Journal of
Agricultural, Food, and Environmental Sciences ISSN 1934-7235
Volume 2, Issue 1, 2008

A Model of Maximization of Rural Household Income and Minimization of Poverty in Africa

Daniel K Song'ony, Professor of Economics, MidAmerica Nazarene University,
dksongony@mnu.edu

Abstract

This study on poverty was analyzed using an econometric model emphasizing the size of agricultural production and the level of prices act as the determinants of the population living below the poverty line. The study outlines the role of international and domestic terms of trade, the size of agricultural production influencing the incidence of poverty in Kenya, and argues the major determinants of Kenyan rural poverty are the size of overall agricultural tradable commodities relative to prices of imports, and the domestic producer price of food and export crops. The study illustrates that given international and domestic prices, technological change in agriculture is fundamental to the achievement of overall agricultural growth as well as the alleviation of poverty and that the pattern of public investments is critical in influencing the rate of technical change.

Introduction - Scope, Definition and Determination of Poverty Line

In Kenya, past and present studies have concluded that the majority of the total population lives below the defined poverty line. These studies on poverty analyzed the extent, its magnitude and gave the definition of what constitutes poverty in the Kenyan context without explaining its cause. Therefore, the objective of this study is to investigate the causes of poverty. Various data on poverty and income distribution in Kenya by Ghai, Godfrey and Lisk (1979), Livingstone (1981), Collier and Lal (1981), Greer and Thorbecke (1983), Hunt (1984) and the Central Bureau of Statistics Small Farm Integrated Rural Survey (IRS, 1994) were reviewed. All these studies concluded that nearly 60% of the rural population in Kenya was living below the defined poverty line. In defining poverty these studies used minimum calorie consumption and monetary expenditure necessary for an adult individual to meet basic needs.

The Poverty line was derived in two ways; absolute and relative. An absolute poverty line is fixed over time and space, i.e., over the entire area and period covered in the study. A relative poverty line is the cost of food expenditure. The measurement of poverty used is the "head count ratio" which is the incidence of poverty and the ratio of the number of poor individuals to the total population. In order to justify and support the claims made that poverty exists in Kenya; the following two tables of statistics are used.

TABLE 1 shows a basket of goods a Kenyan adult should consume in 1992 to meet daily requirements. Column 2 shows monthly expenditure per capita for each item, which is then divided by unit price in column 6 to obtain kilograms consumed. The percentage of the total calorific intake (column 4), attributed to each item, is then applied to the required minimum calorific intake of 2250 k/cal. Using the consumption pattern indicated by the household's total minimum food expenditure necessary to achieve the minimum calorific intake requirement is Shs. 87.47 per capita. This amount was used to make the conclusion that the majority of the Kenyan population lives below the poverty line in 1992.

TABLE 1
National Monthly Rural Food Poverty Line per Adult Equivalent, 1991/1992

Food Item	Monthly Consumption Calories Expense (Kshs)	Calorie Produced	Calories Produced as % of Total Intake	Monthly Quantities Needed to Meet Requirements (Kg)	Prices (Kshs/kg)	Food Expend. Per month at Poverty Line (Kshs)
Bread	2.35	1288	1.65	46	4.38	2.03
Maize	24.46	45445	5.23	11.56	1.83	21.16
Cereals	4.46	5717	7.33	1.50	2.69	4.03
Meat	11.10	1618	2.07	0.70	13.72	9.60
Oils and Fats	2.11	3078	3.94	0.30	16.27	4.92
Fruits	13.43	1082	1.39	1.04	3.11	3.23
Vegetables	1.05	1248	1.60	2.70	2.24	6.05
Beans	5.69	5784	7.41	1.61	4.99	5.15
Roots	6.99	3345	4.29	2.07	2.49	8.05
Sugar	9.31	7.19	7.19	1.29	5.45	7.05
Tea/Coffee	8.15	27	0.03	0.10	19.06	1.85
Eggs	3.74	187	0.24	0.12	7.88	0.91
Milk	2.14	3256	4.17	3.52	3.30	11.62
Total	101.13	78044	100.00			87.47

Source: Economic Survey p.55, Kenya Government Printer, 1997

In Kenya agriculture contributes more than 60% of the GNP. It is the public expenditure patterns that determine the extent to which these revenues extracted by the government from the agricultural sector are siphoned back to agriculture for future agricultural products.
At the aggregate level, Kenyan rural households derived 57.9 percent of their income from farm sources, 10.4 percent from non-farm, 23.1 percent from salaries/wages, and 9.7 percent from other sources. In comparison, the absolute poor, defined as those below the absolute poverty line, derived 63.0 percent of their income from farm sources. This is depicted in TABLE 2.

TABLE 2

Sources of Income by Rural Poverty Group, 1981/82:
Absolute Poverty Line (Kshs 105.94)

	All	Non-Poor	Poor	All %	Non-Poor %	Poor %
Farm	444.18	538.69	308.04	57.93	56.15	62.98
Non-Farm	79.33	100.73	48.50	10.35	10.50	9.92
Salary/Wages	176.73	240.31	85.13	23.05	25.05	17.41
Other Income	66.47	79.71	47.40	8.67	8.31	9.69
Total	766.71	959.44	489.08	100.00	100.00	100.00

Source: Statistical Abstract: Ministry of Planning and National Development p.186

The study on poverty was analyzed using the basic model below. This model uses poverty as a dependent variable in the regression analysis. Previous studies indicate that rural household income plays a significant role in poverty alleviation. This model maximizes net nominal in order to reduce poverty. Therefore, the minimization of poverty is equivalent to the maximization of net nominal income. Thus the problem also, consists of determining the variables that make up the net nominal income that will be maximized.

This study is based on the fact that agriculturally speaking Kenya is an international price taker. By a price taker I mean Kenya's agricultural exports do not influence international agricultural prices. Thus, by and large, the increase in Kenya's exports should not have an adverse effect on Kenya's real incomes. The size and composition of agricultural production is a function of the various relative prices and investments in agricultural production. Investment in agriculture is largely influenced by the patterns of government expenditure in the agricultural sector. International trade dominated by agriculture represents a large portion of GNP.

Given the above structural characteristics, the Kenyan international terms of trade can thus be assumed. These terms of trade are a significant determinant of Kenya's real incomes as well as of the size and composition of agricultural production. Given the need for increased agricultural output, the following objectives must be realized:

a) Increased technological change in the food crop sector which leads to a release of resources for export crop production.
b) Increased technological change in the export crop sector results in an increase in import capacity.
c) The domestic price is influenced by international terms of trade and the extent of net extraction by the government. The latter influences levels of poverty through its effect on both prices and public investment, which in turn can determine levels of agricultural output and avert market failures through investments transport infrastructure, which increases factor and product mobility. The relative importance to be attached to technological change and other investments in two sectors should depend on marginal returns to investments in particular crops.

All the above objectives would lead to maximization of rural household income and minimization of poverty. Therefore variables that would increase exports would be maximized because an increase in exports would lead to increase in rural household income. Thus, an increase in export production depends upon availability of labor and land, producer prices and quantities of exports, level of technology, and expenditure on essential imports and government expenditure on agricultural investment infrastructure. Any policy that affects any of the above variables would affect the level of nominal rural household income.

The Basic Model

The nominal rural household income (Y_R) is defined as:

$$Y_R = P_{Ff} Q_{Ef} + P_E Q_e + S_B + S_S + R \qquad \textbf{[1]}$$

where:

P_{Ff} = price of food crops in the formal sector
Q_{Ef} = quantities of food crops in the formal sector
P_E = producer prices of agricultural commodities exported
Q_E = quantities of agricultural commodities exported
S_B = subsidies received by the agricultural sector
S_S = social services provided by the rural sector
R = remittances of rural workers working in the non agricultural sector

and assumed constant overtime and therefore:

$$\Delta(S_B, S_S, R) \approx 0$$

The quantity of export crops is expressed as a function of the following variables:

$Q_E = Q_E(l, L, P_{Ff}, P_E, t_E, GR, ESE)$ **[2]**

Where:

l = labor
L = land
P_{Ff} = price of food crops in the formal sector
P_E = price of exports
T_E = level of technology in the export crop sector
GR = government investment expenditures in agriculture
ESE = expenditure on import substitutes
$T_E = T_E(GR)$

The nominal rural household income ($\mathbf{Y_R}$) is defined as:

$$Y_R = P_{Ff}Q_{Ff} + P_EQ_E + S_S + S_B + R$$

As the income of households increases the poverty decreases. That is:

Poverty = aY_R, $a < 0$
Maximize $[Y_R = P_{Ff}Q_{Ff} + P_EQ_E + S_S + S_B + R]$
Subject to: $\{P_E, l, L, T_E, GR, P_{Ff}, ESE\}$

As a result, the minimization of poverty is equivalent to the maximization of the rural nominal income. Thus our problem consists of determining the rural nominal income of households which will be maximized. The maximization of the income yields:

Basic Model

$dY_R = 0$

$0 = dY_R = Q_{Ff}dP_{Ff} + P_{Ff}dQ_{Ff} + Q_E dP_E + P_E dQ_E + dS_B + dS_S + dR$ **[4]**

From equation (4), we have:

$$\partial Q_E = \frac{\partial Q_E \partial l}{\partial l} + \frac{[\partial Q_E \partial L]}{\partial L} + \frac{[\partial Q_E \partial P_{Ff}]}{\partial P_{Ff}} + \frac{[\partial Q_E \partial P_E]}{\partial P_E} + \frac{\partial P_E}{\partial t_E} . \frac{\partial t_E}{\partial GR} \partial GR + \frac{\partial Q_E}{\partial ESE} \partial ESE \qquad \textbf{[5]}$$

Substituting equation (5) into equation (4), we obtain:

$$0 = Q_E \partial P_E + P_E \left[\frac{\partial Q_E}{\partial l} \partial l + \frac{\partial Q_E}{\partial L} \partial L + \frac{\partial Q_E}{\partial P_{Ff}} \partial P_{Ff} + \frac{\partial Q_E}{\partial ESE} \partial ESE + \frac{\partial Q_E}{\partial P_E} \partial P_E + \frac{\partial Q_E}{\partial T_E} . \frac{\partial T_E}{\partial GR} \partial GR + \frac{\partial Q_E}{\partial GR} + \frac{\partial Q_E}{p_N} \right] \qquad \textbf{[6]}$$

$$+ \partial S_B + \partial S_S + \partial R$$

Re-arranging equation (6), we obtain:

$$Q_E = Q_{Ff} \frac{\partial P_{Ff}}{\partial P_E} - P_{Ff} \frac{\partial Q_{Ff}}{\partial P_E} - P_E \frac{\partial Q_E}{\partial l} . \frac{\partial L}{\partial P_E} - P_E \frac{\partial Q_E}{\partial L} . \frac{\partial L}{\partial P_E} . P_E \frac{\partial Q_E}{\partial ESE} \partial ESE - P_E \frac{Q_E}{P_E} - P_E \frac{\partial Q_E}{\partial t_E} . \frac{\partial t_E}{\partial GR} \frac{\partial GR}{\partial P_E} - \qquad \textbf{[7]}$$

$$P_E \frac{\partial Q_E}{\partial GR} . \frac{\partial GR}{\partial P_E} - \frac{\partial S_B}{P_E} - \frac{\partial S_S}{\partial P_E} - \frac{\partial R}{\partial P_E}$$

Assuming that $\mathbf{S_B}$, $\mathbf{S_S}$ and **R** are roughly constant in agricultural third world and factoring out dGR/dP_E, we obtain

$$Q_E = Q_{Ff} \left(\frac{dP_{Ff}}{dP_E} \right) - P_E \left[\left(\frac{\partial Q_E}{\partial} \right) \left(\frac{dL}{dP_E} \right) \right] - P_E \left[\left(\frac{\partial Q_E}{\partial L} \right) \left(\frac{dL}{dP_E} \right) \right] - P_E \left[\left(\frac{\partial Q_E}{\partial P_{Ff}} \right) \left(\frac{dP_{Ff}}{dP_E} \right) \right] \qquad \textbf{[8]}$$

$$- P_E \left(\frac{\partial Q_E}{\partial P_E} \right) - P_E \left[\left(\frac{\partial Q_E}{\partial T_E} \right) \left(\frac{\partial T_E}{\partial GR} \right) \left(\frac{\partial Q_E}{\partial GR} \right) \right] \frac{dGR}{dP_E} - P_E \left[\left(\frac{\partial Q_E}{\partial ESE} \right) dESE \right]$$

the respective elasticities from equation (8) are:

$$\frac{dl}{dP_E} = \left\{ \frac{dl}{dP_E} \bullet \frac{P_E}{I} \right\} \bullet \frac{I}{P_E} = e_{l,PE} \left(\frac{I}{P_E} \right)$$

where $e_{l,PE}$ is the elasticity of labor with respect to the price of exported crops.

$$\frac{dL}{dP_E} = \left\{ \left(\frac{dL}{dP_E} \right) \left(\frac{P_E}{L} \right) \right\} \frac{L}{P_E} = e_L, P_E \left(\frac{L}{P_E} \right)$$

where $\mathbf{e_L, P_E}$ is the elasticity of the cultivated area with respect to the price of the exported crops.

$$\frac{dP_{Ff}}{dP_E} = \left\{ \left(\frac{dP_{Ff}}{dP_E} \right) \left(\frac{P_E}{P_{Ff}} \right) \right\} \frac{P_{Ff}}{P_E} = e_{PFf} P_E P_{Ff} P_E$$

where $\mathbf{e_{PFf}\, P_E}$ is the elasticity of the food price in the formal sector with respect to that of the exported crop

$$\frac{dQ_E}{dP_E} = \left\{ \left(\frac{dQ_E}{dP_E} \right) \left(\frac{P_E}{Q_E} \right) \right\} \frac{Q_E}{P_E} = eP_E \left(\frac{Q_E}{P_E} \right)$$

where $\mathbf{eP_E}$ is the price elasticity of exported crop

$$\frac{dGR}{dP_E} = \left\{ \left(\frac{dGR}{dP_E} \right) \left(\frac{P_E}{GR} \right) \right\} \frac{GR}{P_E} = e_{GR}, P_E \left(\frac{GR}{P_E} \right)$$

where $\mathbf{e_{GR} P_E}$ is the elasticity of government expenditure with respect to the price of exported crop.

$$\frac{dESE}{dP_E} = \left(\frac{dESE}{dP_E} \right) \left(\frac{P_E}{ESE} \right) \frac{ESE}{P_E} e_{ESE, PE} \left(\frac{ESE}{P_E} \right)$$

where $\mathbf{e_{ESE,PE}}$ is the elasticity of expenditure on other essential importable with respect to the price of exported crops.

Replacing $\frac{dl}{dP_E}$, $\frac{dL}{dP_E}$, $\frac{dP_{Ff}}{dP_E}$, $\frac{dQ_E}{dP_E}$, $\frac{dGR}{dP_E}$ and $\frac{dESE}{dP_E}$ in equation (8) by their respective

expressions in elasticity forms, we obtain:

$$Q_E = -\left[\left(\frac{1}{1} + e_{PE} \right) \left(\frac{dP_{Ff}}{dP_E} \right) \right] Q_{Ff} - \left[\left(\frac{1}{1} + e_{PE} \right) \left(\frac{dQ_{Ff}}{dP_E} \right) \right] P_{Ff} - \left[\frac{1}{1} + e_{PE} \left(\frac{dQ_E}{dl} \right) e_{lPE} \right] 1 - \left[\left(\frac{1}{1} + e_{Fe} \right) \left(\frac{dQ_E}{dL} \right) e_{LP_E} \right] L$$
$$- \left\{ \left(\frac{1}{1} + e_{PE} \right) e_{GRP_E} \left[\left(\left(\frac{\partial Q_E}{\partial T_E} \right) \left(\frac{\partial T_E}{\partial GR} \right) + \left(\frac{\partial Q_E}{\partial GR} \right) \right) \right] GR - \left[\left(\frac{1}{1} + e_{PE} \right) \left(\frac{dQ_E}{dESE} \right) e_{ESP PE} \right] \right\} ESE \qquad \textbf{[9]}$$

We assume that

$$\sim e_{PE} \sim < 1$$

because the Kenyan agricultural has a capacity constraint (e.g., land fertility and land reform

constraint. As a result

$$1+e_{PE}>0\,.$$

Therefore, the signs of the coefficients in equation (9) remain the same as those of equation (8).

Hypotheses

The coefficient of the food price is expected to be positive. An increase in the price of food means that its quantity sold in this sector decreases. This decrease in the quantity of food also leads to the increase in the price of exported crops.
Thus, we expect:

$$-\frac{dP_{Ff}}{dP_E}<0,\quad -\frac{dQ_{Ff}}{dP_E}>0$$

Also an increase in the food price in the formal sector means that its quantity of exported crop decreases.

We expect the coefficient of labor used in export production to be positive

$$-\frac{1}{1+eP_E}\bullet\frac{\partial Q_E}{\partial}\bullet elP_E>0\,.$$

An increase in the quantity of labor increases the output (Q_E) and decreases the price (P_E). As a result

$$eIP_E=\left(\frac{\partial}{\partial P_E}\right)\left(\frac{P_E}{I}\right)<0\text{, and }\frac{\partial Q_E}{\partial}>0$$

It follows that

$$\frac{-1}{1+eP_E}\bullet\frac{\partial Q_E}{\partial}\bullet elP_E>0$$

Similarly, we expect the coefficient of labor to be positive.

We expect the coefficient of food price in the formal sector to be positive. An increase in the price of food in the formal sector P_{Ff} leads to a decrease in its quantity sold. This decrease in the quantity of food sold in the formal sector increases the price of exported crop P_E.

Thus, $$\frac{dQ_{Ff}}{dP_E}<0$$

As a result, $$\frac{-dQ_{Ff}}{dP_E}>0$$

Finally,

$$-\left[\left(\frac{1}{1+eP_E}\right)\left(\frac{dQ_{Ff}}{dP_E}\right)eP_{Ff}\,P_E\right]>0.$$

That is, the coefficient of food price in the formal sector is expected to be positive.
We expect the coefficient of government expenditure as

$$\left[-\frac{1}{1}+1+e_{PE}\left(\left(\frac{\partial Q_E}{\partial T_E}\right)\left(\frac{\partial T_E}{\partial GR}\right)+\left(\frac{\partial Q_E}{\partial GR}\right)\right)e_{GRPE}\right]>0$$

An increase in government expenditures leads to an improvement in technology in the export sector represented by

$$\frac{\partial T_E}{\partial GR}>0,$$

which in turn increases the quantity of exported crop, represented by

$$\frac{\partial Q_E}{\partial T_E}>0.$$

This leads to a decrease in the price of exported crop. That is,

$$eGRP_E=\left(\frac{\partial GR}{\partial P_E}\right)\left(\frac{P_E}{GR}\right)<0 \quad \text{and} \quad \frac{\partial Q_E}{\partial GR}>0$$

Thus $$\left[\left(\frac{\partial Q_E}{\partial T_E}\right)\left(\frac{\partial T_E}{\partial GR}\right)+\left(\frac{\partial Q_E}{\partial GR}\right)\right]eGRP_E<0$$

It follows that

$$\left(\frac{-1}{1+e_{PE}}\right)\left(\frac{\partial Q_E}{\partial ESE}\right)e_{GRPE}>0$$

Finally, we expect the coefficient of the expenditure on essential importables to be positive.

$$\left(\frac{-1}{1+e_{PE}}\right)\left(\frac{\partial Q_E}{\partial ESE}\right)e_{ESE,PE}$$

An increase in the expenditure on essential imports increases the quantity of exported crops and decreases its price. As a result:

$$\frac{\partial Q_E}{\partial ESE}>0$$

And: $$e_{ESE,PE} = \left(\frac{\partial ESE}{\partial P_E}\right)\left(\frac{P_E}{ESE}\right) < 0$$

Thus: $$\left(\frac{\partial Q_E}{\partial ESE}\right) e_{ESE,PE} < 0$$

It follows that $$\left(\frac{-1}{1+e_{PE}}\right)\left(\frac{\partial Q_E}{\partial ESE}\right) e_{ESE,PE} > 0$$

This means that we expect the coefficient of the expenditure on essential imports to be positive.

The final equation of the alternative model to be estimated is:

$$QE = a_0 + a_1 Q_{Ff} + a_2 P_{Ff} + a_3 I + a_4 L + a_5 GR + a_6 ESE \qquad \textbf{[10]}$$

where:

a_0 = a constant

$$a_1 > 0; a_2 < 0; a_3 > 0; a_4 < 0; a_5 > 0; a_6 > 0.$$

Statistical Results and Interpretations

The regression results of the alternative mathematical model given in equation (10) are shown below and then followed by the policy implications of these results.

Exports = -1718.061 +.000191ESE -0.4658APF + 0.16667AQF –
(4.516) (-1.550) (5.830)
.01034LAND + 0.04995LABOR+ 0.3413GR
(-1.225) (0.0803) (2.2498)
Adjusted R-squared = 98.5
DW = 3.05

The coefficient of **ESE** expenditure on (essential imports) is positive, indicating that there is a positive relationship between exports and expenditure on essentials. This includes inputs such as fertilizers, spare parts and pesticides needed in the food sector. If the essentials imports decrease exports will also decrease. The T-statistic of **ESE** variable is significant at a 5 percent level.

The coefficient of the actual price of food (APF) is negative (-4658), indicating an inverse relationship between exports and the actual price of food (i.e., an increase in the actual price of food leads to a decrease in exports). This may be so because foreign buyers of Kenyan food can get cheaper food in other countries. Additionally, Kenyan producers can directly sell their food on the domestic market since they can get substantially higher revenue from their domestic sale.

The t-statistic of the variable is significant at a 10 percent level of significance. The coefficient for the actual quantities of food (**AQF**) positively indicates that an increase in actual quantities of food leads to an increase in exports because there is enough food to consume locally after the exports.

The coefficient of land is negative indicating that there is a negative relationship between the cultivated land and exports because the land exhibits diminishing returns (in the absence of land-technology and land-reforms). But this observation is not serious because the t-statistics is not significant, indicating that an increase in cultivated land does not play a major role in the alleviation of poverty in Kenya.

The coefficient of labor is positive meaning that increases in labor in the exports sector leads to increases in exports. However, the t-statistic of this variable is not significant, due to the reason of higher intensity of capital (relative to labor) in the production of export crops in Kenya.

The coefficient of government revenues used in the technological improvement of the agricultural sector infrastructure is positive. This shows that when the government invests in agricultural research, education, roads, machinery and technology exports increase. The t-statistic of the variable is significant at a 5 percent level, thus confirming the importance of government expenditures in determining increases in the volume of exports.

The high adjusted R-squared of 98.5 percent (i.e., good fitness of the model) and Durbin-Watson of 3.05 lack of serial correlation indicates a reasonable performance of the model. The statistics reveal that the key determinants of poverty or the lack of it, are the government expenditures in the agricultural sector, the quantity of food produced, the expenditures on essential imports, and the price of food produced.

The above empirical results indicate that actual prices of food (**APF**) have an inverse relationship with exports meaning that increase in the price of food leads to decrease in exports. The coefficient is negative, indicating the inverse relationship which may suggest that increase in food price locally leads to the increase in its supply on the domestic market, and thus, reducing exports. This reduction in exports leads to minimization of rural household income thus leading to increase in poverty.

Policy Implications

The empirical results presented above suggest the following policy recommendations concerning poverty alleviation in Kenya. The study starts from the government expenditure on technology in agricultural sector. The government should increase its expenditure on technology in agricultural sector so that the export output will increase which in turn increases household income and thereby alleviates poverty.

It is noticeable that increase in imports of essentials will increase exports and in turn alleviate poverty. Therefore, the government should subsidize the importation of essentials by farmers so that they can save some of the cost of their production. This will lead to the increase of importables and the export output in the event that they spent more money on importables. This in turn will increase export and rural household income thus alleviating poverty.

Conclusion

Based on the empirical results, we conclude that a decrease in the price of crops leads to an increase in exports. Therefore, it is recommended that the government subsidize the actual price of food, forcing increases in exports and thereby reducing poverty. This is so because when the price of exports is low its demand increases leading to an increase in rural household income that in turn reduces poverty. This is due to our earlier finding that there exits an inverse relationship between the increase in income and poverty reduction.

The increase in quantities of food increases the exports and thus reduces the poverty. Because of this, we recommend that the government increase its expenditures on technological training for new farming techniques. Because improvement in farming techniques will reduce cost of production that leads to higher output due to the allocation efficiency which in turn reduces poverty.

References

Abbot, P.C., and Thompson, R.L. "Changing Comparative Advantage." *Agricultural Economics,* 1987, pp.97-112.

Adelman,I., and Morris, C. T. *Economic Growth and Social Equity in Developing Countries*. Palo Alto, Calif.:Stanford University Press,1973.

Ahluwalia, Montek S. "Rural poverty and agricultural performance in India." *Journal of development Studies*, 14(April) 1978a, pp.298-32.

Bardhan, P.K. *Land, Labor and Rural Poverty*. Cambridge: Cambridge University, 1984.

Bates, R.H. *Markets and states in tropical Africa: The political basis of agricultural policies*. Berkeley: University of California Press, 1981.

Berry, R.A & Cline, W.R. *Agrarian structure and productivity in Developing Countries*. Baltimore: Johns Hopkins, 1979.

Chichilinsky, G., "Terms of trade and domestic distribution: Export-led growth with abundant labor." *Journal of Development Economics*, 1981, pp.163-192.

Collier, P and Deepak, L. "Poverty and growth in Kenya." *World Bank Staff Working Paper No.389.* Washington: D.C., 1980.

Crawford, E and Thorbecke, E. "Employment, Income Distribution, Poverty alleviation and Basic needs in Kenya." *Report of an ILO Consulting Mission*, Cornell University, 1978.

Ellis F. "Agricultural Price Policy in Tanzania." *World Development*, 1982.

--------. *Peasant Economics: Farm Households and Agrarian Development*, Cambridge: Cambridge
University Press, 1988a.

--------. *Agricultural Pricing Policy in Africa*. London: Macmillan, 1988b.

Fei, J., and Ranis, G. *Development of labor surplus economy: Theory and Policy*. Homewood, 1964.

Ghatak and Ingersent. *Agriculture and Economic Development*. John Hopkins, 1984.

Griffin, K. *Land concentration and Rural Poverty*. London: Macmillan, 1976.

--------. *The political Economy of Agrarian Change*. London: Macmillan, 1979b.

ILO. *Employment, Income, and Equality: A Strategy for Increasing Productive Employment in Kenya*. Geneva: U.N, 1972.

Johnson, B.F. "Agriculture and structural transformation in developing countries: A survey of research." *Journal of Economic Literature*, 1970, pp.369-404.

Johnson, B.F., and Clark, W.C. *Redesigning rural development: A strategic perspective*. Baltimore, MD: John Hopkins, 1982.

Lele, Uma. *The Design of Development: Lessons from Africa*. Baltimore: Johns Hopkins, 1979.

--------."Tanzania: Phoenix or Icarius?" *In World Economic Growth*. San Francisco: Studies Institute for Contemporary, 1984.

--------."Rural Africa: Modernization, Equity, and Long -Term Development." *In Agricultural Development in the Third World*. (Eds.) C.K Eicher and J.M Staatz. Baltimore: Johns Hopkins University, 1984.

--------."Agricultural Growth, Terms of Trade and Poverty Alleviation in Sub-Saharan Africa." In Mellor and Desai. (Eds.) *Agricultural Change and Rural Poverty*. John Hopkins, 1985.

Lele,Uma, and Mellor John W. "Technological change distributive bias and labor transfer in a two sector economy*". Oxford Economic Papers*, 1981, pp.426-41.

Lewis, W. A. "Economic Development with Unlimited Supplies of Labor." *Manchester School*, 1954, pp.139-191.

Little, I.M.D.Scitovsky, T., and Scot, M. *Industry and trade in developing countries*. London: Oxford, 1970.

Mellor, John W., and Johnson, Bruce. "The world food equation: Interrelations among development, employment, and food consumption." *Journal of Economic Literature*, 1984.

Mellor, John W. "The use and productivity of farm family labor in early stages of agricultural development." *Journal of Farm Economics*, 1963, pp.517-34.

--------. "The functions of agricultural prices in economic development." *Indian Journal of Agricultural Economics,* Jan-March 1968, pp.23-27.

---------. " Food price policy and income distribution in low income countries." *Economic development and cultural change*, 1978, pp.1-26

Mellor, John W and Lele Uma. "Growth linkage of the new food grain technologies." *Indian Journal of Agricultural Economics*, 28 (Jan-March), 1973.

Mynt, H. *The classical theory of international trade and underdeveloped countries.* Oxford:Blackwell, 1958.

Moock, J.L and Okigbo, B.N (eds.). *Understanding Africa's Rural Households and Farming Systems*. Boulder: Colorado, 1986.

Narain. Dharm. "Growth of productivity in Indian agriculture." Cornell University. *Journal of Agricultural Economics,* 32(Jan-March) 1976.

--------. *The dynamics of supply : Estimation of farmer's response to price.* Baltimore: John Hopkins, 1958.

--------. "The dynamics of supply: Retrospect and Prospect." *American Journal of Agricultural Economics*, 1979, pp.496-509.

Prebisch, R. *The economic development of Latin America and its principal problems*:U.N., 1950.

Rosenstein-Rodan, P.N. "Problems of industrialization of Eastern and South-Eastern Europe." *Economic Journal*, June/September 1943, pp.202-211.

Ritson, C. “A framework for analyzing the contribution of agricultural sector to economic development.” *Journal of Agricultural Economics*, August 1973.

Sandbrook, R “The State and Economic Stagnation in Tropical Africa.” *World Development*. 1986.

Scandizzo, P.I, and Bruce, C. “Methodology for Measuring Agricultural Price Intervention Effects.” *World Bank Staff Paper No.394*, Washington: D.C., 1980.

Sen, Amartya K. “Peasant and dualism with or without surplus labor.” *Journal of Political Economy*, October 1966, pp.425-450.

--------. “Levels of Poverty: Policy Change.” *World Bank Staff Working Paper No.401*, Washington: D.C., 1980.

--------. “Ingredients of famine analysis: Availability and entitlements.” *Quarterly Journal of Economics*, 96 (August) 1981a. pp.433-64.

Stewart, F. *Macro-Policies for Appropriate Technology in Developing Countries*. Boulder, Colorado: Westview Press, 1978.

Stewart, Frances. *Technology and Underdevelopment*. London: Macmillan, 1978.

Stiglitz, J.E., *The Economics of Public Sector*. New York: Norton and Company, 1986a.

--------. “The New Development Economics.” *World Development*, 1986b.

Streeten, P. *What Price Food? Agricultural Price Policies in Developing Countries*. London: Macmillan, 1987.

Thorbecke, E and Hall, I. (eds.). *Agricultural Sector Analysis and Models in Developing Countries*. Rome: FAO, 1985.

USDA. “Food Problems and prospects in Sub-Saharan Africa: The decade of 1980's.” *Foreign Agricultural Economic Report 166,* Washington: D.C., 1981.

Taylor, Lance. *Global Macroeconomics*. New York: Basic Books, 1983.

Wolgin, J.M. ”Resource allocation and risk: a case study of small holder agriculture in Kenya.” *American Journal of Agricultural Economics*, 1980.

World Bank. *The Assault on World Poverty*. Baltimore: Johns Hopkins University Press, 1975, pp.187-261.

--------. *Kenya: Growth and Structural Change*, 1983a.

--------. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. Washington: D.C., 1986a.

Wolpe, H, 1975,”The Theory of Colonialism: The South African Case” in oxaal, I., et al (eds.), *Beyond the sociology of Development*, London: Routledge, 1975.