Norton 1988). In this spirit, this paper is concerned with the role of FFW on income generating production activities and its effects on labour allocation decisions of participant households.

The Study Area

The specified research area is the Ewalel and Marigat locations in Baringo District of the Rift Valley Province, Kenya. Farm production activities occur primarily on two types of farms, rainfed farms planted near the farmer's homestead once a year during the wet season, and water-concentrated farm located near a river, usually far from the farmer's homestead. The major crop activities in the area are finger millet, sorghum and maize (Bezuneh 1985).

Both traditional technology and an intermediate level technology are employed in the study area. The traditional production system depends on own seed, family labour, simple hand tools and own work animals, while the intermediate technology include, in addition, improved seed and hired labour. The use of fertilizer or other chemical inputs, other than own-animals' manure, is almost negligible.

Farms are basically subsistence units with 0.75 hectares of cropland per farm. Livestock (particularly goats) are the major economic activity in the study area. Households have, on average, 29 goats, primarily small local East African breeds. Farmers engage in buying and selling activities

for both crops and livestock during periods of surplus or deficits. In general, the area is the most food deficit of the Baringo District.

Programme Participants in the Study Area

The UN/FAO World Food Programme (WFP) is involved in several rural development and famine relief projects in food-deficit semi-arid areas of Kenya. The WFP-supported project in Baringo District, identified as a Baringo Soil and Water Conservation Project, is part of an integrated rural development project known as the Baringo Pilot Semi-Arid Project (BPSAAP) sponsored by the Government of Kenya (GOK) and the World Bank. FFW bean in 1981 and was initially designed to at least utilize 800 workers per month, within the BPSAAP, on local public work projects particularly sol and water conservation, forage management,and nursery development for fuelwood.

The WFP is involved only through the food it provides and hence the success of this type of project depends heavily on domestic support and on overall programme policy. In Kenya, the GOK is responsible for implementing the FFW projects by providing necessary personnel and financial inputs including both storage and transport.

Most food items provided to WFP-supported projects in Kenya are maize, beans, and vegetable oil. Maize and beans are obtained by WFP from Kenya while the oil is imported. Kenyan maize and beans are provided by the National Cereals and Produce Board (NCPB) of Kenya to WFP for which WFP gives NCPB an equivalent value of imported wheat (WFP 1982). The NCPB is responsible for making the maize, beans, and oil available to the WFP-projects from the nearest NCPB store.

The amount of food needed by the BPSAAP project is usually brought to the Marigat agricultural store for monthly distribution to the participant worker in the field. Sometimes the food collection form the NCPB is distributed directly to the workers due to the limited storage capacity at the Marigat store. For every 100 hours of work, each participant receives 45 kgs. of maize, 4 kgs. of beans, and 1.5 kgs. of oil. All participants are adults and most of them work from 8 a.m. to 1 p.m., twenty days per month.

Participants are employed on the FFW projects in the BPSAAP on a first-come, first-served basis on the assumption that FFW will attract only the very poor, a residual labour force not engaged in either own production activities or other wage-earning activities at the time of participation. A lower social status is attached to FFW employment which increases the likelihood that only the very poor will participate.

Data and Methodology

Data for this study were collected from Ewalel and Marigat locations during seven months of field work by the authors (August 1983 through February 1984) using 16 residents who trained to collect survey data. A comprehensive census of households for study area was taken and then a representative sample of 300 households was randomly selected from the 1030 households; 100 were found

to be participants in FFW projects during the study period (February 1983 through January 1984).

Households were asked to provide recall information on crop and livestock inputs used, quantities of food harvested and disposed of, and labour used by activity. Although it was a long recall period, households seemed to respond with a relatively high degree of certainty about inputs to own production. One explanation for this is that in a subsistence economy input usage changes little from year to year. However, quantifying yield per acre (or total harvest), own consumption, and amount sold was more difficult. Consequently, some question-able figures obtained in the survey were compared with data from secondary sources by the research team. The final budget data for the study area needed for the analysis described below were constructed with the collaboration of the Farm Management Division of the Ministry of Agriculture and Livestock Development at Nairobi with data form other sources.

The analytical procedure used in this paper is a two-year linear programming model (LPM). The objective of the LPM is to determine levels of production activities, with and without the FFW programme, that maximize income subject to available resources and minimum subsistence requirements. The model is presented in aggregate form in Table 1 and contains 96 activities and 82 constraints.1 The activities of the representative farm household that are included in the model basically fall into four classes: (1) crop production; (2) livestock production; 3) participation in FFW projects and (3) hire-in labour. Crop activities in the model include maize, millet, and sorghum at the two technology levels defined earlier, while goats and cows are the only livestock activities. Because livestock are fed from natural pastures on non-arable community grazing land, input requirements, except labour, are low. Hence, only labour is used as a resource constraint for livestock activities. Milk and meat are included as both selling and transfer activities and buying of both goats and cattle is allowed.

The FFW activities in the model involve maize, beans, and oil. These commodities can be either consumed or sold. Because FFW occurs throughout the year, separate activities are included for each month. Representative participant households are allowed to work on FFW activities up to 100 hours per month, thereby receiving all three crops. As noted earlier, a full 100 hours earns 45 kgs. of maize, 4 kgs. of beans, and 1.5 kgs. of oil, and participant households must receive all three items in this same ratio.

Although the family supplies most of the labour, a number of farm households hire-in labour during land preparation, planting, weeding, and harvesting. Thus, activities are included to allow hiring-in labour at 1.50 Kshs. per hired man-hour in February, March, April, May, June, July, and August to relieve labour constraints in those months.

An arable land constraint of 0.75 hectares per farm household and a capital constraints of Kshs.1000 are included in the model. In addition,

representative households are allowed to borrow up to Kshs.1000 per year at 20 per cent interest or save any amount at 5 percent.

Minimum subsistence requirements that conform to the farm household's basic nutrient requirements (protein, fat and carbohydrate) are incorporated into the analysis. These requirements (based on UN/FAO statistics) are calculated using the average size of the study area family of 4.4 people and are included in the model as nutrient transfer rows. A requirement of Ksh. 630 for non-food household consumption is also included.

Results

Net income for representative farm households with FFW is 52 per cent higher than for those that did not participate in the FFW activity (Kshs.7447 versus Kshs.4810).2 Net income for non-participants in FFW is constrained by arable land in both years. Net income for participants is restricted by capital in the first year by arable land in the second. Participants borrowed all the Kshs.1000 allowed in year 1 and none in year 2, while non-participants borrowed Kshs.464 in year 1 and Kshs.400 in year 2. Removal of 1 Ksh. would decrease net income by Ksh.0.24 in year 1 and Kshs.0.05 (the savings rate) in year 2 for participants. FFW increases capital for participants so that by year 2 it is no longer a constraining factor and savings of Kshs.833 occur. Fourty-four per cent of the increase in net income for participant households results directly from the induced effects of FFW activities via capital formation on agricultural production.

The activities in the optimal plan for both non-participants (Table 2) and participants (Table 3) are maize, millet, milk and goats. Non-participants produce on average primarily maize (558 kgs.) and milk (1412 liters) which they consume to meet their nutrient requirements and raise 28 goats and a small amount of millet (42 kgs.) to sell for cash. Participants in FFW produce a small amount of maize (24 kgs. in year 1 and 56 kgs. in Year 2) which they combine with 17 and 15 kgs. of oil years 1 and 2, respectively, to meet their consumption requirements. They produce primarily millet (528 kgs. in year 1 and 544 kgs. in year 2) and goats (21 in year 1 and 25 in year 2) to sell for cash. They produce 1000 liters of milk (selling 108) in year 1 and 1245 liters (selling 140) in year 2. They also sell 46 kgs. of beans earned through FFW in year 1 and 41 in year 2.

Labour utilization is identical in both years for non-participants, with labour hired-in only in February, March, and June. Participants, in FFW hire 160 hours more labour in the first year and 438 hours more labour in the second year than the non-participants. Participants expand employment from year 1 to year 2; they decrease their participation in FFW activities in year 2 by 11 per cent. They spend 1143 hours on FFW activities in year 1 and 1020 hours in year 2. This reflects an increase in marginal value of their own time in farm production activities as the capital constraint is relaxed. Labour used in own-farm production in 3928 hours in both year 1 and year 2 for non-participants and 4063 hours in

Table 2. Enterprise Mix and Net Income without Food for Work

	Hectares Used	Own-Farm Production	Marketable Surplus	Cash Income (Kshs)
YEAR 1				
Maize[a]	0.70	58	0	0
Millet[a]	0.05	42	42	155.40
Milk[b]	N/A	1412	0	0
Goats[c]	N/A	28	28	4064.00
YEAR 2				
Maize[a]	0.70	560	0	0
Millet[a]	0.05	42	42	155.40
Milk[b]	N/A	1412	0	0
Goats[c]	N/A	28	28	4064.00

[a]kilograms [b]litters [c]head

Table 3: Enterprise mix and Net Income with Food for Work

	Hectares used	Own-farm Production	FFW Production	Marketable Surplus	Cash Income (Ksh)
YEAR 1					
Maize[a]	0.03	24	512	0	0
Millet[a]	0.66	528	N/A	528	1953.60
Beans[a]	N/A	0	46	46	195.5
Oil[a]	N/A	0	17	0	0
Milk[b]	N/A	1074	N/A	21	0
Goats[c]	N/A	21	N/A	21	3096.00
YEAR 2					
Maize[a]	0.07	56	456	0	0
Millet[a]	0.68	544	N/A	544	2013.00
Beans[a]	N/A	0	41	41	174.25
Oil[a]	N/A	0	15	0	0
Milk[b]	N/A	1245	N/A	111	255.30
Goats[c]	N/A	25	N/A	25	3584.00

[a]kilograms [b]liters [c]head

year 1 and 4138 hours in year 2 for FFW participants. Own farm labour is higher for participants compared to non-participants and increases form year 1 to year 2.

Finally, the results of the sensitivity analysis suggest that the

optimal enterprise mix of year 2, for participant households, is less sensitive to changes in FFW participation than year 1.

Conclusions and Implications

This study provides information on the relationship between FFW and production activities in participant farm households. The results indicate that FFW in the Ewalel and Marigat locations in Kenya increases net income, augments own farm output by contributing to the minimum nutrient requirement, eases the capital constraint by the second year of participation, increases the marketable surplus from own-farm production, increases hired labour in farm production, causes a shift from maize to millet production, and increases savings. Maize was lower priced than millet. Maize received through FFW substitutes for own-production of maize allowing millet to be grown and sold. Oil received through FFW helps meet the fat requirement, reducing milk consump-tion and increasing milk sold.

Participants in FFW increased own-farm production in year 2 compared to year 1, reducing the hours devoted to FFW activities. One might expect this decline to continue in future years as the opportunity cost of their time increases within their own farm enterprises. This suggests that the FFW itself may encourage a transition from FFW dependence to greater own-farm production in the long run.

In summary, these primary effects of FFW in the Ewalel and Marigat area are to increase capital availability and the market orientation of the farm-households and to increase both own and hired labour use in farm production. The results, given the farming systems of the study area and the condition under which the FFW programme disseminated, do not confirm the existence of a disincentive effect on own-farm production in the absence of price effects for the commodities concerned. Furthermore, the results suggest that FFW programme in food deficit semi-arid areas, such as the Ewalel and Marigat locations where labour is not a serious binding resources, could be expanded by either increasing the monthly participation hours or the number of participants without resulting in any production disincentives.

This paper concentrates only on the immediate direct production effects of FFW. Assessing the long-term total impacts of FFW which are traceable through the agricultural and rural infrastructure it creates is beyond the scope of this paper. Future research ought to capture such effects.

Notes

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1 Detailed explanation of the LP Tableau is in Bezuneh, Mesfin (1985).

2 The model was validated by comparing the predicted with the observed values of farm production and input use.

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Price Elasticity of Supply of Tanzania's Major Export Crops

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Abstract

This paper presents an estimate of the price elasticity of supply for five major export crops in Tanzania: coffee (robusta and arabica), cotton, cashew nuts, tea and tobacco (flue-cured and fire cured). The results indicate that although there are many factors determining production, producer price remains the single most important variable. The price elasticities range from 0.12 for robusta coffee to 0.79 for flue-cured tobacco. The results also suggest that there is smuggling of coffee arabica from Tanzania to Kenya induced by the real producer price difference.

Introduction

Agriculture is the core of Tanzania's economy. It comprises 50 per cent of the gross domestic product, provides 90 per cent of the population with subsistence living and on average, earns 80 per cent of Tanzania's highly valuable foreign exchange.1 Agriculture determines the rate of growth, development and, ultimately, the survival of industries and cities. The countryside supplies raw materials to the factories and nourishes workers in the cities. Under-standing the determinants of agricultural output is thus critically important to understanding Tanzania's growth and development.

This paper documents the role of producer prices in determining the volume of production for five Tanzanian crops: coffee, cotton, cashew nuts, tobacco, and tea.

Agricultural Marketing in Tanzania

Great heterogeneity in the agro-ecological conditions in Tanzania allows cultivation of a wide range of crops: from cashew, a coastal tree, to coffee, a highland plant. The major food crops are maize, wheat, and rice; major cash crops include coffee (arabica and robusta), cotton, sisal, cashew nuts, tobacco (fire-cured and flue-cure), and tea. Within the limits of soil and the whims of nature, farmers normally plant a combination of crops, inorder to minimize the likelihood of a bad return, or have the variety of foods used in traditional cuisine.

An understanding of the operation of the two marketing systems that have been used in Tanzania is necessary because of their substantial influence on prices2. Even though producer prices are nominally set by the government to reflect primarily the costs borne by the farmers, in fact they tend to be more strongly influenced by marketing costs.

Until 1973, the marketing of agricultural products was carried out by farmers' co-operative unions and government-controlled marketing boards, a system held over from colonial times. Co-operative unions purchased a variety of crops from farmers in a region and resold each commodity to its respective marketing board responsible for the final sale. Under the co-operative marketing system, the government set the price paid to co-operative unions by the marketing boards (Ellis 1982). Prices were set by the Cabinet's Economic Committee after considering recommendations by the Marketing Development Bureau (MDB), a World bank/FAO technical assistance project under the auspicies of the Ministry of Agriculture. The MDB recommended producer prices designed to be competitive in the extrapolated world market situation, yet capable of providing adequate rates of return for farmers.

Actual producer prices become residuals after co-operative unions deducted some small fraction from the price paid to them by the marketing boards to cover marketing boards to cover marketing costs. Accordingly, there were slight geographical variations in producer prices following different marketing costs of individual crop unions.

In 1973, at the onset of a massive 'villagization' campaign, the government began a new marketing system for farm products which came into full operation in 1976, upon the completion of villagization. In May, 1976, all co-operative unions were abolished and their functions were transferred to village governments. Marketing boards were replaced by crop 'parastatals' which were multifunctional, semi-autonomous croup authorities (Ellis 1982). The latter were responsible not only for marketing (as the marketing boards were), but also for promoting production of crops entrusted to them. Their functions included provision of agricultural extension services and farm inputs such as fertilizers and pesticides and crop collection.

With the dissolution of co-operative unions in 1976, producer prices became uniform. The government switched from controlling prices paid to co-operative unions to fixing producer prices. As in the co-operative marketing systems, prices were determined by the Cabinet's Economic Committee after consulting with the MDB and crop authorities. The role of crop 'parastatals' was to provide projected marketing costs so that producer prices could be set low enough for them to extract a nominal profit from resale. In practice, the objective of covering marketing costs overshadowed that of ensuring adequate returns to farmers because marketing profits could be collected by the government for general expenditure. Under this marketing system, actual producer prices were deflated to accommodate the well-being of the marketing authorities (Ellis 1982). What was even more disappointing about this mechanism was that the crop authorities were notoriously inefficient, so that even with a considerable margin, there was scant surplus available to be funnelled into state expenditure. Poor accounting records kept by the crop authorities

made it impossible for the state to perform a proper audit in time to project the costs to be incurred the following season. In addition, crops were rarely collected in time, and often farmers would receive promissory notes in lieu of actual payment for their crops. The 'pieces of paper' had to be held until the day when money and a cashier were available. In general, crop authorities were marked with unnecessary bureaucracy, inefficiency, and unwar-rantedly high marketing costs.

After almost a decade of the crippling crop authorities, the government finally admitted their inefficiency and, in 1984, re-established co-operative unions. The government also formed a new ministry, the Ministry of Local Governments and Co-operative Unions, to provide guidance on the formation of co-operative unions and oversee their performance. Although these unions have started to operate in Arusha, Kilimanjaro, and Kagera region (MDB 1984) in most areas the marketing system is still in transition.

Production Estimation

If market forces are effective, producers will respond positively to price incentives, assuming other things are equal. The major objective of this study is to estimate the price elasticity of supply for five major export crops in Tanzania: coffee, cotton, cashew nuts, tea, and tobacco (producer prices of sisal are not available. In estimating supply reponses, one is faced with three alternative measures of output or potential output:

(a) area under cultivation;
(b) production per unit area;
(c) total production.

Which of the three alternative measures a researcher uses as the dependent variable depends on the kind of data available and the objective of the study. However, alternative (c) is a technically superior measure of estimating supply response. By using area under cultivation as the dependent variable, one inaccurately assumes that farmers increase their output in response to price incentives only by employing more land. Increased production can occur by intensive as well as extensive methods. Moreover, where prices differ with quality (a common phenomenon with agricultural crops), farmers often respond by improving the quality of their produce, and this does not require acreage.

There are also problems associated with alternative (b). Whereas alternative (a) over-looks intensive farming as a possible response to increase in price, alternative (b) neglects the possibility of extensive farming. The assumption underlying alternative (b) is that farmers will produce more intensively in response to price incentives and thus cause production per hectare to increase. Although this is theoretically plausible and practically likely, there is a good chance that increasing prices will cause average production per unit area to decrease. A rise in prices may cause land of poor grade to be taken into cultivation and lead average yield per hectare to decline, although aggregate production may be increasing. Likewise, a fall in prices has the potential of increasing per unit area production as farmers take land with marginal

returns out of cultivation. A total output equation can estimate supply responses better than either the acreage or productivity equation because it takes into account both intensive and extensive farming responses.

Alternative Models

The most frequently cited model for estimating farmers' responses to price changes is that developed by Marc Nerlove in1958. Askari and Cumming (1977) summarized Nerlove's model into three equations.7

$$(1)\ A_t^d = a0 + a_1 P_t^e + a_2 Z_t + u_t$$

$$(2)\ P_t^e = P_{t-1}^e + b(P_{t-1} - P_{t-1}^e)$$

$$= bP_{t-1} + (1-b\ P_{t-1}^e)$$

$$(3)\ A_t = A_{t-1} + O(A_t^d - A_{t-1})$$

A_t = Actual cultivated area or production at time t;

A_t^d = area or production desired at time t

F_t = actual price at time t

P_t^e = Expected price at time t

Z_t = other exogenous factors at tme t

U_t = an error term, and

b, c = expectation and adjustment coeffi-cients respectively.

The essence of Nerlove's adaptive expectation model is that a farmer's decision to commit land to production at any time is determined by the previous period's price and acreage. By estimating the expected price level, Nerlove assumes a free market where prices are determined by the forces of supply and demand. However, the Tanzanian government controls producer prices, and so prices cannot be treated as endogenous.

A more suitable model for Tanzania's situation is that developed by Rashidi (1984). The point of departure of Rashidi's model is the assumption that production and consumption decisions are interdependent. He shows formally that farmers' attempt to maximize utility is by distributing labour to food and export (cash) crops. Individuals consume two kinds of goods: food (F) and manufactured goods (M). The utility is given by:

Utility = $U\ (F, M)$

Farmers produce crops either for home consumption or for cash needed to buy manufactured goods. Production of food and cash crops, X is given as a function of labour.

$$F = F(L_f)\ X = X(L_x)$$

Labour and budget constraints are given by $L = L_f + L_x$ and $P_m M = P_x X$ respectively. The budhet constraint states that expendite on manufactured goods is equal to money income from cash crops. The above equations imply that production of food and cash crops is simultaneously determined. More formally, Rashic' specified output of expoert crops as:

(4) $Q_{it} = Q(P_{it}/P_{zt})$

where :

Q_{it} = output of export crop *i* at time *t*;
P_{it} = producer price of export crop *i* at time *t*;
P_{zt} = price level of manufactured goods.

Rashidi's final supply function is given by:

(5) $Q_t = bP^{aO}{}_{(t-j)}Q^{a1}{}_{(t-k)}e^t$

Q_t = output of export crop at time *t*
$P_{(t-j)}$ = real producer price lagged *j* periods,
j = 0,1,.
$Q_{(t-k)}$ = lagged output, k = 1,2,3,
e^t = time trend.

The Model for This Study

Rashidi's model can be improved by disaggregating the time trend variable. Agricultural output depends on natural factors such as rainfall and temperature, on technological changes, on the marketing system, and on the overall economic infrastructure. The model estimated here includes three dummy variables, one to account for weather conditions, another to allow for a possible difference in production between the two marketing systems discussed above, and the third to account for coffee trees' botanical bearing cycle. Coffee trees have a marked tendency to produce a heavy crop one season followed by one or two seasons of light crop. Another improvement that will be made on Rashidi's study is to aggregate production when a crop has two or more distinct varieties. The use of aggregate production when a crop has two or more distinct varieties is likely to hide some response dissimilarities which may be important for policy making. The general equation for estimating output is given by:

(6) $\ln Q_t = a_0 + a_1 \ln P_{t-j} + a_2 \ln Q_{t-k} + a_3 d1 + a_4 d2 + e_t$

where
Q_t = output at time *t*;
$P_{(t-j)}$ = real producer price lagged *j* periods, *j*=0,1,2,...
$Q_{(t-k)}$ = lagged output, k = 1,2,3,...
d1 = dummy variable for weather conditions. It takes the value of one indicating years with severe drought and zero in all other years.
d2 = dummy variable for marketing systems. It is assigned the value of zero indicating co-operative marketing system (1964-75) and one for parastatal marketing system (1976-84)3; and
et = error term.

Since farmers are particularly interested in the purchasing power of their earnings (real, not nominal), prices are used. Askari and Cummings (1977) discuss three alternative price indices that can be used to deflate the nominal prices: (1) National Consumer Price Index (NCPI); (2) Farmers' Inputs Index (FII); (3) Competitive Crops Price Index (CCPI).

FII cannot be used in this study since there is no reliable data for the cost of

production. It is difficult to calculate CCPI because of the different degrees of substitutability in different regions. Given the limitation of data, this study will adjust producer prices using the NCPI although this index underestimates the real level.4 The coefficient of the price variable is expected to be positive and that of d1 (dummy variable for weather) is expected to be negative. The coefficient of the dummy variable for the marketing systems cannot, a priori, be determined. The period beginning in 1976 was characterized by an inefficient marketing system, poor economic infrastructure, and shortage of basic commodities and services, but it was marked by the supply of subsidized inputs to farmers. The sign of the lagged output's coefficient for coffee and cashew nuts is indeterminant but is expected to be positive for other crops. A high level of output means more income to farmers and subsequently more investing, making output in the next season more likely to increase. Cashew and coffee trees, however, have a cyclical production pattern so it is possible for a heavy crop in one season to be followed by a light one the next for biological reasons in spite of increased investment.

An alternative specification for estimating marketed production of coffee arabica allows for smuggling of some of the product to Kenya 6. It is postulated that the volume of coffee smuggled is a function of real producer price difference. Essentially, the price difference variable is added to equation (6) to get alternative equation for estimating coffee arabica. The coefficient of this variable is expected to be negative.

$$(7)\quad \ln Q_t = a_0 + a_1 \ln P_{t-j} + a_2 \ln Q_{t-k} + a_3 d1 + a_4 d2 + a_5 \ln(P_K - P_T) + e_t$$

where

P_K = real producer price of coffee in Kenya (Tanzania shillings per kilogram)

P_T = real Producer price of coffee in (Tanzanian shillings per kilogram)

Problems Posed by Data

A common problem encountered in econometric studies for any developing country is poor data base. This study is no exception. Data was available for, at most, 21 years. To the extent that the sample size was small and some equations were probably autoregressive, there was an intractable problem of trying to detect autocorrelation. In autoregressive equations the conventional Durbin-Watson *d*-statistic may not be used to detect autocorrelation because the computed d is biased towards 2. Durbin has provided an alternative test which is strictly meant for large samples (more than thirty observations), the *h*-test. The *h* statistic is then tested as a standard normal deviate. At the 5 per cent level, the critical value of the normal distribution is 1.645. If *h* is less than the critical value, the null hypothesis of autocorrelation cannot be rejected. The *h*-test is valid only when the variance of the coefficient of the lagged endogenous variable multiplied by the sample size is less than 1. For cases where the multiple is greater than 1, Durbin has proposed that we regress the residual variable et on e_{t-1} and the set of explanatory variables in

the original equation and then do a *t*-test of the null hypothesis that the coefficient of e_{t-1} is not significantly different from zero. If the null hypothesis cannot be rejected, it is concluded that serial correlation is absent (Johnstone 1972).

The problem of testing for auto-correlation in autoregressive models with few observations (the typical situation for studies on developing countries) has been discussed by various econometricians but still lacks a standard solution. In this study, a test-of-reasonableness of the signs of the coefficients approach was adopted. This approach entailed inspection of the reasonableness of the signs of the coefficients and a cautious use of Durbin's *h*-test. Pindyck and Rubinfeld (1976) have advised that Durbin's *h*-statistic is 'strictly valid for large samples of data but can be used for small samples as well'. An autoregressive specification was used where these tests showed better and more reasonable results using it.

Table 1 shows that the price elasticity of supply in the cotton equation is 0.26 and statistically significant at the 0.1 confidence level. These results are similar to those obtained by Alibahuro (1974) in his study of Uganda's cotton industry. The coefficient of MSD3 indicates that production fell during the period when crop authorities were prevailing. However the coefficient of TMSD suggests that output increased over time in that period. Time trend variables were introduced for the entire sample period and for only the co-operative market system period, but in both cases the variables proved to be insignificant.

In the cashew nuts equation, the coefficient of the price variable was found to be statistically significant only after lagging this variable two years. When current period prices were used or when they were lagged one period only, coefficients with the right sign were obtained but were not statistically significant. The main reason for the low short-run elasticity is the slow response of cashew trees to crop husbandry. Although farmers may respond quickly to price incentives, it takes approximately two seasons before their efforts are reflected in output. Overall, the output of cashew nuts was increasing over time,but at a decreasing rate beginning in 1974 as indicated by the coefficients of TIME and TMSD.

Estimation of flue-cured and fire-cured tobacco equations show that disaggregation of tobacco production is necessary because of the dissimilarity of supply elasticities for the two major types of tobacco produced in Tanzania.

Producers of flue-cured tobacco are more responsive to price changes than those of fire-cured. In his study, Rashidi (1984) who used aggregate production reported an elasticity of 0.4. This output of both varieties increased

Table 1 Econometric Results

Independent Variables	Dependent Variables *** TOBACCO					COFFEE		
	COTT	CASH	FLUE	FIRE	TEA	ROB	ARA	ARA2
1. LDV	0.29c	-	0.39a	-	-	0.34b	-0.40	-
1.07b								
2. MSD								
MSD1	-	1.76a	0.19c	.30a	-	-	-	-
MSD2						0.74a		
MSD3	-1.05b	-	-	-	-	0.17b	-0.06	-
0.32b								
TMSD	0.06c	-0.15a	-	-	-.06a	-	-	-
3. TIME	-	0.45a	0.67a	0.12c	0.11a	0.003	0.02	0.08b
4. RPP	-	-	-	0.33a	0.35a	0.12a	0.07	0.46b
RPPO								
RPP1	0.26c	-	0.79a					
RPP2	-	0.63a	-	-	-	-	-	-
5. LPDIF	-	-	-	-	-	-	-	-.26b
6. WD								
WD1	-	-	-	-	-0.11c	-	-	-
WD2	-0.32a	-	-	-	-	-	-	-
WD3	-	-0.34a	-	-	-	-	-	-
WD4	-	-	-	-0.47a	-	-	-	-
7. BCD	-	-	-	-	-	-	0.05	0.26c
8. CONSTANT	6.64a	7.44a	-	6.10	6.49a	5.5a	14.4b	
20.33a								
Sample begins*	1965	1968	1965	1969	1964	1964	1969	1969
R^2 Adjusted	0.99	0.99	0.89	0.99	0.97	0.99	0.93	0.99
Std Error0.13	0.10	0.14	0.10	0.06	0.10	0.32	0.32	
h-statistic1.45	-	0.59	-	-	0.39	* *	* *	
DW statistic-	2.4	-	2.3	2.2	-	-	-	
Method	MLI	MLI	OLS	MLI	OLS	MLI	MLI	MLI

Notes:

a significant at the 0.01 level;
b. significant at the 0.05 level;
c. significant at the 0.10 level;
* the sample period ends in 1984 for all equations
** h-test was not valid because n(var b1) was greater than 1. However, the alternative test using residual variable indicated absence of serial correlation.
*** dependent variables are natural logs of real output

Defination:
MLI = Maximum Likelihood Iterative Technique.
OLS = Ordinary Least Squares

Dependent variables
COTT = Cotton;
CASH = Cashew nuts;
RCB = Coffee robusta
ARA = Coffee arabica without price differential
ARA2 = Coffee arabica with price differential.

Independent Variables
1. LDV = Lagged (one period) dependent variable
2. MSD = Marketing system dummies
   MSD1 = 1974-84 = 1
   MSD2 = 1976-84 = 1
   MSD3 = 1977-84 = 1
   TMSD = Time multiplied by respective MSD
3. Time = Time
4. RPP = Natural log of real producer price
   RPP0 = Current RPP
   RPP1 = RPP lagged one period
   RPP2 = RPP lagged two periods
5. LPDIF = Natural log of Price Difference
6. WD = Weather dummies
   WD1 = 1982, 1984 = 1
   WD2 = 1967, 1973-74, 1976, 1982, 1984 = 1
   WD3 = 1973, 1982-83 =1
   WD4 = 1974, 1983-84 =1
7. BCD = A three-year botanical cycle dummy (A season of heavy crop followed by two seasons of light crop).

over time at a decreasing rate beginning in 1974.

The short-run price elasticity for tea production of 0.35 is much higher than that estimated by Rashidi of 0.017. The time variable, which is a proxy for technological improvement was included in the supply equation, and its coefficient is highly significant. The results reflect both the area expansion of tea cultivation and improvement in technology. Total land under cultivation gradually expanded from an estimated area of 7,300 hectares in 1964 to 18,700 in 1984, and average

production per hectare almost doubled during that period.

The coefficient for the price elasticity of coffee robusta, 0.12 is low relative to that of coffee arabica which is 0.46. The value of 0.46 is smaller than that reported by Maitha (1970) which was 0.644 but larger than the world's short-run price elasticity of coffee production reported by Akiyama and Duncan (1984) as 0.12.

The significance of the coefficient of the price difference between Tanzania and Kenya may reflect the magnitude of smuggling between these countries although this issue has not yet been adequately investigated. However, the sign of this coefficient suggests that there is smuggling of coffee arabica to Kenya prompted by the producer price difference. The big price difference creates a strong inducement to smuggle and the proximity of some coffee farmers to the border makes smuggling feasible. It must be noted that the price difference variable was not significant for estimating any other crops.

Conclusion

This study shows empirically how Tanzanian farmers respond positively to price changes. Although there are many factors determining production of export crops, price remains the single most important variable. The downward trend6 of major crop production beginning in the 1970s was due in part to decline of real producer prices. If prices were 10 per cent higher, production on average would have been 4.5 per higher. Because Tanzania will continue to depend on the agricultural sector for her economic growth and development for many years to come, long-term price policies must be implemented to ensure improved production. Farmers cannot be expected to be moved merely by political inculcation. They respond to price incentives.

Keen observers of the Tanzanian economy would agree that the major contributor to the decline of agricultural production is the inefficiency of the "parastatal" marketing system. Poor management of the crop authorities caused high marketing costs which in turn led to low producer prices. The decision by the government to re-establish co-operative unions could have come too soon. The government must however make sure that these unions are not disguised crop authorities. Farmers must be given some control over the marketing costs. Given their obvious interest, they will try to maintain maximum efficiency at minimum cost.

Notes

1. Bank of Tanzania, Economic Survey, Bank of Tanzania, Dar-es-Salaam.
2. Nominal and real producer prices of the major cash crops are given in Appendices I and II, respectively.
3. The actual year separating these two marketing systems may not be the same for all crops because some crops respond more quickly to a change in marketing system than others.
4. The major cause of this underestimation is the severe shortage of goods and services which began in 1970s and led to the mushrooming of unofficial markets

where goods, services, and foreign currencies are sold at prices much higher than those set and used by the government to calculate NCPI.

5. It is believed that the low producer prices of coffee arabica in Tanzania relative to those offered in Kenya (see producer price differences in Appendix III) have induced smuggling of coffee.
6. Production figures are given in Appendix IV.

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Appendix I. *Nominal Producer Prices of Major Cash Crops (shs/kg)*

Year	PCOF	APCOFR	PCOTT	PCASH	PTOBA	PTOBF	PTEAA
1964	3.54	2.09	1.01	0.67	5.07	1.77	0.55
1965	3.09	1.83	0.92	0.69	4.10	1.80	0.55
1966	3.14	1.86	0.92	0.76	5.47	1.84	0.61
1967	2.85	1.68	0.92	0.76	5.27	1.78	0.61
1968	2.72	1.61	1.12	0.76	5.14	1.75	0.64
1969	4.02	2.37	1.10	0.90	5.13	1.69	0.66
1970	3.93	2.32	1.10	0.90	4.94	2.10	0.67
1971	3.95	3.40	1.10	0.90	5.80	2.36	0.67
1972	4.50	4.00	1.13	0.90	5.80	2.89	0.69
1973	4.15	3.65	1.13	0.90	5.85	2.90	0.71
1974	4.40	3.75	1.50	0.90	5.85	2.31	0.74
1975	3.85	3.15	2.00	1.03	7.00	2.90	0.74
1976	8.00	6.00	2.00	1.03	7.40	4.50	0.80
1977	15.00	8.85	2.30	1.06	7.40	5.20	0.90
1978	0.89	5.27	2.40	1.11	7.40	5.20	1.50
1979	9.07	4.64	3.00	1.63	8.80	6.25	1.50
1980	11.42	5.55	3.20	1.73	10.50	6.25	1.50
1981	12.36	4.50	3.70	2.75	12.60	7.70	1.50
1982	14.90	5.93	4.70	4.63	18.00	11.50	1.50
1983	15.17	10.55	6.00	4.63	18.00	11.50	2.00
1984	22.87	16.35	8.40	6.48	25.20	16.10	2.80

Defination

PCOFA = price of coffee arabica
PCOTT = price of cotton
PTOBA = price of flue-cured tobacco
PTEAA = price of tea
PCOFR = price of coffee robusta
PCASH = price of cashew nuts
PTOBF = price of fire-cured tobacco

Appendix II. *Real Producer Prices (1980) of Major Crops (shs/kg)*

Year	RCOFA	RCOFRP	RCOTTP	RCASHP	RTOBAP	RTOBFP	RTEAAP
1964	28.78	16.99	8.21	5.45	41.22	14.39	4.47
1965	19.56	11.58	5.82	4.37	25.95	11.39	3.48
1966	18.15	10.75	5.32	4.39	31.62	10.64	3.52
1967	14.69	8.66	4.74	3.92	27.17	9.18	3.14
1968	12.09	7.16	4.98	3.38	22.84	7.78	2.84
1969	15.34	9.05	4.20	3.44	19.58	6.45	2.52
1970	14.50	8.56	4.06	3.32	18.23	7.75	2.47
1971	13.96	12.01	3.89	3.18	20.50	8.34	2.37
1972	14.75	13.11	3.70	2.95	19.02	9.48	2.26
1973	12.31	10.83	3.35	2.67	17.36	8.61	2.11
1974	10.95	9.33	3.73	2.24	14.55	5.75	1.84
1975	7.58	6.20	3.94	2.03	13.78	5.71	1.46
1976	14.73	11.05	3.68	1.90	13.63	8.29	1.47
1977	24.75	14.60	3.80	1.75	12.21	8.58	1.49
1978	16.13	7.81	3.56	1.64	10.96	7.70	2.22
1979	11.81	6.04	3.91	2.12	11.46	8.14	1.95
1980	11.42	5.55	3.20	1.73	10.50	6.25	1.50
1981	9.84	3.58	2.95	2.19	10.03	6.13	1.19
1982	9.20	3.66	2.90	2.86	11.11	7.10	0.93
1983	7.37	5.13	2.92	2.25	8.74	5.59	0.97
1984	8.18	5.85	3.01	2.32	9.02	5.76	1.00

Definations

RCOFAP = price of coffee arabica
RCOFRP = price of coffee robusta
RCOTTP = price of cotton
RCASHP = price of cashew nuts
RTOBAP = price of flue-cured tobacco
RTEAAP = price of tea
RTOBFP = price of fire-cured tobacco

Appendix III *Nominal and Real (1980) Producer Prices of Coffee Arabica in Tanzania and Kenya (Tanzania shs/kg)*

	Nominal Price			Real Price		
Year	Kenya	Tanzania	Difference	Kenya	Tanzania	Difference
1969	6.30	4.02	2.28	20.19	14.88	5.30
1970	7.47	3.93	3.54	23.19	14.94	8.25
1971	6.74	3.95	2.79	20.17	13.95	6.22
1972	7.79	4.50	3.29	21.94	14.75	7.18
1973	9.24	4.15	5.09	23.80	12.31	11.49
1974	10.07	4.40	5.67	22.03	10.94	11.08
1975	10.72	3.85	6.87	19.71	7.57	12.13
1976	25.27	8.00	17.27	41.69	14.73	26.96
1977	39.81	15.00	24.81	57.19	24.75	32.44
1978	28.12	10.89	17.23	34.54	16.13	18.40
1979	30.94	9.07	21.87	35.20	11.80	23.39
1980	29.10	11.42	17.68	29.09	11.42	17.67
1981	20.67	12.36	8.31	18.49	9.88	8.60
1982	23.63	14.90	8.73	17.54	9.19	8.34
1983	29.20	15.17	14.03	19.43	7.40	12.03
1984	40.78	22.87	17.91	24.65	7.51	17.14

Sources: (1) Economic Survey and Statistics Abstract, Ministry of Finance and Development, Kenya

(2) MDB, Ministry of Agriculture, Tanzania

Appendix IV *Marketed Production of Coffee (metric tons)*

YEAR	COFARA	COFROB	COTTON	SISAL	CASHEW	FLTOB	FITOB	TEA
1964	28791	6971	53206	233540	74060	1765	332	4812
1965	24362	7901	67034	217588	75985	4003	1089	5682
1966	41819	10141	78814	225084	83277	3858	1532	6800
1967	36270	8343	70830	220093	84317	4601	3146	7157
1968	35929	10297	51348	196892	117585	5133	2130	7923
1969	43233	9430	69403	209303	113482	8154	3528	8778
1970	32501	12085	76445	202180	111167	8901	2143	8492
1971	36682	10094	65338	181104	121510	8816	3155	9182
1972	42883	9543	77661	156849	126409	10558	2504	11613
1973	37384	10133	77000	155407	125622	10786	3632	13291
1974	30812	11543	65148	143442	143349	15292	2917	12258
1975	43250	8832	70920	124000	118947	11939	2259	13872
1976	44567	10792	41903	113698	83755	14229	4546	13049
1977	37687	10995	67623	105018	97645	14670	3650	15221
1978	41073	12023	52376	91873	69288	14403	2664	18462
1979	36404	12946	55768	81384	57028	13005	4018	17633
1980	33818	14216	56477	85978	41376	12972	3643	17312
1981	55524	11237	57151	73753	56558	12164	4027	16333
1982	39789	10947	43435	60635	44419	9575	3989	15595
1983	40650	12624	42901	40200	32966	9006	2100	17551
1984	38134	11449	47057	37500	47023	10700	2700	15197

Defination

COFARA = Coffee arabica
COFROB = Coffee robusta
FLTOB = Flue-cured tobacco
FITOB = Fire-cured tobacco

A Comment on the Determinants of Saving in Ethiopia and the Role of Demographic Variables.

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In a recent contribution to this Review, Asmerom Kidane (1987) presented econometric estimates of the influence of demographic variables on saving and GDP in Ethiopia. He accomplished this by constructing an equation system consisting of economic and demographic sub-models, fitted them to time series data, estimated the equations by the ordinary least squares procedure (OLS), and made specific empirical observations which led him to conclude that 'the overall GDP will increase by the average of 5% as a result of an average of 10% reduction in the crude birth rate' (p.128). Kidane then emphasized the potential efficacy of family planning as a policy tool for the containment of rapid population growth in Ethiopia. In his conclusion, (pp. 128-129) he recommended that family planning programmes in that country be primarily financed with foreign aid, thereby relegating the importance of internally mobilized development funds to a secondary position.

This critical comment argues in two dimensions. First, the parameter estimates furnished by Kidane are grossly misleading, and as such his various observations, conclusions, and policy suggestions should be cautioulsy interpreted. Second, he advocates the policy of financing important and economically productive social services (such as family planning) primarily with foreign aid. We submit here that such an undue emphasis is grossly misplaced; for the attainment of sustained social progress, economic development, and material wealth of a country has depended, and continues to depend "...on people's own faculties, motivations, and ways of life, on their institutions and on the policies of their rulers," (Bauer and Yamey 1982). That is, foreign aid has never been necessary for achieving sustainable economic development in any Third World country.

Particularly, strategic comprehensive resource audits of Third World countries conducted by the U.S. Government and various international agencies reveal that, contrary to the incomplete and outdated information possessed by the governments, the Third World countries are endowed with an array of important natural resources currently unknown to their governments. Thus, the slow pace of economic progress, stagnation, and the socio-economic decay of the Third World mostly '... reflects factors which cannot be overcome by aid, and are

indeed likely to be reinforced by it', (Bauer and Yamey, 1982). Consequently, protracted external aid to these countries are best regarded as temporary reliefs of multiple symptoms, and not as the permanent solution to the myriad of their fundamental problems. We next examine the many facets of the econometric problems of the Kidane study and investigate how foreign aid has stunted Third World economies.

First, the parameter estimates in Kidane's economic-demographic model specification is clearly a system of simultaneous equations, as he himself noted (Kidane1987: 124). Many of the regressors in the various equations are 'endogenous'. The author, however, treated the estimates as structural coefficients and proceeded to report the OLS estimates. Here, we submit that his OLS estimates of the simultaneous equation system are biased (or inconsistent) due to the well-known problem of 'simultaneous equations bias' (Judge, G.G. et al.1985). The three-stage least squares (3SLS) system of equations estimation is one appropriate estimation method. The 3SLS estimators are both consistent and asymptotically efficient by taking into account the correlation of the disturbances across equations in the system. Therefore, the greater these correlations the wider becomes the expected divergence between OLS and 3SLS estimation results and their inferences.

Second, Kidane relied excessively on the use of (mostly weak) proxy variables. Two important cases come to mind. First, the '...conscious effort by government to mobilize saving' (p. 125) was proxied with the number of commercial bank branches, CB. This proxy appears to be weak, as is reflected by the wrong sign and statistically insignificant coefficient on CB in his empirical saving equation (10). Given the likelihood that credit expansion can occur without physical increase in the number of commercial bank branches, the annual growth rate (and not the level measure) of credit expansion at these banks is likely to be an improved proxy. Second, price index was used to proxy real interest rate. The problem of excessive use of (weak) proxies, compounded by his use of several reconstructed and censored demographic variables (p. 126) increases the chance of biased estimation results. It is widely known that, even if the proxy (e.g. price index) and the variable being proxied (e.g. real interest rate) are highly correlated, the use of proxy variables in econometric models can still introduce significant bias and inconsistency into the estimates (Judge et al., 1985). The probable magnitude of this 'errors-in-variables' problem in the specific context of Kidane's study is demonstrated in the sequel.

Assume that a variable P (price index) is used to proxy another variable R (real interest rate) because data on R are censored (that is, unavailable). Further assume R is related to P by

$$(1)\quad R = \gamma P + \xi,$$

where (1) is a linear regression model with R and P measured as

deviations from this respective means, and ξ is an unknown disturbance.

Assume a correctly specified neo-classical saving function, S, which is functionally dependent on R (the rate of interest), then

$$(2)\quad S = \beta R + \mu,$$

where μ is an error term. The use of P in place of R involves replacing R with P in (2) to obtain (3)

$$(3)\quad S = \alpha P + \varphi$$

The parameters β and α differ because of scale differences between R and P. The OLS estimate of β is obtained as α/γ but that estimate is both biased and asymptotically inefficient. The asymptotic bias is obtained by solving (1) for P and substituting the result in (3); thus,

$$(4)\quad S = \beta R + (\gamma - \beta\xi),$$

where β is non-zero. The probability limit of $\hat{\beta}$ provides the OLS estimates of β, that is

$$(5)\quad \text{Plim}\ \hat{\beta} = \beta/(1 + \sigma_\xi^2 / \sigma_R^2)$$

where σ_ξ^2 and σ_R^2 are the variances of ξ and R, respectively. The asymptotic bias induced by this 'errors-in-variables' problem approaches zero the larger the correlation between P and R, and when P is a good proxy for R. Expression (5) demonstrates that the numerical magnitude of the inconsistency in $\hat{\beta}$ is expected to be non-zero, as long as the correlation between P and R are not perfect, that is, as long as $\gamma \neq 1$ in (1) above. Kidane did not explore the likely degree of correlation between each proxy variable and the true variable being proxied.

Third, it is hardly conceivable that capital input, no matter how primitive its form, was not an argument in the specification of the agricultural sector production function equation (YACCO). Morever, if one accepts the various theoretical equations in Kidane (1987) as full specifications, his empirical models are truncated forms. Several relevant regressors appearing in his theoretical models were arbitrarily dropped from empirical estimation equations because of their insignificant t-ratios. This practice further subjects Kidane's results to a misspecification of the 'ommited variables' type. Given sufficient correlation between the omitted and included regressors, the effect of using a truncated (or incorrect) design matrix is to bias the coefficients of the included regressors. This in turn leads to inaccurate inferences, because the estimated residual variance is biased upward (Judgeet al., 1985: 857-859). One effect of fitting truncated models is the inducement of autocorrelated residuals (Judge, et al., 1985: 2276). For instance, a comparison of the Durbin-Watson (D-W) statistic in equation (11) with the appropriate 95% critical bounds indicates the presence of positively autocorrelated errors. In fact, while Kidane provided the D-W statistic for each equation, he did not

entertain any discussion on the presence of absence of first order residual seriality in these equations. He also reported a D-W statistic of 2411 for equation (15), which is quite unrealistic.

Fourth, a less obvious but equally problematic misspecification issue questions the likelihood that all of his estimation equations are of the strictly linear functional form. To quote Kidane (p.126), '...different functional forms were tried and the linear regression estimates which had relatively higher explanatory power are included'. Related previous investigations by Hazledine and Moreland (1977), and by Okunade (1985), for instance, suggest that a mix of functional forms ranging from strict linearity to double logarithmic fit better for some equations than others. Thus, Kidane's result might also be subject to 'functional form' misspecification, if strict linearity is inconsistent with any of the equations. As a corollary, the functional relations that he specified (p. 125) are quite general, and no assumption was made about the likely probability distribution of the various error terms.

Fifth, the way in which the sectoral production functions were specified by Kidane does not permit inferences regarding the form of the production technology and its various parameters, such as sectoral and aggregate returns to scale, factor shares and/or marginal productivities and technical change. Without reference to the question of his data integrity, Kidane had enough information to fit a simple neoclassical production technology of the Cobb-Douglas type with embodied technical change. For instance, that proposed by Solow (1959) is of the form

$$(1)\quad Y_t = B\,\varepsilon^{-\delta(1-\alpha)}\,L_\tau^{\alpha}\,J_t^{(1-\alpha)}$$

where Y_t is sectoral output, $B\varepsilon^{-\delta(1-a)}$ denotes the level of technology advancing at an exponential rate, L_t and J_t are labour and capital stock input levels, with the respective exponents representing the marginal productivities. The stock of capital, J_t, is the 'effective capital stock', a productivity weighted sum of the existing capital goods embodied in all earlier technologies, and at time t, is derived as

$$(2)\quad J_t = \int_{-\infty}^{t} \varepsilon\sigma v\; I_v\, d_v$$

If Kidane assumed the simplified production technology (1'), his study utilizing more recent data could be a useful timely comparison with the Hazledine-Moreland (1977) cross-sectional results, which concluded aggregate diminishing returns to scale for 29 African countries. The low-level equilibrium trap postulated for the Third World by the neo-Malthusians can also be tested using specification (1') above.

Sixth, the demographic sub-model equation (9) appears mis-specified. The interpretation of the associated empirical result [equation (17)] that a one unit increase in the crude death rate (CDR) will tend to increase the proportion of old dependents (PO) by about six-fold contradicts a priori theory. While the proper sign on the CDR coefficient should be negative, Kidane reported a positive and

statistically significant coefficient. A more reasonable specification of the demographic sub-model equations (8) and (9) is to make each of CBR and CDR the dependent variables, and to let PY and PO become the respective regressors. This way, if the coefficient of PO is positive in the empirical equation (17), a logical interpretation might be that an increase in PO likely raises CDR due to the poor nutritional habits and inadequate health opportunities for the aged, mostly in the rural areas.

Given the many sources of mis-specification in the study by Kidane, the extent of bias and inconsistency in his estimates are best assessed by using his data to implement the generalized specification error tests proposed by Ghali and Snow (1987). Nevertheless, the problem of Kidane's specification arbitrariness is particularly serious, because he used the results to conduct sensitivity analysis of the GDP to the changes in crude birth rates (see his Table 1, p. 128). Therefore, the lack of stabilty and robustness of his estimates casts reasonable doubt on the results and projections which he obtained from truncated models.

Seventh, the notational inconsistencies between Kidane's theoretical models [equations (1) ...(9)] and his empirical results [equations (10) ...(17)] compound the misspecification problems. He simply left it to the readers to figure out that the regressor variables B [equation (7)] and BOP [equation (15)] represent BP, the balance of payments variable, as in equation (1). Moreover, he abruptly switched the variable PO [equation (1)] to PQ [equation (10)], and interchanged PY and PO of equations (8) and (9) for P15 and P60 in equations (16) and (17). The coefficient -191.20 in equation (14) with no variable attached to it implies that the production function for 'other services' sector (YOSCO) has two intercepts, which is quite strange. Further notational problem involves CBR in equation (8), which was suddenly transformed to BCBR in equation (16); and it is unknown whether AP, representing acreage (or land input) in the agricultural production function (YACCO), is acreage available or the more relevant fertility-adjusted acreage actually cultivated. This distinction is necessary to differentiate between 'availability' and 'actual utilization' of the factors of production. Also, it is difficult to discern which t-value belongs to what coefficient, as the number of reported t-values in each equation, except the saving function, does not match the number of the estimated parameters.

Finally, Kidane's recommendation incorrectly suggests that externally donated development assistance fund is a crucial determinant of successful family planning programmes and economic progress in Ethiopia. Over forty years of official aid to Third World nations reveal that, except for few highly isolated Asian countries, aid for development only enables recipients to avoid interest and amortization costs of borrowing. Secondly, foreign aid typically contributes less than 1% to the official GDP of Third World nations (Bauer and Yamey 1982). The current quality of foreign aid to the Third World appears to be such that it

perpetrates the material poverty and human misery of the native population, by indirectly promoting the consolidation of economic and political powers in the hands of their rulers. Moreover, some external development aid have been granted conditional upon factors which mostly advance the political, ideological, and strategic economic-cum-defense objectives of the donor countries (Rowe 1985). These external mandates are usually not conducive to the achievement of sustainable economic development of the Third World nations. Nevertheless, as long as the recipient countries are not required to demonstrate improved economic performance (through, say higher marginal propensity to save, reduced balance-of-payments deficit, and reduced incremental capital-output ratio), foreign aid is most likely to continue to inhibit, rather than promote, Third World economic progress (Chenery and Srout 1966) .

Rather than their excessive reliance on external aid, development planners in Third World countries could best understand the secrets of economic progress by the careful case analysis of how most of the advanced western economies evolved through highly co-ordinated self-determination efforts of individual citizens, of the institutions, and with the unflagging commitment of their inspiring selfless leaders. In the forty years following World War II (WWII), Japan reconstructed by first developing a sound agricultural base, which in turn nourished the people and increased labour productivity. Then followed the carefully orchestrated slow, but steady progress toward industrialization and the eventual development of her tertiary sector. Japan was prudent in her strategic deployment of the post- WWII reconstruction finance and foreign aid (or temporary economic assistance) received from the United States. Clearly, Japan of today dominates the international economy, and must be reckoned within the international sphere, even by the United States.

Thus, the Japanese experience demonstrates that a severely devastated country can develop from ashes to riches. This usually requires the indigenous population to dispense with any economically unproductive aspect of its culture, its institutions, its thinking mode, and government practices so as to make significant economic progress. Historical attempts to increase per-capita saving and GDP by reducing population explosion in Africa will continue to fail miserably, as long as the Third World culture regards large numbers of dependent children as economical (human) assets on their farms. In her drastic efforts to forge a zero population growth rate (ZPG) by the year 2000, the Chinese government has restricted consumption (Southerland 1987) and levy taxes on families who have more children than is required to achieve the stated ZPG objective (Graham 1979). The Chinese experiment is reportedly successful, having been erected on sound economic incentives. In Ethiopia, however, as in all Third World countries, family planning initiatives without sound economic incentives, which discourage large family formations, have always failed. Therefore, foreign aid for funding population control measures in

Ethiopia must be such that it reorients the thinking mode of the indigenous population to eventually produce increased GPD through higher marginal propensity to save.

In conclusion, the objectives of this comment were to point out the data problems, econometric estimation inadequacies, and specification flaws in Kidane's study, and to demonstrate that what Ethiopia truly needs is not continued dependence on foreign aid. The real impediments to development are more fundamental than the funding of family planning and other social services with unearned foreign exchange. Ethiopia's future course of socio-economic development and sustainable growth will require drastic and simultaneous changes in the economically unproductive cultural, institutional, and investment practices of her citizens, and in the unflagging determination of her rulers to foster these changes swiftly and efficiently, all within a co-ordinated scheme.

Notes

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Inflation-Growth Trade-off in an Export-Oriented Rural Economy: The Case of Ghana

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Abstract

The economy of Ghana has been suffering from prolonged and severe stagflation. During 1960-86, a negative rate of income growth was accompanied by a high rate of inflation. Estimation results of an inflation-growth model indicate the existence of a strong and significant trade-off between inflation and output growth. In this model, expectations are formed for the unobservable price and income variables. Results are improved when an information set containing politico-economic variables is added to the history of income and price variations.

Introduction

The predominantly agricultural economy of Ghana has been suffering from prolonged and severe stagflation. During 1960-86, a negative rate of per capita real income growth was accompanied by a high rate of inflation.

Although stagflation can be attributed partly to external factors, such as the sharp rise in world energy prices and interest rates in the 1970s, and the collapse of primary commodity prices in the early 1980s, the main cause rests on frequent politico-economic instability and inadequate macroeconomic policy.

Political instability and administrative misconduct have largely contributed to the poor economic performance. The post-independence era is identified with successive military take-overs, unstable civilian rules, and frequent and violent cases of political unrest. Ghana's cocoa production, which traditionally provided about 60% of export earnings, has sharply declined because of the ageing and diseased trees, inadequate farming and marketing facilities, considerable smuggling of cocoa across the borders, and mass migration of labour to major cities and neigbouring countries. In addition to the declining cocoa export, large and successive devaluation of the foreign exchange, rapidly increasing money

supply, and high dependence on energy-intensive imports, contributed to the rising balance of payments deficits and inflation. Economic problems were further aggravated by drought and fire that destroyed almost 40% of the cocoa farms, mass expulsion of illegal immigrants from Nigeria, and severe shortages of food. In recent years, however, renewed regional co-operation, external financial assistance and restrictive macroeconomic policy prescriptions by the IMF and World Bank, and resettlement of the refugees in their home villages to rehabilitate cocoa plantations and to increase food production have led the economy to a period of recovery.

Supply-side Equilibrium: Output and Price Level

To analyse the inflation and real output relationship, a Lucas (1973) type model of inflation-real output growth modified by Nugent and Glezakos (1982) for small developing economies is constructed. In this model, the aggregate price-quantity observations are viewed as intersection points of the aggregate demand and aggregate supply schedule. The aggregate demand schedule represents the output-price relationship implicit in the standard IS-LM model and is being shifted by the demand-pull variables and variation in the export demand.

The aggregate supply schedule is drawn under the condition of labour market equilibrium. Its slope is determined by the underlying assumption of price expectations adjustment. For a small rural economy with suppliers as price takers, higher prices can result in output losses. The main reason for this relationship lies in the structural difference between the labour market of a highly industrialized economy and that of a predominately agricultural economy. In the latter case, the demand for labour is determined by a comparison between the nominal wage rate and output price level that suppliers expect to receive in the near future; eg. at the harvest time. The labour force, which is hardly covered by long-term contracts, offers services in response to the actual real wage rate rather than the expected real wage rate, especially in the informal markets of seasonal, daily, and street-corner labour.

In the modified inflation-growth model, an increase in the actual price level causes the real wage rate and the supply of labour to decline and a rise in the expected price level makes the expected real wage rate to decrease and the demand for labour to increase. But, the decline in the labour supply is more than the increase in the labour demand under the condition of partial expectations adjustment. As a result, the nominal wage rate rises and employment level declines. Through the production function, the level of output supplied decreases in response to an increase in the price level above its expected level. Both employment and real output decline as a result of an increase in the actual price level above its expected level. The inflation-growth trade-off results in a positively-sloped Philips curve (Nugent and Glezakos 1982, Sheehey 1986).

In an open rural economy, however, the trade-off between real output and price level is highly influenced by the

interaction with the usual demand-pull variables: monetary and fiscal policy and variation in the export demand. It is plausible that an expansionary stabilization policy reinforced by an increase in the export demand results in a high rate of output growth such that the expected output loss from the rising price level is, at least partially, offset. For instance, an expansion in the foreign demand for exports relative to that of the domestic demand for imports increases the foreign exchange earning capacity of the economy and improves the trade balance. Increased export earning raises the demand for domestic goods resulting in higher income and price. But the increase in income leads to more import spending which can partially offset the direct improvement from export expansion (Dornbusch and Fischer 1984). Consequently, the relationship between inflation and real output growth needs to be investigated in the context of an empirical model that can capture the effects of both supply and demand-side variables.

Empirical Analysis

In a Lucas-Nugent type model, the real output and price equations have the following specifications.[1]

$$(1)\quad \dot{Y}_t = \alpha_0 \dot{Y}_t^e + \alpha_1 (\dot{P}_t - P_t^e) + \alpha_2 (\dot{PFE}_t - P_t) + \alpha_3 (PFE_{t-1} = P_{t-1})$$

where, $\alpha_0 = 1$; $\alpha_1 * 0$; $a_2 < a_3 < 1$;

and

$$(2)\quad \dot{P}_t = \beta_0 \dot{M}_{t-1} + \beta_2 \dot{Y}_t + (\dot{PFE})_t - \dot{Y}_t) + \beta_4 \ddot{P}_t^e$$

where, $0 < \beta_0, \beta_t + \beta_1 m_{t-1} + \beta_2 \dot{Y} + \beta_3, \beta_4 > 0$. With a dot indicating percentage change, PFE is the price of foreign exchange in terms of domestic currency; i.e., the exchange rate; and M is the real money supply (M2). Here, $\ddot{P}^e$ measures the acceleration of the expected rate of inflation; i.e., $\ddot{P}_t^e = \dot{P}^e = \dot{P}_{t-1}^e$

The money supply variables, M_t and M_{t-1}, capture the current and immediate past adjustment of changes in the money stock and price level. In a developing country where financial institutions are not fully developed and economic activities are insufficiently monetized, a one-period lagged adjustment process should be able to capture most of the delayed effects of an increase in the money stock on price level.

The variable representing the acceleration of expected inflation is used as a proxy for the opportunity cost of holding money. The rate of interest may not correctly reflect the cost of holding money because of the institutional rigidities which keep it lower than its market rate, and also the immaturity of financial markets

which raises questions about the meaningfulness of using the interest rate as the measure of cost of holding money (Nugent and Glezakos 1979 and 1982, and Saini 1982). In a high inflationary environment, where inflation is expected to continuously gain momentum, consumers tend to spend more rapidly to minimize the loss from holding idle cash balances, lenders charge higher nominal interest rates to prevent real interest rates from falling, and investors consider domestic or foreign assets with reasonably high or even zero real rates of return.

There are two competing effects of variations in the foreign exchange rate on the real output growth. The prevailing view is that an increase in the relative price of foreign exchange, typically via devaluation, increases the domestic demand for imports, while decreasing the foreign currency price of exports. The apparent increase in the income terms of trade will encourange domestic production of import substitutes and exportables, thus improving the balance of payments account. However, the positive trade effect of devaluation on real output growth, which itself depends on elasticities of domestic demand for imports and foreign demand for exports, may be realized with some delay. This effect warrants the inclusion of the lagged real exchange rate variable in the income equation (Sheehey 1986). The opposite view is that in a developing country, devaluation of the foreign exchange rate will not necessarily expand production of import substitutes because of existing supply inelasticities and limited absorptive capacities, while increasing the production cost of import-using industries. Increased production cost will give rise to a higher demand for working capital and interset rate, resulting lower output and higher price level (Diaz-Alejandro 1965, and Bruno 1979).

Estimation of the system of equationS (1) and (2) requires formation of expectations for output and price variables. Values for unobservable $\dot{Y}^e$ and $\dot{P}^e$ can be generated by several processes of expectations formation. According to the extrapolative expectation hypothesis, the expected rate of inflation, for instance, is equal to the immediate past rate of inflation plus correction factors which allow for the acceleration of the past rates of inflation. Using a three-period time horizon, the expected rate of inflation is:

$$(3)\ \dot{P}_t^e = \dot{P}_{t-1} + \beta(\dot{P}_{t-1} - \dot{P}_{t-2}) + \delta^2 (\dot{P}_{t-2} - \dot{P}_{t-3}$$

$$= (1 + \delta)\ \dot{P}^{t-1}$$

$$- \delta\ (1 - \delta)\ \dot{P}_{t-2} - \delta^2\ \dot{P}_e$$

where, $O < \delta < 1$. Operationally, the observed rate of inflation is regressed on its three periods with appropriate restrictions imposed on the signs of the lagged price variables. The predicted values of $\dot{P}_t$ approximates the expected rate of inflation.

In the adaptive expectations hypothesis, the expected rate of

inflation is equal to the lagged expected rate of inflation adjusted for the inflation forecast error of the past period,

$$(4)\ \dot{P}_t^e = \dot{P}^{t-1}{}^e + \theta\,(\dot{P}_{t-1} - \dot{P}_{t-1}^e)$$

$$= \theta\,\dot{P}_{t-1} + \theta(1-\theta)\,\dot{P}_{t-2} + \theta(1-\theta)^2\,\dot{P}_{t-3} + \ldots$$

$$= \theta \sum_{1=1}^{\infty} (1-\theta)^{1-1}\,\dot{P}_{t-1}$$

Accordingly, the expected rate of inflation is the predicted value of the observed rate of inflation in geometrically declining infinite distributed lag model of the observed rate of inflation on its own past values. The optimal lag structure is given by a distributed lag equation yielding the highest R^2 value (Nugent and Glezakos 1979, and 1982).

Limiting the process of expectations formation to simple extrapolative and adaptive processes means that only the past history of price variations are considered, while ignoring the effects of other observable variables on the formation of inflationary expectations. Indeed, if expectations are formed on a more rational basis, distributed lag approximations of inflation are inappropriate since they neglect, at least directly, other sources of information. Consequently, the distributed lag expectations bear little relation to the true underlying process of forecasting inflation and lead to generating systematically incorrect expectations. An alternative method of forecasting inflation is the rational expectations hypothesis in which expectations are based on an information set containing all relevant variables at t-1:

$$(5)\ \dot{P}_t^e = E\left[\dot{P}_{t-1} : \Phi_{t-1}\right]$$

Where, Φ_{t-1} is the information set (Lucas 1972, Kantor 1979, and Sarantis 1984).

In case of Ghana, it is argued that poor economic performance is highly influenced by its inherent structural instability. Political instability is mainly caused by ideological and managerial differences of leaders who have frequently used the military force to bring about change and unrest. Economic instability, on the other hand, is largely due to the structural rigidity of the economy which continues to rely on the exportation of a single crop whose price and output have been subject to deep and ripid fluctuations.

To incorporate more relevant information into the process of forming expectations for price and income, an information set containing several economic and political variables is added to the past value of income and price variables. The expected rate of inflation rate, for instance, is defined as the predicted value of the inflation rate in a regression model whose independent variables are the actual rate of inflation, real wage rate, real government expenditures, import price index, and measures of politico-economic instability.2

The political instability measure, which is based upon our observations of historical evolution of Ghana's political system, is a binary variable that takes

the value of zero for periods of severe political instability, 1966-83, and the value of one for periods of relatively stable political environment, 1960-65 and 1984-86. The index of economic instability is defined as the absolute value of the relative deviation of the real GDP of the cocoa sector from its path of trend growth:

$$(6)\quad EI_t = |YC_t - \hat{Y}_{C\,t}| \,/\, YC_t$$

where, $\hat{Y}_{C\,t}$ is the predicted value of the real GDP of the cocoa sector generated by a linear time trend model (Yotopoulos and Nugent 1976). This instability index captures the effects of fluctuations in cocoa output characterized by a succession of surpluses and shortfalls in relation to their trends. Surpluses occured due to the rapid development of the cocoa industry as the main source of foreign exchange earnings. Cocoa GDP continuously rose until 1972 when it reached a record high of 470,000 metric tons. Shortfalls then began because of severe scarcity of pesticide to cure the diseased cocoa trees that caused an estimated loss of 40,000 tons annually and draught and fire that devastated about 40% of the trees. Cocoa output declined to 250,000 tons in 1982 and 158,000 tons in 1984. It then rose to 179,000 tones in 1985 and 201,000 tones in 1986 due to the government policy of redeveloping the cocoa industry. Note that the severe shortfalls in the cocoa output during 1972-84 were partly overestimated because of the existence of a large underground economy engaged in cocoa smuggling. An estimated 10,000-20,000 tones of the annual cocoa crop was lost through smuggling to neigbouring countries (The Europa Year Book, 1987).

Prior to the estimation of the system of equations (1) and (2), expectations of inflation and real output growth were generated according to alternative models of expectations formation. In the extrapolative expectations model, the estimation results indicated insignificant coefficient for the third period lagged income and price variables. Consequently, the process of expectations formation was limited to the past two periods. The model for inflationary expectations, for instance, was modified as per Turnsovsky (1982):

$$(7)\quad \dot{P}^{e} = \dot{P}_{t-1} + \delta\,(\dot{P}_{t-1} - \dot{P}_{t-2})$$

$$= (1+\delta)\,\dot{P}_{t-1} - \delta \dot{P}_{t-2}$$

As a result of this modification, the R^2 and t-statistics values slightly increased. In the adaptive expectations model, the expected values of price and income variables were generated in distributed lag models with maximum lag of four years in order to economize on the degrees of freedom. The lag structure with the highest adjusted R^2 value was 2 for the income equation and 1 for the price expectations model. Evidently, the extrapolative and adaptive expecations processes indicated that higher order lags did not contribute significantly to the explanatory power of the models. [3] In the rational expectations, the observed rate of output growth and price

inflation were regressed on their past values and the lagged values of the variables included in the information set. The predicted values of the dependent variables were used as expectations of output and price growth rate. The expected price and income variables were then added to the data set to estimate the inflation-growth model with alternative methods of two-stage least squares (2SLS) and three-stage least squares (3SLS). Estimation results of the system of equations (1) and (2) are presented in Table 1.

In the income equation, the expected rate of income growth has a positive and highly significant coefficient, which is near unity in the adaptive and rational expectations model. This value of the 'catching up' coefficient indicates that the process of adjusting actual output growth to expected output growth is incomplete, conforming with the general Keynesian hypothesis of partial expectations adjustment. The negative coefficient of the real exchange rate and the positive impact of the lagged real exchange rate are significant only in the rational expectations model. These results support our a priori theorizing about immediate and delayed effects of foreign exchange devaluation on real output growth. However, such impacts are found to be significant only when more information is incorporated into the process of expectations formation. The coefficient of the actual rate of inflation relative to its expected rate is negative and significant at 10% in 2SLS extrapolative expectations, at 5% in SLS and 3SLS adaptive expectations and 2SLS rational expectation, and at 1% in 3SLS rational expectations model. Once, again, such a negative association is an indication of a strong trade-off between inflation and real output growth. The R^2 values vary between 0.41 in the real 3SLS extrapolative expectations and 0.54 in 2SLS rational expectations model.

In the price equation, the rates of growth of the real money supply have the expected positive effects on inflation. The estimated coefficient of the real money supply is significant at the 5% level in 3SLS adaptive expectations and 2SLS rational expectations model and at the 1% level in other processes of expectations formation. However, the coefficient of the lagged real money supply is insignificant, indicating that the process of money stock-price level adjustment occurs with limited delayed effect. The coefficient of the real output growth rate is negative and highly significant in all expectations models. The effect of the real exchange rate variations on inflation is positive and significant at 10% in 3SLS adaptive expectations and 3SLS rational expectations model. This positive impact is expected since frequent and large foreign exchange devaluations contributed to rising inflation. The estimated coefficient for the variable representing the acceleration of expected inflation is positive and significant at 5% in extrapolative expectations and 2SLS adaptive and rational expectations and at 1% in 3SLS adaptive and rational expectations model. Such a strong association between inflation and psychology implies that expectations of

Table 1 Estimation Results of Income and Price Equations Under Alternative Expectations Formation Hypotheses (1960-86)

INCOME EQUATION

Expectations Model	Y_t^e		PFE_t-P_t		$PFE_{t-1}-P_{t-1}$		$Pt-P_t^e$		R^2	
	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS
Extrapolative formation	0.69 (2.21)+	0.84 (2.38)+	-0.03 (-0.30)	-0.02 (-0.16)	0.01 (0.56)	0.01 (0.48)	-0.17 (-0.90)	-0.11 (-1.73)@	0.45	0.41
Adaptive formation	0.94 (2.48)	0.96 (2.74)+	-0.07 (-0.83)	-0.08 (-1.02)	0.01 (0.70)	0.02 (0.99)	-0.15 (-2.15)+	-0.20 (-2.50+	0.48	0.50
Rational formation	0.97 (2.21)+	0.98 (7.17)*	-0.11 (-1.80)@	-0.13 (-2.12)+	0.02 (1.85)@	0.08 (1.74)@	-0.16 (-2.21)+	-0.13 (4.90)*	.54	0.53

PRICE EQUATION

Expectations Model	M_t		M_{t-1}		Y_t		PEF_t-P_t		P_t^e		R^2	
	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS
Extrapolative formation	0.58 (3.89)*	0.54 (3.70)*	0.07 (0.45)	0.07 (0.42)	-1.24 (-4.39)*	-1.36 (4.84)*	0.01 (1.34)	0.02 (1.57)	0.01 (2.64)+	0.01 (2.69)+	0.80	0.73
Adaptive formation	0.58 (3.93)*	0.35 (2.61)+	0.08 (0.50)	0.02 (0.44)	-1.19 (-3.84)*	-2.55 (-8.39)*	0.01 (1.27)	0.07 (1.76)@	0.01 (2.64)+	0.02 (3.20)*	0.80	0.76
Rational formation	0.50 (2.57)+	1.09 (9.16)*	0.19 (0.37)	0.76 (1.46)	-2.61 (-4.30)*	-11.36 (-28.45)*	0.07 (1.84)@	0.10 (2.07)@	0.01 (2.51)+	0.02 (7.28)*	0.78	0.87

NOTE: Numbers in parentheses are the computed t ratios. Levels of significance are 1(*), 5(+) and 10 (@) percent).

high and rising inflation generate further inflationary pressures. The R^2 values vary within the range of 0.73 in 3SLS extrapolative expectations and 0.87 in 3SLS rational expectations model.[4]

Conclusion

Estimation results of the inflation-growth model indicate the existence of prolonged and severe stagflation. Results are improved when an information set containing politico-economic variables is added to the history of income and price variations. Although political stability has improved, the main challenge facing Ghana is now economic stabilization and recovery. Our estimation results led to important policy implications of reducing inflation, while improving output growth and balanced of payments position. Such policies need more market-oriented decisions to establish equilibrium output, factor, and foreign exchange price determination complemented by restrictive fiscal and monetary measures. Improvements in the rural sector require rehabilitations of the badly damaged infrastructures with substantial investment in removing the supply bottlenecks.

Our policy implications are consistent with the IMF and World Bank macroeconomic policy prescriptions aimed at eliminating the relative price distortions and improving the organizational structure of the economy, thereby increasing efficiency at the micro level. Ghana's open door policy has resulted in increased external financial assistance and improved domestic resource mobilization toward price stability and income growth (Chand and van Til1988).

To the extent that Ghana's economy can experience sustained growth with reduced inflation depends upon the success of its recent stabilization and recovery policy and long-term political stability.

Notes

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1 For more detailed model specification see Nugent and Glezakos (1979, 1982).

2 The residuals form this process are not white noise, so these expectations should be considered 'partially rational'. It is, therefore, plausible that the formation of expectations on the basis of utilizing an information subset leads to a process of partial expectations adjustment. See for example McCallum (1978).

3 Nugent and Glezakos (1979) found similar results in their formulations of adaptive expectations.

4 No significant serial correlation was present in the estimation results of the system of equations. More-over, transformation of raw data into percentage changes

alleviated a possible multi-collinearity problem.

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Trade and Macroeconomic Policies' Impact on Agricultural Growth: Evidence To-date

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Abstract

The real exchange rate (RER) plays a central role in the profitability of tradeables. Because agriculture has a larger tradeable component than other sectors of developing countries' economies, the RER provides a long-term signal for resource allocation among sectors thereby affecting the process of growth. This study is an attempt to elucidate the nature of the relationships involved in a long-term context, emphasizing trade and macroeconomic policies' impact on agricultural growth. It explains how trade and macroeconomic policies affect the structure of incentives to a predominantly tradeable sector such as agriculture. It also presents a methodology which can be used to measure the effects of the RER on agriculture, reviews quantitative evidence of the effect of the RER on relative prices relevant to agriculture and presents evidence suggesting that these relative prices have large effects on agricultural production.

Introduction

The underlying theme of this paper is that agricultural growth interacts very closely with developments in other sectors of the economy, particularly through the trade and macroeconomic policies of the govern-ment.This has added significance in many developing countries where agriculture is the backbone of the economy, and in which agriculture is a highly tradeable sector.

Governments typically attempt to influence agricultural growth through sector-specific policies. New roads are built. Irrigation and storage schemes are devised. Agricultural trade restrictions are imposed by establishing import tariffs and by controlling import/export licensing. Exports are sometimes subsidized, sometimes taxed. Prices in input and output markets can be supported or fixed. These represent the sector-specific interventions.

There are other policies, however, directed at trade and macroeconomic management of the economy which are of the utmost importance to agriculture. Changes in industrial protection, government spending, international capital flows, wages, and nominal exchange rates can reinforce or neutralize sector-specific policies, such as government expenditures and investment programmes. Sustained sectoral growth requires resource flows between sectors which adjust to their relative opportunities over time. Therefore, it is necessary to maintain an economy-wide view of returns in

order to understand the dynamics of growth.

One way of studying how a government's macroeconomic decisions and policies towards other sectors affect agriculture is by evaluating the impact of such policies on the real exchange rate (RER), since correct RER alignment is required if a country is to take the greatest advantage of the growth opportunities offered by international trade. The RER can be defined as the ratio of the price of tradeables to the price of non-tradeables.[1] The prices of tradeables are determined by world market prices, nominal exchange rates, and trade policies. The prices of non-tradeables, which consist of home goods and services, are determined domestically in response to changes in domestic supply and demand. The RER plays a central role in the profitability of tradeables. Because agriculture has a larger tradeable component than other sectors, the RER provides a long-term signal for resource allocation among sectors, thereby affecting the process of growth.

This paper, then, is an attempt to elucidate the nature of the relationships involved in a long-run context, emphasizing trade and macroeconomic policies' impact on agricultural growth. The analysis goes beyond the typical concerns of agricultural policies, on the premise that agriculture incentives are derived as much from foreign trade and macroeconomic policies as from sector-specific interventions. With few exceptions, this setting has so far remained outside the scope of the debate on development strategies.[2]

It is hypothesized that one the most dramatic manifestations of the strong bias against agriculture resulting from the trade and exchange rate policies in LDCs in the 1950s and throughout the 1970s is the massive flow of labour out of agriculture during this period. This suggests that the severe production constraints emanating from rural labour shortages, for example, in sub-Saharan Africa, are not independent of real exchange rate phenomena. A first question is how foreign trade and macroeconomic policies affect the structure of incentives to a predominantly tradeable sector such as agriculture.

The Impact of Trade and Macroeconomic Policies on Incentives for Agriculture: A Real Exchange Rate Approach

The real exchange rate is perhaps the most influential price affecting incentives for agriculture. Although short-run fluctuations in the RER have some significance, the long-run equilibrium value is of greater importance.

As a relative price, the RER emphasizes the different impacts which trade and macroeconomic policy have on the prices of tradeable and non-tradeable goods in the aggregate. Thus, the RER is to be understood as a long-term signal for resource allocation between sectors. As such it has a policy significance which is somewhat removed from day-to-day concerns of the central bank whose task is to manage the nominal exchange rate when confronted with fluctuations in the price of the country's principal imports and exports.

Only four types of policies are at a government's disposal in its efforts to affect the RER. These are trade policies, exchange rate policies, policies towards capital movements (including reserve changes and foreign borrowing and assistance), and fiscal policies. A government alters the nominal rate in an effort to modify the real rate. However, as explained in Dervis *et al.* (1982), a given nominal devaluation is consistent with smaller, greater, or equivalent real devaluations, depending on the adjustment in the price of non-tradeable or home goods that result from the nominal devaluation. Labour is the single most important market determining this relationship between nominal and real devaluation, as wages are the principal determinants of changes in the prices of home goods. Variations in the capital account and fiscal and monetary variables all impinge on the final outcome. The RER also moves for autonomous reasons, such as the discovery of oil, or a drastic short-run shift in terms of trade such as a coffee boom.

Since most products in agriculture are tradeables, the main result of RER changes will be intersectoral resource flows (primarily of savings and labour), between agriculture and the other sectors; that is non-traded, non-agricultural sector and the protected tradeable goods sector in industry.

The analysis of trade and RER issues is best carried out with a desaggregated version of the RER, which allows one to focus on the relative prices between import-competing, non-traded goods, and exportables. Furthermore it is useful to divide an economy into six sub-sectors as illustrated in Table 1.

Table 1. *Division of an Economy*

	Non-agricultural	Agricultural
Importables	Most industrial products, final machinery, and intermediate products	Cereals, edible oil, oil, sugar
Exportables	Minerals, oil, textiles, some industrial products	Sugar, cotton, coffee, cereals, fruits, tea.
Home Goods and services	Communications, transportation, banking, housing and other construction, and public services.	Cassava, yams some varieties of beans

Because of the complexity of categorizing goods and producing the appropriate price indices, empirical analyses usually compare the RER in

other ways. For conceptualizing the impact of the RER on the economy, however, the domestic relative price interpretation is quite helpful. An attempt follows to sketch the impact of each of government's three tools on the RER.

Trade Policy and the Exchange Rate

Industrial protection helps industry at the expense of agriculture. This reality is usually ignored by the partial equilibrium view so common in justifying assistance to industry. However, a policy which protects industry raises the cost of importable inputs such as fertilizers, machinery, and other materials used by farmers. Indirectly, and possibly more importantly, the resulting changes in the RER could penalize producers in other import-competing industries, as well as the exportables sector. As domestic import prices increase in response to import restrictions, import demand declines and the 'surplus' generated in the trade account will require a lower RER to restore external equilibrium. Thus, the exchange rate of protection to industry is below the RER at lower levels of protection. How does this work?

Import restrictions are taxes. Whether direct such as tariffs, or indirect such as quotas, these taxes have the same effect: increasing the price of imported protected goods compared to the price of exportables, home good, and other importables. The question however, is who pays the tax?

Initially, the import tax is paid by direct consumers - farm and non-farm households alike. But eventually wages and prices of home goods are also driven up. The exportable sector is especially hard hit since exportables must be priced to compete on world markets; exporters therefore cannot raise prices to recoup the high costs of industrial protection. In most LDCs, these exporters are primarily farmers.

In addition to these cost pressures on the unprotected sectors, import restrictions cause prices of different goods and services to change in different ways. Protectionism increases the prices of industrial imports relative to exports, home goods, and other unprotected sectors. Theoretical and methodological advances in recent years have elucidated the nature of some of these relationships (Dornbusch 1974;Sjaastad 1980; and others). These different price changes can be measured, as can the resulting changes in output and demand.

A striking consequence of import price hikes in many countries is that the prices of home goods, which are closely related to wage levels, rise nearly as much as import prices, thus reducing 'true' protection. Export industries and unprotected sectors are even worse off. Empirical studies of the economies of Colombia, Uraguay, Argentina, Chile, Brazil, Nigeria, and Peru confirm that exporters in all these countries, and producers of import-competing foods in some of these countries, have paid at least half of the cost of industrialization programmes (Clements and Sjaastad, 1984; Valdes, 1985; Oyejide, 1986). Government policy controls nominal protection through commercial policy. But, the incidence of trade policy on resource allocation and income distribution will depend on 'true' and not

on nominal protection, and the two could be quite different. The true protection measures the changes in the price of the protected activity relative to the price of home goods and other tradeables. The discouragement to agricultural tradeables is usually across-the-board, affecting exportables as well as import-competing commodities, since agricultural imports are rarely protected. Moreover, this penalty cannot be reversed by nominal devaluation. Indeed, as long as industry is highly protected, agriculture will suffer the consequences of a lower RER.

In the case of export promotion policies, such as tax rebates, drawbacks, export credit subsidies, and direct subsidies on inputs, the equilibrium RER is reduced by permitting a higher level of exports. In most countries, however, agricultural exports have not received such export subsidies. Infact in some countries such as Argentina, agricultural exports were subject to export taxes. And, generally, input subsidies on exportables were small compared to import protection on industrial products.

Although large-scale trade liberalization efforts will help reduce the anti-export bias of previous policy through reductions in import tariffs and export taxes,trade liberalization per se does not guarantee an increase in the RER. This is because the accompanying macroeconomic policies could offset the increase in the RER resulting from lower import restrictions, and because a reduction of export taxes will tend to appreciate the RER.

Government Spending

Consider an economy facing continuous budget deficits, leading to a chronic balance-of-payments problem. If the foreign trade deficit is met mainly by foreign borrowing or assistance, the RER will drift to a level lower than what it would otherwise be. This would work against the entire tradeable component of agriculture, both exportable and importable. On the other hand, if the balance-of-payments problem is tackled by means of quantitative import restrictions or by explicit tariffs (rather than by devaluation), the consequence for the exportable sector of agriculture will be clearly adverse, while the favorable impact on agricultural import-competing components will depend on how these policies restrict farm imports.

The link between the RER and government spending goes beyond budget deficit problems. The distinction between real private and real government expenditure rests on the premise that the government's propensity to spend on home goods, particularly services, is likely to be higher than that of private agents, and that private agents react more to changes in relative prices and disposable income.

As argued by Rodriguez (1980), expansionary government spending raises the relative price of home goods, thereby reducing the RER.[3] This effect occurs regardless of whether the additional expenditure by the government is financed by domestic borrowing (thereby increasing interest rates and crowding out the private sector), by an 'inflation tax' which

results if financed by printing money, thus decreasing real balances of private agents), or by higher taxation. Thus, government expenditures can affect the level of private spending (and thereby the RER) through changes in interest rates, tax revenues, and/or through a transfer of income from private agents through the inflationary tax.

When increased government spending is financed through foreign borrowing, the effect is ambiguous. Some appreciation of the RER will occur as a result of the expansion in government expenditure on home goods, since no reduction is likely in private spending. A principal link between the RER and an expansionary fiscal policy has to do with the possible effects of such policy in raising the level of wages in the economy . The end result could be a squeeze in the profitability of producing tradeables (which at constant nominal exchange rates have exogenously determined prices) in contrast to non-tradeables whose price would rise. Thus, increases in government expenditure lower the RER, thereby lowering the relative profitability of producing tradeables. The lower RER then increases consumption of tradeables, thereby expanding imports and reducing the export surplus. The result in both cases is the imbalance in the current account often associated with increased government spending.[4]

Foreign Capital Movements

Capital movements can substantially influence the RER. A policy of heavy over-seas borrowing can lower the RER, as happened in Argentina and Chile in the late 1970s and early 1980s. Conversely, a policy of large overseas investments can raise the RER. The adverse effects of a booming export sector on the non-booming tradeable sectors can then be reduced by a conscious policy of foreign exchange sterilization, as was accomplished to some extent, by Indonesia . This might include the retirement of previously contracted foreign debts, a conscious policy of overseas investment, and accumulation of foreign exchange receipts by the central bank. These related issues are discussed in the next session. The connection between capital flows and the RER can be sketched as follows: for a given level of international reserves, equilibrium in the balance of payments requires a higher balance in the capital account which thereby lowers the balance in the current account. In other words, a larger net inflow of capital will induce a lower RER, reducing the surplus in the current account. This can be expressed in terms of the identity $(C/y) + (K/y) - (R/y) = 0$, , where C, K, R and y represent current account, capital account, a change in reserves, and total product, respectively.

Moreover, several adjustments must be made in the identity to consider the dynamic adjustments in capital flows, as shown by Edwards (1985). Over the long run, the balance in the capital account is a function of a 'desired' level of foreign indebtedness. If one is prepared to express numerically the 'desired' levels of international reserves and foreign debt, given an expected growth rate, the RER level becomes determinable as a function of these parameters.[5] The long-run 'desired' levels link together

the volume of capital flows controlled by private agents with capital controls, government foreign borrowing, domestic trade policy, and the level of international interest rates. Although these links are crucial since they impinge on RER movements from one equilibrium to another, they are, unfortunately, most difficult to quantify.

Export Booms and the Dutch Disease Phenomenon

Wide and unpredictable fluctuations in the terms of trade which influence macro-economic developments make it difficult to determine and maintain a RER consistent with long-term growth objectives and export diversification. Exogenous changes in export prices associated with a booming sector and the Dutch disease phenomenon fall into this general category. The large influx of foreign exchange resulting from high oil export prices in the 1970s into Nigeria and from high world prices of coffee into Columbia has been linked with a real appreciation of the exchange rate, which in turn affected the exchange rate applied to importables and to non-oil and and non-coffee exports. This occurs because the 'spending' effect of this additional income can raise the demand of both tradeables and non-tradeables, increasing the price of the latter. In addition, the 'resource movement ' effects of new revenues could induce higher employment in the booming sector and/or in government, moving labour from agriculture to work in the services and government sectors.[6] Thus, an export boom can result in a loss in competitiveness of non-oil or non-coffee tradeables, the extent of which would depend on the success of sterilization policies. The paradox is that even a promising development such as the discovery of petroleum resources or a sharp rise in world prices of certain exportables can have an adverse impact over a period of several years for the other tradeables, particularly in agriculture.

Recapitulation

So far, we have described the determinants of the equilibrium RER. In terms of RER management, what is needed is a measure of the difference between actual and 'equilibrium' prices of tradeables relative to non-tradeables in the absence of interventions for every year over the time period in question. We have learned that what is to be taken as exogenous to intervention is a question which should be addressed explicitly. While the RER adjustment calculation should be attempted, we know that dealing conceptually and quantitatively with normal issues such as the desired size of government expenditures, foreign capital flows, and trade interventions is an extremely complex matter.

An equilibrium RER represents that relative price of tradeables to non-tradeables which is consistent with a sustainable long-run equilibrium in a country's external account.[7] Black market exchange rates and short-run values are not necessarily good indicators of long-run disequilibrium in the RER. The success in equilibrating the current account over time is

affected by the desired rate of capital inflows in the private and public sectors, the desired rate of accumulation of foreign assets by domestic residents, a long-run desired level of protection, the desired size of the government sector, and the compatibility of the policies with full employment. Changes in the terms of trade are certain to impinge on the management of the RER. Attempts to estimate possible RER misalignment must, therefore, make judgments as to the desired level of protection, government expenditures, and openness of the trade and foreign capital account. In the next section, we review the methodology of estimating the RER and the effects of trade and macroeconomic policy and agriculture.

Methodology

There is no single method for estimating the degree of misalignment of the RER in a particular country and any such estimates should be considered approximate in their orders of magnitude. Since the empirical attempts to estimate a model of the determinants of the RER are plagued with measurement problems, one must resort to using proxies for several latent variables.

Let *Pa/Pna* measure the actual ratio of agricultural prices to nonagricultural prices at the official exchange rate, and let *pa*/Pna** measure what would have been the ratio in the absence of interventions, adjusting the exchange rate. Thus, the effect of both macroeconomic and agricultural policies on the domestic agricultural terms of trade can be expressed as:

$$(1) \quad \frac{Pa/Pa}{Pa^*/Pna^*} - 1$$

The term Pa^* is defined as $P_w^* E^*$, where P_w^* is the world price and E^* is the equilibrium exchange rate in the absence of government intervention. What is usually referred to as the price effect of agricultural price policy, resulting from agricultural trade restrictions and direct price controls, is captured by $(Pa - Pa^*_w Eo)$, where Eo represents the official exchange rate. [8] The Pna is a weighted average of the actual price index of non-agricultural goods and services, and includes the price indices of non-agricultural importables (Pm), exportables (Px), and home goods (Ph). The term Pna^* adjusts for policies in the non-agricultural sector, and the exchange rate adjustment applies to both Pa^* and Pna^*.

The computation of Pna^* can be broken down into two steps: adjusting for trade policy, and adjusting for the exchange rate. The effect of trade restriction can be captured by T, the uniform tariff equivalent, which represents the hypothetical value of a tariff which one would get by substituting a single measure for the prevailing structure of trade barriers on imports and exports, resulting in the same total volume but not composition of trade, without adjusting the nominal exchange rate or the price of home goods. This parameter can be decomposed into t_m and t_x, the tariff equivalent of import restrictions and

export restrictions, respectively. Empirical estimates of T are available for Argentina, Chile, and Peru for the 1960s and the 1970s. A second parameter, ω, represents the incidence parameter and captures the effect that changes in tariffs and/or subsidies) will have on the price of home goods. A technique for estimating ω is described in Valdes (1985). Available estimates of ω for Argentina, Chile, Colombia, Brazil, Peru, Uruguay, and Nigeria are between between 0.5 and 0.8, suggesting that exporters and producers of unprotected import-competing goods have been paying at least half of the cost of industrial protection programs (Clements and Sjaastad1984; Valdes, 1985). The rise in the price of home goods resulting from protection (measured by ω) lowers the 'true' price of exportables and unprotected importables relative to the price of home goods.

So far, the adjustments introduced above have dealt exclusively with corrections for trade policy. We can introduce adjustments for the effect of fiscal policies, monetary policies, and foreign capital flows on the RER. Let E^*/E stand for the exchange rate adjustment, with E^* and E representing the equilibrium and actual exchange rate, respectively. Then, both the direct and indirect adjustments in Pna* can be expressed as:

$$Pn^* = a_1 \frac{Pm}{(1+t_m)} \frac{E^*}{E} + a_2 \frac{Px}{(1-t_x)} \frac{E^*}{E} + a_3 \frac{Ph}{(1+T)^{\omega}}$$

in a situation with no direct taxes or subsidies. Economy-wide interventions can be summarized as the effect of *Pna* and the impact of E^*/E on *Pa*. That is represented by:

$$\frac{Pa/Pna}{\frac{E^*}{E} Pa/Pna^*} - 1 = \frac{\frac{1}{Pna}}{\frac{E^*}{E} \cdot \frac{1}{Pna^*}} - 1$$

Evidence on Agriculture's Terms of Trade

As theoretical developments in the area are rather recent, empirical results are scanty as yet. A large multi-country study on the Political Economy of Agricultural Pricing Policies funded by the World Bank will increase substantially the number of countries for results are available by mid-1989. At this point, some of the more interesting results are for Argentina, Chile, Nigeria, and Colombia. A summary is presented in Table 1.[9]

In Argentina, between 1960 and 1984, agricultural and economy-wide policies taxed wheat, beef, and corn production, as indicated by the negative signs in Table 1. This result could be anticipated given the existence of an explicit export tax on some agricultural exports (the highest of which were applied during years of high world prices such as 1974-75). Direct price

Table 1. *Average Annual Direct and Indirect Price Subsidies to Agricultural Producers*

ARGENTINA	(a) Direct Price and Interventions			(b) Total (Direct and Indirect) Interventions		
Years	Wheat	Beef	Corn	Wheat	Beef	corn
	(percent)			(percent)		
1960-65	-19.7	-35.3	-5.4	-41.6	-53.0	-31.1
1966-70	-12.3	-26.9	-13.7	-37.8	-47.7	-38.7
1971-75	-42.3	-28.8	-38.9	-55.8	-46.1	-53.7
1976-80	-22.6	-11.1	-22.4	-48.1	-39.7	-47.8
1981-84	-17.3	-13.8	-18.7	-46.5	-53.3	-47.7

CHILE	(a) Direct Price Interventions			(b) Total (Direct and Indirect) interventions		
Years	Wheat	Beef	Milk	Wheat	Beef	Milk
	(percent)					(percent)
1960-65	6.4	-13.0	212.5	-43.8	-53.7	-63.9
1966-70	5.3	-25.4	156.4	-32.9	-51.9	-6.8
1971-75	-29.6	-39.4	78.6	-61.4	-64.5	-4.8
1976-80	5.3	-16.6	112.8	9.9	-14.5	51.5

COLOMBIA	(a) Direct Price Interventions			(b) Total (Direct and Indirect) Interventions		
	Wheat	Cotton	Coffee	Wheat	Cotton	Coffee
	(percent)			(percent)		
1960-65	24.2	10.7	-18.0	11.6	-0.6	-10.1
1966-70	24.3	15.6	-34.6	9.7	1.9	-11.7
1971-75	-8.3	-0.1	-35.0	-16.1	-8.5	-8.5
1981-83	20.2	11.6	-34.3	1.3	-5.9	-15.6

NIGERIA	(a) Direct Price Interventions			(b) Total (Direct and Indirect) interventions		
Years	Cocoa	Groundnuts	Palm Kernel	Cocoa	Groundnuts	Palm Kernel
	(percent)			(percent)		
1979	-38.0	-1.0	3.0	-80.25	-36.75	-33.25
1980	-8.0	-11.0	-0.0	-50.25	-46.75	-36.25
1981	33.3	18.0	31.0	-9.25	-17.75	5.25

Source: Sturzenegger for Argentina Hurtado, Muchnik, and Valdes for Chile; Garcia and Montes for Colombia; and Oyejide for Nigeria.

interventions reduced the domestic price between 12 and 42 per cent for wheat, and between 11 and 35 per cent beef. Economy-wide interventions added a substantial amount to the total taxation on the production of these goods as shown in column (b) of Table 1. for example, during the period 1981-84, the effect of economy-wide price interventions added 29.2 and 39.5 per cent to the total tax on wheat and beef, respectively, over and above the direct taxation of 17.3 and 18.3 per cent. Of course, the reverse is true for domestic consumers in Argentina. As a result of direct taxation of exports, prices to domestic consumers during 1960-84 were subsidized between 12 and 42 per cent for wheat and 11 and 35 per cent for beef. Fiscal revenue objectives and cheap food policy for urban consumers were undoubtedly very strong economic and political forces behind the taxation of agricultural exports in Argentina.

The results for Chile indicate the strong effect of economy-wide policies on incentives to farmers. Beef producers were subject to both direct and indirect taxation throughout the period. On the other hand, wheat growers received slightly positive nominal protection (except during 1971-75, a period coinciding with two years of high world prices), and dairy farmers received a very substantial level of nominal protection during the entire period. Economy-wide intervention, however, substantially reduced the net level of protection to milk production (with a net effect of taxation in 1971-75). Never-theless, the dairy sector had a level of overall protection around 50 to 65 per cent throughout most of the period 1960-80. In contrast, for wheat the slightly positive direct protection was overwhelmed by substantial indirect taxation resulting in overall taxation during the period 1960-75. For beef production, economy-wide interventions added between 25 and 41 per cent between 1960 and 1975, yet had practically no effect during the period 1976-80.

In Colombia, coffee producers were taxed consistently throughout the 1960-83 period. However, part of this

export tax was applied to improve world coffee prices, as part of an international commodity agreement between large coffee exporters. How much was an 'optimum' export tax and how much was determined by fiscal revenue motives is unclear. Wheat, an importable, and cotton, an exportable, present the opposite case: substantial nominal protection for wheat production production (except 1971-75) and lower protection for cotton. Adjustment for economy-wide interventions reduces real protection substantially for wheat and cotton production. In fact, wheat was taxed between 1971-80, and cotton was taxed over the entire period except during 1966-70.

In Nigeria, a much shorter time series is available, although direct interventions have shifted dramatically during this time. Cocoa moves from a direct tax of 38 per cent in 1979 to a 33 per cent subsidy in 1981. The indirect effect, however, dominates the direct intervention as the total effect was a tax on exports throughout the period. The situation with groundnuts and palm kernel is similar, although the changes in direct taxes are less dramatic. It should be noted that the Oyejide's estimates of indirect effects are almost certainly underestimates as he does not attempt to include quantitative restrictions in his estimate of a uniform equivalent tariff (Oyejide 1986: 49).

As can be observed for Argentina, Chile, Columbia, and Nigeria, the effect on agriculture's relative prices attributable to economy-wide policies has been in most cases of larger magnitude than the effect of sectoral price policies. This measured economy-wide effect represents in essence the impact on the RER of the trade, fiscal, and monetary policies followed during this time.

So far, we have focused on the effects of economic policies on incentives for agriculture. These incentives are the signals to which economic agents can react. But do they react? Is the supply of total agricultural output 'responsive' to incentives in the long run? To this we turn next.

The Effects of Discrimination

Implicit in much of the literature on infant industry is that agriculture is destined for a static role technologically while industry is supposed to be dynamic. This reasoning suggests the idea that while individual crop output responds to price movements, the aggregate supply of agricultural products form the sector as a whole is quite unresponsive to incentives - the so-called (aggregate) supply inelasticity of agriculture. If that really is the case, then the 'social cost' of the indirect price effects measured above is low.

We challenge this assumption. Moreover, if we examine in particular the conventional arguments for the subsidization of infant industries, we can easily establish that they are as relevant for agriculture as much as in industry. [10] One expects the aggregate supply response to price movements to be lower than that of individual crop output, since the cost of switching resources between sectors required for significant aggregate supply response is

higher than it is for switching resources between crops. But favouring industry on the grounds that the price responsiveness of aggregate agricultural output is low is a mistake. [11]

The relationship between agriculture's aggregate supply response and incentives is quite complex and not yet fully understood. Empirical work on the long-run responsiveness of agriculture has recently begun defying the narrow approach taken in some much of past literature on supply response.

The long-run supply response is the sum of the short-run response (in which land, labour, and capital are fixed) and the effect of the price change on output via its impact on inter-sectoral reallocation and 'fixed' factors. Thus, the key distinction between short-term and long-term output response to prices relates to intersectoral flows of labour and capital, and on the relationship between incentives and new technology. As mentioned above, the real exchange rate is the determinant of these flows. The well-known 'distributed-lag' approach which dominated the supply-response literature in the 1960s and 1970s failed to capture the response of labour migration, investment in agriculture, and productivity changes to changes in the sector's terms of trade.

In the long run,the rate of labour migration depends on intersectoral differences in income. Influenced by real wage differentials between these sectors, labour will move from agriculture into non-agriculture. Unemployment in the urban sector will also affect migration.[12] A similar pattern is true for capital. Given a total level of investment for the whole economy, the sectoral allocation will be influenced by prospective returns to capital in each sector. Thus, the flows of both labour and capital from agriculture to non-agriculture should accelerate when prospective returns to these factors in the non-agricultural sector increase relative to those in agriculture.

The analysis of the relationship between prices and the generation and adoption of new technology in agriculture indicates that technical changes in agriculture (in the form of tubewells, fertilizer, electricity, equipment) usually require an increase in capital stock, and are subject to capital constraints. The adoption of the techniques therefore depends on the rate of capital accumulation and incentives (Mundlak, 1985).

Several recent works on aggregate agricultural supply response include a fuller specification of rural-urban linkages in the labour and capital markets. The results are beginning to challenge the pessimistic view of the supply response of the agricultural sector. Some of the best technical studies in this field are those by Cavallo and Mundlak on Argentina (1982), and Coeymans and Mundlak on Chile (forthcoming).

In their analysis for Argentina during the 1950-71 period, Cavallo and Mundlak consider two policies. One policy, trade liberalization, modelled the elimination of the tax on agricultural exports and the tariff on non-agricultural imports. Although the elimination of the export tax would have promoted agricultural output, the resulting decline in the RER diluted the

effect of the tax reduction and, combined with the elimination of import tariffs, decreased agricultural output, resulting in lower overall growth.

The other policy involved keeping the RER from falling in response to liberalized trade. Through fiscal and monetary policies within the simulation, the combination of liberalized trade and managed RER produced impressive increases in both agricultural and non-agricultural output per capita. But trade liberalization caused the price of food to increase more than non-agricultural wages. Thus, perhaps food subsidies should be considered as means to compensate wage earners for the improved economic environment for agriculture.

A follow-up study by Cavallo (1985) for Argentina, using Cavallo and Mundlak's dynamic general equilibrium approach with explicit modelling of agriculture, shows that agricultural output response to permanent changes in relative prices converges gradually to an elasticity close to 1.0. That is, a 10 per cent increase in relative agricultural prices generates a 10 per cent increase in aggregate output. Cavallo observes a very high elasticity of capital with respect to price (which reaches 2.3 after 20 years). Trade liberalization scenarios for Argentina show an impressive increase in capital utilization in agriculture . Despite a low labour response to price, and an elasticity of cultivated land to price of 0.4, the high response of capital and significant response of land results in a strong overall agricultural output response to relative prices in Argentina.

In the Chilean study, the economy is divided into five sectors linked by an input-output matrix for the period 1962-82. Coeymans and Mundlak show that a permanent increase of 10 per cent in agricultural prices relative to non-agriculture generates an increase in output of 20 per cent, implying a long-run elasticity of about 2.0.[13]

The potential impact of changes in economic incentives should not be viewed as a 'once and for all' impact. Consideration of the dynamics of the sectoral growth process indicates that this is a cumulative process, and one in which the output effect could be significantly greater than what might have been predicted by the agricultural price response analysis utilized during the 1960s and 1970s.

These values are not consistent with the unresponsiveness of agricultural output to prices presumed by the structuralist view of development economics. Rather, these results suggest that the costs of economic policies that discriminate against agriculture are high.

Policy Implications and Conclusions

The clear conclusion from the existing research is that agricultural price intervention is likely to be effective if seen in isolation from trade and macroeconomic policies. Although the realization is emerging that the macroeconomic setting has a special significance for agriculture, so far this setting has remained outside the scope of an appropriate strategy for agricultural development. In the past, empirical research on foreign trade regimes in developing economies has

generally emphasized the consequences for domestic industry, but with only slight and occasional emphasis on agriculture. This is curious given the economic importance of agriculture for most developing countries. On the other hand, agricultural economists have focused mainly on agricultural policies which impinge on resource reallocation within the sector. But agricultural growth is heavily influenced by resource flows between sectors. The flows are conditioned by returns in agriculture relative to returns in other sectors.

One clear conclusion of the arguments presented above is that the effects of trade and macroeconomic policy can dominate the effects of agricultural price policies. This occurs most often through the unintended effects that these policies have on the real exchange rate. This leads to the two important policy conclusions discussed in this section: the first best solution is a uniform structure of protection rather than a selective structure. If such a policy is not accepted and industry remains protected, it is vital that agriculture be compensated in some way.

A uniform tariff has several advantages. First, it is simple and it does not allow a large measure of discretion. The *ad hoc* discretionary, and often arbitrary nature of a selective system allow pressure groups to dominate in the process of adjustment of the 'optimum' tariff structure. This leads to a large degree of uncertainty about the long-term costs of international trade. But there is a second important argument in terms of effectiveness. Trade policy is basically a single tool, and is most effective for achieving a single objective; it is ineffective for dealing with multiple objectives. A selective trade regime is likely to lead to an actual system of protection which is not intended and seldom anticipated. For example, protection to close the balance-of-payments gap succeeds by introducing distortions in relative prices. A tariff structure to overcome the effect of distortion in the labour market could distort the allocation of capital. Discriminatory border regulations to reduce the domestic price of exportables to help poor consumers will harm farmers, many of whom are as poor or poorer than the urban consumers.

In addition to tariffs, government trade policy usually relies extensively on quantitative restrictions. Protection through a tariff system alone has many advantages. It is less discretionary, and the signals in the economic systems are much clearer. It is more realistic to expect that the economic agents will be able to understand and anticipate the domestic price effects of tariffs than of quantitative restrictions.

A simple way to achieve uniformity in the structure of protection is to adopt a uniform tariff on all imports, be they final consumer goods, raw materials, or intermediate inputs. Under such a rule, the ranking of protection by industries will be the same as the ranking of effective rate of protection on all import-competing activities. Differential sales tax can then be used to tax consumption, but without discrimination with respect to the source of supply. Under such a proposal, the question then becomes

that of finding the appropriate level of this uniform tariff.

Such a system does discriminate against exports. A uniform treatment of importable and exportable sectors would imply that roughly the entire revenue from import duties has to be used up in paying out export subsidies. Consequently, if the need for government revenue is quite strong, some net taxation of trade, implying a net discrimination against the export sector, appears unavoidable.

The first best solution, then, is for import tariffs to be uniform across commodities; and, in order to minimize the impact through the exchange-rate effect on the exportable sector (which in many countries would mainly agriculture), the level of the import tariff should be as is needed for revenue.[14]

If this first-best policy to remove protection to industry is not considered feasible, a second-best approach would be a form of tariff compensation assistance to rural producers of tradeables. [15] This is particularly important in order to encourage the development of non-traditional agricultural exports.

Since non-traditional exports usually have a high supply elasticity, a small tax on trade can effect their volume and growth. As argued by Garcia for Colombia, protection increased the dependence of foreign exchange earnings in Colombia on a reduced number of primary products in which the country has a strong comparative advantage but low supply elasticity. To diversify and promote non-traditional exports, it is necessary to reduce trade barriers against imports. If only the industrial sector is protected from import competition, which is usually the case in developing countries, much of the lost output from this trade regime will fall on non-traditional agricultural exports.

Thus, the studies reported on this paper suggest that agriculture can be a dynamic sector, the source of a diversified export base, if the policy discrimination which it usually suffers is reversed. Agricultural price policies, however, generally have a smaller effect on the relative prices facing the sector than the unintended, indirect effects of trade and macroeconomic policies. Nominal devaluations alone will not solve the problem as the real exchange rate is also affected by fiscal deficits, capital movements, and trade restrictions. A movement to a uniform structure of protection would be a major step forward in assisting agricultural growth. In absence of such trade reforms, some sort of general export subsidy will be necessary if exports are to diversify and the country is to become more self-reliant.

Notes

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1. In this paper we emphasize the domestic relative price interpretation of the RER. The RER can also be interpreted as the price at

which the demand and supply of foreign exchange are in balance, or the real price of foreign currency in units of domestic currency. For empirical applications, the RER can be measured as the nominal exchange rate divided by the domestic CPI multiplied by a dollar deflator.

2. In addition to articles cited later in this paper, the exceptions include Killick (1985).
3. Of course, specific government invest-ments such as investments in transport and communications infrastructure can lower the cost of foreign trade and thus stimulate the tradeables sector. General increases in government expenditure, however, have the effect described.
4. Dornbusch argued the existence of two fiscal budget-related factors which often induce a lag in a real depreciation of the exchange rate. First, a devaluation raises the budgetary cost of servicing the public foreign debt; second, as a result of foreign exchange rate guarantee. Thus, in a situation of public foreign debt and central bank exchange rate guarantees, there is a tendency to overvalue as a means of avoiding increasing the fiscal deficit.
5. This is a difficult task since a country's desired ratios of both international reserves and debt to income are not necessarily constant through time, and are themselves functions of risk evaluations by foreign lenders
6. A Dutch Disease type of model is formally discussed in Corden and Neary (1982). An application to the non-coffee sector in Columbia is found in Edwards (1985*b*).
7. That is, when income equals expenditure and both traded and home goods markets are in equilibrium. A good presentation on the concept of the equilibrium RER is found in Edwards (1985a). If we are interested in real factors, assuming equilibrium in the monetary sector, long-run equilibrium in the external accounts implies compatibility with long-run equilibrium in the home goods market.
8. Pa/Pa^* is equivalent to the so-called nominal protection coefficient (NPC), adjusted for the exchange rate, and where we abstract from differential rates of protection on intermediate inputs. In contrast, NPC at the official exchange rate is a simpler concept, usually utilized in the day-to-day policy debate, and supported by numerous empirical estimates. Adjustments for exchange rate on Pa^* unfortunately complicate our life, but it is essential in most cases.
9. The results reported to date have adjusted the nominal protection coefficient for trade and exchange rate policies. No one at this point has undertaken the difficult task of computing an effective rate of protection adjusted for these policies. Such a computation based on value-added would be quite interesting.
10. One of the arguments is that infant industries are unable to obtain risk-capital on account of the greater

uncertainties and, therefore, have to be artificially provided an assured market by governmental measures such as protection and subsidies. In addition, there is the question of externalities which were thought to be more acute in industry than in agriculture. Both apply equally well in agriculture (Valdes and Siamwalla 1984). See Mellor (1986) for the supporting argument that discrimination against agriculture leads to development based on capital intensive inputs.

11. There are, of course, other possible arguments for taxing agriculture. There are essentially two: trade to help finance government, and the distributive argument in terms of cheap food policy and presumed lower demand for labour.
12. That is, adjusted for differences in cost of living, and for determinant in the productive capacity such as age and education.
13. These values are consistent with estimates of the aggregate long-run supply elasticity for agriculture for the U.S. made by Griliches (1959) where he obtained value of about 1.2, and Tweeten and Quance (1969) who obtained values of about 1.5; for Australia, Pandey (1982) obtained values close to 1.0.
14. We are abstracting from the admittedly large problems of transition. Clearly, any country contemplating such reforms should study the potential impact ahead of time and consider assistance to those who are most severely affected to adjust to the new trade regime.
15. This was, for example, the case in Australia, in debate articulated initially by Gruen. The argument of tariff compensation is implicit behind various forms of assistance to agriculture, such as subsidies on inputs and price supports.

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Potential Effects of Privatization on Economic Growth: The Nigerian Case

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Abstract

This paper estimates the impact of a very popular, if not the most popular, form of privatization, namely divestiture through the sale of public assets, on economic growth. It constructs a model using the neo-classical growth model as a basis, and estimates this model using Nigerian data. The result shows that the GDP depends on private and public investment expenditures, the structure of capital stock by sector, and the GDP lagged one period. Moreover, private investment has a greater influence on the GDP than public investment, and the ratio of public capital stock to private capital stock has a negative influence. One can then infer that privatization has the potential of enhacing growth. However, certain measures such as regulatory reforms should be taken so as to realise this benefit.

Introduction

An important feature of the 1980s is the burst of interest in privatization the world over. Privatization, according to Hemming and Mansoor (1988: 31), is 'the transfer of public sector activities to the private sector', and it can take several forms (Berg 1987, Fitch 1988 and Shirley 1988), including deregulation, contracting out activities that were previously done by the public sector, and privatization of management of public sector activities through contracts and leases. Another form of privatization, which has attracted the greatest attention, is divestiture. The government can divest in several ways, namely, through sale of public sector assets, i.e. transfer of ownership of public enterprises to the private sector, load shedding whereby a public enterprise abandons some of its activities, and outright liquidation.

There are several possible motives for privatization (Waters 1987, Hanke 1988, and Hemming and Mansoori 1987). First, we have pressures of fiscal and monetary constraints which can motivate a government to adopt privatization as a way of dispensing with poorly run and budget sapping public enterprises. They can also make external bodies such as the World Bank and the Internation Monetary Fund to compel a country, particularly a debt-ridden one, to adopt privatization as an instrument of adjustment policies (e.g. debt conversion and reduction in government expenditure) before obtaining further financial assistance. Secondly, privatization can be used to broaden share ownership and, therefore, to build a constituency of

political support. Thirdly, it can be used to create a flexible economic environment that will foster the necessary adjustment when an economy is exposed to shock. The other possible motives for privatization include the need to reduce or eliminate union power in public markets. Perhaps the most important and most common motive for privatization, however, is to improve economic efficiency, both productive and allocative and, therefore, economic growth.

Whether privatization will actually improve economic efficiency and therefore, economic growth depends largely upon the net benefit of public ownership vis-a-vis that of private ownership. This is tantamount to comparing the sum of the absolute values of the gains of private ownership (e.g. employment) and the cost of private ownership (e.g. monopolistic practices). Public enterprises are known to pursue objectives and engaged in activities which the free market would ignore completely, and they also cater for activities which the free market would ignore completely; further, they cater for activities which suffer from partial market failures such as private monopoly and externalities (Musgrave and Musgrave 1976, Prest and Barr 1979: 21-24). But these enterprises tend to suffer from political pressures, bureaucratic failure and lack of financial discipline imposed in the private sector, all of which lead to poor performance, in terms of both output and finance. On the other hand, private ownership tends to be more conducive to competition and financial discipline, both leading to economic efficiency, but this competition is very unlikely to be perfect in that there would be private monopoly, public and merit goods, externalities and information problems (Layard and Walters 1978: 22-25). The degree of these areas of market failure depends on a number of factors including the nature of the private sector and government regulations. Overall then, the issue is whether a defective competitive market is superior in terms of its ability to promote economic growth, to public ownership which takes care of social objectives but faces political pressures and bureaucratic failure, and lacks financial discipline.

The experiences of many countries, particularly those of LDCs in the last three decades show that public ownership is not a panacea to the problem of economic growth, contrary to what many of them assumed when they embarked upon a process of nationalization (Aylen 1987: 69). It is not, however, proven that private ownership could have done better in the circumstances these countries found themselves. Nor is one now sure, on the basis of *a priori* reasoning, that private ownership will now guarantee economic efficiency and growth even if we assume away problems which are normally associated with the implementation of a programme of privatization. This is why we find it necessary to construct and estimate a model which will tell us more accurately the impact that privatization would have on economic growth. The purpose of this study is to do just that, but the scope is limited to divestiture through the sale of public assets, and estimation is done using Nigerian data.

It must be stressed that the impact of privatization on economic growth dealt with in this paper is potential, for two reasons. First, the data used for the estimation of our model do not really cover the implementation stage of the privatization policy, particularly divestiture through sale of public assets. Secondly, the success of a privatization programme depends on a number of factors such as the institutional framework under which implementation takes place and preparation of the enterprises to be privatized; consequently, a lot depends on the accompanying policies and actions of the government.

Privatization in Nigeria

Soon after Nigeria attained independence in 1960, the privatization policy was incorporated in the *National Development Plan, 1962-68* and adopted as an integral part of the strategy of economic development. The various governments (federal and regional) were supposed to use public enterprises for pioneering activities and for investment in basic industries where the private investor was unwilling or unable to invest sufficiently: and then transfer them to the private sector at a suitable opportunity once the enterprises had been launched successfully so as to free funds for new activities. According to the Federal Government:

Although Governments do not wish to build up substantial government-owned sectors, they will not refrain from substantial investment in any sector where necessary or where private capital is not forthcoming in sufficient quantity. In such cases, attention will be paid to the desirability of disposing of such investment to Nigerians at a suitable opportunity so as to free funds for further investment (Federation of Nigeria; 1962, p. 360).

The same idea was restated on pages 359 and 362 of the same document and it has been analysed in detail by Ajakaiye (1988).

The privatization policy was not implemented before the *Second National Development Plan, 1970-74* was launched which plan even marked a change away from the planned divestiture. According to the government:

The view has often been expressed that the interests acquired by Government in industry should be handed over to indigenous businessmen if and when they have the capital and business know-how for operating these particular industries. This view flows from the narrow conception of the role of government in national development which is not tenable in Nigerian circumstances . . . Government investment activities will no longer be limited to public corporations and 'dying industries' in which no private company can thrive, whilst leaving the virile, expansive and profitable industries to private enterprises (Federal Republic of Nigeria: 1970, p. 289).

The emphasis was changed to joint participation. According to the government:

As a matter of general policy, the Government will encourage nation-wide equity participation in all manufacturing industries. Shares will be allocated to the Federal Government, the State in which a particular industry is located, other states and to Nigerian nationals

willing to participate in industrial development (Federal Republic of Nigeria; 1970, p. 145).

In short, the privatization policy of the early 1960s in the form of divesture of government activities, to allow for expansion in new activities, was abandoned. However, there was privatization in other areas, particularly contracting-out, outright liquidation and management franchise. For example, the Nigeria National Supply Company and all Commodity Boards were dissolved; the Nigeria Airways and the Nigeria Railway Corporation had their management contracted-out to the Dutch Airlines and RITE of India, respectively (Umoh 1988: 10-11).

The current privatization programme is an integral part of the Structural Adjustment Programme (SAP) which was introduced by the Federal Government in July of 1986, following the poor performance of the of the economy, including problems of debt servicing, inorder to promote non-inflationary economic growth, diversify the productive base of the economy away from oil, and to correct the disharmony between the demand profile and domestic production. It also sought to achieve fiscal and balance-of-payments viability and to eliminate the dominance of unproductive investments in the public sector (Federal Republic of Nigeria 1986: 8). The policy package itself has many constituents, but the major ones are the adoption of a flexible exchange rate system; debt management policies such as debt capitalization and controls on new foreign loans; a programme of rural transformation, export promotion policy; and privatization (including commercialization) of public enterprises.

The privatization policy places emphasis on both deregulation (including commercia-lization) and divestiture. For reasons stated in earlier we focus on the latter. The privatization policy in the form of divestiture was endorsed in December of 1986, decreed in July of 1987 and commenced operation in January, 1989. It covers 92 companies, 67 of which are to be fully privatized, while the remaining 25 are only to be partially privatized. They include hotels, insurance companies, oil marketing companies, steel rolling mills, paper mills and cement companies, but exclude commercial and merchant banks and motor vehicle and truck assembly plants, all of which are at present jointly owned by the private and public sectors.

Turning to the motives for privatization in Nigeria, we find that because SAP is an adjustment package, and privatization is an integral part of it, privatization is an instrument of adjustment policies which, according to the SAP document, is 'to lessen the dominance of unproductive investments in the public sector, improve the sector's efficiency and intensify the growth potential of the private sector' (Federal Government of Nigeria 1986: 8). The Federal Government has consistently maintained that SAP, privatization included, has not been imposed by the World Bank or the IMF, or any other external agency. So we assume that the motives for privatization were set by the government.

The Model

We start with the neo-classical production function with two factors, namely, capital stock *(K)* and labour *(L)*. Capital stock is disaggregated into two, namely public stock *(Kp)* and private capital stock *(Kg)*. We also assume that there is technical progress which is manifested in factors becoming more effective over time (i.e it is factor augmenting), and is assumed to go on at constant exponential rates. All of these put together yield the following production function:

$$(1) \qquad Y = F[e^{a1t} Kp, e^{a2t} Kg, e^{a3t} L]$$

where Y is the national income and a_1, a_2 and a_3 are the rates of factor augmentation.

Following the same procedure for the derivation of neo-classical growth model (Solow 1956 and Atkinson and Stiglitz 1980, Lecture 8), by differentiating (1) with test to time, we have:

$$(2 \ \& \ 3) \qquad \frac{\dot{Y}}{Y} = \frac{F_{kp}K_p}{Y}\left[\frac{\dot{K}_p + a_1}{K_p}\right] + \frac{F_{kg}K_p}{Y}\left[\frac{\dot{K}_g + a_2}{K_g}\right] + \frac{F_L L}{Y}\left[\frac{\dot{L}}{L + a_3}\right]$$

$$= (a_1\alpha_1 + a_2\alpha_2 + a_3\alpha_3) + \alpha_1 \frac{\dot{K}_p}{K_p} + \alpha_2 \frac{\dot{K}_g}{K_g} + \alpha_3 \frac{\dot{L}}{L}$$

where the αs are the shares of factors in total output, and a dot on a variable indicates the time rate of change of that variable. If we now assume that labour supply is exogenously determined and grows exponentially at rate n (i.e $\frac{\dot{L}}{L} = n$) then

$$(4) \qquad \frac{\dot{Y}}{Y} = \alpha_o + \alpha_1 \frac{\dot{K}_P}{K_P} + \alpha \frac{2\dot{K}_g}{K_g}$$

$$= \alpha_o + \alpha_1 \frac{I_P}{K_P} + \alpha_2 \frac{I_g}{K_g}$$

where Ip and Ig are private and public investment expenditures respectively, and $\alpha_O = a_1\alpha_1 + a_2\alpha_2 + a_3\alpha_3 + n\alpha_3$. This equation relates the growth rate of the national income to the growth rates of capital in the private and public sectors. It is still not, however, in a form suitable for the analysis of the impact of privatization on the growth rate of the economy. This implies that we need to make some transformations. Noting that $Y = Y_t - Y_{t-1}$ and rearranging (4), we have

$$(5) \qquad (1-\alpha o)\ Y = \alpha 1 Y \frac{I_P}{K_P} + \alpha 2 Y \frac{I_g}{K_{Pg}} + Y_{t-1}$$

$$(6) \qquad \Rightarrow Y = \alpha_a{}^1 Y \frac{I_P}{K_P} + \alpha 2^1\, Y \frac{I_g}{K_g} + \alpha 3^1\, Y_{t-1}$$

where $a_1{}^1 = \frac{\alpha_1}{1-\alpha_0}$, $a_2{}^1 = \frac{\alpha_2}{1-\alpha_0}$

and $a_3{}^1 = \frac{\alpha_1}{1-\alpha_0}$,

If we assume constant returns to scale, we can write equation(1) in the intensive form as:

$$(7)\quad Y = e^{a1t} K_P F\left[\frac{e^{a2t}K_g}{e^{a1t}K_P}, \frac{e^{a3t}L}{e^{a1t}K_P}\right]$$

or(8)

$$Y = e^{a2t} K_g F\left[\frac{e^{a1t}K_P}{e^{a2t}K_g}, \frac{e^{a3t}L}{e^{a2t}K_g}\right]$$

Substituting (7) and (8) into the right hand side of (6), we have

(9)

$$Y = \alpha_1{}^1\frac{I_P}{K_P} e^{a1t} K_P F\left[\frac{e^{a2t}K_g}{e^{a1t}K_P}, \frac{e^{a3t}L}{e^{a1t}K_P}\right] +$$

$$\alpha_2{}^1 \frac{I_g}{K_g} e^{a2t} K_g F\left[\frac{e^{a1t}K_P}{e^{a2t}K_g}, \frac{e^{a3t}L}{e^{a2t}K_g}\right] + \alpha_3{}^1 Y_{t-1}$$

$$\alpha_1{}^1 I_P\ e^{a1t}\ F\left[\frac{e^{a2t}K_g}{e^{a1t}K_P}, \frac{e^{a3t}L}{e^{a1t}K_P}\right] +$$

$$\alpha_2{}^1 I_g\ e^{a2t}\ F\left[\frac{e^{a1t}K_P}{e^{2t}K_g}, \frac{e^{a3t}L}{e^{a2t}K_g}\right] + \alpha_3{}^1 Y_{t-1}$$

We can infer that:

(10)

$$Y = Y\left(I_p, I_g, \frac{K_g}{L}, \frac{K_p}{L}, \frac{K_g}{L}, Y_{t-1}\right)$$

The mathematical form of this equation was decided empirically. The log-linear function performed best; consequently, our estimating equation is of the form:

(11)

$$\ln Y = b_0 + b_1 \ln I_p + b_2 \ln I_g + b_3 \ln \frac{K_g}{K_p} + b_4 \ln \frac{K_p}{L} + b_5 \ln \frac{K_g}{L} + b_6 \ln Y_{-1}$$

where Y, the national income, is measured by the gross domestic product (GDP).

Four observations are noteworthy at this stage. First, it is not always expedient to make the growth rate of the GDP, i.e. $Y = Y_t - Y_{t-1}$, the dependent variable. Equation (11) shows that this will be correct if b_6 approximates to unity, which is not the case as shown under estimation method. Secondly, this equation states that the GDP depends on private and public sectors, the ratio of capital stock in each sector to aggregate employment and the GDP lagged one period. It is particularly noteworthy that the capital-labour ratio in each sector does not feature in the equation. This is true even if we disaggregate labour by sector. Turning to equation (1), our production function would have been:

(12)

$$Y = F[e^{a1t}K_p, e^{a2t}K_g, e^{a3t}L_p, e^{a4t}L_g]$$

where L_p and L_g refer to employment in the private and public sectors,

respectively. Equations (7) and (8) would then have been:

(13)

$$Y = e^{a1t}K_p\, F\left[\frac{e^{a2t}K_g}{e^{1t}K_p}, \frac{e^{a3t}L_P}{e^{1t}K_p}, \frac{e^{a4t}L_g}{e^{1t}K_g}\right]$$

(14)

$$Y = e^{a2t}K_g\, F\left[\frac{e^{a1t}K_p}{e^{2t}K_g}, \frac{e^{a3t}L_P}{e^{2t}K_g}, \frac{e^{a4t}L_g}{e^{2t}K_g}\right]$$

Equation (9) would then have been

(15 & 16)

$$Y = \alpha_1{}^1\, I_p e^{a1t}\, F\left[\frac{e^{a2t}K_g}{e^{2t}K_p}, \frac{e^{a3t}L_P}{e^{1t}K_p}, \frac{e^{a4t}L_g}{e^{2t}K_p}\right] +$$

$$\alpha_2{}^1\, I_g e^{a2t}\, F\left[\frac{e^{a1t}K_p}{e^{2t}K_g}, \frac{e^{a3t}L_P}{e^{2t}K_g}, \frac{e^{a4t}L_g}{e^{2t}K_g}\right] +$$

$$\alpha_3{}^1\, Y_{t1}$$

$$= \alpha_1{}^1\, I_p e^{a1t}\, F\left[\frac{e^{a2t}K_g}{e^{1t}K_p}, \frac{e^{a3t}L_P}{e^{1t}K_p}, \frac{e^{a4t}(L-L_g)}{e^{1t}K_p}\right] +$$

$$= \alpha_2{}^1\, I_g e^{a2t} F\left[\frac{e^{a1t}K_p}{e^{2t}K_g}, \frac{e^{a3t}(L-L_g)}{e^{2t}K_g}, \frac{e^{a4t}L_g}{e^{a2t}K_g}\right] + \alpha_3{}^1\, Y_{t-1}$$

It is clear that both $\frac{L_p}{K_p}$ and $\frac{L_g}{K_g}$ appear twice in an offsetting manner, leaving $\frac{K_p}{L}$ and $\frac{K_g}{L}$, as in equation (10).

Thirdly, we have no reason to believe that b_4 and b_5 in equation (11) will be equal. It is possible, however, for both of these parameters to be statistically insignificant, in which case, we can restrict them. We can also restrict b_1 and b_2 to check for their equality. Finally, from (11), we can trace the impact of the type of privatization being considered in this paper, i.e. divestiture through the sale of public assets, on the GDP through a decrease in I_g coupled with the same increase in I_p; a decrease in $\frac{K_g}{K_p}$ whichreflects the changing structure of capital stock by sector; and a decrease in $\frac{K_g}{L}$ coupled by the same increase in $\frac{K_p}{L}$ The last of these channels will not be valid if the parameters of $\frac{K_p}{L}$ are restricted. If privatization is going to promote economic growth, we should expect $b_1 > b_2 > b_3 < 0$; and, in the unrestricted case, $b_4 > b_5 > 0$.

Estimation Method

The estimating equations have been stated in equation (11) above. The next step is to identify an appropriate method of estimation. The ordinary least squares method is not appropriate for our model mainly because we have reason to believe that the GDP, which is our dependent variable, can influence all but one of the independent variables,

implying that these variables cannot be regarded as truly exogenous. For instance, we expect an increase in GDP to influence the structure of capital stock by sector (e.g. K_g/K_p), following Wagner's law of increasing state activity (Brown and Jackson 1982: 96) and the capital-labour ratio. The only variable which is predetermined is the GDP lagged one period.

We then adopted the two-stage least square (2SLS) method partly because of the presence of stochastic regressors and partly because of the possibility of overidentification of the model. Each equation was tested for autocorrelation. Equations with autocorrelated errors were re-estimated using the method of autoregressive 2SLS. And equations with restricted parameters were estimated using the method of restricted 2SLS or restricted autoregressive 2SLS depending on whether there is autocorrelation or not (Godfrey 1974).

Various tests were carried out to evaluate each regression for acceptability. They include test of significance of the coefficient using F-statistic; test of goodness of fit (R^2), and autocorrelation test using the Durbin h-statistic. The h-statistic is preferred to the *d*-statistic because of the presence of lagged endogenous dependent variable among the list of regressors (Johnstone: 1972: 313), and is tested as a standard normal variate. In cases where *h* is undefined, the likelihood ratio test (*p*) is used. The appropriateness of restrictions on parameters is tested using the *t*-statistic (Desai1977: p. 62) or the *F*-statistic (Koutsoyiannis 1977: 170-172).

We also tested for economic meaningfulness, particularly in terms of the signs of the parameters. As stated in the preceding section, we expect all the parameters, except that of K_g/K_p to be positive. Once the signs are correct, the relative magnitudes of relevant parameters, those of I_p and I_g, and of K_p/L and K_g/L, would inform us whether privatization would have a positive impact on economic growth or not.

Time series data for the period 1960 to 1986, the latest year for which reliable data are available, were used to estimate the regressions. They were obtained from several sources, namely (1) Central Bank of Nigeria, *Annual Report and Statement of Accounts* (various issues) and *Economic and Financial Review* (various issues) (2) Federal Office of Statistics, *Annual Abstract of Statistics,* (various issues) *Digest of Statistics* (various issues) and *Economic and Social Statistics Bulletin,* various issues; and (3) IMF, *International Financial Statistics* (various issues).

It should be noted that all values are expressed in real terms at 1962 prices.

Empirical Results

Our best estimated results are presented in Table 1 which contains six estimated equations. The basic difference in specification among the first five of these equations lies in the treatment of the capital-labour ratio. The first equation includes both K_p/L and K_g/L; the second one excludes K_p/L; the third one excludes both K_g/L, the fourth one restricts the parameters

attached to K_p/L and K_g/L in equation (1a) by combining these explanatory variables, while the fifth one does not include any capital- labour ratio at all. In spite of the various treatment given to it, the captal-labour ratio is not significant in any of the equations in which. Partly because of this and partly because of the relative values of the various test statistics, equation (5*a*) is preferred to equations (1*a*) to (4*a*).

Equation (6*a*) is an attempt to improve upon equation (5*a*) by restricting the parameters of I_p and I_g for the purpose of testing whether they are equal or not. Although both equations perform well, judging by the criteria stated in the preceding section, the restriction is not valid. The calculated X^2 is 8.14 vis-a-vis the theoretical value of 3.841 at 1 d.f., implying that the parameter attached to *Ip* is significantly greater than that attached to *Ig*. Equation (5*a*) is, therefore, the best estimated regression in the table.

Before passing comments on this equation in particular, it is probably worthwhile to pass some general comments on on all the equations. First, the parameters have the right signs in all the equations: a positive sign for each one except K_g/K_p, which is in conformity with our expectations. Secondly, all the equations show that *Ip* has a greater influence on the GDP than *Ig*: and equation (1*a*) shows that although both K_p/L and K_g/L are insignificant at 10.0 per cent level of significance, but it is significantly less than unity, which confirms our view stated in earlier, that it is not always expedient to make the growth rate of national income the dependent variable. Turning to equation (5*a*), we find that divestiture through the sale of public assets affects the GDP in two major ways. First, we have the flow affect arising from the fact that the private sector is investing while the public sector is divesting; and because private investment has a greater impact on the GDP than public investment (0.11578 vis-a-vis 0.11277), the net impact is positive. Secondly, we have the stock effect arising from the fact that there is now a change in the capital structure in favour of the private sector. In the equation, K_g/K_p will decrease and the absolute value of its coefficient (i.e. 0.25026) will then measure the impact on the GDP. Since both effects are positive, the potential impact of privatization on economic growth is positive.

Whether this potential benefit is realized depends on a number of factors (Hanke 1988, Usman 1987). These factors include the following: First, there must be clearly defined objectives and the political environment must be sufficiently stable to ensure that these objectives are in force for a reasonable length of time. Secondly, the public enterprises to be privatized must be prepared, (e.g. by investing in them) to make them attractive to the private market. Thirdly, there should be an effective timetable for implementation, starting with public enterprises that minimize difficulties and guarantee success to enhance public response and to ensure that the government gets value for money without crowding out the private sector for access to investible resources.

Table 1 : Empirical Results

	Explanatory Variables								
Equation	Constant	I_p	I_g	K_g/K_p	K_p/L	K_g/L	K/L	Y_{-1}	h,F & R^2
1a	3.99393	0.12749	0.12350	-0.24535	0.01193	0.00464		0.3339	h- = 1.021
	(2.738)	(1.869)	(2.503)	(-1.963)	(0.086)	(0.038)		(1.389)	R^2 = 0.97652
2a									h = 0.895
	.4.00869	0.12647	0.11376	-0.23732		0.01466		0.33117	R^2 = 0.97641
	(2.832)	(1.932)	(2.579)	(-2.927)		(0.423)		(1.423)	F = 165.56
3a									h = 0.856
	4.00868	0.12646	0.11377	-0.25199	0.01467			0.33116	R^2 = 0.97641
	(2.831)	(1.930)	(2.580)	(-3.350)	(0.425)			(1.422)	F = 165.57
4a									h = 0.872
	4.01606	0.12661	0.11372	-0.24649		0.01479	0.33142		R^2 = 0.97641
	(2.845)	(1.931)	(2.578)	(-3.259)		(0.424)	(1.424)		F = 165.58
5a									h = 0.734
	4.12623	0.11578	0.11277	-0.25026				0.31777	R^2 = 0.9762
	(3.033)	(1.995)	(2.658)	(-3.380)				(1.406)	F = 215.33
6a									h = 0.738
	4.11034	0.11445		-0.24981				0.31688	R^2 = 0.96928
	(2.906)	(3.1)		(-3.291)				(1.485)	F = 153.77

Source: Author's computation

Note: t values in parentheses. The critical claue of t at 95.0 per cent confidenelevel is ±2.086 for equation (1a), ±2.080 for equations (2a) - (4a), ±2.074 for equation (5a) and +2.069 for equation (6a). The corresponding critical values of F are 2.60, 2.68, 2.82 and 3.03 respectively. The critical value of h at the same level of significance is ±1.645.

Fourthly, the government must properly handle the problems that will be created by the privatization exercise. One of the major problem areas is the loss in welfare to those who are currently benefiting from the public enterprises to be privatized. This can take several forms including loss of jobs and suspension of privileges. In order to avoid concentrated opposition, the government should adopt strategies that would minimize losses in welfare to those who will lose as a result of privatization. Finally, we have reforms in the regulatory environment. These should cover not only the private sector, including the financial

institutions, but also the public sector so as to make remaining public enterprises more efficient.

Conclusion and Recommendations

Our estimating equations state the relationship between the GDP on the one hand and public and private investment expenditures, the ratio of public sector capital stock to private capital stock, the capital-labour ratio (variously defined), and the GDP lagged one period, on the other. Our estimated results shows that private investment has a greater influence on the GDP than public investment, the ratio of public sector capital stock to private capital stock has a negative influence, the capital-labour ratio is not significant, while the GDP lagged one period has a positive influence but its parameter is less than unity. We can, therefore, infer that privatization in the form of divestiture through the sale of public assets has the potential of enhancing economic growth because private investment is more productive than public investment, and because there is a change in the capital structure in favour of the private sector.

This result coupled with our brief discussion of the factors for successful privatization lead to the following recommendations:

1. If the objective is to promote economic growth, privatization is a potentially viable policy and it should be pursed;
2. It is necessary, however, to adopt certain measures to enable the realisation of this benefit, including:
   (a) preparation of the enterprises to be privatized for the purpose of making them attractive to private investors,
   (b) drawing of an effective timetable,
   (c) a fair distribution of the gains and burden of privatization, and
   (d) reforms in the regulatory environment.

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