

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

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Batch 69

1. SUBJECT CLASSIFICATION	A. PRIMARY Development and economics	DA00-0000-G200
	B. SECONDARY General--Ghana	

2. TITLE AND SUBTITLE
The labor-and-land surplus economy: Ghana

3. AUTHOR(S)
Brecher, R.A.

4. DOCUMENT DATE 1972	5. NUMBER OF PAGES 24p.	6. ARC NUMBER ARC
--------------------------	----------------------------	----------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Yale

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)

9. ABSTRACT

10. CONTROL NUMBER PN-AAE-581	11. PRICE OF DOCUMENT
----------------------------------	-----------------------

12. DESCRIPTORS Ghana Land use Manpower Employment	13. PROJECT NUMBER
	14. CONTRACT NUMBER CSD-2492 Res.
	15. TYPE OF DOCUMENT

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SUMMARY

OF

The Labor-and-Land Surplus Economy (Ghana)

by

Richard A. Brecher

Economic Growth Center
Department of Economics
Yale University

October 1972

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Two well-known cases in the development literature are the labor surplus economy in which land is scarce (see Fei and Ranis [6] and Lewis [15]), and the land surplus economy in which labor is scarce (see Helleiner [8]). The present paper extends the set of cases to include the situation in which there is both surplus labor and surplus land in the same agricultural sector. A model of this labor-and-land surplus economy is outlined, and is shown to be suggested by the Ghanaian experience. An important implication of this demonstration is that the analysis of surplus labor may be relevant even to countries like Ghana where land is plentiful.

The surplus labor takes the form of disguised (rather than open) unemployment. That is, part of the work force is employed in an agricultural sector where its marginal product is lower than in the rest of the economy (but still positive). The intersectoral difference in marginal productivity is the result of institutional features (sharecropping and minimum-wage legislation). This surplus labor can be drawn at a constant wage for use in the higher-productivity sectors. The reason for the constant cost of surplus labor is the fact that everyone

has guaranteed access to an abundance of uncultivated arable land, i.e., surplus land.

The model has three sectors--food agriculture (the pool of disguised unemployment), manufacturing and cocoa. Domestic production of the first two goods is supplemented by imports, whereas the third good is exported. Labor is used in all three sectors, capital is used in only cocoa and manufacturing, and land is used in only cocoa and food.

In the context of this model (with several additional plausible assumptions), it is possible to reach results like the following:

1) In the event of an increase in foreign demand for home exports (cocoa), unemployment will increase if cocoa is more capital-intensive than manufactures, but will decrease if cocoa is more labor-intensive.

2) An across-the-board increase in the home tax on either exports (cocoa) or imports will normally have the same impact on unemployment as a decrease in foreign demand for home exports. (It is assumed here that the tax increase is not great enough to cause trade to cease altogether.)

3) If a technical improvement occurs at home in either cocoa or manufacturing, unemployment may increase even when the technical change is Hicks-neutral. The likelihood of a rise in unemployment depends (in part) upon the relative factor intensities of these two sectors.

4) An increase in the home stock of capital will decrease unemployment.

The first three propositions highlight the importance of determining relative factor intensities in a labor-and-land surplus economy. In the

Ghanaian case, this has not been done decisively for cocoa and manufacturing. All that seems clear at the moment is that a considerable proportion of the country's capital stock is utilized in the cocoa industry (as argued in the paper).

THE LABOR-AND-LAND SURPLUS ECONOMY (GHANA)*

Richard A. Brecher

INTRODUCTION

Two well-known cases in the development literature are the labor surplus economy in which land is scarce (see Fei and Ranis [6] and Lewis [15]), and the land surplus economy in which labor is scarce (see Helleiner [8]). The present paper extends the set of cases to include the situation in which there is both surplus labor and surplus land in the same agricultural sector.¹ A model of this labor-and-land surplus economy is outlined below, and is shown to be suggested by the Ghanaian experience. An important implication of this demonstration is that the analysis of surplus labor may be relevant even to countries like Ghana where land is plentiful.

The paper is divided into three parts. Part I sketches the production and employment aspects of the model, emphasizing the way in which the two surpluses arise. The surplus labor takes the form of disguised (rather than open)² unemployment. That is, part of the work force is employed in an agricultural sector where its marginal product is lower than in the rest of the economy (but still positive).³ The intersectoral difference in marginal productivity is the result of institutional features (sharecropping and minimum-wage legislation). This surplus labor can be drawn at a constant wage for use in the higher-productivity sectors. The reason for the constant cost of surplus labor is the fact that everyone has guaranteed access to an

*This paper is the outline of a work in progress. Many of its arguments and proofs are just sketched briefly or omitted entirely here, but will be presented more fully in a future draft.

abundance of uncultivated arable land, i.e., surplus land.

In Part II, some applications of the model are considered. This discussion is made brief by exploiting the close analytic similarity between the model of Part I and an earlier model developed by Brecher [2 and 4].

A few concluding comments are made in Part III.

PART I

PRODUCTION AND EMPLOYMENT

The model assumes three sectors--food agriculture, cocoa, and manufacturing. There are fixed endowments of four primary, homogeneous factors of production--capital, labor, cocoa land, and food land. It is assumed that the first two factors are perfectly mobile domestically (though completely immobile internationally), but that the second two factors are not shiftable between sectors.

There are four important reasons why, in the case of Ghana, cocoa should be treated separately from food agriculture. First, cocoa is exported, while food products (and manufactures) are imported to supplement domestic production of these commodities. Second (as argued below), cocoa uses a great deal of capital, whereas food agriculture uses very little. Third, the cocoa sector accounts for a sizeable share of total employment, gross national product, and total exports (see Killick [14]). Fourth, food land and cocoa land in Ghana are best treated as different factors of production, since cocoa cannot be grown in many areas suitable for food production (although food can be grown in the cocoa belt). The question of capital and labor mobility in Ghana will be

considered below.

Each of the three sectors will now be discussed one at a time.

A. Food Agriculture

The output of food agriculture (X_a) is assumed to be given by

$$X_a = \alpha L_a \quad \dots (1)$$

where L_a is the amount of labor used in food production, and α is a constant representing the average and marginal physical products of labor in food. Labour's productivity is constant because it is assumed that arable land of homogeneous quality is available in unlimited supplies at no cost, and that capital is not used to produce food. Under these circumstances, the wage rate in terms of food (w_a) is simply

$$w_a = \alpha \quad \dots (2)$$

These assumptions are reasonable first approximations for Ghana. On the whole, Ghanaian food agriculture does not appear to suffer from a shortage of arable land.⁴ Any individual wishing to grow food crops has the right to use his tribe's land at virtually no cost (see Ollennu [18]).⁵ The use of capital is negligible, with most farmers utilizing little more than hoe and cutlass.⁶

The work force in food agriculture (L_a) can be thought of as a pool from which the other sectors may draw labor at a constant wage rate (α). The next step

in the analysis is to see why the marginal productivity in these other sectors may exceed α , in which case the pool of agricultural labor is the location of disguised unemployment.

B. Cocoa

The output of cocoa (X_c) is assumed to be given by

$$X_c = F_c(K_c, L_c) = L_c f_c(k_c) \quad \dots (3)$$

where F_c , the production function for cocoa, exhibits constant returns to scale in its two arguments; $k_c \equiv K_c/L_c$ is the capital/labor ratio used in cocoa; and $f_c \equiv F_c/L_c$, the average physical product of labor in cocoa, depends only on k_c because of constant returns to scale. Once again, land has been excluded from the production function on the assumption that it is not in scarce supply.

These assumptions are plausible first-order simplifications in the case of Ghana. Capital is an important factor of production, especially given the considerable value of investment in cocoa trees⁷ and the long gestation period.⁸ The tree capital may be treated as mobile in the long run, in the sense that the farmer always has the option of not replacing trees which have outlived their productive years.⁹ As for the availability of land, there is evidence to suggest that not all of the good cocoa land is currently utilized.¹⁰

In the present model, the total cocoa output is assumed to be divided equally into three traditional shares--one third of the output for labour, one third for capital, and one third for land.¹¹ This implies that each

factor unit receives one third of its average product. For example, labor's wage in terms of cocoa (w_c) is

$$w_c = \frac{f_c}{3} \quad \dots (4)$$

This tripartite distribution of the cocoa produce is suggested by sharecropping arrangements found in the Ghanaian cocoa industry. Ollennu [18, pages 256-257] discusses two types of sharecroppers--the abusa laborer and the abusa tenant. The former receives one third of his output for providing labor only. The latter receives two-thirds of his output for providing both labor and capital. Thus, it appears that the share of labor is 1/3, that the share of capital is 2/3 - 1/3 = 1/3, and that the remaining 1/3 is the share of land.

The model also assumes that the money wage paid in the cocoa sector equals the money wage paid in the food sector, i.e.

$$p_c w_c = p_a w_a \quad \dots (5)$$

where p_a and p_c are the world prices of foodstuffs and cocoa, respectively.

In the case of Ghana, equation (5) is suggested by the great mobility of labor (see Caldwell [5] and Hill [9]), and by the absence of convincing wage data to the contrary.¹²

From equations (2), (4) and (5), it follows that

$$p_c f_c = 3p_a \alpha \quad \dots (6)$$

With a well-behaved production function, the average product exceeds the marginal. That is,

$$f_c = \lambda(f_c - k_c f'_c), \quad \lambda > 1 \quad \dots (7)$$

where λ is generally a variable; $f'_c \equiv df_c/dk_c$ is the derivative of f_c with respect to k_c ; and $f_c - k_c f'_c$ is the marginal physical product of labor in cocoa. From equations (6) and (7), it follows that

$$p_c (f_c - k_c f'_c) = \frac{3p_a \alpha}{\lambda} \quad \dots (8)$$

If $\lambda < 3$, labor's marginal value product is greater in cocoa than in food, which implies that there is disguised unemployment in the food sector. For the sake of brevity, this is the only case considered here. (If $\lambda > 3$, there is disguised unemployment in cocoa instead of food. This case may be analyzed similarly. The case of $\lambda = 3$ is not interesting in the present context, since then no disguised unemployment is revealed when the cocoa and food sectors are compared.)

C. Manufacturing

Output of manufactures (X_m) is assumed to be given by

$$X_m = F_m(K_m, L_m) = L_m f_m(k_m) \quad \dots (9)$$

where F_m , the production function for manufactures, exhibits constant returns

to scale in its two arguments; $f_m \equiv F_m/L_m$; and $k_m \equiv K_m/L_m$. Because entrepreneurs in this sector are assumed to maximize profits, the wage in terms of manufactures (w_m) equals the marginal physical product of labor ($f_m - k_m f'_m$). That is

$$w_m = f_m - k_m f'_m \quad \dots (10)$$

It is also assumed that the money wage in manufacturing exceeds the money wage in the other two sectors. That is

$$p_m w_m = \sigma p_c w_c = \sigma p_a w_a, \quad \sigma > 1 \quad \dots (11)$$

where p_m is the world price of manufactures, and σ (a measure of the wage differential) is assumed to be constant for the sake of simplicity.

The assumption of a wage differential between manufacturing and agriculture is consistent with the Ghanaian data (see Rourke and Sakyi-Gyinae [19]). A likely explanation of this differential is the minimum wage legislation which affects the former sector more than the latter. (See Killick [12] for evidence of the impact of this legislation on urban wages.)

It follows from equations (2), (4), (7), (10) and (11) that

$$p_m (f_m - k_m f'_m) = \frac{\sigma \lambda p_c (f_c - k_c f'_c)}{3} = \sigma p_a \alpha, \quad \sigma > 1 \text{ and } \lambda > 1 \quad \dots (12)$$

Comparing the manufacturing and food sectors, there is clearly disguised

unemployment of labor in the latter where the marginal value product of labor is less. Assuming for the sake of simplicity that $\sigma\lambda/3 = 1$, labor's marginal value product is the same in cocoa as in manufacturing. Thus, all disguised unemployment occurs in the food sector.¹³ (As $\sigma\lambda/3 \geq 1$, the marginal value product in cocoa is less than or greater than the marginal value product in manufacturing, and there is disguised unemployment in cocoa or manufacturing, respectively. For the sake of brevity, these cases are not discussed here, but may be analyzed similarly.) Any shift of labor out of food and into either of the other two sectors will increase national income, ceteris paribus.

D. The Wage Floor

The quantity $w_a = \alpha$ serves as a constant wage floor for the entire economy. This constant floor can also be expressed in terms of manufactures, under the following assumptions.

It is assumed that the home country (i.e., the labor-and-land surplus country) is a small trader in world markets for manufactures and food, and cannot affect the prices of these goods. Therefore, from the viewpoint of the home country,

$$P_a = \text{constant} \quad (13)$$

and

$$P_m = \text{constant} \quad (14)$$

As a large trader in world cocoa markets, however, the home country's level of exports can affect the price of cocoa. Thus, p_c is a variable.

This set of assumptions is a fair characterization of the Ghanaian trade position. As a small trader in world markets for manufactures and foodstuffs, Ghana's influence on the international prices of these goods is probably negligible. On the other hand, as a major supplier of cocoa (see FAO [7]), Ghana is undoubtedly able to influence the world cocoa price.

It follows from equations (2), (11), (13), and (14) that

$$w_m = \frac{\sigma p_a \alpha}{p_m} = \text{constant} \quad \dots (15)$$

In other words, the economy's wage floor can also be expressed in terms of a constant amount of manufactures. The importance of this result will be seen below.

PART II

APPLICATIONS

How to apply the model is best understood by observing its close analytic relationship to an earlier model outlined by Brecher [2 and 4]. This earlier case and the present one are both extensions of the standard (full-employment, two-commodity, two-factor) Heckscher-Ohlin model of a trading economy. (Since land in the present paper does not enter any production functions explicitly, there is no formal departure from the two-factor assumption.) In both extended cases, the main amendment to the standard model is the fact that the wage is

everywhere downwardly rigid in terms of one of the two goods that use capital. Labor not absorbed in the production of either of these two goods flows into a third sector--the pool of unemployed--where labor's marginal product is relatively insignificant. (In the earlier case, unemployment is open, and labor's marginal product in the pool of unemployed is zero. In the present case, unemployment is disguised, and labor's positive marginal product in the pool is lower than in the rest of the economy.)¹⁴

In view of their similarity, it is not surprising that these two unemployment models have many results in common. Nor is it surprising that the method of proof developed in the earlier case may also be applied here with minor modifications. A sample of four of the propositions common to both models will now be stated. It is assumed that ^{no commodity is inferior, that} there is always some labor in the pool of unemployed, and that neither cocoa production nor manufacturing ceases at home. (In the earlier model, the two goods were simply called commodities one and two.) The four propositions are as follows:

1) In the event of an increase in foreign demand for home exports (cocoa), unemployment will increase if cocoa is more capital-intensive than manufactures, but will decrease if cocoa is more labor-intensive.

2) An across-the-board increase in the home tax on either exports (cocoa) or imports will normally¹⁵ have the same impact on unemployment as a decrease in foreign demand for home exports. (It is assumed here that the tax increase is not great enough to cause trade to cease altogether.)

3) If a technical improvement occurs at home in either cocoa or manufacturing, unemployment may increase even when the technical change is Hicks-neutral. The likelihood of a rise in unemployment depends (in part) upon the

relative factor intensities of these two sectors.

4) An increase in the home stock of capital will decrease unemployment.

These results may be understood intuitively as follows. In the standard trade model with perfectly flexible factor prices, it is well known how the equilibrium real wage responds to various parametric shifts (such as a shift in demand, a rise in tariffs, a change in technology, and an increase in factor endowments). If, however, the real wage is rigid (as in the unemployment models discussed here), the adjusting variable must be the level of unemployment rather than the real wage. Whenever a parametric shift would decrease (increase) a perfectly real wage, instead it will increase (decrease) the level of unemployment in the presence of real wage rigidity.

The first three propositions highlight the importance of determining the relative factor intensities of cocoa and manufacturing. In the Ghanaian case, this has not been done decisively. All that seems clear at the moment is that a considerable proportion of the country's capital stock is utilized in the cocoa industry (see above).

PART III

CONCLUSION

It appears that, for some countries like Ghana, labor surplus and land surplus are not mutually exclusive phenomena. The abundance of land may lead to a situation where the most productive sectors of the economy face unlimited supplies of labor at a constant wage, and where the social opportunity cost of

this labor ~~that~~ is constant and relatively low. An important question in this case is how to increase the total demand for labor by the high-productivity sectors. The way to do this depends (in part) upon the relative factor intensity of these two sectors.

FOOTNOTES

¹Hill [11] reports an area in Nigeria where she observes no shortage of either land or labor. Her notion of labor scarcity, however, is not identical to one considered here.

²A subsequent paper will show how the model may be extended easily to include open unemployment as well.

³As Marglin [16, page 63] has argued, labor can be in surplus in a meaningful sense even when its marginal product exceeds zero.

⁴According to Morgan and Pugh [17, page 521], "Except in the crowded areas of the south-east, in parts of Sierra Leone, in Western Senegal and in the Mossi and Hausa districts, there is no land shortage in West Africa. The limitation on productivity has lain in the limit to which the cultivator can extend the area under cultivation with his present techniques." Although there may be increasing pressure of population in parts of Ghana (see Killick [13, page 218]), land shortage in food agriculture does not seem to be a problem in most areas of the country. In any case, at least the historical relevance of the surplus land assumption would probably be accepted by most experts.

⁵The main responsibility of the individual, according to Ollennu, is "to give some portion of what he collects for the performance of the periodic rites and ceremonies for the land, the sea, river or the lagoon" (page 254). Since these costs are likely to be negligible, it is probably safe to ignore

them. In any case they could be incorporated by having w_a reduced slightly below α , without importantly affecting the subsequent analysis.

⁶According to Wills [22, page 203]: "In Ghana, subsistence agriculture, whether commercialized or not, is almost entirely uncapitalized and only rarely are non-traditional methods or industrial techniques employed. The hoe and cutlass are universal implements of cultivation."

According to an estimate on the basis of 1960 data (see Killick [13, page 221]), agriculture (excluding cocoa) accounted for only about 1.5% of the total capital stock. This minimal use of capital could be incorporated into the model--without importantly affecting the results--by assuming fixed proportions between labor and capital (e.g., one hoe and one cutlass per worker), and by having w_a slightly less than α .

⁷According to an estimate on the basis of 1960 data (see Szereszewski [21]), the cocoa sector employed over 30% of Ghana's total capital stock (including the value of the cocoa trees). An argument in favor of treating the trees as capital is given by Killick [14, page 240].

⁸According to Morgan and Pugh [17, page 475]: "New cocoa plots begin to produce abundantly by about the tenth year, and reach a peak in most areas between 18 and 22 years." In making an estimate of yields for 1958-59 and 1959-60, the Ghanaian Ministry of Agriculture assumed a zero yield from trees up to 7 years of age (see Killick [14, page 242]).

⁹See Morgan and Pugh [17, page 475] and Killick [14, page 242] for the productive life span of cocoa trees.

¹⁰ According to Hill [10, page 282]: "It is to be presumed that owing to the introduction of the capsid sprayer many hitherto marginal lands have become worth planting, so that the supply of plantable lands in the possession of farmers has suddenly increased. It is easy to understand why the migrant farmers themselves are not worried by the prospect of land scarcity in the foreseeable future; and this quite apart from the fact that the re-establishment of the devastated lands will occupy many of them for years to come... It should always be remembered that the original planting of their southern Akim lands occupied many migrant farmers for a quarter of a century or more."

According to Benneh [1, page 61]: "In certain cases, people even clear plots of land which they do not intend to cultivate during the current farming season with the sole purpose of staking their claims over them." This practice would make cocoa land appear more fully utilized than it actually is.

Direct evidence of cocoa land still available for new planting or rehabilitation (after disease) is the Ghana government's current Eastern Region Cocoa Rehabilitation Project, involving 36,000 acres of new planting and 54,000 acres for rehabilitation.

Admittedly, many experts would still argue that cocoa land is scarce today. If so, the assumption still has historical relevance, since cocoa land was undoubtedly in surplus during the earlier years of cultivation. In any case, a subsequent paper will show that a scarcity of cocoa land could be incorporated easily into the model without destroying the major conclusions.

¹¹ An abundance of land can be consistent with a traditional return to land in the case where the land market is not perfectly competitive. This situation

is similar to the familiar case of a positive institutional wage when labor's marginal product is zero (a case considered by Fei and Ranis [6] and Lewis [15]).

¹² Hopefully, further research will uncover the wage data necessary to test equation (5) directly, or data on sectoral income per man-hour necessary to test equation (6) as an indirect test of (5). The available data on sectoral income per capita is not an acceptable proxy for income per man-hour, especially because farm labor is not perfectly specialized between cocoa and foodstuffs (see Szereszewski [20, page 71]). Szereszewski [20, page 71] has made only the vague estimate that "labor productivity in cocoa farming must be considerably higher" than in foodstuffs, and that the difference would be much greater if cocoa were valued at export prices rather than domestic producer prices. (Imperfect specialization presents much less of a problem for computing an urban-rural wage differential.)

In any case, the subsequent analysis would not be importantly affected by a wage differential in favor of cocoa or by a sufficiently small wage differential in favor of the food sector.

¹³ There could also be disguised unemployment of capital in one sector for reasons explained by Brecher [3]. To keep the exposition simple, this complication is ruled out here by assuming that the marginal value product of capital is the same in cocoa and manufacturing (for reasons that could easily be specified). Nevertheless, disguised unemployment of capital could be introduced into the model without difficulty, along the lines suggested by Brecher [3]. Doing so would not destroy the main thrust of the analysis.

¹⁴ Although there is sharecropping in the present model but not in the earlier one, this difference does not destroy their most important analytic similarities, as shown by Brecher [3]. (To adapt the Brecher [3] analysis for the present analysis, replace the constant shares δ and $1-\delta$ of the former by the shares $1/3$ and $1/3$ of the latter.)

¹⁵ Following the usual convention in the trade literature, the normal (perverse) case is the one in which output of home exportables decreases (increases or is constant).

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