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Title: Potential of Agricultural Development to Increase Rural Employment

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POTENTIAL OF AGRICULTURAL DEVELOPMENT TO INCREASE RURAL EMPLOYMENT

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ABSTRACT

The paper examined whether increasing agricultural output would lead to an expansion of employment in rural areas in the Caribbean and Sub-Saharan Africa (SSA). The paper found that the agricultural development problems in the Caribbean and SSA are very similar, especially, declining export demand for products, adverse trade policies and the actions of nature, causing damage to agricultural production. The simulations performed showed that in both regions, even a 4% annual increase in agricultural output has the potential for annually increasing agricultural employment by over 6%, even with an annual technical progress of 1.5% in the case of SSA and 2% in the case of the Caribbean. Expanding rural employment through expansion of agricultural output is therefore a definite opportunity in the two regions.

Keywords: Increasing rural employment, Rural Development, Agricultural Development in Caribbean and Sub-Saharan Africa

Introduction

Rural development is multi-disciplinary or interdisciplinary in nature. Moris (1981), an anthropologist/rural sociologist in describing the contribution of Economics to rural development states:

> "To criticize the preponderant influence of economics in the analysis of rural development makes one feel like a tick complaining of the quality of blood it gets from a dog … concepts and arguments from "folk" economics abound … It then appears mean–spirited to insist that economics as a discipline has too large an influence in analyses of rural development, but that is what I suggest."

The purpose of this paper is not to engage in the debate of the relative contributions of Economics and Anthropology to rural development. The point is even outside of Economics, its contribution to rural development is recognized, if not always sanctioned.

This paper intends to further that contribution to rural development by first examining the constraints to agricultural development facing Sub-Saharan Africa (SSA) and the Caribbean. Then the paper develops a theoretical framework to determine the potential increase in agricultural labor employment in response to growth in agricultural output. This theoretical framework is then used to determine the potential of increasing agricultural output as a measure to improve rural development through the expansion of employment in rural areas in the Caribbean and SSA. This analysis involved the estimation of an aggregate production function for agriculture in the Caribbean, which is briefly described and a simulation of the increases in labor required for different scenarios of increases in agricultural output.

Agricultural development and rural development are definitely interrelated. Rural development has been defined as "A systematic process in which the control and productive use of resources and opportunities are directed to material and qualitative improvement of standards of living of rural households." (Gomes 1985). Thus while rural development is more than agricultural development, particularly in developing countries where agriculture is the main activity in the rural areas, the two areas must be closely related. In fact agricultural development remains one of the major pathways to rural development.

Increasing agricultural output is a major facet of agricultural development. However, while

increasing levels of agricultural output may provide increasing incomes to rural areas, unless there is an accompanying expansion of rural employment, it is quite possible for the increasing output to lead to wider income disparity in the rural society which can work against the process of rural development.

Factors Affecting Agricultural Development in the Caribbean and Sub- Saharan Africa

To a surprising extent the major factors affecting agricultural development in the Caribbean and SSA are remarkably similar. These major factors will now be summarized.

Dependence on Export Markets and The Decline of These Markets

The agricultural sectors of the Caribbean and SSA still depend heavily on exports of agricultural commodities, especially to the countries of the Organization for Economic Co-operation and Development (OECD). In the recent past, in response to greater liberalization of world trade, there has been a reduction of the levels of protection of these exports. This has particularly affected banana and sugar exports from the Caribbean. Also, most of the economies of the OECD countries have been growing slowly recently, so this has meant little expansion of the demand for tropical agricultural commodities. This has particularly affected SSA.

Natural Risk Factors Especially Drought

Natural risk factors have had a very serious impact on agricultural development in SSA as well as Caribbean countries. In SSA, drought is the major natural risk factor. Most agricultural production systems of SSA are rain-fed and depend on the whims of the rainfall distribution. Countries like Kenya, Nigeria, Sudan, Chad and Cape Verde have had six drought years in last 20 years (30% chances of crop failure due to drought).

In the Caribbean, the major natural risk factors have been hurricanes and tropical storms, which have wrecked havoc to most of the island countries. Damage is caused not only by the high winds blowing over crops, but by severe flooding through storm surges and heavy rains accompanying such storms.

Access to Land

Access to land has been a major factor affecting agricultural development in the Caribbean. In the first instance, the small size of islands and their high population levels have led to low land per agricultural worker ratios in several islands. Then there is a skewed pattern of land ownership, with a few large holders owning the majority of the land best suited to farming, and on the other hand, the large numbers of the smallest farmers having access to only a small percentage of the land. The fact that many of the larger holders often leave their lands underutilized adds to land scarcity problems, especially on the smaller Caribbean island states. Also in recent times, access to land by agriculture has been restricted by the competing demands for land by other more productive sectors such as housing and tourism.

It may seem surprising that countries on a vast continent like Africa would suffer from the same lack of access to land for agriculture as the tiny countries of the Caribbean. Khan (1997) states, however, that for most rural households in SSA "who earn their living by working in agriculture, the most important determinant of productivity and income is access to land." He states that even though arable land per agricultural worker in SSA is more than twice as much as in land-scarce Asia (but less than a quarter as much as in land-abundant Latin America), "…once the higher cropping intensity due to irrigation and the better land quality in Asia are taken into account, the relative advantage of SSA over Asia in terms of land/worker ratio becomes much narrower." In addition he mentions additional institutional constraints to land access in SSA, such as the inequality in land distribution and the informality of land rights.

Environmental Degradation

Khan (1997) also points out that degradation of the environment has been an important factor limiting the sustainability of agriculture in SSA. Often he states, environmental degradation is induced by poverty and in turn further aggravates poverty. This is illustrated by the spread of the rural society into environmentally fragile areas in East Africa, the rangelands of Angola, Somalia, Sudan and the region of the Southern African Development Coordination Conference (SADCC). These farmers also practice poor husbandry which reduces crop yield, and leads to the degradation of land quality and a reduced supply of animals.

Land and water resources in several Caribbean states have been severely reduced by environmental degradation. The destruction of forests, in particular has damaged water-sheds, leading to a reduction in the water supply

and also to the loss of potential agricultural land area. Severe soil erosion characterizes several Caribbean states (especially Haiti). Also the damage to watersheds has so reduced the water supply that the limited water available has to be reserved for the direct use of households, leading to severe shortages of water for agriculture, especially in the dry season that characterizes the Caribbean weather pattern.

Macro Economic Policy

Macroeconomic policy in SSA countries has often been highly detrimental to the agricultural development. (Khan, 1996). He states that discrimination against the rural economy in SSA countries has taken place through:

(a) distorted trade policies, which reduce the relative profitability of agricultural activities, and
(b) a low share of public resources for the rural economy.

In the first category he states that countries of SSA have a long tradition of subjecting agricultural products, especially exports, to low producers' prices, through instruments such as the overvaluation of the exchange rates and the manipulation of the foreign trade regime to purchase the commodities at unfavorable prices.

Khan also states that while it is very hard to devise a standard by which one could judge the absolute levels of the proportion of government expenditure allocated to the rural areas, for many countries of SSA "… this proportion declined between the 1970s and the 1980s, a period over which the international development community was suggesting that SSA needed to change its past anti-rural bias."

Macroeconomic policy has also been detrimental to Caribbean agriculture. For example the FAO (2002) states that "across the Caribbean region, the absence of a policy environment that not only provides incentives but also control is seen as a major constraint. In terms of incentives, the main challenges are national macroeconomic management (fiscal incentives and management, monetary policies) sectoral policy and correcting the bias against the agricultural and rural sector, policy consistency and continuity over time, social policy and safety nets in an increasingly uncertain global environment."

Limited Financing And Inadequate New Investments

Khan (1997) reports that it is widely known that rural SSA is poorly endowed with infrastructural resources and in many cases these resources have deteriorated in quality and volume. He also states that agriculture in SSA generally lacks capital and technology. Finally he concludes that infrastructural poverty also extends to finance, and other institutional and organizational spheres.

Limited Human Capital Development

Human capital improvement is another factor within the sector itself that has affected agricultural development in the Caribbean and SSA. In the Caribbean there are a range of agricultural training institutes. However the graduates of these institutes have largely entered the public and teaching services and related extension services and only a very small percentage of them have actually gone into farming. Thus there is a shortage of skilled human resource in the practice of agriculture in the Caribbean.

SSA suffers from an acute shortage of human capital. Incredibly, Khan (1997) states, primary school enrolment in SSA declined for both male and female children between 1980 and 1993, while the rest of the developing world has increased enrollment. The rural work force of SSA has therefore, suffered an absolute decline in the ability to benefit from extension services and to adopt improved production techniques.

Analytical Approach

As seen in the section above there are many factors affecting agricultural development in the Caribbean and SSA. Some of these factors are natural, some emanate within the sector itself and others are exogenously determined within the macro-economy. Many leading economists (Kreuger, 2004; Schiff and Valdes, 1993) have argued that the exogenous factors have a much greater impact on growth in the sector than the endogenous factors. We shall accept this position.

This section develops a theoretical framework for examining the employment impact of different rates of increase in agricultural output. The increases are treated as annual percentage changes, as this is the measurement popular in the literature for macro-economic variables, such as GDP, prices etc.

We consider an aggregate production function for the agricultural sector (Allen, 1967 p 240):

$$Y' = \alpha f(K, L) \quad (1)$$

Where we assume α denotes technical progress (by itself) increasing output at a constant annual percentage rate of m% with $\alpha = 1$ at $t = 0$. Then we define the output not due to technical change Y as:

$$Y = Y'/\alpha \quad (2)$$

And

$$Y = f(K, L) \quad (3)$$

Taking the total derivative of (3) gives:

$$dY = f_K dK + f_L dL \quad (4)$$

Where $f_L = \partial Y / \partial L$

is the marginal value product of labor and f_K is similarly defined. Dividing (4) by Y , then:

$$dY/Y = f_K dK/Y + f_L dL/Y$$

we shall denote $100 * (dY/Y)$, the percentage change in Y as Y^* and K^* and L^* similarly. Y^* can be termed the percentage increase of agricultural sector output. Hence:

$$Y^* = (f_K dK/K)(K/Y) + (f_L dL/L)(L/Y) \quad (5)$$

i.e. $$Y^* = K^* \varepsilon_K + L^* \varepsilon_L \quad (6)$$

where $f_K(K/Y) = \varepsilon_K$, the elasticity of production with respect to capital etc.

It is clear that if the land input E (or indeed any other input) is included in (1), then (6) becomes:

$$Y^* = K^* \varepsilon_K + L^* \varepsilon_L + E^* \varepsilon_E \quad (7)$$

Technical change in (1) was assumed to be increasing output at an additional constant annual percentage rate of m%. Hence the rate of growth of output with technical change would be:

$$Y'^* = K^* \varepsilon_K + L^* \varepsilon_L + E^* \varepsilon_E + m \quad (9)$$

Now since it is accepted that agricultural output is constrained by macro-economic forces, and also by non-agricultural and foreign demand, it is also argued that the maximum rate of growth of agricultural output $Y'_{\max}$ is largely determined outside of the sector itself. The aggregate agricultural production function therefore provides the range of factor proportions that can be utilized to achieve $Y'_{\max}$. (This is similar to the classical problem of where one operates along a given isoquant.)

Under these conditions (9) becomes:

$$L^* = (Y'_{\max} - m)/\varepsilon_L - (K^* \varepsilon_K / \varepsilon_L + E^* \varepsilon_E / \varepsilon_L) \quad (10)$$

In (10) the first term on the left hand side measures the labor increase required to attain a given increase of output $(Y'_{\max} - m)$ if the increase of labor is the only source of the output increase. The second term in brackets gives the contribution of increases in other factors to $(Y'_{\max} - m)$ and these contributions of course reduce the increase required of labor.

An indication of the potential future contribution of growth of agricultural output to rural employment for the Caribbean and SSA was obtained by using selected values of $Y'_{\max}$ to simulate values of L^* using equation (10). For SSA, for major input variables, estimates of production elasticities and annual percentage increases were available. However these estimates were not available for the Caribbean and they were estimated as part of this study.

A Cobb Douglas aggregate production function for agriculture in the "Caribbean" as defined in the FAOstat website was estimated using data from that site for 1961-2002.

Results

Table 1 presents the results of estimating the Cobb Douglas production function. As can be seen in Table 1 most of the coefficients are significant and the regression does have a reasonably high R^2. However both the Durbin-Watson test and the Breusch –Godfrey tests indicate the presence of auto-correlation. This would mean that the coefficients are unbiased, but are perhaps less significant than indicated in Table 1. However none of the usual methods removed the autocorrelation.

Table 1: Estimation of Production Elasticities for Caribbean Agriculture

Dependent Variable: LOG(Output)				
Sample: 1961-2002				
Included observations: 42				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(Labour)	0.159422	0.073300	2.174913	0.0361
LOG(Fertilizer)	0.085528	0.022076	3.874193	0.0004
LOG(Land)	0.238816	0.304945	0.783143	0.4385
LOG(Tractors)	-0.147865	0.050228	-2.943881	0.0056
C	4.171498	1.997399	2.088465	0.0437
R-squared	0.400592	Mean dependent var		7.385170
Adjusted R-squared	0.335791	S.D. dependent var		0.042257
S.E. of regression	0.034439	Akaike info criterion		-3.787918
Sum squared resid	0.043883	Schwarz criterion		-3.581052
Log likelihood	84.54627	F-statistic		6.181890
Durbin-Watson stat	1.227500	Prob (F-statistic)		0.000650
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	4.878801	Probability		0.013521
Obs*R-squared	9.156417	Probability		0.010273

In any case these methods would have interfered with the interpretation of the coefficients as production elasticities.

Only the labor time series showed serious evidence of non-stationarity, but since the output time series was stationary (using the Dickey-Fuller test), there was no evidence of "spurious regression".

Table 2 gives the elasticities and annual percentage changes for agricultural inputs for SSA and the Caribbean. Here it is seen that the estimates of the elasticities are indeed quite similar for land, labor and fertilizer. However for the Caribbean, livestock is not a major farm input and machinery has a much higher elasticity than for SSA. In both regions but especially in SSA labor appeared to be much more efficiently used that machinery.

Table 2: Elasticities of Production and Annual % Change for Agricultural Inputs and Output for SSA and the Caribbean

	Labor	Fertilizer	Machinery	Livestock	Land	Output
SSA*						
Production Elasticity	0.21	0.16	0.04	0.23	0.19	
Annual % change (1970-1990)	1.7%	4.2%	2.2%	1.2%	0.1%	2.0%
Caribbean**						
Production Elasticity	0.159	0.086	0.148		0.239	
Mean Annual % change (1961-2002)	1.94%	2.70%	4.14%		0.73%	0.15%

Sources: * (Wiebe, Soule and Schimmelpfennig, 2001) ** Estimated from FAOstat

Proxy estimates of the annual percentage technical progress in SSA agriculture (1.5%) and the Caribbean (2.0%) were obtained from estimates of the average annual increase in total factor productivity from FAO (2000). Using these estimates, Table 2 and equation (10), simulations were carried out and Table 3 presents the results.

Table 3: Results of the Simulation Analysis

	Annual % Increase in Labor	Annual % Increase in Labor
	SSA	**Caribbean**
3.0%	2.12%	-0.12%
4.0%	6.88%	6.17%
5.0%	11.64%	12.46%
7.0%	21.17%	25.04%

Discussion and Conclusions

This paper examines the potential of increasing agricultural output to improve rural development through the expansion of employment in rural areas in the Caribbean and SSA. The paper found that the problems facing agricultural development in the Caribbean and SSA are very similar. Both sets of countries face the reality that factors external to the agricultural sector play perhaps the major roles in determining the rate of agricultural development and in particular, the rate of growth of agricultural output.

These factors are associated with the demand for the products from agriculture, especially the export demand, the macro – economy, especially exchange rate regimes and trade policies and the actions of nature affecting production systems and also causing damage to agricultural production.

The paper found that the two agricultural inputs fertilizer and machinery showed the greatest increase in use for SSA, and the Caribbean. Again reflecting the land scarcity in both regions, land was the factor that showed the smallest increase in use for both regions. Assuming that the annual percentage increases of non-labor factors remained at the historical mean levels in Table 2, the simulations performed showed that because of the higher annual percentage increase in technical change for the Caribbean, low annual percentage increases of agricultural output (<3%) can be attained without an annual percentage increase of labor. However at higher annual increases in output (>5%) the higher elasticity of labor in SSA and the presence of livestock as an input for agriculture makes SSA require less labor than the Caribbean.

However in both regions, the figures show clearly that even a 4% annual increase in agricultural output has the potential for annually increasing agricultural employment by over 6%, even with an annual technical progress of 1.5% in the case of SSA and 2% in the case of the Caribbean. Clearly there is definite potential for expanding rural employment through expansion of agricultural output, provided there is not the continued substitution of labor by capital inputs like machinery.

A final note is that the theoretical model developed throws some doubt on the accuracy of statements such as the following quoted in (Wiebe, Soule and Schimmelpfennig, 2001): “The USDA's Economic Research Service (Shapouri and Rosen, 1998) projects that food production in SSA will grow at an average rate of 2.3 percent per year between 1995-1997 and 2008 through a combination of area expansion (1.3 percent per year) and yield increases (1.0 percent per year).” Such statements apparently fail to take account of the elasticities of the inputs as indicated in equation (9) or simply assume they are equal to one. However, this may be in error, because, for example, in the statement just quoted, land in the case of SSA does not have unitary elasticity of production.

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