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Dynamic Structure

Economists have traditionally been suspicious of changing tastes, and intellectual tastes change slowly.[1] Nevertheless, it is time to reconsider the conventional wisdom that tastes are not the business of economists.

Those who favor incorporating taste formation and taste change into economic analysis fall into two groups whose intersection is virtually empty. One group is primarily interested in the welfare implications of changing tastes, the other in the analysis of household behavior. Galbraith, who emphasizes the ability of producers to manipulate consumers through advertising, provides an articulate statement of the welfare view. Characterizing his own work, he writes, "The surrender of the sovereignty of the individual to the producer or producing organization is the theme, explicit or implicit, of two books, *The Affluent Society*... and *The New Industrial State*" [1970, p. 471]. Veblen's notion of "conspicuous consumption" suggests a model in which preferences for goods depend directly on prices because people judge quality by price or because a higher price enhances "snob appeal." Pollak [1977] discusses price-dependent preferences and provides references to the literature. "Radical" economists of both Marxist and non-Marxist persuasions also reject the notion that taste formation and change are outside the province of economics or else deny that economics can be separated from the other social sciences (see, for example, Gintis [1974]).

The recent impetus to incorporate taste formation and change into economic analysis, however, has come primarily from those interested in household behavior rather than welfare, and the principal focus of this work has been empirical demand analysis. In Chapter 1 we pointed out that empirical demand analysis must either assume that all demand system parameters remain constant over time or specify how they change. We showed that the LES could be given a dynamic structure by allowing the b's to depend linearly on consumption in the previous period and interpreted that dynamic structure as habit formation. In Section 1 of this chapter we extend that analysis to other specifications of habit formation and to other demand systems, examining the implied short-run and

[1] This chapter is based on Pollak [1970, 1976a, 1976b, 1978, 1990].

long-run behavior. In Section 2 we discuss interdependent preferences, an alternative dynamic specification in which preferences and demand depend on the consumption patterns of others. Finally, in Section 3 we discuss briefly the implications of these dynamic specifications for the evaluation of welfare.

1. HABIT FORMATION

The LES

$$h^i(P, \mu) = b_i - \frac{a_i}{p_i} \sum p_k b_k + \frac{a_i}{p_i} \mu \tag{1}$$

is generated by the direct utility function

$$U(X) = \sum a_k \log(x_k - b_k), \qquad a_i > 0, \qquad (x_i - b_i) > 0, \qquad \sum a_k = 1. \tag{2}$$

In Chapter 1 we introduced a simple model of habit formation in which the b's depend linearly on consumption in the previous period

$$b_{it} = b_i^* + \beta_i x_{it-1}. \tag{3}$$

Under this specification the utility function becomes

$$U(X_t; X_{t-1}) = \sum a_k \log(x_{kt} - b_k^* - \beta_k x_{kt-1}) \tag{4}$$

and the corresponding short-run demand functions

$$h^i(P_t, \mu_t; X_{t-1}) = b_i^* - \frac{a_i}{p_{it}} \sum p_{kt} b_k^* + \frac{a_i}{p_{it}} \mu_t + \beta_i x_{it-1} - \frac{a_i}{p_{it}} \sum p_{kt} \beta_k x_{kt-1}. \tag{5}$$

Because the b's are linear in past consumption and because current consumption depends linearly on the b's, these short-run demand functions imply that present consumption of each good is a linear function of past consumption of all goods. Because the β's are positive, an increase in past consumption of a good implies an increase in current consumption of that good

$$\frac{\partial h^{it}(P, \mu; X_{t-1})}{\partial x_{it-1}} = \beta_i - a_i \beta_i > 0 \tag{6}$$

and a decrease in current consumption of every other good

$$\frac{\partial h^{jt}(P, \mu; X_{t-1})}{\partial x_{it-1}} = a_j p_i \beta_i / p_j < 0, \qquad i \neq j. \tag{7}$$

When the b's in the LES are positive, we can interpret them as a necessary collection of goods, but the utility function (2) and the demand functions (1) are defined for negative as well as positive b's. Even if b_i^* and b_{it} are negative, the short-run demand functions retain all of the general properties described above. The only casualty is the interpretation of b_i^* and b_{it} as components of a necessary basket. The habit hypothesis, however, does not require this interpretation. The two essential features of habit formation are: first, that past consumption influences current preferences and, hence, current demand; second, that a higher level of past consumption of a good implies, ceteris paribus, a higher level of current consumption of that good. It is easily verified that these conditions are satisfied by (4) regardless of the signs of b_{it} and b_i^*.

The habit formation specification (3) implies that consumption in the previous period influences current preferences and demand but that consumption in the more distant past does not. An example of a specification that allows consumption in the more distant past to matter is one in which the necessary quantity of each good depends on a geometrically weighted average of all past consumption of that good. The analogue of (3) is

(8) $$b_{it} = b_i^* + \beta_i z_{it-1}$$

where

(9) $$z_{it-1} = (1 - \delta_i) \sum_{\tau=0}^{\infty} \delta_i^{\tau} x_{it-1-\tau}.$$

The δ's are "memory" coefficients. The one-period lag specification, (3), corresponds to the special case in which all $\delta_i = 0$. Substituting (8) into (1), we obtain a short-run demand system that depends on all past levels of consumption, not just on consumption in the previous period. This demand system is of the same form as (4) except that x_{it-1} is replaced by z_{it-1}. Because z_{it-1} depends linearly on past consumption of the ith good, it is easy to show that, ceteris paribus, a higher level of past consumption of a good implies a higher level of current consumption of that good.

An alternative habit hypothesis is that the b's depend linearly on the previous peak consumption of a good:

(10) $$b_{it} = b_i^* + \beta_i \max_{\tau < t} x_{i\tau}.$$

This implies an irreversible ratchet similar to that suggested by Duesenberry [1949] and Modigliani [1949] in the consumption function context. The long-run irreversibility of the ratchet is implausible because it implies that the effect of previous peak consumption on current demand is independent of how long ago the peak occurred. There are several ways of avoiding this irreversibility while maintaining the appealing features of the ratchet hypothesis. One is to assume that tastes are influenced by the highest consumption level attained in the previous t* periods:

(11) $$b_{it} = b_i^* + \beta_i \max_{\tau - t^* < \tau < t} x_{i\tau}.$$

Another is to assume that the influence of the previous peak diminishes with the passage of time, an assumption that avoids the need to specify a fixed horizon beyond which everything is forgotten and before which everything is recalled perfectly. The implied habit function is of the form

$$b_{it} = b_i^* + \beta_i(\delta_i)^{t-\tau} \max_{\tau<t} x_{i\tau} \tag{12}$$

where δ_i is again the memory coefficient for the ith good. An alternative formalization assumes the habit function depends on the previous peak of perceived consumption rather than actual consumption. If the memory of past consumption decays geometrically, then consumption in the distant past is "discounted" more heavily than consumption in the recent past and the ratchet is reversible:

$$b_{it} = b_i^* + \beta_i \max_{\tau<t} (\delta_i)^{t-\tau} x_{i\tau}. \tag{13}$$

We have thus far ignored the simplest dynamic specification, the linear time trend,

$$b_{it} = b_i^* + \beta_i t. \tag{14}$$

Time trend specifications have three serious drawbacks. First, time trends give no insight into the social or economic forces generating taste change. In contrast, the lagged consumption specification may be interpreted as habit formation or interdependent preferences. Second, time marches on and the time trend specification implies inexorable taste change even if prices and expenditure remain constant for many periods. We find this implausible. Third, in conjunction with the LES, the generalized CES, and some other widely used functional forms, time trends applied to the necessary quantities imply an eventual violation of regularity conditions: the difficulty is that if prices and expenditure remain constant, then the value of the necessary basket will eventually exceed expenditure. For these reasons, we prefer dynamic specifications based on past consumption.

Our assumptions about the form of the habit function can be generalized in three directions. First, the habit function can be nonlinear in past consumption

$$b_{it} = H^i(x_{it-1}), \tag{15}$$

where $H^i(x_{it-1})$ denotes a continuous, increasing function. Second, the habit function for each good can depend not only on past consumption of that good but also on past consumption of other goods:

$$b_{it} = H^i(x_{it-1}, \ldots, x_{nt-1}). \tag{16}$$

Third, as we have already seen, the habit function can depend not only on consumption in the previous period but also on consumption in the more distant past:

$$b_{it} = H^i(X_{t-1}, X_{t-2}, \ldots, X_{t-\tau}, \ldots). \tag{17}$$

Because these generalizations introduce no new conceptual issues, we have chosen to emphasize the most transparent specification—the one in which the habit function for each good depends linearly on consumption of that good in the previous period.

The specifications we have considered thus far assume that some but not all of the LES parameters depend on past consumption. Because the demand functions are linear in the b's, a specification in which the b's depend linearly on past consumption yields dynamic demand systems that are linear in past consumption. It might appear that this is also true of a specification in which the a's depend linearly on past consumption, but it is not. Unlike the b's, which can be specified independently, the a's must sum to 1: $\sum a_k = 1$. Hence, a change in past consumption causing an increase in one of the a's must cause offsetting decreases in the others.

The issues that arise in applying alternative dynamic specifications are similar to those that arise in applying demographic specifications to arbitrary demand systems. This is not surprising because in both instances we seek to incorporate additional explanatory variables. There are, however, two significant differences. First, dynamic specifications typically involve one lagged consumption variable for each good, while demographic specifications must be capable of accommodating both a single explanatory variable (e.g., family size) and a large number of such variables (e.g., race, ages, and sexes of family members, place of birth, etc.). Second, dynamic specifications often postulate a close association between the lagged and current consumption of each good; with demographic specifications there is often little reason to postulate a close association between the consumption of a particular good and a particular demographic variable, even when the number of demographic variables happens to be equal to the number of goods.

A general procedure for obtaining a dynamic specification of an arbitrary demand system is to allow some or all of its parameters to depend on past consumption. Theory provides little guidance in specifying the parameters that depend on past consumption, the variables that represent past consumption, or the functional form that the habit function assumes. Even if we confine ourselves to dynamic specifications that depend only on consumption in the previous period, each demand system parameter may depend on the lagged consumption of all goods. Two kinds of restrictions are implied by the theory. First, and most important, are those that follow from the fact that the demand system parameters themselves are often not independent (e.g., in the LES, the a's must sum to unity). Second, habit formation postulates a positive relationship between past and current consumption of each good.

Dynamic translating and dynamic scaling single out particular subsets of demand system parameters and assume that these and only these parameters depend on past consumption. Both translating and scaling are general procedures in the sense that they can be used in conjunction with any original demand system, $\{x_i = \bar{h}^i(P, \mu)\}$. As in Chapter 3, we assume that these original demand systems are theoretically plausible, and denote the corresponding direct and indirect utility functions by $\bar{U}(X)$ and $\bar{\psi}(P, \mu)$.

There are two versions of dynamic translating. If the original demand system contains constant terms, then we assume that the constants depend on past consumption. In principle, the constants may depend on any variables representing past consumption, but we assume that they depend only on the previous period's consumption. Log linear dynamic translating, one of the specifications we estimate in Chapter 7, is given by

$$D^i(x_{it-1}) = d_i x_{it-1}^{\gamma_i} \tag{18}$$

and adds n parameters to the original demand system.

When the original demand system does not contain constant terms (e.g., in the Cobb–Douglas case), dynamic translating introduces them by replacing the original system by

$$h^i(P, \mu) = b_i + \bar{h}^i(P, \mu - \sum p_k b_k). \tag{19}$$

These newly introduced constants are then assumed to depend on past consumption. In this case, the dynamic demand system does not contain constant terms independent of past consumption unless all of the γ's are 0. A more general formulation avoids this difficulty by retaining the constant term:

$$D^i(x_{it-1}) = b_i^* + d_i x_{it-1}^{\gamma_i}. \tag{20}$$

If the original demand system is theoretically plausible, then the modified system is also, at least for d's close to 0. The modified system satisfies the first order conditions corresponding to the indirect utility function $\psi(P, \mu) = \bar{\psi}(P, \mu - \sum p_k d_k)$. With linear translating, provided $\partial D^i/\partial x_{it-1} > 0$, an increase in past consumption of a good implies an increase in current consumption of that good provided that the good's marginal budget share is less than 1:

$$\frac{\partial h^i}{\partial x_{it-1}} = \frac{\partial D^i}{\partial x_{it-1}} \left[1 - p_i \frac{\partial \bar{h}^i}{\partial \mu} \right]. \tag{21}$$

Again provided $\partial D^i/\partial x_{it-1} > 0$, the increase in past consumption of a good implies a decrease in current consumption of every noninferior good:

$$\frac{\partial h^j}{\partial x_{it-1}} = - \frac{\partial \bar{h}^j}{\partial \mu} p_i \frac{\partial D^i}{\partial x_{it-1}}. \tag{22}$$

Dynamic translating was originally proposed by Stone [1954, p. 552] in the context of the LES; he implemented his own proposal in Stone [1966a, 1966b]. Houthakker and Taylor [1966, 2nd ed. 1970] proposed and estimated a model in which past consumption influences consumption patterns through a "state" variable which they interpret as a "psychological stock" of habits. In their second edition they showed how such a dynamic demand system can be obtained from utility maximization. Theoretical models of habit formation are investigated in Gorman [1967], Peston [1967], Pollak [1970, 1976b], von Weizsäcker [1971], Gaertner [1974], Lluch [1974], McCarthy [1974], Phlips [1974, rev. ed. 1983], El-Safty [1976a, 1976b], Hammond [1976], Klijn [1977], Spinnewyn [1981], Boyer [1983], Pashardes [1986], and Becker and Murphy [1988]. Empirical investigations based on various specifications of habit formation include Pollak and Wales [1969, 1987], Wales [1971], Phlips [1972], Brown and Heien [1972], Taylor and Weiserbs [1972], Boyce [1975], Manser [1976], Anderson and Blundell [1983], and Darrough, Pollak, and Wales [1983]. Blundell [1988] provides a recent survey.

Dynamic scaling, an alternative dynamic specification, replaces the original demand system by

$$h^i(P, \mu) = m_i \bar{h}^i(p_1 m_1, \ldots, p_n m_n, \mu), \tag{23}$$

where the m's are scaling parameters that depend on the previous period's consumption: $m_i = M^i(x_{it-1})$. A more general formulation would allow all m_i to depend on consumption in all previous periods. If the original demand system is theoretically plausible, then the modified system is also, at least for m's close to 1. The modified system satisfies the first order conditions corresponding to the indirect utility function $\psi(P, \mu) = \bar{\psi}(p_1 m_1, \ldots, p_n m_n, \mu)$ and the direct utility function $U(X) = \bar{U}(x_1/m_1, \ldots, x_n/m_n)$. Loosely speaking, we can interpret x_i/m_i as a measure of x_i in "efficiency units" rather than in physical units. The effect of an increase in past consumption of good i on current consumption of good i is given by

$$E^i_{it-1} = \hat{M}^i_{it-1} + E^i_i \hat{M}^i_{it-1}, \tag{24}$$

where E^i_{it-1} is the elasticity of demand for good i with respect to lagged consumption of good i and $\hat{M}^i_{it-1}$ is the elasticity of m_i with respect to x_{it-1}. The effect of an increase in past consumption of good i on current consumption of good j is given by

$$E^j_{it-1} = E^j_i \hat{M}^i_{it-1}. \tag{25}$$

In certain special cases (e.g., the LES) dynamic translating and dynamic scaling coincide.

Log linear dynamic scaling, one of the specifications we estimate in Chapter 7, is given by

$$M(x_{it-1}) = x^{\gamma_i}_{it-1}. \tag{26}$$

This specification, which adds n parameters to the original demand system, guarantees that the implied value of m_i will be positive, as theory requires.

We now consider the long-run behavior corresponding to a short-run demand system. Given the consumption vector of period 0, and given prices and expenditure of period 1, the short-run demand functions yield a consumption vector for period 1. Suppose prices and expenditure remain the same in period 1 as in period 0. A "steady-state" or "long-run equilibrium" consumption vector is one that, if it prevailed in period 0, would also prevail in period 1. If prices and expenditure remain constant over time, the consumption vector in each subsequent period would also equal the consumption vector of period 0.

Although estimation must be based on the short-run demand system, we are often interested in long-run as well as short-run responses to changes in prices or expenditure. The long-run equilibrium consumption vector can be found by solving the short-run demand functions (5) under the assumption that $x_{it} = x_{it-1} = x_i$ for all i, but an alternative solution procedure is sometimes simpler. As usual, the LES provides an example. The first order maximization conditions corresponding to (4) are

$$\text{(27)} \qquad \frac{a_i}{(x_{it} - b_{it})} = \lambda p_i, \qquad \sum p_k x_{kt} = \mu.$$

In the short run the utility maximizing x's must satisfy (27), where the b's are determined by past consumption. In the long-run equilibrium, however, the b's are given by $b_i = b_i^* + \beta_i x_i$ where x_i is the long-run equilibrium value of x_{it}. Thus, in the long-run equilibrium the x's must satisfy

$$\text{(28)} \qquad \frac{a_i}{(x_i - b_i^* - \beta_i x_i)} = \nu p_i, \qquad \sum p_k x_k = \mu,$$

where ν represents the long-run value of the Lagrangian multiplier. In the short run, the value of the Lagrangian multiplier depends on the values of the b's and, hence, on past consumption as well as on prices and expenditure. In the long run, however, the values of x_{it} and x_{it-1} must be equal, and the long-run value of the Lagrangian multiplier depends only on prices and expenditure. Solving the "long-run first order conditions," (28), for x_i yields

$$\text{(29)} \qquad x_i = \frac{b_i^*}{1 - \beta_i} + \frac{a_i}{1 - \beta_i} \frac{1}{\nu} \frac{1}{p_i}.$$

Multiplying (29) by p_i, summing over all goods, solving for $(1/\nu)$, and substituting into (29), we obtain the "long-run" or "equilibrium" demand functions

$$(30)\qquad h^i(P,\mu) = B_i - \frac{A_i}{p_i}\sum p_k B_k + \frac{A_i}{p_i}\mu,$$

where

$$(31)\qquad A_i = \frac{a_i/(1-\beta_i)}{\sum a_k/(1-\beta_k)}, \qquad B_i = \frac{b_i^*}{1-\beta_i}.$$

These long-run demand functions show the steady-state consumption patterns consistent with the short-run demand functions (5).

In general, there is no guarantee that a long-run demand system defined as the steady-state or equilibrium values corresponding to the short-run demand system will satisfy the symmetry or negative semidefiniteness conditions, or, equivalently, that they can be "rationalized" by a "long-run utility function." When the short-run demand system is an LES, however, it is obvious that the long-run demand functions (30) are also an LES and can be rationalized by the long-run utility function

$$(32)\quad U(X) = \sum A_k \log(x_k - B_k), \qquad A_i > 0, \qquad (x_i - B_i) > 0, \qquad \sum A_k = 1$$

where A_i and B_i are defined by (31). Clearly $A_i > 0$ and $\sum A_k = 1$. If $\bar{x}_i$ is an admissible long-run equilibrium, then $[\bar{x}_i - (b_i^* + \beta_i \bar{x}_i)] > 0$, so $(x_i - B_i) > 0$. Since the long-run demand functions (30) can be derived from a well-behaved utility function, they must satisfy the symmetry and negative semidefiniteness conditions.

These long-run LES demand functions were not derived by maximizing a long-run utility function and, in particular, they are not the demand functions implied by maximizing the utility function obtained by replacing b_{it} by $b_i^* + \beta_i x_{it-1}$ in (2):

$$(33)\qquad V(X) = \sum a_k \log[x_k - (b_k^* + \beta_k x_k)].$$

The procedure used here for the LES can be applied directly to the generalized CES, and, with slight modification, to the additive exponential utility function.[2] These forms, together with the LES, exhaust the class of demand systems generated by additive direct utility functions that imply linear Engel curves.

In most cases the long-run demand functions generated as steady-state solutions of a habit formation model cannot be rationalized by a long-run utility function. Pollak [1976b] shows that if the short-run demand functions are locally linear in expenditure, then only the subclass corresponding to additive direct utility functions generates long-run demand functions that can be rationalized by a long-run utility function. El-Safty [1976a, 1976b] shows that separability is the crucial requirement.

[2] Pollak [1970] works out the details.

Establishing local dynamic stability of the long-run demand system requires matrix algebra. It is straightforward to write the short-run demand system in matrix form as

$$X_t = b_t - \gamma_t P_t' b_t + \gamma_t \mu_t \tag{34}$$

where b_t is given by

$$b_t = b^* + \hat{\beta} X_{t-1} \tag{35}$$

and γ^t is a column vector whose elements are $\gamma^{it}(P_t)$; in the case of the LES these are given by

$$\gamma^{it}(P_t) = a_i / p_{it}. \tag{36}$$

If X_0 (that is, the consumption vector in period 0) is given, then (34) determines X_1 as a function of P_1, μ_1, and X_0. In the same way, X_2 is determined by (34) as a function of P_2, μ_2, and X_1, or, more conveniently, as a function of $X_0, P_1, \mu_1, P_2, \mu_2$. Thus, for any initial consumption vector X_0 and any price–expenditure sequence $\{(P_1, \mu_1), (P_2, \mu_2), \ldots\}$, (34) determines the corresponding consumption sequence $\{X_1, X_2, \ldots\}$.

We have already identified the equilibrium consumption vector X^* corresponding to the price–expenditure situation (P^*, μ^*). Clearly, if $X_0 = X^*$ and $\{(P_1, \mu_1), (P_2, \mu_2), \ldots\} = \{(P^*, \mu^*), (P^*, \mu^*), \ldots\}$, then $\{X_1, X_2, \ldots\} = \{X^*, X^*, \ldots\}$. To establish local dynamic stability, it is necessary to show that if X_0 is sufficiently close to X^*, then the consumption sequence corresponding to $\{(P^*, \mu^*), (P^*, \mu^*), \ldots\}$ converges to X^*.

With prices and expenditure assumed constant over time, we drop the time subscripts on P_t, μ_t, and γ_t. Substituting (35) into (34) yields

$$X_t = M X_{t-1} + d, \tag{37}$$

where

$$M = (I - \gamma P')\hat{\beta} \tag{38}$$

and

$$d = (I - \gamma P')b^* + \gamma\mu. \tag{39}$$

It is easily verified that X_t is given by

$$X_t = M^t X_0 + \left[\sum_{\tau=0}^{t-1} M^\tau\right] d. \tag{40}$$

The stability of this system of difference equations (37) rests on the following theorem.

Theorem: Let M be the matrix defined by (38) where γ and P are $n \times 1$ vectors with positive elements such that $P'\gamma = 1$, and $\hat{\beta}$ is the diagonal matrix diag $(\beta_1, \ldots, \beta_n)$ where $0 \leqslant \beta_i < 1$ for all i; then the characteristic roots of M are all less than 1 in modulus. The proof is given in Pollak [1970, Appendix A].

If the characteristic roots of M are less than 1 in modulus, it is well-known that

$$\lim_{t \to \infty} M^t = 0 \tag{41a}$$

and

$$\lim_{t \to \infty} \sum_{\tau=0}^{t-1} M^\tau = (I - M)^{-1} \tag{41b}$$

so the system of difference equations (37) converges to

$$X = (I - M)^{-1} d.^3 \tag{42}$$

A rigorous discussion of dynamic stability is inevitably complicated by regularity and nonnegativity conditions that must be satisfied in every period. The local argument is easy: corresponding to every admissible price–expenditure situation, there exists a neighborhood of the long-run equilibrium such that, for initial values of X in this neighborhood, the sequence of consumption vectors $\{X_1, X_2, \ldots\}$ satisfies the nonnegativity and regularity conditions in each period.

This local stability argument can be applied directly to the generalized CES demand system and, with slight modification, to the demand system corresponding to the exponential direct utility function. The analysis in these cases is relatively straightforward because these demand systems, like the LES, are linear in lagged consumption.

Our stability analysis assumes that habit formation depends only on consumption in the previous period. McCarthy [1974] extends the local stability proof to the case in which habit formation depends on a geometrically weighted average of all past consumption.

2. INTERDEPENDENT PREFERENCES

Interdependent preferences—preferences that depend on other people's consumption—have a long history on the margin of economic analysis. The post-Veblen literature on interdependent preferences begins with Duesenberry's well-known book on the consumption function [1949]. Leibenstein [1950] and Prais and Houthakker [1955, Chapter 2] discuss interdependent preferences, but the subject appears to have been dormant from the mid-1950s until the 1970s when it was revived by Krelle [1973], Gaertner [1974], Pollak [1976a], and Hayakawa and Venieris [1977]. Easterlin's "relative income" model of fertility contains elements of both habit formation and interdependent preferences; see Easterlin [1973, 1976],

[3]For a discussion of stability see Luenberger [1979, pp. 154–157].

Easterlin, Pollak, and Wachter [1980], and Leibenstein [1975, 1976]. Case [1991] proposes a specification in which demand has a spatial component and points out that her spatial specification can be interpreted in terms of interdependent preferences.

Interdependent preferences can be incorporated into demand analysis using models similar to the habit formation models described in Section 1. We begin by specifying a short-run model of interdependent preferences, "linear interdependence." We introduce linear interdependence in the context of the LES by postulating that the necessary quantities depend linearly on other people's *past* consumption. If the necessary quantities were determined by other people's current consumption, then analyzing the model would require determining everyone's consumption simultaneously. By assuming that interdependent preferences operate through past consumption, we retain the central insight while avoiding peripheral mathematical complications. We consider a number of alternative specifications of interdependent preferences, and extend the results from the LES to more general demand systems. We then aggregate over individuals to obtain the per capita demand functions and investigate the long-run or steady-state equilibrium implied by these per capita demand functions. We emphasize the per capita rather than the individual demand functions because the outcome of the mutual interaction of consumption and tastes that characterizes interdependent preferences is manifested only in the long-run per capita demand functions. Although in models of interdependent preferences one might expect the expenditure distribution to be a significant determinant of per capita consumption patterns, our analysis of a number of different specifications shows that this is not necessarily the case: with some specifications it matters, while with others it does not.

Interdependent preferences and habit formation are alternative dynamic specifications, but it is often impossible to distinguish between them on the basis of aggregate or per capita demand behavior. Panel data (i.e., observations on the same individuals or households in successive periods) enable us to distinguish between interdependent preferences and habit formation.

2.1. Individual Demand Functions in the Short Run

In this section we examine the individual demand functions corresponding to alternative specifications of interdependent preferences. For expositional convenience we introduce and discuss them in the context of the LES and then show that they can be applied to a wide variety of demand systems.

In the LES the demand function of individual r for good i in period t is given by

$$x_{it}^r = h^{rit}(P_t, \mu_t^r) = b_{it}^r - \frac{a_i^r}{p_{it}} \sum p_{kt} b_{kt}^r + \frac{a_i^r}{p_{it}} \mu_t^r. \tag{43}$$

Individuals are identified by superscripts on a, b, x, and μ, but everyone faces the same prices.

We incorporate interdependent preferences, into the LES by postulating that some of the demand system parameters depend on other people's consumption. For reasons of tractability, we assume that the a's are constant and that interdependence operates through the b's. The most straightforward assumption is that the b's depend linearly on other people's consumption

$$(44) \qquad b_{it}^r = b_i^{r*} + \sum_{\substack{s=1 \\ s \neq r}}^{R} \beta_i^{rs} x_{it}^s,$$

where R is the number of individuals. We expect the interdependence coefficients, the β's, to be nonnegative, so that an increase in someone else's consumption of a good implies, ceteris paribus, an increase in its consumption by individual r. As in habit formation models, dynamic stability implies restrictions on the β's; we discuss these restrictions in Section 2.4. As a specification of interdependent preferences, (44) has two major defects. First, it involves too many interdependence coefficients—$n \times (R - 1)$ for each individual. Second, because each person's tastes depend on everyone else's current consumption, the simultaneous determination of an equilibrium consumption pattern for everyone in the society is a formidable task.

Instead of specifying that each individual's preferences depend on everyone else's current consumption, we shall assume that they depend on other people's past consumption. This assumption has the merit of analytical tractability, a virtue not to be despised. It is also consistent with the plausible belief that the acquisition of preferences is an integral part of an ongoing process of socialization. It is tempting to argue that lagged interdependence is more plausible than simultaneous interdependence, but because we have not specified the length of the time periods, such an argument would be fragile.

To incorporate lagged interdependence into the LES, we postulate that b_{it}^r depends linearly on every individual's consumption of good i in the previous period:

$$(45) \qquad b_{it}^r = b_i^{r*} + \sum_{s=1}^{R} \beta_i^{rs} x_{it-1}^s .$$

This specification differs from (44) both because it embodies the hypothesis of *lagged* rather than simultaneous interdependence, and because the summation in (45) runs over *all* individuals, not just *all other* individuals. One might argue that pure interdependence requires the "own effect" β_i^{rr} to be 0, and that when it is nonzero the interdependence model is contaminated by traces of habit formation; nevertheless, we prefer the more general model, especially since we are free to consider pure interdependence as a special case.

The linear interdependence specification (45) involves an unmanageably large number of interdependence coefficients or "weights": unless there is a systematic relationship among the β's, each individual assigns $n \times R$ independent weights. We now consider alternative assumptions that reduce the interdependence parameters to a manageable number.

We begin by treating two closely related cases. In the first, each individual gives equal weight to everyone's past consumption, including his or her own:

$$\beta_i^{rs} = \beta_i^r, \qquad s = 1, \ldots, R. \tag{46}$$

In the second, each individual gives equal weight to everyone else's past consumption and 0 weight to his or her own:

$$\beta_i^{rs} = \begin{cases} \beta_i^r, & s \neq r \\ 0, & s = r \end{cases}. \tag{47}$$

Under (46), (45) becomes

$$b_{it}^r = b_i^{r*} + \hat{\beta}_i^r \bar{x}_{it-1}, \tag{48}$$

where

$$\bar{x}_{it-1} = \frac{1}{R} \sum_{s=1}^{R} x_{it-1}^s \qquad \text{and} \qquad \hat{\beta}_i^r = R\beta_i^r. \tag{49}$$

Under (47) it becomes

$$b_{it}^r = b_i^{r*} + \hat{\beta}_i^r \bar{x}_{it-1} - \beta_i^r x_{it-1}^r. \tag{50}$$

Both of these cases enable us to discuss interdependent preferences in terms of per capita past consumption, $\bar{x}_{it-1}$, although in (50) a further adjustment is made for the individual's own past consumption.

Substituting (48) and (50) into the LES and dropping individual subscripts on a and time subscripts on p and μ yields the demand functions of individual r:

$$x_{it}^r = b_i^{r*} - \frac{a_i}{p_i} \sum p_k b_k^{r*} + \frac{a_i}{p_i} \mu + \hat{\beta}_i^r \bar{x}_{it-1} - \frac{a_i}{p_i} \sum p_k \hat{\beta}_k^r \bar{x}_{kt-1} \tag{51}$$

$$\begin{aligned} x_{it}^r = b_i^{r*} &- \frac{a_i}{p_i} \sum p_k b_k^{r*} + \frac{a_i}{p_i} \mu + \hat{\beta}_i^r \bar{x}_{it-1} - \frac{a_i}{p_i} \sum p_k \hat{\beta}_k^r \bar{x}_{kt-1} \\ &- \beta_i^r x_{it-1}^r + \frac{a_i}{p_i} \sum p_k \beta_k^r x_{kt-1}^r, \end{aligned} \tag{52}$$

respectively.

This model of interdependent preferences, like the habit model, can be extended in a number of directions. For example, per capita consumption in the more distant past may influence current tastes, or b may depend linearly on the previous peak of per capita consumption, with or without memory coefficients that allow the influence of the peak to diminish as it recedes into the past. The linearity assumption can be dropped to permit the b's to be nonlinear functions of per capita consumption in the previous period, or, more generally, of per capita consumption in the more distant past.

An individual's preferences are likely to be influenced more by the consumption of those with whom he or she has close contact than by those with whom contact is more distant because, as Duesenberry [1949, p. 27] points out, changes in tastes are caused by frequent contact with superior goods, not by mere knowledge of their existence. The per capita lagged consumption specification, which requires that everyone's lagged consumption count equally, is inconsistent with this observation. We now turn to specifications in which individual demand depends on the distribution of consumption in the previous period, not just on its average. The models we consider are based on the premise that individuals are arrayed in a hierarchy in which each individual's preferences are influenced by the consumption behavior of higher ranked individuals. For definiteness, one can imagine that each individual is attempting to imitate the consumption behavior of individuals perceived as having higher social status, but introducing social status or any other new explanatory variable is unnecessary. Position in the hierarchy is defined in terms of who influences whom, and no sociological concepts are required. It is convenient to number individuals in terms of their position in the hierarchy, so that Person 1 is at the top and Person R at the bottom. To simplify the exposition, we assume that there are no "ties," although these could be accommodated without altering the substance of the analysis.

A simple model of interdependent preferences can be built on the assumption that each individual is concerned only with the consumption of the individual one step above in the hierarchy. The model does not require an individual to recognize the entire hierarchy but only to recognize the next ranked individual; the essential hypothesis is that patterns of influence are consistent with an underlying one-dimensional array. To close the model the behavior of the first individual must be specified. Since there is no one above Person 1, it could be argued that the most appropriate specification is constant tastes (i.e., $\beta_i^{1s} = 0$ for all s, so that $b_{it}^1 = b_i^{1*}$). This, however, implies a sharp break between the preferences of the first individual and the preferences of those immediately below. We prefer to assume that Person 1's preferences depend on own past consumption, as in models of habit formation.

A "two-class" model of interdependent preferences in which the members of the lower class (L) emulate the consumption standards of the upper class (U) is an alternative hierarchy model. Again working with the LES, suppose that the necessary basket of an individual in the lower class depends linearly on the average consumption of those in the upper class. We could assume constant tastes (i.e., $b^r_{it} = b^{r*}_i$) for members of the upper class, but we prefer to postulate that their tastes are influenced by the average past consumption of their own class.

Any of these specifications of interdependent preferences can be applied to any demand system locally linear in expenditure by introducing constant terms, if necessary, and allowing them to depend on the consumption of others. Regularity conditions, however, imply restrictions on admissible parameter values. More generally, any of these specifications can be applied to demand systems that are nonlinear in expenditure, provided the system contains n independent parameters, analogous to the b's: $x_t = h^t(P_t, \mu_t; b_t)$. Except in special cases, however, the resulting demand system will be nonlinear in the consumption of others.

2.2. Per Capita Demand Functions in the Short Run

In Section 2.1 we examined alternative specifications of "linear" interdependent preferences and discussed their implications for individual short-run demand behavior. We now consider a society made up of individuals whose preferences are interdependent and examine per capita short-run demand behavior. Our emphasis on per capita rather than market demand functions is a matter of form, not substance; we emphasize per capita results to facilitate comparisons with individual behavior under habit formation (Section 1) and with individual short-run behavior under interdependent preferences (Section 2.1).

Although the per capita short-run demand functions are of interest for their own sake, we treat them primarily as a bridge between the individual short-run demand functions and the per capita long-run demand functions we discuss in Section 2.3. We emphasize the per capita long-run demand functions because the ramifications of interdependent preferences are manifested only in the long run.

Although we base our exposition on the LES, the results generalize immediately to any demand system locally linear in expenditure. If the per capita short-run demand functions are locally linear in per capita expenditure, then the distribution of expenditure has no direct effect on the long-run consumption pattern; its influence must be indirect and operate through interdependent preferences. If the per capita short-run demand functions are locally linear in per capita expenditure and independent of the distribution of past consumption, then the long-run demand system will be independent of the distribution of per capita expenditure. We shall see that under some specifications of interdependent preferences, the distribution of past consumption is a significant determinant of the short-run consumption pattern, while under others it is not.

We opened our discussion of interdependent preferences by considering two specifications in which an individual gives equal weight to everyone else's past consumption. They differed in that one specification, (46), gives the individual's own past consumption the same weight as anyone else's, while the other, (47), gives it no weight. With the LES the individual demand functions corresponding to these two specifications are given by (51) and (52), respectively. To examine the per capita demand functions, we assume that everyone has the same marginal budget shares and the same interdependence coefficients, that is,

$$a_i^r = a_i, \qquad r = 1, \ldots, R \tag{53}$$

$$\beta_i^r = \beta_i, \qquad r = 1, \ldots, R. \tag{54}$$

These assumptions enable us to drop the individual superscripts on the a's and β's.

The per capita demand functions are obtained by summing the individual demand functions over all individuals and dividing by R. If each individual gives equal weight to everyone's consumption in the previous period including his own, then (51) yields

$$\bar{x}_{it} = \bar{b}_i^* - \frac{a_i}{p_i} \sum p_k \bar{b}_k^* + \frac{a_i}{p_i} \bar{\mu}_t + \hat{\beta}_i \bar{x}_{it-1} - \frac{a_i}{p_i} \sum p_k \hat{\beta}_k \bar{x}_{kt-1}, \tag{55}$$

where $\bar{b}_i^*$ and $\bar{\mu}_t$ denote the average values of b_i^{r*} and μ_t^r:

$$\bar{b}_i^* = \frac{1}{R} \sum_{s=1}^{R} b_i^{s*}, \qquad \bar{\mu}_t = \frac{1}{R} \sum_{s=1}^{R} \mu_t^s. \tag{56}$$

If each individual gives equal weight to everyone else's consumption in the previous period and no weight to his own, then (52) yields

$$\bar{x}_{it} = \bar{b}_i^* - \frac{a_i}{p_i} \sum p_k \bar{b}_k^* + \frac{a_i}{p_i} \bar{\mu}_t + \beta_i^* \bar{x}_{it-1} - \frac{a_i}{p_i} \sum p_k \beta_k^* \bar{x}_{kt-1}, \tag{57}$$

where β_t^* is defined by

$$\beta_i^* = (R-1)\beta_i = \hat{\beta}_i - \beta_i. \tag{58}$$

Thus, the alternative specifications (46) and (47) lead to per capita demand systems that differ only in the *interpretation* of one parameter. It would not be surprising to find that these specifications imply similar per capita demand functions—if the number of individuals is large and income is fairly evenly distributed, then the difference between the average of everyone's past consumption and the average of everyone else's past consumption must be small. But our assertion is stronger: the per capita demand functions implied by these two specifications are identical.

In these cases the distribution of consumption in the previous period has no influence on the current per capita consumption pattern. In (55), when each individual is influenced by the average of everyone's past consumption including his own, this is obvious: since the individual demand functions are independent of the distribution of past consumption, so are the per capita demand functions. In (57), when each individual is influenced by the average of everyone else's past consumption, individual demand is influenced to some degree by the distribution of past consumption, although the influence is small unless the community is small or the distribution of past consumption very unequal; per capita demand, however, depends only on average past consumption, and not on its distribution.

We now examine the implications for the per capita demand functions of the hierarchy models of interdependent preferences in which individuals are influenced by the consumption behavior of persons of higher rank. Again assume that everyone has the same a's and β's. When each individual is concerned with the consumption of the person immediately above in the hierarchy, one might expect the distribution of past consumption to be a major determinant of the per capita consumption pattern. Surprisingly enough, it is not. It is straightforward to show that the only parameter of the distribution of past consumption other than its average that enters the per capita demand functions is the "range" of the distribution, $x^1_{it-1} - x^R_{it-1}$. (Our use of "range" is nonstandard; x_1 and x_R need not be the highest and lowest consumption in the community.) The range enters only in terms of the form $\bar{x}_{it-1} + (x^1_{it-1} - x^R_{it-1})/R$, and average past consumption, $\bar{x}_{it-1}$, is likely to swamp the effect of the range, because the latter is divided by R. Hence, unless the community is small or the distribution of past consumption very unequal, the influence of the distribution of past consumption is small.

In the hierarchy model it is straightforward to show that the distribution of past consumption has a substantial impact on individual consumption patterns but not on the per capita consumption pattern. A similar result holds under habit formation, where each individual's demand depends only on own past consumption, yet the implied per capita demand functions are independent of the distribution of past consumption.

The two-class model provides a simple example in which the distribution of past consumption has a substantial impact on the per capita consumption pattern. In general, if individual demand functions are independent of the distribution of past consumption, then so are the per capita demand functions. The converse, however, need not hold: the per capita demand functions may be independent of the distribution of past consumption even when the individual demand functions are not.

2.3. Long-Run Demand Functions

We now examine the "long-run" demand functions corresponding to various specifications of interdependent preferences. As in habit formation models, a steady-state or long-run equilibrium consumption vector is one that, if it prevailed in period 0, would also prevail in period 1. If prices and each individual's total expenditure remain constant over time, the per capita consumption vector in each subsequent period would also equal the consumption vector of period 0.

Only in the long run can we observe the full effects of interdependent preferences. In the short run the distribution of expenditure among individuals can influence the per capita consumption pattern only if different individuals have different marginal budget shares. When the individual short-run demand functions are locally linear in expenditure and everyone has the same marginal budget shares, then the distribution of expenditure among individuals has no direct influence on the per capita short-run consumption pattern, but the distribution of expenditure can influence the long-run consumption pattern indirectly, through interdependent preferences.

Our exposition thus far has been based on the LES. In this section we use a more general framework, namely, demand functions locally linear in expenditure, to emphasize the similarity of the per capita long-run demand functions under interdependent preferences and the individual long-run demand functions under habit formation.

We begin by discussing specifications of interdependent preferences in which each individual is influenced by average past consumption. There are two such specifications, (46) and (47), which differ only in their treatment of the individual's own past consumption. Because both specifications imply the same per capita short-run demand functions, they must also imply the same per capita long-run demand functions.

The per capita long-run demand functions can be found by solving this system of short-run demand functions under the assumption that $\bar{x}_{it} = \bar{x}_{it-1} = \bar{x}_i$ for all i. Mathematically, this problem is identical to one considered in Pollak [1976b], where it was necessary to solve the system of short-run demand functions implied by habit formation to find the long-run demand functions. There is no need to repeat here the argument used there; we simply assert its conclusion.

Theorem: Suppose that the short-run per capita demand functions are locally linear in per capita expenditure,

$$\bar{x}_{it} = b_{it} + f_i(P_t) + \gamma^i(P_t)[\bar{\mu}_t - f(P_t) - \sum p_{kt} b_{kt}], \tag{59}$$

and b_{it} is given by

$$b_{it} = \bar{b}_i^* + \beta_i \bar{x}_{it-1}. \tag{60}$$

Then the per capita long-run demand functions are given by

$$h^i(P, \bar{\mu}) = B^i(P) - \Gamma^i(P) \sum p_k B^k(P) + \Gamma^i(P)\bar{\mu}, \tag{61}$$

where

$$B^i(P) = \frac{\bar{b}_i^* + f_i(P)}{1 - \beta_i} \tag{62}$$

(63) $$\Gamma^i(P) = \frac{\gamma^i(P)/(1-\beta_i)}{\sum p_k \gamma^k(P)/(1-\beta_k)}.$$

Interdependent preferences do not imply that the distribution of expenditure among individuals influences the long-run consumption pattern. With some specifications distribution matters, and with others it does not. Our theorem implies that under the specifications of interdependent preferences in which each individual is influenced by average past consumption, the per capita long-run demand functions depend only on per capita expenditure, not on its distribution.

Now consider the hierarchy specification in which each individual is influenced by the past consumption of the individual ranked immediately above. Assuming only that the demand functions are locally linear in expenditure, these per capita short-run demand functions can be solved for the long-run equilibrium values, just as under habit formation. The per capita long-run demand functions, like their short-run counterparts, depend on per capita expenditure and on the range of the distribution of consumption. It is awkward to include the long-run consumption of individuals 1 and R as arguments of the per capita long-run demand functions. If habit formation determines the long-run consumption pattern of individual 1, then we can eliminate X^1 from the per capita long-run demand functions, replacing it by a function involving μ_1. We cannot, however, eliminate the X^R in a similar manner, so we retain the form involving both X^1 and X^R because it is more transparent.

Except for the terms involving the range, these demand functions are identical to those implied by the average past consumption specification, (61). In the limit, as the size of the community increases while the range of the distribution of consumption remains bounded, the terms involving the range approach 0 and the demand functions approach those of the average past consumption specification. In the limit, the distribution of expenditure among individuals is no longer a determinant of the long-run consumption pattern. One must take care, however, in applying this conclusion to large finite communities, because we would not expect the range to be independent of the size of the community.

Now consider the two-class specifications in which the tastes of both classes depend on the average past consumption of the upper class. Assuming linearity in expenditure and the same interdependence coefficients for both classes, the per capita short-run demand functions are easily determined. Since the behavior of the upper class is determined by habit formation, the per capita long-run demand functions of the upper class are given by the habit formation formula. Substituting this result into the per capita short-run demand function for the lower class yields the long-run consumption pattern of the lower class. It is easily seen that in the two-class model the long-run per capita consumption pattern depends on the distribution of expenditure between the classes.

2.4. Lagged Interdependence, Simultaneous Interdependence, and Dynamics

In this subsection we tentatively evaluate the specifications of lagged interdependent preferences introduced above and compare them with simultaneous interdependence, a specification in which preferences are influenced by other people's consumption. We then discuss the dynamics of interdependent preferences and conclude by describing a specification that combines interdependence and habit formation.

Because models of interdependent preferences begin with assumptions about the preferences or behavior of an individual, they are suitable for interpreting household budget data. We have emphasized their implications for per capita rather than individual demand functions because the full ramifications of interdependent preferences depend on the reciprocal interaction of all individuals. The outcome of this interaction manifests itself only in the long run. We have focused on demand functions locally linear in expenditure, so that the distribution of expenditure has no direct effect on per capita consumption patterns. We have focused on demand functions that depend linearly on other people's consumption to keep the model tractable. Although our initial intuition was that with interdependent preferences the expenditure distribution would be a determinant of the per capita long-run consumption pattern, we found that, for a number of plausible specifications, it is not. Whether the expenditure distribution matters depends on which specification of interdependence is employed; the notion that interdependence automatically implies a role for expenditure distribution is false.

Because economists' views of interdependent preferences have been largely shaped by the simultaneous specification, some will be uncomfortable with our lagged specification. Simultaneous interdependence implies that the complete adjustment from one equilibrium to another takes place in a single period. Because periods are not "instants," it is misleading to characterize simultaneous interdependence as implying instantaneous adjustment, but it does imply that responses to changes in prices and expenditure work themselves out in a single period. If the periods are long enough, say a decade or a generation, full adjustment in a single period is not a problem, but if periods are years or quarters, the gradual adjustment implied by lagged interdependence seems more plausible.

Corresponding to each specification of pure lagged interdependence (i.e., lagged interdependence untainted by habit formation) is a related specification of simultaneous interdependence. If a specification of pure lagged interdependence is replaced by the corresponding model of simultaneous interdependence—that is, by the specification obtained by replacing each lagged value by the corresponding current value—then the demand functions of the simultaneous specification are identical with the long-run demand functions of the lagged specification. With simultaneous interdependence there is no distinction between the short run and the long run, because the long run works itself out in a single period. Thus, lagged interdependence is both more plausible and more tractable than simultaneous interdependence.

The dynamics of interdependent preferences differ from those of habit formation. Even though the per capita demand functions are identical, individual demand functions are not, and this complicates regularity conditions and stability. In the LES, regularity conditions require that each individual's expenditure be at least as great as the cost of the individual's "necessary basket." With habit formation, the necessary basket depends on the individual's own lagged consumption and the demand system is locally stable if the β's are all less than 1. With interdependent preferences, if an individual is influenced by the average of everyone's past consumption, then regularity conditions will be violated for individuals at the bottom of the expenditure distribution unless the β's are substantially less than 1. With interdependent preferences, if an individual is influenced by the consumption of the next ranking individual in the expenditure hierarchy, and if the distribution of expenditure among individuals does not change drastically from one period to the next, then β's slightly less than 1 imply stability.

Habit formation and interdependent preferences can operate together. In particular, suppose that each individual is equally concerned with everyone else's past consumption, so that $\beta_i^{rs} = \beta_i^r$, $r \neq s$, and that β_i^{rr} assumes a different (nonzero) value. The implied individual demand functions are slightly messy, but the per capita short-run demand functions (derived under the assumption that all individuals have the same interdependence coefficients, the same marginal budget shares, and the same habit formation coefficients) are of the same form as those obtained under the separate hypotheses of habit formation and interdependent preferences. It follows that the per capita long-run demand functions are of the same form as the long-run demand functions under either hypothesis alone. Hence, on the basis of the per capita demand behavior, one cannot distinguish among habit formation, interdependent preferences, and a combination of the two: distinguishing requires data on individual behavior. Thus, although the implications of interdependent preferences and habit formation happen to coincide for one particular type of data, they are empirically distinct and distinguishable hypotheses.

3. WELFARE

Taste formation and change pose difficult problems for welfare analysis. Variable tastes undermine the normative significance of the fundamental theorem of welfare economics, which asserts—in a precise sense and under fairly stringent assumptions—that, in competitive equilibrium, people get what they want, subject to the constraints imposed by technology, resources, and the satisfaction of the wants of others. If tastes are sufficiently malleable, however, this theorem may be no more than a corollary of the more general proposition that people come to want what they get.

Taste differences among households associated with differences in their demographic characteristics have long been a mainstay of the analysis of household budget data, but specifications of taste formation and taste change have only recently come to play a role in the analysis of time series data. The economist's traditional reluctance to investigate taste change is well expressed by Milton Friedman [1962]. After discussing the relative nature of human wants, he writes

> Despite these qualifications, economic theory proceeds largely to take wants as fixed. This is primarily a case of division of labor. The economist has little to say about the formation of wants; this is the province of the psychologist. The economist's task is to trace the consequences of any given set of wants. The legitimacy of and justification for this abstraction must rest ultimately, in this case as with any other abstraction, on the light that is shed and the power to predict that is yielded by the abstraction. (p. 13)

Although Friedman expresses the dominant view, three points should be noted. First, his strictures apply to taste formation and taste change, not to taste differences: thus, the use of demographic characteristics in the analysis of household budget data does not violate his dictum. Second, Friedman recognizes that tastes are not really fixed and, by implication, that they are endogenous to the socioeconomic system. Nevertheless, he is willing to forgo descriptive accuracy, arguing that taste formation and change are not the economist's business and that their study should be left to the psychologist. He regards the proper test of the validity of this intellectual division of labor as its power to predict. This is an essential point, because the recent impetus to treat taste formation and change has come largely from empirical demand analysis. Finally, Friedman's argument presupposes an exclusive concern with "positive economics": whether this division of labor between economics on the one hand and psychology and sociology on the other is appropriate for welfare analysis is a distinct issue that Friedman does not address.

In "De Gustibus Non Est Disputandum," Stigler and Becker [1977] appear to take the more extreme position that economic analysis should shun not only taste formation and change, but also taste differences. They rightly object to invoking taste differences and taste change as a deus ex machina to "explain" whatever we cannot otherwise explain; but they do not take an equally critical view of attributing observed differences or changes in behavior to unobserved differences or changes in household technology. Whether one accounts for the observation that "exposure to good music increases the subsequent demand for good music" (p. 78) in terms of taste change (as we would) or in terms of the accumulation of "music capital" (as Stigler and Becker do) is a matter of semantics, not substance. There is no more explanatory power in a model of household production that postulates the accumulation of unobservable "consumption capital" (e.g., music capital, p. 79) than in a model of habit formation.

Demand analysis and welfare analysis require different interpretations of preferences. In demand analysis the objects of choice are vectors of private decision variables, X, and preferences over them depend on a vector of predetermined "state variables," Z. The state variables may include the individual's own lagged consumption, the current or lagged consumption of others, or demographic variables such as family size. We denote the individual's conditional preference ordering by R(Z) and interpret the statement $X^a\ R(\bar{Z})\ X^b$ to mean that X^a is at least as good as X^b when the state variables are given by $\bar{Z}$. Because the individual takes the state variables as fixed when choosing among vectors of private decision variables, conditional preferences and conditional demand functions provide an adequate foundation for demand analysis. Furthermore if the individual takes the state variables as given when making consumption decisions, then we observe only the conditional demand functions and, from them, we can recover only the conditional preference ordering. In demand analysis we need never ask how an individual would choose between alternatives that differ with respect to the state variables.

In welfare analysis, on the other hand, we often seek to compare the individual's well-being in alternative situations that differ with respect to both private decision variables and state variables. For example, we might ask whether the individual is better off in the status quo or in an alternative situation in which the individual's own consumption of every good is 10% higher while everyone else's is 20% higher. This comparison requires a preference ordering that evaluates the state variables as well as the private decision variables; thus, it cannot be based on conditional preferences but requires unconditional preferences. We denote the unconditional preference ordering (i.e., the ordering over both private decision variables and state variables) by R; the statement $(X^a, Z^a)R(X^b, Z^b)$ means that the individual finds (X^a, Z^a) at least as good as (X^b, Z^b). We denote the "unconditional utility function" that represents the unconditional preference ordering by U(X, Z) and the "conditional utility function" that represents the conditional preference ordering by U(X; Z). The semicolon separating X and Z in the conditional utility function signals that the z's are treated as state variables rather than as choice variables. Although the conditional utility function is an increasing transformation of the unconditional utility function, the transformation itself may depend on the vector of state variables. Formally,

$$U(X; Z) = T[U(X, Z), Z] \qquad (64)$$

where the transformation $T(\cdot, z_1, \ldots, z_m)$ is increasing in its first argument. The dependence of the transformation on the vector of state variables reflects the impossibility of recovering unconditional preferences from observed demand or other conditional choices.

If unconditional preferences cannot be inferred from market behavior or from any other conditional choices, how might they be recovered? There are two possibilities. First, in some cases we can observe an individual's unconditional choices, even though they are nonmarket choices. For example, with interdependent preferences we might infer unconditional preferences from an individual's support for alternative redistributive tax and transfer programs. Second, and less congenial to the revealed preference tradition of economics, we might ask individuals about their unconditional preferences ("which would you prefer: the status quo or an alternative situation in which your own consumption of every good is 10% higher while everyone else's is 20% higher?"). These are the only alternatives when the state variables are the current or lagged consumption of others, demographic variables, health status, environmental variables (e.g., climatic conditions or pollution), or goods or services provided by the government (e.g., highways, schools, recreational facilities). With habit formation, when the state variables are the individual's own past consumption, the situation is more complex. Two issues set habit formation apart from other specifications involving state variables.

First, von Weizsäcker [1971] has suggested that with habit formation one can finesse the problem of recovering unconditional preferences by basing welfare comparisons on the "long-run utility function." As Pollak [1976b] argues, this is problematic for two reasons. First, when there are more than two goods, the long-run demand system generated by a habit formation model cannot be rationalized by a long-run utility function, except in very special cases. Second, even when the long-run utility function exists, it is an inappropriate welfare criterion. The difficulty is that the long-run utility function, when it exists, is similar to a "community indifference map" rather than an individual's indifference map. Samuelson [1956] shows that, in very special cases, there exists a community indifference map that rationalizes market demand functions; when the community indifference map exists, it is a convenient device for coding information about market demand behavior, but it has no normative or welfare significance. Similarly, the long-run utility function, in those very special cases in which it exists, is merely a convenient device for coding information about long-run demand behavior; it has no normative or welfare significance.

The second issue distinguishing habit formation from other state variable specifications is the relationship between habit formation and intertemporal utility maximization. The threshold distinction is between models of "naive" habit formation and models of "rational" habit