Econometric Study of Monthly Consumption Expenditures in Rural Uttar Pradesh*

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This study presents some evidence of monthly consumption functions in the rural areas of the North Indian State of Uttar Pradesh. Since this region constitutes one of the largest and least monetized in India, attention is specifically focused on the cash and kind (or non-cash) components of (a) expenditure on food articles and (b) total consumption expenditure. Dynamic demand functions of a stock-flow variety are obtained for these broad groups. It is shown that cash outlays act as an inventory-adjustment mechanism whereas non-cash expenditure indicates a habit formation process. This behavioral difference of rural households with respect to cash and non-cash components of consumption expenditure has not yet been demonstrated and is regarded as one of the major results of this paper. With the use of a stock-flow adjustment system, numerical estimates of the instantaneous and steady-state equilibrium elasticities are derived with respect to total expenditure (a proxy for income) and prices.

THE main feature of a rural household economy is the integration of two decision units into one; viz., a family acts both as an entrepreneurial agent cultivating the land with hired and family labor and as a consumer unit determining the pattern of consumption expenditures. The production decision may be assumed to depend on the previous year's harvest and input prices, exogenous variables such as rains and weather, the input-output coefficients, and labor and capital availability. The consumption decision, on the other hand, is governed by behavioral considerations, ruling market prices, and income (in cash or kind) earned from production.

The purpose of this paper is to study a specific phenomenon emerging from the dual role of a rural household: the behavioral decision related to the consumption out of one's own produce or expenditure in kind (also referred to as "non-cash" expenditure) and expenditure in cash. The quantitative importance of this phenomenon in a predominantly rural, semi-monetized, developing economy needs no special emphasis.

The analysis begins with construction of a theoretical model of consumer behavior, with modifications appropriate for the peculiarities of semi-monetized agricultural consumer units, and continues with an exploration of some qualitative implications regarding the effects of prices.[1] Next, a

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[1] A really full-fledged general theory of a rural household economy will have to explain

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brief outline is given of dynamic demand functions of a stock-flow character, and their steady-state properties are analyzed. This is followed by a description of data and variables used and a discussion of empirical findings. In a concluding section, the major results and some limitations of this study are summarized.

Slutsky-Hicks Theory Adapted to Rural Households

Imagine a household with stocks of agricultural commodities, faced with a decision of how much to sell and how much to retain for self-consumption, given the prices ruling in the market. It will maximize the utility function

$$u(q_1, q_2, \cdots, q_n) \tag{1}$$

subject to a budget constraint

$$\sum_{i=1}^{n} p_i(\bar{q}_i - q_i) = 0 \tag{2}$$

where q_i is the amount of the i^{th} commodity consumed, $\bar{q}_i$ is the stock of the i^{th} commodity with which the household enters the market, and p_i is the market price. The cash in hand is assumed to be negligible.

The familiar necessary conditions for equilibrium are:

$$u_i - \Omega p_i = 0 \qquad (i = 1, 2, \cdots, n) \tag{3}$$

where $u_i = \partial u/\partial q_i$ and these n conditions along with (2) determine the $(n+1)$ variables $q_1, q_2, \ldots, q_n$ and Ω, the marginal utility of income. Defining $u_{ij} = \partial^2 u/\partial q_i \partial q_j$, the second order conditions are given by

$$\begin{vmatrix} 0 & u_1 & u_2 \\ u_1 & u_{11} & u_{12} \\ u_2 & u_{21} & u_{22} \end{vmatrix} > 0, \quad \begin{vmatrix} 0 & u_1 & u_2 & u_3 \\ u_1 & u_{11} & u_{12} & u_{13} \\ u_2 & u_{21} & u_{22} & u_{23} \\ u_3 & u_{31} & u_{32} & u_{33} \end{vmatrix} < 0, \cdots,$$

$$(-1)^n \begin{vmatrix} 0 & u_1 & u_2 & \cdots & u_n \\ u_1 & u_{11} & u_{12} & \cdots & u_{1n} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ u_n & u_{n1} & u_{n2} & \cdots & u_{nn} \end{vmatrix} > 0$$

If we denote the last Hessian by U and the cofactor by a capital letter with the same subscripts as the corresponding element, we get, by differentiating equilibrium conditions (2) and (3) with respect to $\bar{q}_i$,

simultaneously the interdependent decisions related to the entrepreneurial and organizational factors on the one hand and behavioral responses regarding consumption expenditures on the other, in a general equilibrium framework. Our purpose is not so ambitious, however, both because of theoretical complexities and the lack of time-series data on all the relevant variables.

$$\frac{\partial q_j}{\partial \bar{q}_i} = p_i \cdot \Omega \cdot \frac{U_j}{U} \qquad (i, j = 1, 2, \cdots, n) \tag{4}$$

The partial income effect thus explicitly depends on the price of the commodity whose stocks are varied. The Slutsky equation is given by

$$\frac{\partial q_j}{\partial p_i} = \frac{(\bar{q}_i - q_i)}{p_i} \cdot \frac{\partial q_j}{\partial \bar{q}_i} + x_{ji} \qquad (i, j = 1, 2, \cdots, n) \tag{5}$$

where x_{ji} denotes the substitution term involving rates of change of marginal utilities. Defining the elasticities

$$\begin{aligned} \eta_{ji}^{p} &= \frac{p_i}{q_j} \cdot \frac{\partial q_j}{\partial p_i} = \frac{\partial \log q_j}{\partial \log p_i} \\ \eta_{ji}^{\mu} &= \frac{\bar{q}_i}{q_j} \cdot \frac{\partial q_j}{\partial \bar{q}_i} = \frac{\partial \log q_j}{\partial \log \bar{q}_i} \\ \bar{x}_{ji} &= \frac{p_i}{q_j} x_{ji} \end{aligned} \tag{6}$$

(5) may be written in elasticity terms as

$$\eta_{ji}^{p} = \left[1 - \frac{q_i}{\bar{q}_i} \right] \eta_{ji}^{\mu} + \bar{x}_{ji} \qquad (i, j = 1, 2, \cdots, n) \tag{6a}$$

and

$$\eta_{ii}^{p} = \left[1 - \frac{q_i}{\bar{q}_i} \right] \eta_{ii}^{\mu} + \bar{x}_{ii} \qquad (i, j = 1, 2, \cdots, n) \tag{6b}$$

Note that $\eta_{ii}^{\mu} > 0$ unless a commodity is an inferior good. The sign of the first term on the right depends on $(1 - q_i/\bar{q}_i)$. If for any given $\eta_{ii}^{\mu} > 0$ the household ends up consuming more of the i^{th} commodity than the stock with which it starts, the overall income-effect will be negative, thereby strengthening the gross-substitution effect. On the other hand, if $q_i < \bar{q}_i$, the price elasticity would turn out to be less than the pure substitution effect. The intermediate case $q_i = \bar{q}_i$ results in equality between gross and pure substitution effects. There also arises a possibility of a strong income effect dominating a pure substitution term, thereby yielding a "perverse" gross-own-price-elasticity. The actual occurrence of these possibilities would obviously depend on the levels of initial stocks of different crops and their substitution elasticities in consumption.

Modifications

So far we have been dealing with essentially a classical theory of household behavior analyzed by Hicks [1]. Additional restrictions must be added to the model to take into account some peculiar features of an agricultural economy.

In the first place, if households happen to be below or near subsistence level, the analytical effects of rigidities introduced become uncertain. For example, there may be some minimal requirements of bare necessities to be consumed, whatever the income and price situation. Defining S to be a set of bare subsistence commodities, if for any $i \epsilon S$ the minimal $q_i > \bar{q}_i$, the other commodities q_j where $j \notin S$ may be sold in order to acquire these subsistence quantities, whatever the price situation. In fact, they may be sold in *higher* quantities in situations where (a) the minimal required $q_i > \bar{q}_i$, (b) the prices of commodities $i \epsilon S$ are going up, and (c) the prices of commodities $j \notin S$ are declining. In such cases, we get what are widely described as backward-bending marketed supply curves. The phenomenon is also exhibited for $i \epsilon S$ when the complement of S is empty and cash requirements remain fixed in nature so that when prices received increase, *less* will be sold to the market. The case in which large income effect exceeded the substitution effect, already noted, would create the same situation. These possibilities, however, have to be posed as empirical questions and no *a priori* treatment can be given to them in judging a collective behavior in a given situation.

Secondly, the quantities $\bar{q}_i$ may be understood in a *net* sense, after allowing for seed requirements and non-consumption payments such as rent and debt charges. However, if a farmer is at or below the subsistence level, he may choose to eat the seeds rather than make any non-consumption payments. In addition, $\bar{q}_i$ may also be taken to subsume income received in kind from hired-out labor services and other secondary sources of livelihood.[3]

A final major modification relates to the introduction of prices. The rural retail price indices alone are not sufficient predictors when a basic unit acts as both producer and consumer of the commodities and must decide how much to sell and how much to consume. Under these conditions, the parity index becomes theoretically relevant. The parity index is given by a ratio of the index of wholesale or harvest prices received by farmers to the index of retail prices of non-agricultural commodities paid by them. It indicates the terms of trade of the agriculturists and introduces three effects: (1) an income effect—since prices received by a farmer directly affect his real income level; (2) an own-price-gross-substitution effect in consumption —since prices received by a farmer in most cases refer to those commodities which his household also consumes; and (3) the effect of prices of substitutes and complements upon the composition of the expenditure group under consideration—induced by the component in the denominator, viz., the retail price index of nonagricultural commodities. Both the rural retail price index and the parity index have been introduced into our em-

[3] The author is indebted to J. R. Behrman for these suggestions.

pirical analysis as alternative explanatory variables. It is therefore appropriate to explore their qualitative implications with reference to some broad expenditure groups considered in our later econometric investigations.

Some Qualitative Deductions Regarding Price Effects

Since food articles account for about three-fourths of the total consumer expenditure in rural areas, we begin by examining the qualitative effects of the retail food prices (p_f) and the parity index (p) upon this group, denoted by q_f, and further subdivided into cash and non-cash components, denoted respectively by q_f^c and q_f^{nc}. Note that q_f^c contains on-farm produced as well as certain off-farm produced commodities, whereas the latter subgroup includes mainly on farm produced goods and perhaps a small part acquired through barter.

With regard to the normal effects of the Retail Food Price Index,

$$\frac{\partial q_f^c}{\partial p_f} < 0; \qquad \frac{\partial q_f^{nc}}{\partial p_f} < 0; \qquad \frac{\partial q_f}{\partial p_f} < 0$$

since p_f catches the usual own-price effect, the important qualification being that the income effects[3] do not overwhelm pure substitution effects. If the last statement does not hold, the signs would be reversed.

As to the effect of the parity index, it may be observed that

$$\frac{\partial q_f}{\partial p} = \frac{1}{\dfrac{\partial p}{\partial q_f}} \tag{7}$$

This is justified because two functions involved are $q_f = \phi(E,p)$ and $p = \psi(E,q_f)$ which may be assumed to be single-valued and the same expenditure level is held constant in both cases. Equation (7) can be expressed further as

$$\frac{\partial q_f}{\partial p} = \frac{1}{\dfrac{\frac{1}{p_n}}{\frac{\partial q_f}{\partial p_r}} - \dfrac{p_r}{p_n} \cdot \dfrac{\frac{1}{p_n}}{\frac{\partial q_f}{\partial p_n}}} \tag{8}$$

where p_r is the index of prices received and p_n the index of prices paid by farmers. Is it possible to assess *a priori*, the directions of $\partial q_f/\partial p_r$ and $\partial q_f/\partial p_n$ and hence of $\partial q_f/\partial p$? Taking into consideration the set P of produced

[3] Income-effect in this context, as well as in later discussions, is to be interpreted as a composite entity resulting from $\{(1-q_1/\bar{q}_1)\eta^u_{11}\}$ in equation 6 (b).

and N of non-produced commodities in a consumer basket indicating the areas of applicability of p_r and p_n, several cases may be distinguished, depending upon the composition of the expenditure group:

(a) q_f^c belongs entirely or mainly to set P, so that commodities in this group would be substitutes for or are identical with those produced by a farmer. But these are also the goods whose rise in prices leads to increased incomes for him. Consequently, if the income effect of prices received is weaker than the pure substitution effect, $\partial q_f^c/\partial p_r < 0$; otherwise, $\partial q_f^c/\partial p_r > 0$. If the non-agricultural commodities whose prices are changing act as substitutes for those in the group, $\partial q_f^c/\partial p_r > 0$; if complements, $\partial q_f^c/\partial_{p_n} < 0$. The last case appears unlikely when broad groups are considered.

(b) q_f^c belongs entirely or mainly to set N. If commodities in this group are substitutes for those in set P, $\partial q_f^c/\partial p_r > 0$; if complements, $\partial q_f^c/\partial p_r < 0$, the magnitude being determined by the income effect of changes in prices received. $\partial q_f^c/\partial p_n \gtrless 0$ depending on whether income effect does or does not dominate the pure substitution effect.

(c) q_f^{nc} would belong mainly to P, therefore, $\partial q_f^{nc}/\partial p_r \gtrless 0$, depending again upon the relative magnitudes of income and substitution effects; whereas $\partial q_f^{nc}/\partial p_n \gtrless 0$, according as commodities in set N act as substitutes for or complements to those in the group.

The prospect of determining *a priori*, the direction of $\partial q_f/\partial p$ thus appears bleak. If, however, we assume that there is no close relation between p_n and p_r, we can narrow down the possibilities by using the following relationships:

$$\begin{aligned} \frac{\partial q_f}{\partial p_r} &= \frac{\partial q_f}{\partial p}\cdot\frac{\partial p}{\partial p_r} = \frac{\partial q_f}{\partial p}\cdot\frac{1}{p_n} \\ \frac{\partial q_r}{\partial p_n} &= \frac{\partial q_f}{\partial p}\cdot\frac{\partial p}{\partial p_n} = -\frac{\partial q_f}{\partial p}\cdot\frac{p_r}{(p_n)^2} \end{aligned} \qquad (9)$$

so that it is clear that $\partial q_f/\partial p_r$ and $\partial q_f/\partial p_n$ will have opposite signs. Hence, although *a priori* it is not possible to find out the direction of change, it may be equally interesting, *once* the direction of the slope, $\partial q_f/\partial p$ is known empirically, to infer about the relative importance of the income and substitution effects as well as substitute-complement relationships between the various groups.

The same considerations apply to the effects of parity price index on the cash and non-cash components (q_c and q_{nc}) of total expenditure, with the additional specific notation that cash expenditures now also include off-farm produced food, non-food, and non-agricultural commodities. Since broad groups are under consideration, the composition of the cash component may conform more closely to that of the price index p_n; therefore, as long as substitution effect dominates (i.e., $\partial q_c/\partial p_n < 0$ and hence, $\partial q_c/\partial p_r > 0$), there is a possibility of getting a positive slope $\partial q_c/\partial p$. The complement of this group may then be expected to have a negative direction with reference to the same parity index.

Analytical Model

The analytical model employed in this paper is the dynamic demand function of the stock-flow variety formulated in continuous time. It was suggested by Houthakker [2] and presented in detail with empirical applications by Houthakker and Taylor [3]. A brief outline is presented here.

Assuming that demand for each good is influenced by one state variable and two flow variables, the following linear relationship is postulated:

$$q(t) = \alpha + \beta s(t) + \gamma x(t) + \lambda p(t) \qquad (10)$$

where $q(t)$ and $x(t)$ are instantaneous flows of consumption and income, respectively; $p(t)$ is price; and $s(t)$ is the level of the state variable at t. α, β, γ, and λ are parameters. The direction of β determines whether $q(t)$ is subject to inventory adjustment ($\beta < 0$) or habit formation ($\beta > 0$).

The generally unobservable state variable can be eliminated by using the relationship:

$$\dot{s}(t) = q(t) - \delta s(t) \qquad (11)$$

were $\dot{s}(t)$ denotes derivative of s with respect to time and δ is a depreciation rate assumed as a constant proportion of the level of the state variable. It has a conventional interpretation in the case of an inventory-adjustment process, whereas, for commodities subject to habit formation, it is taken to measure the speed at which the habit wears off.

By using a finite linear approximation to continuous time, it can be shown that the final estimation equation is:

$$q_t = A_0 + A_1 q_{t-1} + A_2 \Delta x_t + A_3 x_{t-1} + A_4 \Delta p_t + A_5 p_{t-1} + \nu_t \qquad (12)$$

where $A_0, \ldots, A_5$ may be shown to be simple functions of the structural parameters and ν_t is the error term.[4] This is referred to as the Standard Dynamic Model in this paper. The overidentification of δ when both prices and incomes are used as predictors can be handled by an iterative procedure. (For further details, see [3] pp. 8–25.)

In the structural equation (1), γ and λ denote short-term income and price derivatives when state variable is held fixed. However, when stocks are permitted to adjust so that $\dot{s}(t) = 0$, we get from (10) and (11) after rearrangement:

The structure of this term is investigated in detail in [3], pp. 20–21 and 40–42.

$$\hat{q} = \left[\frac{\alpha\delta}{\delta - \beta}\right] + \left[\frac{\gamma\delta}{\delta - \beta}\right]\hat{x} + \left[\frac{\lambda\delta}{\delta - \beta}\right]\hat{p} \tag{13}$$

where "hats" denote steady-state variables. This gives static limit of the dynamic model with long-run derivatives given by $\gamma' = \gamma(\delta/\delta-\beta)$ and $\lambda' = \lambda(\delta/\delta-\beta)$. Observe that so long as $|\delta| > |\beta|$, with inventory adjustment process ($\beta < 0$), $\gamma' < \gamma$, implying that the initial response to change in income is larger than the long-run effect. On the other hand, in the habit formation case ($\beta > 0$), $\gamma' > \gamma$ because short-run impact is characterized by lethargy and inertia. Similar considerations apply to λ and λ'.

A special case of (12) that occurred in our empirical investigations may here be noted. In certain cases, the statistical difference $|A_2 - A_3|$ and $|A_4 - A_5|$ in equation (12) was found to be insignificant, implying $\delta = 2$, thus eliminating lagged income and prices and leaving current income and prices in the estimation equation. This equation takes the form

$$q_t = B_0 + B_1 q_{t-1} + B_2 x_t + B_3 p_t \tag{14}$$

which has the same form as the Koyck distributed lag equation. However, the interpretation of structural parameters differs from the Koyck formulation and is designated in this paper as the Distributed Lag Variant.

Before closing this section it may be emphasized that from the point of view of our present analysis, the dynamic model has two advantages: (1) it determines operationally whether any given commodity group is subject to an inventory-adjustment or habit-formation process; and (2) it enables us to study both the short-run and steady-state behavior of structural coefficients. It is thus an appropriate theory for bringing out the different impacts of the state variables and the underlying mechanisms of adjustment operating on different groups of expenditure. A somewhat unsatisfactory feature of the model,[5] as used here, is the lack of explicit grounding in utility function. However, the qualitative conclusions reached earlier would nevertheless be verified, since all of them involve observable phenomena in comparative static equilibrium situations. What we deduce from the dynamic demand functions presented in this section are the characteristics of two equilibrium situations: (1) an instantaneous equilibrium with the state variable held fixed and (2) a steady-state equilibrium when stocks are permitted to adjust. Consequently, in both cases, the stock-flow model may be expected to provide an empirical confirmation of the theoretical deductions previously formulated regarding the direction and implications of the price and income effects.

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[5] This drawback has been removed from this theory by introducing a quadratic utility function involving state and flow variables. Preliminary findings are reported by Houthakker and Taylor [4].

The Data and Variables

The data used in this study have been drawn from a time-series of a changing and aggregated cross-section of over 1200 households surveyed monthly in the North Indian State of Uttar Pradesh.[6]

At a monthly level, the concept of a disposable income becomes nebulous and non-operational, especially in seasonal, semi-monetized, and self-employed occupations such as agriculture and related activities in rural areas. Consequently, total expenditure has been used as a surrogate for disposable income, since it is readily observed and more stable in the rural economy. Three price-series (all with the base 1957–58 = 100) have been used in the computations:

(1) The Rural Retail Price Index of food articles (p_f), which forms a part of the Rural Consumer Price Index;
(2) The parity index (p), representing the ratio of the agricultural wholesale prices received by farmers (p_r) to the Rural Retail Price Index of non-agricultural commodities (p_n) bought by them; and
(3) The Rural Wholesale Price Index of agricultural commodities (p_r).

The Rural Wholesale Price Index was used to deflate the total expenditure, its cash and non-cash components, and the Rural Retail Price Index of food articles which in its undeflated form was employed to reduce the expenditure on food articles, both cash and non-cash, to a constant price level.

Choice of Expenditure Groups

The empirical analysis has been carried out for the following broad groups of expenditures per household:

(i) Cash Expenditure on Food Articles (27%)
(ii) Non-cash (imputed) Expenditure on Food Articles (49%)
(iii) Total (Cash plus Non-cash) Expenditure on Food Articles (76%)
(iv) Cash Component of Total Expenditure (46%)
(v) Non-cash (imputed) Component of Total Expenditure (54%).

The figures in brackets indicate the percentage weight of the corresponding groups in the average total consumer expenditure over the six-year period, July 1957 to June 1963, covered by this study. Choice of broad groupings is governed by a practical consideration—that a stable consumption function

[6] Per household value of consumption is published monthly for broad groups of expenditures on a regional basis and detailed for separate classes, such as cultivators, agricultural laborers, and others. The basic data have been collected from the various numbers of the *Monthly Bulletin of Statistics*, published by the Directorate of Economics and Statistics, Government of Uttar Pradesh, India. This study was carried out for the total of all classes and for the entire State of Uttar Pradesh. Anyone interested in details regarding sources, scope, and reliability of the data may obtain this information by writing directly to the author.

at a monthly level is likely to exist for those groups of commodities that (a) are consumed frequently within a unit of time interval chosen and (b) form sizeable proportions of total outlays. It may be noted that our concern with cash and non-cash components (especially with reference to total expenditure) violates the generally accepted aggregation criterion of a within group homogeneity, based either on physical similarity of goods or similarity in satisfying a set of related wants. But it is justified if the consuming units treat cash and non-cash components differently with respect to their behavioral responses. That they in fact do so is one of the major findings of this paper.

Seasonal Adjustment

With regard to the seasonal adjustment procedure, it should be noted that the seasonal influence is very important in models with time intervals smaller than a year. Several statistical techniques are available to eliminate seasonality (see, e.g., Kendall and Stuart [5], Chapter 46); but in most of these there is some degree of arbitrariness, while in some several observations may be lost. Recently, Klein, et al. [6], have suggested an introduction of seasonal dummies in a regression equation for seasonally unadjusted series to catch the effect of seasonality. Their procedure assumes that a seasonal factor works only as a shift factor on an intercept and does not affect regression slopes. In principle, seasonal effects on regression coefficient can also be permitted but the procedure becomes computationally complicated and the loss of degrees of freedom is considerable. In this study, eleven monthly dummy variables are used to represent each month (except June). The choice of the month left out does not affect the slopes and hence is immaterial (see Suits [9]).

Cash, Non-Cash and Total Expenditures on Food Articles

Table 1 presents the reduced form estimation equations for the standard dynamic model for cash, non-cash, and total expenditures on food articles (groups (i), (ii), and (iii), listed above) with three sets of predictors: (a) Total Expenditure, (b) Total Expenditure and Retail Food Price Index, (c) Total Expenditure and Parity Index. Statistically, the corrected squared multiple correlation increases as we move in each case from (i) to (ii) to (iii), as well as from (a) to (b) to (c). The Durbin-Watson statistic is either in an approximately doubtful range (for (a) (i), (b) (i) and (c) (i)) or shows no serial correlation, except 1 (c) (iii), where some evidence of negative correlation exists.[7] The equation I (c) (iii) is unsatisfactory statistically and

[7] As referees of this paper pointed out, it is not clear, in view of the Nerlove-Wallis paper [7], how much faith one should place in a Durban-Watson statistic when lagged endogeneous variables are included as explanatory variables. The problem of determining the existence of autocorrelation in such situations appears insurmountable. See also [3, pp. 40–42] in this connection.

Table 1. Estimation equations for cash, noncash and total expenditure on food articles: standard dynamic model[a]

$$q_t = A_0 + A_1 q_{t-1} + A_2 \Delta x_t + A_3 x_{t-1} + A_4 \Delta p_t + A_5 p_{t-1} + \text{seasonal dummies}^{b}$$

Eqn. no.	Dependent variable	Explanatory variables	A_0	A_1	A_2	A_3	A_4	A_5	$\bar{R}^2$	D.W.
1 (a) (i)	Cash Expenditure	Total expenditure	7.7574 (3.4776)[c]	0.2259 (0.0946)	0.2318 (0.0616)	0.1247 (0.0382)	—	—	0.5629	1.4992
1 (a) (ii)	Non-Cash Expenditure	Total expenditure	−0.5735† (4.2529)	0.4154 (0.1031)	0.2364 (0.0764)	0.2679 (0.0569)	—	—	0.7594	2.1069
1 (a) (iii)	Total Food Expenditure	Total Expenditure	5.6577 (4.3399)	0.6151 (0.1210)	0.4572 (0.0760)	0.2293 (0.0861)	—	—	0.8331	2.2188
1 (b) (i)	Cash Expenditure	Total Expenditure & Retail Food Price Index	23.2525 (8.6068)	0.1919 (0.0921)	0.2529 (0.0647)	0.1633 (0.0399)	−0.2940 (0.1452)	−0.1899 (0.0925)	0.5966	1.6561
1 (b) (ii)	Non-Cash Expenditures	Total Expenditure & Retail Food Price Index	15.0603 (13.5132)	0.3364 (0.1252)	0.3042 (0.0929)	0.3195 (0.0765)	−0.1575† (0.1855)	−0.1654 (0.1397)	0.7579	2.0433
1 (b) (iii)	Total Food Expenditure	Total Expenditure & Retail Food Price Index	42.5382 (13.5590)	0.3402 (0.1496)	0.5970 (0.0794)	0.4422 (0.1147)	−0.5240 (0.1683)	−0.3881 (0.1397)	0.8616	2.0826
1 (c) (i)	Cash Expenditure	Total Expenditure & Parity Index	0.4389† (9.6408)	0.2202 (0.1264)	0.2816 (0.0691)	0.1554 (0.0759)	0.0832† (0.1765)	−0.0459 (0.0423)	0.5676	1.5236
1 (c) (ii)	Non-Cash Expenditures	Total Expenditure & Parity Index	16.9663 (9.5995)	0.3359 (0.1093)	0.1734 (0.0805)	0.2257 (0.0598)	−0.0743† (0.1501)	−0.0967 (0.0433)	0.7766	2.1330
1 (c) (iii)	Total Food Expenditure	Total Expenditure & Parity Index	5.2404† (9.9588)	0.8425 (0.0738)	0.4537 (0.1031)	0.0464† (0.0499)	0.1627 (0.0719)	0.0167† (0.0519)	0.8162	2.5094

[a] The structural coefficients and elasticities of the estimation equations are given in Table 2 identified by the same subscripts for the equation number as in this table.
[b] The coefficients of the seasonal dummies are not included for reasons of brevity. They may be made available on request.
[c] *Figures in brackets* denote the standard errors of the coefficients.
† Statistically insignificant (so regarded whenever any standard error exceeded the magnitude of the coefficients).

is presented only for the sake of completeness. Most of the important reduced form coefficients turn out to be statistically significant with expected directions. The structural estimates and elasticities of the equations corresponding to Table 1 are given in Table 2.

The conspicuous finding of Table 2 is the basic difference in the behavior of the households with respect to cash and non-cash expenditure on food articles. The cash component exhibits an inventory adjustment process with $\beta<0$, the immediate impact of increased expenditure being larger than the long-run effect when the stocks of these commodities are permitted to adjust. On the other hand, the non-cash imputed component follows a habit-formation process ($\beta>0$), the impact effect being sluggish and consequently smaller than in the steady-state situation. In the aggregate, food expenditure appears to be slightly habit-forming.

This basic difference is also reflected in marginal propensities and corresponding expenditure elasticities. The marginal propensity to spend cash on a food article lies in a reasonable range—between 0.27 and 0.33 in the short-run; between 0.16 and 0.20 in the long-run. The non-cash food expenditure containing the commodities produced as well as consumed by the farmers turns out to be sensitive to the effects of prices introduced and shows a broader range of marginal propensity to spend—between 0.09 and 0.22 in the short-run; between 0.34 and 0.48 in a steady-state.

For households whose cash outlay on food articles forms about 27 percent of the total, the short-run demand for these commodities may be expected to be more elastic than their demand for goods they themselves produce and consume. This is indeed brought out in our findings: the short-run expenditure elasticity estimates for the former range between 1.00 and 1.23; for the latter, between 0.19 and 0.45. In the long-run, the situation is reversed in cases (a) and (b), whereas the two estimates come fairly close to each other in (c). It is in explaining this phenomenon that the dynamic demand theory outlined earlier proves most useful and illuminating. We have observed that the cash and non-cash components of food expenditure are subject to different adjustment mechanisms which, acting in opposite directions, end up reversing the magnitudes of elasticities in a steady-state equilibrium. For cash outlays, the adjustment of stocks lowers the immediate impact effect in the long-run; whereas for non-cash expenditure, overcoming initial inertia raises the long-run effect considerably. In this connection, reference may be made to a similar empirical finding from budget studies by Sinha [8].

The introduction of Rural Retail Price Index of food articles (case (b)) consistently produces a negative-gross-substitution effect, thereby eliminating one of the sources of backward-bending supply curve; viz., the overwhelming income factor dominating the pure substitution term. The short- and long-term pure substitution effects show *a priori* directions. Cash out-

Table 2. Structural coefficients and elasticities for cash, noncash and total expenditure on food articles: standard dynamic model[a]

$$q(t) = \alpha + \beta s(t) + \gamma x(t) + \lambda x(t) + \lambda p(t)$$
$$\dot{s}(t) = q(t) - \delta s(t)$$

Eq^n. No.	Dependent variable	α	β	δ	γ	γ'[b]	λ	λ'	Expend. elast. S.R.[c]	Expend. elast. L.R.[c]	Price elast. S.R.	Price elast. L.R.	S.R. Subst.[d]	L.R. Subst.
2 (a) (i)	Cash expenditure	17.1935	−0.5868	0.7361	0.2764	0.1610	—	—	1.0187	0.5933	—	—	—	—
2 (a) (ii)	Non-cash expenditure	−0.5719	1.7902	2.6162	0.1447	0.4583	—	—	0.2998	0.9497	—	—	—	—
2 (a) (iii)	Total food expenditure	10.2370	0.1911	0.6695	0.4149	0.5807	—	—	0.5503	0.7702	—	—	—	—
2 (b) (i)	Cash expenditure	40.9033	−0.4021	0.9539	0.2873	0.2021	−0.3339	−0.2350	1.0589	0.7449	−1.2703	−0.8940	−0.9811	−0.6906
2 (b) (ii)	Non-cash expenditure	10.1910	1.2185	2.2116	0.2162	0.4814	−0.1119	−0.2492	0.4480	0.9977	−0.2394	−0.5331	−0.0218	−0.3155
2 (b) (iii)	Total food expenditure	56.9630	0.1918	1.1763	0.5609	0.6702	−0.4924	−0.5883	0.7440	0.8889	−0.6741	−0.8054	−0.1095	−0.1308
2 (c) (i)	Cash expenditure	0.9443	−0.5163	0.7618	0.3343	0.1993	0.0928	0.0589	1.2321	0.7344	0.3682	0.2194	0.7025	0.4187
2 (c) (ii)	Non-cash expenditure	6.8159	2.7324	3.7267	0.0907	0.3399	−0.0389	−0.1457	0.1879	0.7043	−0.0814	−0.3052	0.0099	0.0369
2 (c) (iii)	Total food expenditure	52.7767	−0.0631	0.1079	0.4673	0.2947	0.1676	0.1057	0.6198	0.3910	0.2247	0.1418	x	x

[a] The corresponding estimation equations of these relations are given in Table 1, identified by the same subscript for the equation number as in this table.
[b] Primed letters denote long-run steady-state coefficients.
[c] S.R. & L.R. indicate short-run and long-run, respectively.
[d] Substitution effect (denoted by "Subst." in the last two columns) is given by $(\eta_p{}^i + \alpha_i \eta_s{}^i)$ where $\eta_p{}^i$ and $\eta_s{}^i$ are elasticities with respect to price & total expenditure, respectively, evaluated at their respective means, and α_i denotes the proportion of the ith expenditure group in total expenditure.

lays on food show higher price elasticity than non-cash expenditure, in accordance with the expectations.

The parity index (case (c)) introduces the three influences previously noted. For both cash and non-cash purchases of food, the effects of changes in prices turn out to be statistically insignificant in the estimation equations 1(c) (i) and 1(c) (ii), yielding short-run price coefficients of somewhat doubtful value.[8] The long-run effect is positive for cash outlay. Based on equation (8), this implies that $\partial q_f^c/\partial p_r > 0$ and $\partial q_f^c/\partial p_n < 0$, and case (b) appears plausible. In other words, commodities in the cash outlay group are mainly off-farm produced agricultural goods. For non-cash food expenditures, a negative long-run price effect is exhibited which might have resulted from $\partial q_f^{nc}/\partial p_r < 0$ and $\partial q_f^{nc}/\partial p_n > 0$, indicating that the pure substitution effect of changes in prices received dominates the income term; commodities in this group act as substitutes for those in the non-agricultural group covered by p_n. There is thus a basic asymmetry in the effect of parity prices upon the two components of food expenditure.

Especially for the non-cash group, the coefficients in the reduced-form equations indicate a possibility that the statistical difference $|A_2 - A_3|$ and $|A_4 - A_5|$ may not be significant, thereby giving rise to a Distributed Lag Variant. The absolute differences and their standard errors in different equations are as follows:

	$\lvert A_2 - A_3 \rvert$	$\lvert A_4 - A_5 \rvert$
Equation 1(a)(ii)	0.0315	—
	(0.1140)	
Equation 1(b)(ii)	0.0153	0.0079
	(0.1503)	(0.2640)
Equation 1(c)(ii)	0.0523	0.0224
	(0.1179)	(0.1456)

Consequently, the value of δ was fixed *a priori* at 2.0, and the Distributed Lag Variant was estimated. The resulting estimation equations and corresponding structural estimates are presented in Tables 3 and 4, respectively. The corrected $\bar{R}^2$ goes up, and Durbin-Watson statistics remain

[8] Intuitively it seems obvious that if one or more reduced form coefficients are statistically insignificant, so would be estimates of structural coefficients. However, it need not necessarily be so. If a function involving reduced form coefficients is expanded in a Taylor series around a true structural parameter, neglecting second and higher order terms, the resulting expression would contain variances as well as covariances of reduced form estimates. A possibility then clearly arises that a structural coefficient may turn out to be statistically significant even though one or more reduced form estimates are not. Hence the use of a loose phrase in the text "of somewhat doubtful value." I am indebted to L. D. Taylor for pointing this out to me.

Table 3. Estimation equals for non-cash expenditure on food: distributed lag variant[a]

$$q_t = B_0 + B_1 q_{t-1} + B_2 x_t + B_3 p_t + \text{seasonal dummies}$$

Eq[a] No.	Dependent variable	Explanatory variables	B_0	B_1	B_2	B_3	$\bar{R}^2$	D.W.
3 (a) (ii)	Non-cash food expenditure	Total expenditure	0.4531 (3.9700)	0.4162 (0.0979)	0.2650 (0.0526)	—	0.7683	2.1890
3 (b) (ii)	Non-cash food expenditure	Total expenditure & retail food price index	22.0840 (12.2290)	0.2959 (0.1154)	0.3408 (0.0656)	−0.2284 (0.1224)	0.7783	2.0700
3 (c) (ii)	Non-cash food expenditure	Total expenditure & parity index	18.1370 (7.7336)	0.3524 (0.0962)	0.2155 (0.0535)	−0.0970 (0.0370)	0.7906	2.2472

[a] The corresponding structural coefficients and elasticities are presented in Table 4. See notes to Table 1.

Table 4. Structural coefficients and elasticities for non-cash food expenditure: distributed lag variant[a]

$$q(t) = \alpha + \beta s(t) + \gamma x(t) + \lambda p(t)$$
$$\dot{s}(t) = q(t) - (2.00)s(t)$$

Eq[a] No.	Dependent Variable	α	β	γ	γ'	λ	λ'	Expend. S.R.	Elast. L.R.	Price S.R.	Elast. L.R.	S.R. Subst.	L.R. Subst.
4 (a) (ii)	Non-cash food expenditure	0.4199	1.1755	0.1871	0.4541	—	—	0.3877	0.9410	—	—	—	—
4 (b) (ii)	Non-cash food expenditure	17.0414	0.9133	0.2630	0.5838	−0.1762	−0.3912	0.5450	1.2098	−0.3769	−0.8367	−0.1121	−0.2490
4 (c) (ii)	Non-cash food expenditure	13.4110	1.0423	0.1593	0.3328	−0.0717	−0.1498	0.3301	0.6896	−0.1502	−0.3139	−0.0102	0.0229

[a] See notes to Table 2. The values of depreciation parameter δ are a priori fixed at 2.00 and hence do not appear in this table

broadly unchanged. The current price term is significant in both equations 3(b) (ii) and 3 (c) (ii), implying that the dynamic effects in non-cash components operate directly through the lagged dependent variable and only indirectly through lagged prices and expenditure. This contrasts with the cash component where dynamic influences act directly through lagged cash outlays, lagged expenditures and prices, the first differences in total outlay, and price changes. When comparing the long-run expenditure elasticities in equations 2(a) (ii), 2(c) (ii), and 4(c) (ii), note that the addition of parity index lowers the estimate and makes it slightly *lower* than that for cash purchases (contrast equations 2(c) (i) and 4(c) (ii)). It thus appears that the explicit introduction of the forces of income effect, own-price-effect, and effects of prices of related goods, represented by the terms of trade index of agriculturists, yields a net expenditure elasticity lower, as expected, than that of retail food price or cash purchases. The overall pure substitution effect in equation 4(c)(ii) is positive and close to zero, implying that different influences of parity index seem to be mutually offsetting in nature. The fact that pure short- and long-run substitution effects in equation 2(c) (i) also are positive is no contradiction, since the cash plus non-cash food expenditures do not exhaust the total expenditure.

The conventional static linear, log-linear, semi-log, and inverse-semi-log forms of demand functions were also fitted to the data. It was found that in most cases dynamic equations perform better, and in a few cases do at least as well as the static forms, in terms of both corrected $\bar{R}^2$ and Durbin-Watson statistic.

Cash and Non-Cash Components of Total Expenditure

We now examine the behavioral relations connected with the cash and non-cash components of total consumption expenditure for which the parity index has been used as an appropriate overall price variable.

Tables 5 and 6 present the relevant estimation equations and structural coefficients, respectively. The corrected squared multiple correlation coefficient is statistically significant in all the equations. Moreover, in most cases, the reduced form coefficients exceed their standard errors by large multiples. A close scrutiny of the equation 5(e)(v) for non-cash expenditure indicates that $|A_2 - A_3| = 0.0089$ with a standard error of 0.1597 and $|A_4 - A_5| = 0.0087$ with a standard error of 0.2057. This suggested a Distributed Lag Variant whose estimated reduced form relation is denoted by 5($\bar{e}$)(v) in Table 5.

The cash component, now including non-agricultural, non-food articles, such as clothing, footwear, and fuel and light, exhibits an inventory adjustment behavior, whereas the non-cash portion is habit forming in character. Due to omission of a price variable in the first two equations in Table 6, the mis-specification bias in the expenditure coefficient appears to be down-

Table 5. Estimation equation for cash and non-cash components of total expenditure: standard dynamic model[a]

Eqn. No.	Dependent variable	Explanatory variable	A_0	A_1	A_2	A_3	A_4	A_5	$\bar{R}^2$	D.W.
5 (d) (iv)	Total cash expenditure	Total expenditure	− 4.7134† (6.3645)	0.3977 (0.1045)	0.3139 (0.0851)	0.6269 (0.1112)	—	—	0.6807	2.4762
5 (d) (v)	Total non-cash expenditure	Total expenditure	2.0305† (6.4146)	0.4276 (0.1050)	0.2753 (0.0716)	0.2978 (0.1115)	—	—	0.6518	2.4202
5 (e) (iv)	Total cash expenditure	Total expenditure & parity price index	−35.8697 (13.5537)	0.2773 (0.1176)	0.7185 (0.1173)	0.5123 (0.1151)	0.2328 (0.1660)	0.1660 (0.0633)	0.7165	2.5311
5 (e) (v)[b]	Total non-cash expenditure	Total expenditure & parity price index	37.2760 (14.4886)	0.2688 (0.1259)	0.2032 (0.1158)	0.1943 (0.0709)	−0.2000† (0.2097)	−0.1913 (0.0633)	0.7016	2.3863

[a] The structural coefficients and elasticities of this equation are presented in Table 6, corresponding to equation number 6 (δ) (v). See notes to Table 1.
[b] The Distributed Lag Variant of 5 (e) (v) is given below and is referred to by equation number 5 (δ) (v) in the text.

$$q_t = 42.7210 + 0.2351 q_{t-1} + 0.1946 x_t - 0.2141 p_t \qquad \bar{R}^2 = 0.7314,\ \text{D.W.} = 2.3986$$
$$(11.9250)\ (0.1022)\qquad (0.0656)\qquad (0.0562)$$

Table 6. Structural coefficients and elasticities for cash and non-cash components of total expenditure[a]

Eqn No.	Dependent variable	α	β	δ	γ	γ'	λ	λ'	Expend. S.R.	Elast. L.R.	Price S.R.	Elast. L.R.	S.R. Subst.	L.R. Subst.
6 (d) (iv)	Total cash expenditure	− 0.3350	−0.3406	0.5212	0.6724	0.5136	—	—	1.4746	1.1263	—	—	—	—
6 (d) (v)	Total non-cash expenditure	1.2074	1.1171	1.7196	0.2243	0.4810	—	—	0.4123	0.8842	—	—	—	—
6 (e) (iv)	Total cash expenditure	−50.8510	−0.0334	1.1079	0.7262	0.7050	0.2353	0.2284	1.5964	1.5497	0.5230	0.5077	1.4233	1.3817
6 (e) (v)	Total non-cash expenditure	32.9270	0.6798	1.8320	0.1672	0.2657	−0.1645	−0.2616	0.3080	0.4896	−0.3565	−0.4869	−0.1893	−0.2212
6 (δ) (v)[b]	Total non-cash expenditure	34.5891	0.7614	2.0000	0.1576	0.2544	−0.1733	−0.2799	0.2897	0.4676	−0.3226	−0.5210	−0.1650	−0.2666

[a] See notes to Table 2.
[b] Corresponding to the Distributed Lag Variant presented in the notes to Table 5 by fixing $\delta = 2.00$ a priori.

ward for the cash component and upward for its complement. (Compare the estimates in equation 6(d)(iv) with 6(e)(iv) and in 6(d)(v) with 6(e)(v) and 6(ē)(v)). The marginal propensity to spend on cash purchases is very high at 0.73 in the short-run and 0.71 in a steady state situation; for non-cash expenditure, the corresponding short-run estimates are around 0.17 while long-term estimates range between 0.25 and 0.27. Only a slight difference is evident between the short- and long-run expenditure and price coefficients (equation 6(e)(iv)), indicating that the adjustment mechanism of the cash outlays works speedily. As previously conjectured, the asymmetrical impact of the parity index on cash and non-cash components is brought out in a sharper focus. The pure substutition effect is positive for cash purchases and negative for its complement, as we would expect in a mutually consistent consumer behavior. The expenditure elasticity in the short-run, as well as long-run, turns out to be higher for the cash component than for the non-cash group. Its numerical magnitude amounts to 1.50 (short-run) and 1.55 (long-run) for cash and ranges between 0.29 and 0.31 (short-run) and 0.47 to 0.49 (long-run) for non-cash outlays. The demand with respect to parity index tends to be inelastic for both the groups, although its impact is positive for cash purchases and negative for its complement. These findings are in line with *a priori* reasoning that, in the long run, the effects of increased incomes (expenditures) and improved terms of trade would be reflected in a rural household's expanding demand for non-produced non-agricultural commodities.

Conclusions

As far as the author is aware, this study represents the first attempt at econometric analysis of monthly rural consumption expenditures with an explicit introduction of expenditure and price effects. Dynamic demand functions of a stock-flow variety are shown to be appropriate for this purpose.

By focusing attention on cash and non-cash (imputed) outlays on broad groups of consumption, this paper shows for the first time behavioral differences of rural households with respect to these components. Cash purchases act as an inventory adjustment mechanism, while non-cash outlays exhibit a habit persistence process. This finding may have far-reaching policy implications in projecting rural consumer expenditures in a predominantly agricultural, semimonetized developing economy in the process of industrialization.

Theoretical considerations suggested that the parity index may be an appropriate factor in explaining the rural household's consumption behavior. Consequently, the parity index was introduced in the demand functions as an alternative predictor and found to yield plausible results, especially with respect to its asymmetrical impact on cash and non-cash components. Its inclusion also led to confirmation of the oft-repeated statement regarding the favorable effect of expanding incomes and improved terms of trade of agriculturists on their increasing demand for non-produced, non-agricultural commodities in the process of development. The significance of this phenomenon is stressed continually in theories of economic development.

Finally, numerical estimates have been obtained for the expenditure and price elasticities of cash and non-cash components of (a) expenditure on food articles and (b) total consumption expenditure. The instantaneous short-run and the steady-state long-run equilibrium values have been deduced in each case. The importance of this empirical information in formulating long-range development plans needs no special justification.

With regard to the shortcomings of our analysis, it may be noted that some important influences acting on the consumer expenditure were omitted, such as size and age composition of the rural families, wealth and liquid assets, etc. Also omitted from consideration was the simultaneity in decision making on the production and the consumption side.[9] Most important, the justly famous limitations of a repetitive, multi-purpose survey carried out by official agencies among poorly literate rural people apply equally to the data used in this paper. However, if plausibility of results may be taken as a confirmation of the overall accuracy, the data appear to do reasonably well.

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[9] See footnote 1.