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CEREAL PRODUCERS, PRICES AND THE SUPPLY OF MANUFACTURED CONSUMER GOODS: A NOTE*

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ABSTRACT: *The study presents a simple model of a peasant household, which extends the basic agricultural household model, by attempting to explicitly incorporate the operational milieu of such a household in Ethiopia during the 1980s. Specifically, quantity constrained markets for labour and manufactured consumer goods are introduced. The resultant comparative static results indicate that the response of cereal-producing peasant households to market-related incentives is more complex than in an un-rationed context. Income and substitution effects, as well as input substitution possibilities are identified as key determinants of that response. Although the paper is based on the situation in the 1980s, its results are valid so long as shortages in manufactured consumer goods persist in the rural areas.*

1. INTRODUCTION

Ethiopian agriculture:

- (i) accounts for 40-50 percent of national output;
- (ii) provides employment for more than 80 percent of the country's labour force; and
- (iii) generates almost the entire export earnings of the country.

In fact, alternative rural employment opportunities being, at best, marginal and centred around it, the agricultural sector effectively constitutes the rural economy of Ethiopia. Furthermore, this sector is characterised by:

- (i) overwhelming dominance by small-scale peasant (or semi-subsistence) producers (they produce above 80 percent of total agricultural output); and
 - (ii) imperfect market structure with underdeveloped or non-existent infrastructures.
- These circumstances support the observations that:

- (i) the Ethiopian economy as a whole, and its rural sector in particular, cannot be transformed without radical changes in, and subsequent influences from, agriculture; and
- (ii) despite unenlightened, and thus detrimental, policies of the past two decades (including forced cooperativisation, extremely radical land reform with complete

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nationalisation of land; discrimination against private peasant producers; and the compulsory grain delivery system) the government has a potentially beneficial role if it adopts a temporally, spatially and internally consistent set of policies and instruments.

Indeed the direct implication to development-oriented government policy initiatives is that they should be founded on a reasonable understanding of:

- (i) the behavioral dynamics of subsistence agriculture's basic unit - the peasant household; and
- (ii) the interaction of the agricultural sector with the rest of the national economy.

These observations warrant a systematic attempt to model the microeconomic behaviour of agricultural households. Particular emphasis, in this regard, should be accorded to cereal-producing semi-subsistence households given their dominance in agricultural production, food supply and exports.

Such an attempt can be deemed a priority area of research in Ethiopia because it contributes towards:

- (i) identifying correct policy directions and instruments; and
- (ii) avoiding a repeat of disastrous policy experiments of the past.

Both are critical to a country with a history of famine (perhaps largely due to man-made factors); with an urgent need for reconstruction; and with a new government that seems to have a different policy orientation.

As a contribution in that direction this study proposes to formulate a particular economic model of peasant households by introducing quantity constraints in the basic agricultural household model outlined in Strauss [26]. The main emphasis is on shortages of manufactured consumer goods and limited opportunity for labour market participation that such a household appears to face.

2. CEREAL PRODUCING FARM HOUSEHOLDS IN ETHIOPIA - A SCHEMATIC CHARACTERISATION

2.1 This section briefly outlines the pertinent features of a semi-subsistence cereal-producing farm household in Ethiopia. This schematic characterisation is bound to abstract from the substantial degree of diversity to be expected from peasant farming in the country. However, it is deemed sufficient for the purpose of this paper.

During the study period a cereal-producing household in Ethiopia:¹

- (a) simultaneously produced a number of crops, cereals being the most important;
- (b) operated a small land holding - allotted to it by the state on usufruct - divided into a number of variously endowed and located plots;
- (c) employed a traditional technology of production with little or no application of improved inputs;
- (d) sold a portion of its output, largely on the 'free' market;
- (e) bought manufactured consumer goods, primarily from the public sector, but appeared to be unable to fully satisfy its demand for such goods; and
- (f) relied on family labour, and may have participated in a labour market, which was conditioned by institutional, technological and economic constraints.

Given the main objectives of the paper more has to be said about the last two items.

2.2 Manufactured Consumer Goods Supply

In the study period, peasant households had two sources of manufactured consumer goods. The first was the Ethiopian Domestic Distribution Corporation (EDDC). EDDC supplied such goods to Service Cooperatives (SCs), which subsequently ration what was available to members of Peasant Associations, mainly according to family size. The second source was the 'free' market on which private traders sell consumer goods, partly supplied to them by EDDC itself, at higher prices.

There is little direct evidence regarding how satisfactory manufactured consumer goods (MCGs) availability to peasant households was in the study period. The following, however, may shed some light:²

- (a) During the 1979-82 period, the average share of the peasant sector - which accounts for more than 80 percent of the country's population and about 40 percent of its GDP - out of the total EDDC supply of MCGs was only 20 percent. Even this may overestimate the actual share of the sector because leakages at different stages of distribution were highly probable.
- (b) A survey conducted in a relatively prosperous administrative region - Arsi - during 1983, found that EDDC-supplied SCs constituted the primary source of MCGs for 69 percent of sample households.
- (c) As a matter of government policy importation of MCGs was highly restricted.
- (d) Private traders are likely to prefer urban centres due to, among others, discouraging transport difficulties in rural Ethiopia. In 1983/84, for instance, the country - with a surface area of 1.25 million sq. km - had only 13,195 km of all-weather roads.

These facts indicate the likely severity of MCGs shortages that farm households had to cope with. Obviously, it is necessary to consider the demand side of the problem to make definitive inferences, particularly given the low level of income attained by peasants. However, it can be argued that the sheer size of the farming population in Ethiopia and its proportionately meagre share of available MCGs make excess demand more probable than otherwise.

2.3 Labour Market

During the period under consideration, the sell and purchase of labour was prohibited by law. Nevertheless, there is some evidence of hired labour use, suggesting that the restriction was not fully effective. Indirect evidence of the practice is furnished by the Rural Household Income, Consumption and Expenditure Survey (1981/82). The survey revealed that wages and salaries contribute about 1 percent and 0.2 percent of total household income in cash and in kind, respectively.

Given the smallness of landholdings, as well as the apparently lax application of restrictions on wage labour, heavy reliance on hiring-out family labour is to be expected. However,

- (a) little variation in size-distribution of farms;

- (b) virtual absence of complete landlessness;
 - (c) seasonality of production and the probable imperfect substitutability of family and hired labour; and
 - (d) almost complete absence of non-agricultural employment opportunities;
- suggest that peasant households were unable to sell or buy as much farm labour as they wish. Hence, although establishing the existence, nature and role of a labour market under these circumstances is a non-trivial task, it is possible to tentatively observe that such a market, if it exists, is likely to be incomplete.

On the basis of the above characterisation and relevant assumptions, an economic model of a peasant household is presented in the next section.

3. CEREAL SUPPLY, PRICES, AND THE SUPPLY OF MANUFACTURED GOODS

The description of a peasant household in the last section reveals that, typically, such a household is simultaneously a production and consumption unit. As such it faced the problem of optimal choices in production and consumption. These choices are likely to be affected by market variables, including prices and availability of goods and factors; and non-market-variables such as household size/composition and production technology. These variables, in turn, relate to government policies; public investment in infrastructure, education and health; dissemination of improved technology; pattern of land tenure; the involvement of markets; as well as household resource endowments and corresponding capabilities to deal with change.

In other words, the production and consumption decisions of cereal producers in Ethiopia and their adjustment to economic change depend on a large number of interconnected market, technological and institutional factors. These interconnections mean that the degree of responsiveness to one is either promoted or hampered by the state of the others. For instance, higher producer prices may fail to stimulate substantial increases in farm output not because farmers are unresponsive to such an incentive, but because the technology of production limits their capacity to fully adjust to the new situation. Similarly, rationing in one or more markets may constrain the speed and extent of adjustment. It is imperative, therefore, to place theoretical and empirical

analysis of the responsiveness of farm supply to market-related incentives (especially prices) within the overall socio-economic dynamics of agriculture. In this sense, the formal model presented in the next section is only a partial representation of the behavioural dynamics of a peasant household.

3.1 A Static Model of a Peasant Household

Beginning in the late 1960s the assertion that peasant producers are, in principle, unresponsive to market-related incentives has been challenged both on theoretical and empirical grounds. At about the same time, the fact that a farm household is simultaneously a production and a consumption unit started to be emphasised by economists.⁴ Theoretical and empirical analysis of this peculiarity eventually evolved into what is known as the theory of the farm household - a hybrid of the theory of the firm and that of the consumer [16]. In principle, this theory models farm households as simultaneously making production and consumption decisions. Nevertheless, it also stipulates conditions under which these decisions became logically sequential though simultaneous in time.

In a related, but more recent, development, the impact of shortages in manufactured consumer goods on the economic behaviour of peasants began to receive increasing attention. A common feature of the growing literature is the argument that quantitatively rationed supply of manufactured goods, with or without government price control, may modify farmers' behaviour such that they respond negatively to price incentives. The corollary is increasing the supply of these goods to peasants may, in itself, induce them to produce more and/or restore the positive impact of farm output prices.⁵

An economic model that attempts to incorporate these considerations, and the main attributes of the cereal-producing peasant households in Ethiopia, is presented below. Essentially, it is the general model of an agricultural household developed in Strauss [26], now modified by the introduction of quantity-constrained (or rationed) markets of manufactured consumer goods and labour.

3.1.1 The Model⁶

In the light of section 2, a typical peasant household in Ethiopia can be described as follows. This household:

- (a) maximises utility subject to a production function, cash income (or explicit budget) and time constraints;
- (b) applies inputs of its own (particularly labour) in agricultural production and consumes part of the output thus generated;
- (c) sells part of its agricultural output and uses the receipts to buy market goods - particularly manufactured consumer goods;
- (d) makes labour supply decisions involving its participation in the labour market to the extent possible;
- (e) faces quantity constraints in terms of available supply of manufactured consumer goods and the amount of labour it can buy or sell.

To construct a static model of this household's behaviour (without worrying about comparative statics for the time being) it is sufficient to assume that:⁷

- (i) there exists a single household utility function (U) - with household consumption of farm output (X_a), market purchased manufactured consumer good (X_m), and Leisure (X_l) as its arguments - which is twice continuously differentiable, monotonically increasing and quasi-concave;
- (ii) the farm production function, $Q_a(L, V, A, K)$ - where L , V , A and K are total labour input, variable input, acreage (or land) and fixed input, respectively - is twice continuously differentiable and quasi-concave;
- (iii) leisure includes short-term, non-traded outputs of household production activities, i.e. Z-goods; and
- (iv) farm production is risk-free.⁸

Under these assumptions, and noting that the labour market constraint translates into a constraint in terms of leisure, the short-run (i.e., a single agricultural cycle) optimisation problem of the farm household becomes:

$$(A.1) \quad \text{Max } U(X_a, X_l, X_m)$$

subject to:

$$(A.2) \quad p_m X_m \leq p_a(Q_a - X_a) - p_L(L - F) - p_v V + E; \text{cash income constraint.}$$

$$(A.3) \quad Q_a \leq Q_a(L, V, A, K); \text{production function.}$$

$$(A.4) \quad X_m \leq \bar{m}; \text{level of manufactured consumer goods ration.}$$

$$(A.5) \quad X_L \leq T - L + \bar{L}; \text{constraint on leisure consumption due to the ration in the labour market; i.e. } L - F \leq \bar{L}.$$

where p_i = prices; $i = a, L, m, V$

F = family farm labour input

T = household's total time endowment

$L - F$ = hired labour (hired-in if positive, hired-out if negative)

$(Q_a - X_a)$ = marketed surplus

E = non-wage, non-farm net other income.⁹

\bar{L} = maximum volume of labour a household can buy or sell.

To achieve (short-run) equilibrium, such a farm household should equate its maximised expenditure with its maximised full income (Y_f), i.e., at a given utility, U , achieve the equality:¹⁰

$$p_a X_a + p_L X_L + p_m X_m = Y_f [= p_L T + (p_a Q_a - p_L L - p_v V) + E]$$

This condition is always necessary. However, additional equilibrium conditions are introduced by the presence of rationing. Thus, the specific forms of the expenditure and full income functions have to be modified accordingly. Indeed, the model is non-recursive.

Recursiveness in farm household models implies production and consumption decisions, though temporally simultaneous, are logically separable, such that the household makes the former independently and incorporates them in reaching the latter. For this property to hold, the following additional assumptions, concerning commodities which enter both production and consumption by the household, are sufficient [26]:

- (i) all markets relating to such commodities exist and clear
(i.e. are unrationed);
- (ii) the household is a price-taker in all markets relating to such commodities; and
- (iii) all such commodities are homogeneous.¹¹

It is obvious that the rationing in the X_m market alone does not violate the conditions of recursiveness because the good is consumed, but not produced, by the household. However, the fact that the household is rationed in the labour market, with or without rationing in X_m , leads to the breakdown of recursiveness.¹²

Assuming that the rations bind and one of the constraints (A.2) - (A.3) holds with equality, the relevant Lagrangean can be written as:¹³

$$(A.6) \quad \Phi = U(X_a, X_L, X_m) + \lambda_1 [p_L T + p_a Q_a - p_L L - p_v V + E - p_a X_a - p_L X_L - p_m X_m] + \lambda_2 [\bar{X}_m - X_m] + \lambda_3 [T - L + \bar{L} - X_L]$$

With interior solutions, the first-order conditions are:¹⁴

$$(A.7) \quad U_a = \lambda_1 p_a$$

$$(A.8) \quad U_L = \lambda_1 (p_L + \frac{\lambda_3}{\lambda_1})$$

$$(A.9) \quad U_m = \lambda_1 (p_m + \frac{\lambda_2}{\lambda_1})$$

$$(A.10) \quad p_a \frac{\partial Q_a}{\partial L} = p_L + \frac{\lambda_3}{\lambda_1}$$

$$(A.11) \quad p_a \frac{\partial Q_a}{\partial V} = p_v$$

$$(A.12) \quad p_L T + (p_a Q_a - p_L L - p_v V) + E = p_a X_a + p_L X_L + p_m X_m$$

$$(A.13) \quad X_m = \bar{X}_m$$

$$(A.14) \quad X_L = T - L + \bar{L}$$

First-order conditions (A.7)-(A.14) form a system of eight equations with eight unknowns - $X_a, X_L, X_m, L, V, \lambda_1, \lambda_2$, and λ_3 . Solving, we obtain the goods (Marshallian) and factor demands. Since these demands depend on the ration levels \bar{X}_m and \bar{L} , they are rationed demands. Thus, following Deaton [14], and Neary and Roberts [20], we can write these equations as:

$$(A.15) \quad \tilde{X}_a = \tilde{X}_a(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E)$$

$$(A.16) \quad \tilde{X}_L = \tilde{X}_L(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E) = T - \tilde{L} + \bar{L}$$

$$(A.17) \quad \tilde{X}_m = \tilde{X}_m(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E) = \bar{X}_m$$

$$(A.18) \quad \tilde{L} = \tilde{L}(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E)$$

$$(A.19) \quad \tilde{V} = \tilde{V}(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E)$$

where, $(\tilde{\cdot}) = \text{rationed}$.

Accordingly, output decisions depend not only on prices and fixed input levels but also on the levels of \bar{X}_m and \bar{L} . Alternatively, production decisions depend on consumption decisions through λ_3 .

In order to examine the influence of rationing on household behaviour it is necessary to work out the relationship between rationed and unrationed demands. This task is simplified if the utility maximisation problem is reformulated as an expenditure (or cost of utility) minimisation problem using the duality theorem.¹⁵ To specify the dual under these circumstances we have to use the only exogenous part of the household's full income, E (this in fact can be read directly from the rationed demand functions above).

Given the relation:

$$p_a X_a + p_L X_L + p_m X_m = p_a Q_a - p_L L - p_v V + p_L T + E$$

we have

$$(A.20) \quad E = p_a X_a + p_L X_L + p_m X_m - p_a Q_a + p_L L + p_v V - p_L T$$

Hence, the optimisation problem reduces to minimising (A.20) subject to a given level of utility and constraints (A.3) - (A.5). The resultant represents minimum exogenous income required to achieve a given utility level, say \bar{U} . Minimised (A.20) can be considered as an expenditure function, say e' .¹⁶ Formally this can be stated as:

$$\text{Min } p_a X_a + p_L X_L + p_m X_m - p_a Q_a + p_L L + p_v V - p_L T$$

subject to:

$$\begin{aligned} U(X_a, X_L, X_m) &\geq \bar{U} \\ Q_a &\leq Q_a(L, V, A, K) \\ X_m &\leq \bar{X}_m \\ X_L &\leq T - L + \bar{L} \end{aligned}$$

With binding constraints and interior solutions, duality ensures that the first-order conditions will be the same as in the case of utility maximisation.¹⁷ The resulting expenditure function is a rationed one:

$$(A.21) \quad e' = e'(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, \bar{U})$$

Applying the results of Neary and Roberts [20], this expenditure function can be assumed to possess the following properties:

- (i) It is increasing and concave in prices.
- (ii) Its partial derivatives with respect to commodity prices are, by Shepard's lemma, rationed Hicksian (or compensated) demands \bar{X}_a^e , \bar{X}_L^e and \bar{X}_m^e .

where c represents "compensated".

Based on these and noting that,

$$(i) \quad \bar{X}_L^c = (T - \bar{L} + \bar{L}) \quad \text{and} \quad \bar{X}_m^c = X_m; \text{ and}$$

- (ii) a virtual price is defined as that price which would induce an unrationed household to purchase (or consume) the ration levels of a commodity [20, p.30]; the following hold:

$$(A.22) \quad \bar{\theta}'(\cdot) = p_a \bar{X}_a^c + p_m \bar{X}_m^c + p_L (T - \bar{L} + \bar{L}) \\ - (p_a Q_a - p_L \bar{L} - p_v \bar{V}) - p_L T$$

$$(A.23) \quad e'(p_a, \bar{p}_L^*, \bar{p}_m^*, p_v, T, A, K, \bar{U}) = p_a \bar{X}_a^c + \bar{p}_m^* \bar{X}_m^c \\ + \bar{p}_L^* (T - L + \bar{L}) - (p_a Q_a - \bar{p}_L^* L - p_v V) - \bar{p}_L^* T$$

$$(A.24.1) \quad \bar{X}_a^c(p_a, \bar{p}_L^*, \bar{p}_m^*, p_v, T, A, K, \bar{U}) = \\ \bar{X}_a^c(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, \bar{U})$$

$$(A.24.2) \quad \bar{X}_L^c(p_a, \bar{p}_L^*, \bar{p}_m^*, p_v, T, A, K, \bar{U}) = T - L + \bar{L}$$

$$(A.24.3) \quad \bar{X}_m^c(p_a, \bar{p}_L^*, \bar{p}_m^*, p_v, T, A, K, \bar{U}) = \bar{X}_m$$

$$(A.25) \quad e(p_a, \bar{p}_L^*, \bar{p}_m^*, \bar{U}) = p_a \bar{X}_a^c + \bar{p}_L^* \bar{X}_L^c + \bar{p}_m^* \bar{X}_m^c$$

where $e'(\cdot)$ = unrationed expenditure function at virtual prices.

\bar{X}_i^c = unrationed compensated demands at virtual prices ($i = a, L, m$).

$e(\cdot)$ = unrationed ordinary expenditure function at virtual prices.

\bar{p}_i^* = compensated virtual price ($i = L, m$).

Therefore, we are able to derive the following three major results:

- (a) (A.24.2) and (A.24.3) implicitly define the compensated virtual prices of labour and X_m as

$$(A.26.1) \quad \bar{p}_L = \bar{p}_L(p_a, \bar{p}_m, p_v, T, A, K, \bar{U})$$

$$(A.26.2) \quad \bar{p}_m = \bar{p}_m(p_a, \bar{p}_L, p_v, T, A, K, \bar{U})$$

These prices do exist given standard assumptions about preferences [14, p.59].

- (b) Subtracting (A.23) from (A.22) and making use of (A.24.1) - (A.24.3) produces the required relationship between the rationed and unrationed expenditure functions as:

$$(A.27) \quad \bar{e}'(\cdot) = e'(\cdot) + (p_m - \bar{p}_m) \bar{X}_m + (p_L - \bar{p}_L) \bar{L}$$

- (c) Finally, using (A.23) and (A.25) and the definition of short-term profits we obtain the relationship between the rather unconventional unrationed expenditure function $e'(\cdot)$ and its ordinary counterpart $e(\cdot)$:

$$(A.28) \quad e'(\cdot) = e(\cdot) - \eta(p_a, \bar{p}_L, p_v, A, K) - \bar{p}_L T$$

Note that the profit function is assumed convex in all prices.

In order to conduct comparative static analysis of household behavior it is necessary to establish the impact of exogenous variables on compensated virtual prices and the relationship between compensated and uncompensated virtual prices. To achieve the first we start by differentiating (A.28) with respect to \bar{p}_L^* :

$$e_L' = e_L - \eta_L - \tau$$

Noting from (A.23), $e_L^* = \bar{L}$ and rearranging we have:

$$e_L = T + \eta_L + \bar{L}$$

This is a restatement of the labour market ration translated into a constraint on leisure consumption since e_L is unrationed Hicksian leisure demand at virtual prices and, by Hotelling's lemma, L expresses labour demand at the same prices.

Doing the same with respect to \bar{p}_m^* and noting that \bar{p}_m^* does not affect profits,

$$e_m' = e_m$$

By (A.23) and (A.24.3),

$$e_m = \bar{X}_m$$

Thus we obtain

$$(A.29) \quad e_L = T + \eta_L + \bar{L}$$

$$(A.30) \quad e_m = \bar{X}_m$$

Given T and U, and differentiating (A.29) and (A.30) with respect to $\alpha = [p_a, p_v, A, K]$ and noting the interdependence between \bar{p}_L and \bar{p}_m [see (A.26.1) and (A.26.2)]:

$$e_{La} + e_{\alpha} \frac{\partial \bar{p}_L}{\partial \alpha} + e_{Lm} \frac{\partial \bar{p}_m}{\partial \alpha} = \eta_{La} + \eta_{\alpha} \frac{\partial \bar{p}_L}{\partial \alpha},$$

$$e_{ma} + e_{mL} \frac{\partial \bar{p}_L}{\partial \alpha} + e_{mm} \frac{\partial \bar{p}_m}{\partial \alpha} = 0$$

Given the symmetry of the Slutsky matrix, solving the above system simultaneously produces the desired expression for the effects of exogenous variables on virtual prices:

$$(A.31) \quad \frac{\partial \bar{p}_L}{\partial \alpha} = \frac{-e_{mm}(e_{La} - \eta_{La}) + e_{Lm} e_{ma}}{e_{mm}(e_{Lk} - \eta_{Lk}) - (e_{mL})^2}, \quad \alpha = p_a, p_v, A, K$$

$$(A.32) \quad \frac{\partial \bar{p}_m}{\partial \alpha} = \frac{-e_{ma}(e_{Lk} - \eta_{Lk}) + e_{mL}(e_{La} - \eta_{La})}{e_{mm}(e_{Lk} - \eta_{Lk}) - (e_{mL})^2}, \quad \alpha = p_a, p_v, A, K$$

As can be observed from (A.31) and (A.32) the impact of α on \bar{p}_L and \bar{p}_m is complex, and depends on the degree of substitution characterising consumption and production. The denominator in both cases can be described as:

$$(A.33) \quad \left(\frac{\partial^2 e'}{\partial \bar{p}_m^2} \right) \left(\frac{\partial^2 e'}{\partial \bar{p}_L^2} \right) - \left(\frac{\partial^2 e'}{\partial \bar{p}_L \partial \bar{p}_m} \right)^2$$

Such that, by the concavity of the expenditure function, it is greater than or equal to zero. The latter case cannot produce economically meaningful results, and thus has to be excluded.

As to the numerators, it can be generally noted that the key factors are:

- (i) the degree of substitution, in household consumption, between X_a , X_L , and X_m ; and
- (ii) the degree of substitution between labour and other, if any, variable inputs.

The ultimate effect of a change in p_a , for instance, on the two compensated virtual prices depends on the sign of the respective numerators. From the concavity and convexity of the expenditure and profit functions, respectively, $(e_{LL} - \eta_{LL})$ and e_{mm} are negative. This means, the sign of the effect is indeterminate unless explicit assumptions are made about whether X_a , X_L , and X_m are substitutes or complements, i.e. e_{La} , e_{ma} and e_{mL} ($= e_{Lm}$) are positive or negative, respectively. Indeed, only if we assume that all are substitutes for one another that it is possible to deduce the sign of $\partial p_L^* / \partial p_a$ and $\partial p_m^* / \partial p_a$. In that case both are positive, although the size of the effect depends on the possible extent of substitution between labour and other variable inputs in production. Otherwise, both are indeterminate a priori and depend on the relative strength of the opposing influences.

The task of working out the relationship between compensated and uncompensated virtual prices proceeds as follows. The rationed Marshallian demands derived initially can be equated with their unrationed counterparts at virtual prices so long as the household is compensated for the imposition of rations [20, p.33]. Since the rationed demands are defined at E , and since the income effect of the rations are $(p_L^* - p_L) \bar{L} + (p_m^* - p_m) \bar{X}_m$ we have:

$$(A.34) \quad \bar{X}_i(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E) = X_i(p_a, p_L^*, p_m^*, p_v, T, A, K, E + (p_L^* - p_L) \bar{L} + (p_m^* - p_m) \bar{X}_m)$$

where X_i = unrationed Marshallian demands at virtual prices.

p_i^* = uncompensated virtual prices, $i = L, m$.

However, at equilibrium $E = \bar{e}(\cdot)$, and using (A.27)

$$(A.35) \quad E + (p_L^* - p_L) \bar{L} + (p_m^* - p_m) \bar{X}_m = \bar{e}'(\cdot) - (p_L - p_L^*) \bar{L} - (p_m^* - p_m) \bar{X}_m = e'(\cdot)$$

Therefore,

$$(A.36.1) \quad \tilde{X}_L(\cdot) = X_L[p_a, p_L^*, p_m^*, p_v, T, A, K, e'(\cdot)]$$

$$(A.36.2) \quad \tilde{X}_m(\cdot) = X_m[p_a, p_L^*, p_m^*, p_v, T, A, K, e'(\cdot)]$$

Since:

$$\begin{aligned} \tilde{X}_L(\cdot) &= X_L(\cdot) = T - L + \bar{L} \\ \tilde{X}_m(\cdot) &= X_m(\cdot) = \bar{X}_m \end{aligned}$$

(A.36.1) and (A.36.2) implicitly define the uncompensated virtual prices of labour and X_m as:

$$(A.37.1) \quad p_L^* = p_L^*[p_a, p_m^*, p_v, T, A, K, e'(\cdot)]$$

$$(A.37.2) \quad p_m^* = p_m^*[p_a, p_L^*, p_v, T, A, K, e'(\cdot)]$$

$e'(\cdot)$ being the minimum expenditure (and thus exogenous income) required to achieve U , we have

$$\begin{aligned} \bar{p}_L^* &= p_L^*[p_a, p_m^*, p_v, T, A, K, e'(\cdot)] \\ \bar{p}_m^* &= p_m^*[p_a, p_L^*, p_v, T, A, K, e'(\cdot)] \end{aligned}$$

Therefore, the impact of an exogenous variable $\alpha [= p_a, p_v, A, K]$ decomposes into direct and indirect effects

$$(A.38.1) \quad \frac{\partial \bar{p}_L^*}{\partial \alpha} = \frac{\partial p_L^*}{\partial \alpha} \Big|_E + \frac{\partial p_L^*}{\partial E} \frac{\partial e'}{\partial \alpha} + \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial \alpha}$$

$$(A.38.2) \quad \frac{\partial p_m^*}{\partial \alpha} = \frac{\partial p_m^*}{\partial \alpha} \Big|_E + \frac{\partial p_m^*}{\partial E} \frac{\partial E}{\partial \alpha} + \frac{\partial p_m^*}{\partial p^*} \frac{\partial p_L^*}{\partial \alpha},$$

We close this section by emphasising that the virtual prices reflect both the production and consumption decisions of the peasant household. Changes in exogenous variables - particularly those of market prices - now produce additional effects working through these virtual prices. The latter, in straddling the consumption and production segments of the decision-making process transmit influences between them. Hence, apart from being affected by production decisions, consumption decisions now produce reverse effects, thereby resulting in non-recursiveness. Note, however, that the last result critically depends on the argument that the labour market is incomplete or effectively absent.

3.2 Comparative Statics

In this section the comparative static effects of changes in the levels of X_m , p_m and p_L are outlined.

3.2.1 Change in the Level of the Ration in the Manufactured

Consumer Good (X_m)

Suppose the rationing constraint, X_m , is partially relaxed. As illustrated by Neary and Roberts [20] for the pure consumer case, this change has repercussions to the equilibrium of the household. In the present case of a peasant household the following effects can be identified.

3.2.1.1 Impact on Total Expenditure (\bar{e})

Differentiating (A.27) with respect to X_m reveals the effect of increasing the availability of the manufactured consumer good on total expenditure of farm households:

$$(A.39) \quad \frac{\partial \bar{e}}{\partial X_m} = \frac{\partial e}{\partial X_m} + \frac{\partial [(p_m - \bar{p}_m) \bar{X}_m]}{\partial X_m} + \frac{\partial [(p_L - \bar{p}_L) \bar{L}]}{\partial X_m}$$



Decomposing $\partial e' / \partial X_m$ and noting that, by (A.23),

$$\frac{\partial e'}{\partial \bar{p}_L} = \bar{L} \text{ and } \frac{\partial e'}{\partial \bar{p}_m} = \bar{X}_m, \text{ we have}$$

$$\frac{\partial \bar{e}'}{\partial X_m} = \bar{X}_m \frac{\partial \bar{p}_m}{\partial X_m} + \bar{L} \frac{\partial \bar{p}_m}{\partial X_m} + (p_m - \bar{p}_m) - \bar{X}_m \frac{\partial \bar{p}_m}{\partial X_m} - \bar{L} \frac{\partial \bar{p}_L}{\partial \bar{p}_m} \frac{\partial \bar{p}_m}{\partial X_m}$$

Thus:

$$(A.40) \quad \frac{\partial \bar{e}'}{\partial X_m} = (p_m - \bar{p}_m)$$

In the postulated context of excess demand for manufactured consumer goods, $(p_m - \bar{p}_m)$ is non-positive, if not actually negative. It implies that relaxing the ration increases the possibility of substitution in consumption afforded by peasant households, and thus, is likely to reduce the expenditure (or cost) required to attain a given level of utility. Therefore, ceteris paribus, relaxing the rationing constraint improves the welfare of such households. Note, however, that possible distributional effects of rationing and its relaxation are being ignored.

3.2.1.2 Impact on Own-Consumption of Farm Output (X_a)

At equilibrium E is evaluated at \bar{e}' such that rationed Marshallian and Hicksian demands are equal:

$$(A.41) \quad \bar{X}_a^c(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, \bar{U}) \\ = \bar{X}_a(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, \bar{e}'(\cdot))$$

Differentiating with respect to X_m and rearranging:

$$\frac{\partial \bar{X}_a}{\partial X_m} = \frac{\partial \bar{X}_a^c}{\partial \bar{X}_m} - \frac{\partial \bar{X}_a}{\partial E} \frac{\partial \bar{e}'}{\partial X_m}$$

By (A.40):



$$\frac{\partial \bar{E}^f}{\partial X_m} = (p_m - \bar{p}_m) = -(\bar{p}_m - p_m)$$

This can be considered as the reduction in the expenditure necessary to achieve U due to a unit increase in the ration level. Substituting:

$$(A.42) \quad \frac{\partial \bar{X}_a}{\partial X_m} = \frac{\partial \bar{X}_a^c}{\partial X_m} + (\bar{p}_m - p_m) \frac{\partial \bar{X}_a}{\partial E}$$

Essentially equation (A.42) can be interpreted as a Slutsky equation with the first term on the right-hand-side considered as a "substitution effect", and the second as an "income effect" of the change in the ration level [20]. Assuming that X_a is a normal good, the impact of relaxing the ration on the demand for it depends on whether it is a substitute or a complement for X_m . If it is a substitute, the negative "substitution effect" works against the positive "income effect" (positive because $\bar{p}_m > p_m$ in the present case of excess demand for X_m) such that the net effect is indeterminate a priori. However, if the two are complements, both effects are positive and lead to a rise in own-consumption of farm output as the availability of X_m increases.

3.2.1.3 Impact on Farm Output (Q_a)

By Hotelling's Lemma:

$$Q_a = \frac{\partial \eta_a}{\partial p_a} (p_a, p_L^*, p_V, A, K)$$

Then the impact of a change in the level of X_m operates through p_L^* via p_m^* and appears as:

$$\frac{\partial Q_a}{\partial X_m} = \frac{\partial Q_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial X_m}$$

Thus:

$$(A.43) \quad \frac{\partial Q_a}{\partial X_m} = \eta_{aL} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial X_m}$$

Given excess demand for X_m , $\partial p_m^* / \partial X_m$ is bound to be negative. Hence, since η_{aL} is negative, the direction of the output effect expressed by (A.43) depends on whether X_m and X_L are substitutes or complements to one another. If they are substitutes, then output increases due to increasing X_m . Otherwise it falls. Moreover, the extent of the change in Q_a depends on the degree of substitution between labour and other variable inputs as well as the supply of all inputs that the peasant household faces. The weight of X_m in the household's consumption bundle matters in that regard.

3.2.1.4 Impact on Marketed Surplus ($Q_a - \bar{X}_a$)

The response of marketed output is measured by the net effect of increased availability of X_m on farm output and own-consumption:

$$(A.44) \quad \frac{\partial (Q_a - \bar{X}_a)}{\partial X_m} = \eta_{aL} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial X_m} - \left[\frac{\partial \bar{X}_a^c}{\partial X_m} + (\bar{p}_m^* - p_m) \frac{\partial \bar{X}_a^c}{\partial E} \right]$$

From what has been noted about output and own-consumption responses of changes in X_m , it is possible to observe that, with increasing X_m :

- (i) marketed surplus falls if (X_a, X_m) and (X_L, X_m) are complement pairs;
- (ii) if they are pairs of substitutes, marketed surplus changes in the direction of the output effect and the "substitution effect" [of (A.42) which will be positive in this context] net of the "income effect" [of (A.42) which will be negative in this context].

3.2.2 Change in the Price of the Manufactured Consumer Good (p_m)

A change in the price of the rationed X_m , p_m , can only affect own-consumption as can be seen from (A.27), (A.28) and (A.42). This effect can be derived by differentiating (A.41) with respect to p_m :

$$\frac{\partial \tilde{X}_a^c}{\partial p_m} = \frac{\partial \tilde{X}_a}{\partial p_m} + \frac{\partial \tilde{X}_a}{\partial E} \frac{\partial \tilde{E}}{\partial p_m}$$

From (A.22) we have

$$\frac{\partial \tilde{E}}{\partial p_m} = \bar{X}_m$$

Noting from (A.24.3) that, at a given level of utility, p_m does not affect demand for X_m , i.e. does not result an own-substitution effect, and thus has no substitution effect [20]:

$$\frac{\partial \tilde{X}_a^c}{\partial p_m} = \frac{\partial \tilde{X}_a}{\partial p_m} + \bar{X}_m \frac{\partial \tilde{X}_a}{\partial E} = 0$$

Rearranging:

$$(A.45) \quad \frac{\partial \tilde{X}_a}{\partial p_m} = -\bar{X}_m \frac{\partial \tilde{X}_a}{\partial E}$$

Therefore, a rise in the price of X_m produces only an income effect. At a given E , it forces farm households to spend more on the same ration level. Assuming X_a is normal, this induces a reduction in own-consumption of farm output. The magnitude of this reduction, as indicated by (A.45) depends on the level of the ration, X_m . The implication to government policy is obvious. By raising the price of X_m , which it controls (or, at least, regulates), it can stimulate expansion in marketed surplus within the bounds of the subsistence requirements of peasant households. This result, however, critically depends on the assumptions that:

- (i) peasant households are unrationed in the market for farm output; and
- (ii) the ration on X_m binds.

3.2.3 Change in the Price of Farm Output (p_a)

As noted at the outset, rationing is expected to modify the response of peasant households to changes in output prices. This problem is considered below. Suppose the

price of farm output, p_a , has increased. This change will work through the system ultimately influencing consumption, labour supply and input demand decisions.

3.2.3.1 Impact on Own-Consumption of Farm Output (X_a)

In the manner of (A.36.1) - (A.36.2) above, the relationship between the rationed and unrationed Marshallian demands at virtual prices can be written as :

$$(A.46) \quad \bar{X}_a(p_a, p_L, p_m, p_v, \bar{X}_m, \bar{L}, T, A, K, E) \\ = X_a[p_a, p_L^*, p_m^*, p_v^*, T, A, K, e'(\cdot)]$$

Accordingly, the effect of a change in p_a appears as:

$$(A.47) \quad \frac{\partial \bar{X}_a}{\partial p_a} = \frac{\partial X_a}{\partial p_a} \Big|_{p_L^*, p_m^*} + \frac{\partial X_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_a} + \frac{\partial X_a}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a} + \frac{\partial X_a}{\partial Y_f} \frac{\partial Y_f}{\partial p_a}$$

Noting that:

(a) $\partial Y_f / \partial p_a$ constitutes the profit effect and thus:

$$\frac{\partial Y_f}{\partial p_a} = \frac{\partial m_a}{\partial p_a} = Q_a$$

(b) (A.23) implies:

$$\frac{\partial e'}{\partial p_a} = (X_a - Q_a) = -(Q_a - X_a)$$

(c) By (A.38.1) and (A.38.2)

$$(A.48.1) \quad \frac{\partial p_L^*}{\partial p_a} = \frac{\partial \bar{p}_L^*}{\partial p_a} - \frac{\partial p_L^*}{\partial E} \frac{\partial e'}{\partial p_a} - \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a}$$

$$(A.48.2) \quad \frac{\partial p_m^*}{\partial p_a} = \frac{\partial \bar{p}_m^*}{\partial p_a} - \frac{\partial p_m^*}{\partial E} \frac{\partial e'}{\partial p_a} - \frac{\partial p_m^*}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_a}$$

and rearranging after substitution:

$$\begin{aligned}
 (A.49) \quad \frac{\partial \bar{X}_a}{\partial p_a} &= \frac{\partial X_a}{\partial p_a} \Big|_{p_L^*, p_m^*} + \frac{\partial X_a}{\partial p_L^*} \frac{\partial \bar{p}_L}{\partial p_a} + \frac{\partial X_a}{\partial p_m^*} \frac{\partial \bar{p}_m}{\partial p_a} \\
 &\quad - \frac{\partial X_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a} - \frac{\partial X_a}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_a} \\
 &\quad + (Q_a - X_a) \left[\frac{\partial X_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial E} + \frac{\partial X_a}{\partial p_m^*} \frac{\partial p_m^*}{\partial E} \right] \\
 &\quad + Q_a \frac{\partial X_a}{\partial Y_f}
 \end{aligned}$$

The existence, albeit rationed, of markets for X_m and X_L leads to income as well as substitution effects by both virtual prices. Thus, using the Slutsky relation we have:

$$\begin{aligned}
 &\frac{\partial X_a}{\partial p_a} \Big|_{p_L^*, p_m^*} + \frac{\partial X_a}{\partial p_L^*} \frac{\partial \bar{p}_L}{\partial p_a} + \frac{\partial X_a}{\partial p_m^*} \frac{\partial \bar{p}_m}{\partial p_a} \\
 &= \frac{\partial X_a^c}{\partial p_a} \Big|_{\bar{p}_L^*, \bar{p}_m^*} + \frac{\partial X_a^c}{\partial p_L^*} \frac{\partial \bar{p}_L}{\partial p_a} + \frac{\partial X_a^c}{\partial p_m^*} \frac{\partial \bar{p}_m}{\partial p_a} - \bar{L} \frac{\partial \bar{p}_L}{\partial p_a} \\
 &\quad - \bar{X}_m \frac{\partial \bar{p}_m}{\partial p_a} - X_a \frac{\partial X_a}{\partial Y_f}
 \end{aligned}$$

Substituting in (A.49) and rearranging we obtain:

$$\begin{aligned}
 (A.50) \quad \frac{\partial \bar{X}_a}{\partial p_a} &= \frac{\partial X_a^c}{\partial p_a} \Big|_{\bar{p}_L^*, \bar{p}_m^*} + \frac{\partial X_a^c}{\partial p_L^*} \frac{\partial \bar{p}_L}{\partial p_a} + \frac{\partial X_a^c}{\partial p_m^*} \frac{\partial \bar{p}_m}{\partial p_a} \\
 &\quad - \frac{\partial X_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a} - \frac{\partial X_a}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_a} \\
 &\quad + (Q_a - X_a) \left[\frac{\partial X_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial E} + \frac{\partial X_a}{\partial p_m^*} \frac{\partial p_m^*}{\partial E} + \frac{\partial X_a}{\partial Y_f} \right] \\
 &\quad - \bar{L} \frac{\partial \bar{p}_L}{\partial p_a} - \bar{X}_m \frac{\partial \bar{p}_m}{\partial p_a}
 \end{aligned}$$

Little can be said about (A.50). Obviously, it cannot be signed a priori. However, (A.50) reveals, and indeed there lies its usefulness, the complex set of influences which determine own-consumption response to changes in p_a . These include:

- (a) the degree of substitution between goods in consumption;

- (b) the share of commodities in the total expenditure of the household;
- (c) the character of goods in consumption, i.e. whether they are normal or inferior;
- (d) the degree of substitution between factors in production
-particularly between labour and other variable inputs; and
- (e) the status of the household in the farm output market, i.e. whether it is a net-seller or net-purchaser.

Depending on the relative strength of these, the net effect on own-consumption can be of either sign. As such (A.50) illustrates the need for a comprehensive approach in policy formulation and implementation if development objectives are to be realised. In particular, the significance of household production activities (here subsumed in leisure) should be reassessed. Usually, these activities are ignored by analysts and government policy-makers, who almost exclusively emphasise farm production.

3.2.3.2 Impact on Farm Output (Q_a)

The impact of the change in p_a on output can be derived using the profit function. By Hotelling's lemma:

$$Q_a = \frac{\partial \pi}{\partial p_a} (p_a, p_L^*, p_v, A, K)$$

Differentiating with respect to p_a produces the desired relation, i.e.:

$$(A.51) \quad \frac{\partial Q_a}{\partial p_a} = \frac{\partial Q_a}{\partial p_a} \Big|_{p_L^*} + \frac{\partial Q_a}{\partial p_L^*} \frac{\partial p_L^*}{\partial p_a}$$

Thus, change in p_a affects output in two ways; directly and indirectly via the virtual wage. Noting that:

$$\frac{\partial Q_a}{\partial p_a} \Big|_{p_L^*} = \eta_{aa}$$

substituting for $\partial p_L^* / \partial p_a$ from (A.48.1) and rearranging:

$$(A.52) \quad \frac{\partial Q_a}{\partial p_a} = \eta_{aa} + \eta_{aL} \frac{\partial \bar{p}_L^*}{\partial p_a} - \eta_{aL} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a} \\ + (Q_a - X_a) \eta_{aL} \frac{\partial p_L^*}{\partial E}$$

Replacing $\partial \bar{p}_L^* / \partial p_a$ from (A.31) and rearranging:

$$(A.53) \quad \frac{\partial Q_a}{\partial p_a} = \eta_{aa} + \eta_{aL} \left[\frac{e_{mm}(\eta_{La} - e_{La}) - e_{Lm} e_{ma}}{e_{mm}(e_a - \eta_a) - (e_{mL})^2} \right] \\ - \eta_{aL} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a} + (Q_a - X_a) \eta_{aL} \frac{\partial p_L^*}{\partial E}$$

Here again, a more intricate response is observed. Although the direct output supply response to own-price, η_{aa} , is positive, output response to the virtual wage, η_{aL} , is negative. Moreover, the other terms in the expression complicate the effect further. For instance, we already observed that $\partial \bar{p}_L^* / \partial p_a$ can be signed a priori only when all goods are substitutes to one another in consumption-in which case it is positive. The entire effect, in that case, depends on the relative strength of the income effect:

$$(Q_a - X_a) \eta_{aL} \frac{\partial p_L^*}{\partial E}$$

which is negative if leisure is assumed a normal good and the household a net-seller and

$$\eta_{aL} \frac{\partial \bar{p}_L^*}{\partial p_a} - \eta_{aL} \frac{\partial p_L^*}{\partial p_m^*} \frac{\partial p_m^*}{\partial p_a}$$

which is also negative, on the one hand, and the positive direct effect η_{aa} , on the other. In this particular case the possibility of a negative output response is clearly higher than the unrationed case. Indeed, it is higher than the case of an absent labour market but no rationing in X_m . To see this, we compare (A.52) with the output response implied by equations (IA.17) and IA.28) of Strauss [26] which is:

$$(A.54) \quad \frac{\partial Q_a}{\partial p_a} = \eta_{aa} + \eta_{aL} \frac{\partial \bar{p}_L}{\partial p_a} + (Q_a - X_a) \eta_{aL} \frac{\partial p_L^*}{\partial E}$$

Given the assumption that X_L and X_m are substitutes (A.52) has one more term, the third on the right-hand side, which is negative. This illustrates the argument that the possibility of a "perverse" output response to own-price can increase under rationing in X_m relative to the unrationed situation.

In general, the ultimate effect again depends on variables (a) - (c) listed in relation to own-consumption response. Nevertheless, the structure of our model suggests the following key questions:

- (i) does the rise in p_a increase the virtual wage;
- (ii) if so, to what extent does the resultant decline in profitability perceived by the household induce a fall in labour demand; and
- (iii) to what extent this fall can be compensated by a rise in the demand for and application of other variable inputs, whose price(s) have now declined relative to that of labour.

4. CONCLUSION

This study presented a simple model of cereal-producing peasant households by extending a basic agricultural household model, and by attempting to explicitly incorporate the specific operational milieu of such households in Ethiopia. The resultant comparative static results suggest the response of these producers to market-related incentives is much more complex than in an unrationed situation. Important influences include:

- (a) income and substitution effects;
- (b) possibilities of input substitution in production; and
- (c) levels of rations.

These results, however, should be accorded limited significance due to the exclusion of risk and the static nature of the model. In spite of its limitations, the model provides some insights. The major implication is liberalising output markets alone does

not necessarily lead to desired expansion in production. Increased supply of manufactured consumer goods, and greater possibilities of input substitutions through technological and institutional innovations appear to be critical. Similarly significant are home activities and non-agricultural rural employment opportunities.

NOTES

¹ These features are summarized from various sources including: [1, 11, 12, 23, 27, 28, 29, 30].

² [1, p. 97; 10; 28, p. 11; 29].

³ [27].

⁴ Important contributions of that period include: [16, 18, 24]. More recent ones include: [3, 4, 25, 26].

⁵ The most comprehensive treatment of the issues so far is [8]. Other important contributions include: [5, 6, 7].

⁶ This particular model builds upon, and uses the notations of, the basic agricultural household model due to [25] and [26].

⁷ Although we have restricted ourselves to single-crop, single manufactured consumer good case, the essential results remain valid for the m crops and n manufactured goods case. That the latter are a 1:1 rationed is necessary for the extension of subsequent analysis as it is presented here.

⁸ This appears to be a strong assumption in the Ethiopian context because of, among others, semi-subsistence agriculture's almost total dependence on rain and the natural endowments of the soil. Nevertheless, risk cannot be incorporated in this simple static model. As such the significance of the model is restricted.

⁹ E summarises non-wage and non-farm sources and uses of income, and reduces to exogenous income in a static model.

¹⁰ The notion of a full income appears particularly pertinent because income is endogenous being determined by, and determining, household output - variable input choice including the labour-leisure trade-off.

¹¹ So long as (i) and (ii) hold heterogeneity can be allowed if interior solutions are, as is customary, assumed [26].

¹² The model with a clearing labour market and rationed X_m was considered, but only a brief summary of comparative statics are presented due to space limitation.

¹³ Note that since the model is static the cash income (or explicit budget) constraint binds.

¹⁴ $p_L^* = p_L + (\lambda_3/\lambda_1)$ and $p_m^* = p_m + (\lambda_3/\lambda_1)$, can be considered as uncompensated virtual prices of labour

(i.e., virtual wage) and manufactured consumer good, respectively.

¹⁵ For details of the problems of using the direct utility function see Deaton [14, pp. 57-58].

¹⁶ Following Strauss [26], e^* is assumed to satisfy all the requirements of an expenditure function.

¹⁷ The exception being now we have:

$$\begin{aligned}\bar{p}_L^* &= p_L + \lambda_3, \\ \bar{p}_m &= p_m + \lambda_2\end{aligned}$$

which can be considered as compensated virtual prices.

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