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A Food Demand System for Canada

(Technical Report 1/93)

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Introduction

The purpose of this report is to detail the theoretical specification, data, estimation procedures, and results of a full system of demand equations for Canada that emphasizes food consumption. The report is organized as follows. First, we review briefly the theory of consumer demand, discuss the restrictions implied by this theory, and relate it to market demand functions. Next we present the demand model that will be used in this study, the Almost Ideal Demand System (ALIDS). This is followed by an analysis of alternative separability assumptions that are used to lessen the degrees of freedom problem arising in specifying a large demand system. The econometric estimation techniques used are then described.

The empirical part of the report starts with a discussion of data available for estimating the demand system. We then present the grouping of commodities used in the demand system, and the results of some preliminary analysis of some separable structures. The two-stage demand system suggested by this analysis is then introduced. This is followed by a presentation of estimation results, including some validation statistics. We then present a number of complete matrices of elasticities that are computed from the estimated complete demand system.

Review of Consumer Theory

One of the hallmarks of modern demand analysis is its reliance on the system approach. This has its roots in the pioneering work of Stone (1954), the innovations of Barten (1966) and Theil (1965) which marked a truly important turning point, and the duality *cum* flexible functional form revolution of the 1970s. This approach is now a part of accepted theory in applied demand analysis (Deaton and Muellbauer, 1980b; Johnson, Hassan, and Green, 1984; Pollak and of the first order conditions implied by (1).

An alternative representation of preferences is obtained by considering the cost minimization problem dual to (1), which leads to the cost (expenditure) function C(p,u):

$$C(p,u) \equiv \min_{q} [\, pq : U(q) \geq u \,] \tag{4}$$

where u is a utility level. The cost function C(p,u) is continuous and monotonic (nondecreasing) in p and u, homogeneous of degree one in p, and concave in p. Moreover, if C(p,u) is differentiable, the derivative property (Shephard's lemma) implies:

$$h_i(p,u) = \frac{\partial C}{\partial p_i} \tag{5}$$

where the compensated or Hicksian demand function $h_i(p,u)$ is an element of the vector that solves problem (3).

The cost function C(p,u) allows an alternative derivation of the set of Marshallian demand functions q(p,x) via the derivative property (5) once it is recognized that the following identity must hold: $q_i(p,x) \equiv h_i(p,V(p,x))$, and V(p,x) can be obtained by inverting the cost function C(p,u).

Properties of Consumer Demands

The properties of indirect utility and cost functions allow a straightforward characterization of consumer demand functions. The main properties of demand functions are the following.

Homogeneity. Individual demands $q_i(p,x)$ are homogeneous of degree zero in (p,x) and $h_i(p,u)$ are homogeneous of degree zero in p. This property simply follows from the (linear) budget constraint: if all prices and income are scaled by some positive constant, the constraint is unaffected.

Adding-up. Marshallian demand functions satisfy adding-up, that is $\Sigma_i p_i q_i(p,x) = x$. This property is also a straightforward implication of the fact that the budget constraint must hold, and that it will hold as an equality under nonsatiation.

Symmetry. Hicksian demand functions are symmetric in that $\partial h_i/\partial p_j = \partial h_j/\partial p_i$. This follows from the fact that $\partial h_i/\partial p_j = \partial^2 C/\partial p_j \partial p_i$ and $\partial h_j/\partial p_i = \partial^2 C/\partial p_i \partial p_j$ (Shephard's lemma) and that $\partial^2 C/\partial p_j \partial p_i = \partial^2 C/\partial p_i \partial p_j$ (Young's theorem). This symmetry property can be expressed in terms of derivatives of Marshallian demands because of the fundamental relationship of the Slutsky equation:[3]

$$\frac{\partial q_i}{\partial p_j} = \frac{\partial h_i}{\partial p_j} - q_j \frac{\partial q_i}{\partial x} \tag{6}$$

Hence, in terms of marshallian demands, symmetry requires $\partial q_i/\partial p_j + q_j(\partial q_i/\partial x) = \partial q_j/\partial p_i + q_i(\partial q_j/\partial x)$.

Negativity. The matrix of compensated substitution effects $[\partial h_i/\partial p_j]$ is negative semi-definite. Because $\partial h_i/\partial p_j = \partial^2 C/\partial p_j \partial p_i$, this matrix is the Hessian of the cost function, and therefore the negativity property is a consequence of the concavity of the cost function, a property that itself depends on the assumed optimization process and not on the nature of preferences. One of the implications of this property is that the diagonal elements of the matrix $[\partial h_i/\partial p_j]$ are nonpositive. Hence, the own-price compensated effects are nonpositive (i.e., the compensated Hicksian demands $h_i(p,u)$ slope downward).

Because the focus of this study is an empirical one, at times it will be useful to express the properties of demand in terms of demand elasticities. To

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[3] The Slutsky equation can be obtained by differentiating the identity $h_i(p,u) \equiv q_i(p,C(p,u))$, the validity of which is obvious from duality.

this end, define the following:

Hicksian (compensated) elasticities: $\eta_{ij} \equiv (\partial h_i/\partial p_j)(p_j/h_i)$

Marshallian elasticites: $\epsilon_{ij} \equiv (\partial q_i/\partial p_j)(p_j/q_i)$

$\epsilon_i \equiv (\partial q_i/\partial x)(x/q_i)$

expenditure shares: $w_i \equiv (p_i q_i)/x$

Allen-Uzawa elasticities of substitution: $\sigma_{ij} \equiv [C\cdot(\partial h_i/\partial p_j]/(h_i \cdot h_j)$

Then, it is easily verified that the properties of demand functions can be expressed in elasticity terms as follows.

Homogeneity: $\sum_{j=1}^{n} \epsilon_{ij} + \epsilon_i = 0$

Adding-up: $\sum_{i=1}^{n} w_i \epsilon_{ij} + w_j = 0$ (Cournot aggregation)

$\sum_{i=1}^{n} w_i \epsilon_i = 1$ (Engel aggregation)

Symmetry: $\sigma_{ij} = \sigma_{ji}$

or: $w_j \ \eta_{ij} = w_i \ \eta_{ji}$

or: $w_i \ \epsilon_{ij} + w_i w_j \ \epsilon_i = w_j \ \epsilon_{ji} + w_i w_j \ \epsilon_j$

Negativity: the matrix $[\sigma_{ij}]$ is negative semi-definite.

Market Demand Functions

The theory briefly reviewed above applies to an individual decision making unit. Because the purpose of this paper is to apply a demand model to aggregate data, a relevant question is whether the properties of demand are preserved by aggregating over consumers. This problem has been studied extensively.[4] The crucial issue is that the income level varies across consumers. In principle, therefore, aggregate demand functions should depend on the entire distribution of income. This clearly introduces an informational requirement that cannot be

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[4] For a good review, see Deaton and Muellbauer (1980, chapter 6).

met with aggregate data.

What is typically done in most studies is to specify total demand (more exactly, per-capita demand) as a function of per-capita (average) income. This procedure is admissible if the conditions for exact linear aggregation hold (Deaton and Muellbauer, 1980b, chapter 6). These conditions require individual demands to be linear in income with all individuals having the same propensity to consume. In other words, individual preferences must be quasi-homothetic, that is of the Gorman polar form type, although they need not be identical. These conditions ensure that any reallocation of income that leaves average aggregate income unaffected will not change total quantity demanded, so that total demand is not affected by the higher moments of income distribution.

Quasi-homothetic individual preferences not only ensure that one can write aggregate demand as a function of the price vector and per capita income, but also imply that these aggregate demand functions will satisfy all the theoretical properties of individual demands (homogeneity, adding-up, symmetry, and negativity).[5] Despite this, the conditions for exact linear aggregation are perhaps too restrictive. In particular, the fact that Engel curves are linear (although not necessarily born in the origin) means that income elasticities converge to unity as income increases.

Somewhat more general conditions, allowing aggregation of individual preferences with nonlinear Engel curves, have been derived by Muellbauer (1975). These conditions, termed Generalized Linearity, allow aggregate demand to be written as a function of the price vector and a representative budget level (not necessarily average income). A special case of practical interest occurs when

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[5] This follows from the fact that the individual quasi-homothetic cost functions can be aggregated into a representative consumers' quasi-homothetic cost function with all the properties of the individuals' ones.

the representative budget level is independent of prices and depends only on the distribution of income, which yields preferences of the so-called Price Independent Generalized Linearity (PIGL) type. A limiting case of this family of preferences is its logarithmic version, or PIGLOG, whereby preferences take the form of what Blackorby, Primont, and Russell (1978) have called Generalized Gorman Polar Form (GGPF).[6]

An alternative approach to aggregation over consumers is to regard the 'representative consumer' as a statistical average. This approach is followed by Theil (1975, chapter 4) who considers the convergence approach to aggregation. For example, if individual preferences are quasi-homothetic but marginal propensities to consume vary across individuals, one can still obtain results similar to those of exact linear aggregation if income and marginal propensities to consume are distributed independently. The bottom line, in any case, is that aggregate demand functions need not depend simply on per-capita income, and may not satisfy the theoretical properties of homogeneity and symmetry, unless somewhat restrictive conditions are satisfied. Because of this, maintaining the theoretical properties of consumer demand functions at the aggregate level is probably best justified on more practical grounds (Johnson, Green, Hassan, and Safyurtlu, 1986). In particular, the degree of freedom gain due to such restrictions takes overriding importance when one attempts to specify and estimate large demand systems.

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[6] A specific parametric representation of the PIGLOG cost function gives rise to a very common demand system, the Almost Ideal Demand System (ALIDS) of Deaton and Muellbauer (1980a). Another common demand system, the Translog introduced by Christensen, Jorgenson and Lau (1975), can be reduced to a member of the PIGLOG family of preferences by a simple parametric restriction (Lewbel, 1987). Hence, an aggregate ALIDS or translog model in principle could have been obtained by exact aggregation of individual preferences.

The Almost Ideal Demand System

The Almost Ideal Demand System (ALIDS) of Deaton and Muellbauer (1980a) is obtained from a specific parameterization of the PIGLOG cost function. In particular, the cost function is written as:

$$\log C(p,u) = A(p) + B(p)u \tag{7}$$

where A(p) is a price aggregator function of the type:

$$A(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log(p_i) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij}\log(p_i)\log(p_j) \tag{8}$$

and B(p) is written as:

$$B(p) = \beta_0 \prod_{k=1}^{n} p_k^{\beta_k} \tag{9}$$

Applying the derivative property to (7) yields a system of demand equations which can be written in share form as:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij}\log(p_j) + \beta_i \log\left(\frac{x}{P}\right) \tag{10}$$

where P is a price index satisfying log(P) ≡ A(p). Deaton and Muellbauer (1980a) termed this the Almost Ideal Demand System (ALIDS). Note that homogeneity, adding-up, and symmetry will hold globally if $\Sigma_i\ \alpha_i = 1$, $\Sigma_j\ \gamma_{ij} = \Sigma_i\ \gamma_{ij} = \Sigma_i\ \beta_i = 0$, and $\gamma_{ij} = \gamma_{ji}$. The system as it stands is nonlinear in the parameters. While in general this is not of great consequence given the ready availability of nonlinear estimation techniques, the particular structure of (10) makes the estimation of parameter α_0 virtually impossible. Hence, following the suggestion of Deaton and Muellbauer (1980a) α_0 may be fixed before estimation.

One of the reasons for the popularity of the ALIDS model in applied demand analysis is probably due to the fact that a linear version of this demand system can be estimated. This is achieved by replacing the price aggregator log(P) in equation (10) with a price index log(P^*) constructed prior to the estimation. In particular, Deaton and Muellbauer (1980a) suggest the use of the geometric index $\log(P^*) = \Sigma_k w_k \log(p_k)$, which they term Stone Price Index. The resulting linear ALIDS model is straightforward to estimate, and because log(P^*) typically tracks log(P) very well, the empirical results thus obtained are usually indistinguishable from those of the nonlinear ALIDS model.[7] Some caution in using the linear ALIDS model is warranted by the fact that the Stone index is not invariant to the choice of units of measurement. Hence, it is imperative that prices be properly scaled prior to the computation of the Stone index (say, by dividing through by the mean).

The demand elasticities for the nonlinear ALIDS model can be written as:

$$\epsilon_{ij} = \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i} - \delta_{ij} + \frac{\beta_i \beta_j}{w_i} \log(\frac{x}{P}) \tag{11}$$

$$\epsilon_i = \frac{\beta_i}{w_i} + 1 \tag{12}$$

$$\eta_{ij} = \frac{\gamma_{ij}}{w_i} + w_j - \delta_{ij} + \frac{\beta_i \beta_j}{w_i} \log(\frac{x}{P}) \tag{13}$$

$$\sigma_{ij} = \frac{\gamma_{ij}}{w_i w_j} + 1 - \frac{\delta_{ij}}{w_j} + \frac{\beta_i \beta_j}{w_i w_j} \log(\frac{x}{P}) \tag{14}$$

where δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ for $i = j$ and $\delta_{ij} = 0 \ \forall \ i \neq j$).

For the linear ALIDS model the elasticities can be written as:

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[7] Another variant of the ALIDS model discussed by Deaton and Muellbauer (1980a), which may turn out to be useful at the application stage, is the first difference version of the linear ALIDS model. As pointed out by Deaton and Muellbauer (1980a), this model is very similar to an alternative parameterization of the Rotterdam model (see also Keller and van Driel, 1985).

(15) $$\epsilon_{ij} = \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i} - \delta_{ij}$$

(16) $$\eta_{ij} = \frac{\gamma_{ij}}{w_i} + w_j - \delta_{ij}$$

(17) $$\sigma_{ij} = \frac{\gamma_{ij}}{w_i w_j} + 1 - \frac{\delta_{ij}}{w_j}$$

with the income elasticity formula being the same as that of equation (12).[8]

As mentioned earlier, the theoretical properties of homogeneity, adding-up, and symmetry can be imposed by parametric restrictions and will hold globally (that is, for any level of the exogenously given prices and income), and as such they will be reflected in the elasticities of equations (11) to (17). The property of negativity, on the other hand, is a different matter. First of all, it involves inequalities rather than equality restrictions. Specifically, the property of negativity establishes that the matrix of Slutsky substitution terms $S_{ij} \equiv \partial h_i/\partial p_j$ is negative semi-definite. Hence, the Cholesky factors of the matrix $[S_{ij}]$ must be nonpositive. The Slustky substitution term for the nonlinear ALIDS is:

(18) $$S_{ij} = \frac{x}{p_i p_j}\left[\gamma_{ij} + \beta_i\beta_j \log(\frac{x}{P}) + w_i w_j - \delta_{ij} w_i\right]$$

whereas for the linear ALIDS the formula is the same except that the term $[\beta_i\beta_j \log(x/P)]$ is not present. Note that the Slutsky terms are not constants but depend on prices and income. Thus, for ALIDS the inequality restrictions of

[8] Green and Alston (1990) derive alternative formulae for the elasticities of linear ALIDS models, but the results they report show that their new formulae gives the same results as the simple formulae indicated here. In fact, given that elasticities are typically evaluated at a point, the two sets of formulae are identical if one scales the data such that (p,x) = (1,1) at the point of interest.

negativity can only hold locally (for some value of the exogenously given prices and income).

Alternatively, negativity can be checked by verifying that the matrix $[\Gamma_{ij}]$, where $\Gamma_{ij} = S_{ij}\ (p_i p_j/x)$, is negative semidefinite. Another equivalent way is to check that the matrix of Allen-Uzawa elasticities of substitution $[\sigma_{ij}]$ be negative semidefinite. While the negativity condition can be readily checked using the properties of one of the above three matrices, it is difficult to maintain at the estimation stage. In principle, the Cholesky factorization method illustrated by Lau (1978) could be used. It should be stressed, however, that maintaining curvature conditions along these lines requires highly nonlinear restrictions that may prove daunting in the context of a relatively large demand system. The near-Bayesian approach of Chalfant, Gray, and White (1991) is an alternative, although it suffers similar computational problems for a large demand system such as the one envisaged in this study.

Degrees of Freedom and Separability Assumptions

The practical problem that arises when estimating a flexible demand system, such as ALIDS, is that the number of parameters to be estimated essentially increases quadratically, while the number of effective observations increases only linearly. Hence, for large demand systems flexible functional forms run into a degrees-of-freedom problem. The problem is lessened somewhat by maintaining the theoretical properties, especially symmetry, but it does not disappear.

To illustrate, assume that there are n goods, such that (n-1) equations are estimated with T observations on each. A flexible system (homogeneous and symmetric) possesses $k = \frac{1}{2}(n-1)(n+4)$ parameters. On the other hand, to achieve any hope of asymptotic validity of the estimates, the maximum number of parameters should not exceed $[(n-1)T]^{2/3}$ (Chalfant and Gallant, 1985). Hence, solving the equation $\frac{1}{2}(n-1)(n+4) = [(n-1)T]^{2/3}$ gives the maximum number of goods n for a flexible demand system, as a function of the time series length T, consistent with desirable statistical properties. For example, if T=30 (say, annual data for 1961-1990) then the maximum number of goods that one could consider is approximately n=7. If one wants any more individual goods, and still wants desirable statistical properties for the estimates, then more structure must be imposed on the problem.

A way to proceed is to make judicious use of separability assumptions. Separability is important in applied demand analysis for several reasons. First, it relates to aggregation across commodities. In general some information may be lost with such a procedure, although some kind of commodity aggregation is inevitable in applied demand analysis, whether the aggregation is done by the analyst or is a property of the data at hand.[9] However, under some separability assumption no information is lost by aggregation across commodities, implying that demand models can be specified in terms of a few broad aggregate goods. In particular, if a set of goods is homothetically weakly separable from the other goods, then it can be treated as a single aggregate with a corresponding single price index.[10]

Second, separability can simplify the consumer problem by allowing two-stage

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[9] For example, even in a very disaggregated food demand system we are likely to be concerned with commodities such as 'beef' or 'cheese,' where these goods are clearly the result of an aggregation over a number of individual beef cuts or cheese products.

[10] An alternative condition that allows aggregation over goods is Hicks' "composite commodity theorem," which states that a group of commodities can be treated as a single good if their relative prices move together (Hicks, 1946).

(multi-stage) budgeting, a concept originally introduced by Strotz (1957) and characterized by Gorman (1959). The postulate is that consumers allocate total expenditures first to broad groups of goods, based on a price index for each group, and then allocate expenditure within groups, based on group individual prices and group expenditures. There are two conditions that allow this informationally efficient budgeting structure that Gorman (1959) called "perfect price aggregation": the direct utility function is homothetically weakly separable or the direct utility function is strongly separable (additive in subutility functions) and each group has a dual structure of the generalized Gorman polar form type. A mixture of these two conditions is, of course, also allowed.

Third, if the direct utility is simply weakly separable, so that commodity aggregation or two-stage budgeting as described above are not possible, useful implications still emerge because such a separable structure provides the necessary and sufficient conditions for conditional demand functions to exist. Hence, one can carry out the empirical analysis of this group of goods in isolation from other goods. For example, it is common to model demand for meats (say beef, pork, and poultry) as a function of the price of these three meat aggregates and of total meat expenditure.

There are at least two undesirable features associated with the empirical use of conditional demand systems. First, the first stage income allocation often is left unspecified or is specified in an ad hoc manner, which makes the resulting elasticity estimates of limited value. Second, although direct weak separability guarantees the existence of conditional demand systems, econometric problems still may exist in estimation because group expenditures are endogenous (LaFrance, 1991). In view of this, a more comprehensive use of separability assumptions is perhaps warranted.

To make consistent use of the powerful implications of separability, in this study we consider the suggestion of Moschini, Moro, and Green (1992) of explicitly building the restrictions implied by direct weak separability into a full demand system. Specifically, the approach consists of specifying a flexible demand system for the full model, say an ALIDS, and then impose the necessary and sufficient conditions for weak separability. Such a procedure, while still resulting in considerable degrees of freedom gain, would be free of the expenditure endogeneity problem discussed by LaFrance (1991). Moreover, it would account in a theoretically consistent fashion for the first stage income allocation and yields unconditional demand elasticities suitable for policy and welfare analysis. The practical drawback, as compared to estimating conditional demand systems, is that this approach requires estimating a potentially very large demand system subject to highly nonlinear restrictions.

Direct Weak Separability Restrictions

The relevant necessary and sufficient conditions for direct weak separability are reviewed and discussed in Moschini, Moro, and Green (1992). To illustrate, let the set of indices of the n goods be $I = \{1, \ldots, n\}$, and assume that these goods are ordered in S separable groups defined by the mutually exclusive and exhaustive partition $\hat{I} = \{I_1, \ldots, I_S\}$ of the set I. If the utility function U(q) is symmetrically directly separable in the partition $\hat{I}$ it can be written as:

$$U(q) = U^0\left(U^1(q^1), U^2(q^2), \ldots, U^S(q^S)\right) \tag{19}$$

where $U^s(.)$ are subutility functions that depend on a subset q^s of goods whose indices are in I_s (s=1,...,S). We assume $U^0(.)$ and the subutility functions $U^s(.)$ satisfy conditions typically required of a utility function (in particular, strong monotonicity, strict quasi-concavity, and differentiability).

It is known that the separable structure in (19) imposes a number of restrictions on the substitution possibilities between goods in different groups. Specifically, Goldman and Uzawa (1964) showed that the Slutsky substitution terms $\partial h_i(p,u)/\partial p_k$, between two goods in different groups is proportional to the income effects of the two goods involved as:

$$\frac{\partial h_i\big(p,V(p,x)\big)}{\partial p_k} = \mu_{gs}(p,x)\,\frac{\partial q_i(p,x)}{\partial x}\frac{\partial q_k(p,x)}{\partial x} \tag{20}$$

for all $i \in I_g$ and $k \in I_s$, for all $g \neq s$. Note that the proportionality term $\mu_{gs}(p,y)$ is the same for all goods in the two groups involved. It is important to emphasize that the restrictions in (20) are **necessary and sufficient** for the weakly separable structure in (19). Hence, (20) summarizes all the relevant restrictions of the separable structure in (19) and can be used to maintain this form of separability or to test it.

Asymmetric separability assumes weaker conditions on the utility function. For a group of goods indexed by I_s, let I^c be the set of indices of all other goods. Then the goods indexed by I_s are directly separable from their complement if U(q) can be written as:

$$U(q) = U^0\big(q^c, U^s(q^s)\big) \tag{21}$$

Blackorby, Davidson, and Schworm (1991) point out that the result of Goldman and Uzawa (1964) does not apply to the asymmetric structure in (21), and go on to derive the relevant necessary and sufficient conditions for this case. Their results can be reformulated in a form similar to (20), that is (Moschini, Moro, and Green, 1992):

(22)
$$\frac{\partial h_i(p,V(p,x))}{\partial p_k} = \mu_k(p,x)\,\frac{\partial q_i(p,x)}{\partial x}\,\frac{\partial q_k(p,x)}{\partial x}$$

for all $i \in I_s$ and $k \in I^c$, where μ_k depends on which q_k in I^c one is considering, but not on which q_i in I_s is being considered. Somewhat loosely, from (22) we can conclude that the restrictions of asymmetric separability reduce to those of symmetric separability by reinterpreting each good in I^c as being a separable group.

Given the above, explicitly consider the case in which the first t groups in the partition $\hat{I}$ contain only one good each, such that the separable utility function can be written as:

(23)
$$U(q) = U^0\left[q_1,\ldots,q_t,U^{t+1}(q^{t+1}),\ldots,U^S(q^S)\right]$$

Then the combination of the results from Goldman and Uzawa (1964), and Blackorby, Davidson, and Schworm (1991) can be stated as follows. If we take any two goods $(i,j) \in I_g$ and any two goods $(m,k) \in I_s$ ($i = j$ or $m = k$ is possible), for any two groups $g \neq s$, it follows the substitution terms between goods belonging to different groups are proportional to the respective income terms as:

(24)
$$\frac{\dfrac{\partial h_i(p,V(p,x))}{\partial p_k}}{\dfrac{\partial h_j(p,V(p,x))}{\partial p_m}} = \frac{\dfrac{\partial q_i(p,x)}{\partial x}\,\dfrac{\partial q_k(p,x)}{\partial x}}{\dfrac{\partial q_j(p,x)}{\partial x}\,\dfrac{\partial q_m(p,x)}{\partial x}}$$

Because equation (24) is an alternative representation of the necessary and sufficient conditions, it summarizes the relevant empirical restrictions of direct weak separability. It can be expressed in convenient elasticity form by using the Allen-Uzawa elasticity of substitution σ_{ij} and the income elasticities ϵ_i defined previously. Then, the restrictions in (24) can be expressed as:

(25) $$\frac{\sigma_{ik}}{\sigma_{jm}} = \frac{\epsilon_i \epsilon_k}{\epsilon_j \epsilon_m}$$

for all $(i,j) \in I_g$ and $(m,k) \in I_s$, for all $g \neq s$. Equation (25) defines a set of restrictions that can be maintained in any of the commonly used demand systems, or can be subjected to a statistical test.

Note that if the subutility functions are homothetic, then $\epsilon_i = \epsilon_j$ and $\epsilon_k = \epsilon_m$.[11] Hence, in this case the restrictions in equation (25) reduce to $\sigma_{ik} = \sigma_{jm}$. This is essentially the result of Blackorby and Russell, who proved that $\sigma_{ik} = \sigma_{jk}$ for $(i,j) \in I_s$ and $k \notin I_s$ (they considered the case of asymmetric weak separability).[12]

To implement the restrictions in (25) for the purpose of testing for separability, it is important to keep track of the number of restrictions that are implied by the particular separability structure that is postulated. If n is the total number of goods, there are a total of $\frac{1}{2}n(n-1)$ cross-substitution terms $\partial h_i/\partial p_k$ $(i \neq k)$. If n_s is the number of goods belonging to the s^{th} group $(s = 1,2,\ldots,S)$, then there are $\frac{1}{2}[\Sigma_s\, n_s(n_s-1)]$ within-group cross-substitution terms. Taking the difference between these two quantities yields the number of substitution terms that pertain to goods belonging to different groups, say n_0. Moreover, there will be $\binom{S}{2} \equiv n_\mu$ proportionality coefficients μ's which completely identify the n_0 cross-substitution terms given the income effects. Hence, $n_\mu = \frac{1}{2}S(S-1)$, and the number $n_R \equiv (n_0 - n_\mu)$ of nonredundant restrictions

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[11] Note that these elasticities need not equal unity unless the utility function $U^0(.)$ is itself homothetic.

[12] For the case of nonhomothetic asymmetric weak separability the restrictions in (25) become $\sigma_{ik}\, \epsilon_j = \sigma_{jk}\, \epsilon_i$, and can be expressed in convenient form using compensated elasticities or Marshallian elasticities as well. In particular, equivalent expressions are $\eta_{ik}\, \epsilon_j = \eta_{jk}\, \epsilon_i$ and $\epsilon_{ik}\, \epsilon_j = \epsilon_{jk}\, \epsilon_i$, where $\epsilon_{ij} \equiv (\partial q_i/\partial p_j)(p_j/q_i)$ are Marshallian elasticities.

implied by equation (25) is:[13]

(26) $$n_R = \frac{1}{2}\left[n(n-1)-\sum_{s=1}^{S} n_s(n_s-1) - S(S-1)\right]$$

If the hypothesis of interest is that of homothetic weak separability additional restrictions are required. Because a homothetic function $U^s(q^s)$ implies that $\epsilon_i = \epsilon_j$, for all $(i,j)\in I_s$, then a homothetic subutility with n_s goods will entail (n_s-1) added restrictions.

By putting further structure on the utility function, the approach described above can be easily adapted to entertain more complex separable utility trees. The procedure involved will be best described in the applications that follow.[14]

Separability and The Almost Ideal Demand System

The separability conditions summarized by the elasticity restrictions of equation (25) can be maintained or tested upon a parametric specification of a demand system. For the almost ideal demand system of interest here, using the elasticities of equations (12) and (14), the separability restrictions of equation (25) can be written as:

(27) $$\frac{\gamma_{ik} + w_i w_k + \beta_i\beta_k\log(\frac{X}{P})}{\gamma_{jm} + w_j w_m + \beta_j\beta_m\log(\frac{X}{P})} = \frac{(w_i + \beta_i)(w_k + \beta_k)}{(w_j + \beta_j)(w_m + \beta_m)}$$

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[13] In a similar fashion, Theil (1976, pp. 68-69) discusses the number of unconstrained parameters under blockwise dependence (symmetric weak separability).

[14] The formula in (26), developed for a 2-stage utility tree, cannot be used as such with more complex trees.

where $(i,j) \in I_g$ and $(k,m) \in I_s$ for all $g \neq s$.[15]

It is evident that the restrictions in (27) involve prices and income [recall that the shares are defined as in (10)]. They can hold globally, that is for every possible realization of prices or income, only under very restrictive conditions. In particular, the restrictions in (27) will hold globally if $\beta_i = \beta_k = \beta_j = \beta_m = 0$ and $\gamma_{ik} = \gamma_{jm} = 0$. These conditions imply the unwanted restriction of homotheticity for the separable groups, and, in addition, force the income elasticities of goods belonging to the separable group to equal unity (which is not necessary even under homothetic separability). This result corresponds to the well known separability-inflexibility property of a number of flexible functional forms (Blackorby, Primont, and Russell, 1977).

Because of the extremely restrictive implications of imposing the separability restrictions globally, as documented above, it may be of interest to test the separability restriction at a point only, following the suggestion of Denny and Fuss (1975) and Jorgenson and Lau (1975). If the point of interest is the mean point of the explanatory variables, it is convenient to scale all prices and income to equal unity at the mean. Moreover, because of the practical impossibility of estimating α_0 (Deaton and Muellbauer, 1980), one may want to set $\alpha_0 = 0$. At this point, then, $w_i = \alpha_i$ and $\log(x/P) = 0$, so that the restrictions in equation (27) can be written as:

$$\frac{\gamma_{ik} + \alpha_i \alpha_k}{\gamma_{jm} + \alpha_j \alpha_m} = \frac{(\alpha_i + \beta_i)(\alpha_k + \beta_k)}{(\alpha_j + \beta_j)(\alpha_m + \beta_m)} \tag{28}$$

for all $(i,j) \in I_g$ and $(k,m) \in I_s$, for all $g \neq s$. This equation defines a set of nonlinear restrictions that involves only the parameters of the ALIDS model, and

[15] These restrictions reduce to those reported by Eales and Unnevehr (1988) only if k=m, which yields restrictions appropriate for asymmetric separability.

these restrictions can be either maintained or tested.[16]

Often it is a linear version of the ALIDS model that is estimated, where the translog price aggregator log(P) is substituted by a price index before estimation, say the Stone index $\log(P^*) = \Sigma_i w_i \log(p_i)$. In this case, using the elasticity formulae of the nonlinear ALIDS model is appropriate only if one ensures that the parameters of the linear ALIDS model approximate the parameters of the nonlinear ALIDS model, which can be achieved easily if prices are appropriately scaled.[17] An alternative formula for elasticities of substitution for the linear ALIDS with the Stone price index, which is consistent with taking this index as given in estimation, is (Chalfant (1987; Moschini and Meilke (1989)):

$$(29) \qquad \sigma_{ik} = \frac{\gamma_{ik}}{w_i w_k} + 1 \qquad (i \neq k)$$

Hence, the separability restrictions for the linear ALIDS model can alternatively be expressed as:

$$(30) \qquad \frac{\gamma_{ik} + w_i w_k}{\gamma_{jm} + w_j w_m} = \frac{(w_i + \beta_i)(w_k + \beta_k)}{(w_j + \beta_j)(w_m + \beta_m)}$$

These restrictions are very similar to those of the nonlinear ALIDS model of

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[16] In a testing framework, (28) is not equivalent to plugging in sample mean values of shares in (27), a procedure that is sometimes used but which ignores the randomness of estimated shares and their covariance with other estimated parameters.

[17] Scaling is very important for the linear ALIDS because the Stone price index is not invariant to the choice of the units of measurement. Scaling prices to equal unity at the mean is one way to deal with such (non) invariance problem. If one further sets $\alpha_0=0$, then the parameters of the linear ALIDS will approximate the parameters of the nonlinear ALIDS well, and the elasticity formulae of the nonlinear ALIDS will be appropriate (the problems discussed by Green and Alston do not arise). Hence, the separability restrictions in (27) will also be appropriate.

equation (27). In particular, the local separability restrictions (at the mean point $(p,x) = (1,1)$) are exactly the same as those of the nonlinear ALIDS model as given by equation (28).

If one were interested in testing for homothetic separability, the global test for weak separability is clearly unchanged, given that it entails homotheticity of the subutility functions. The local test restrictions of equation (28), however, in this case must be supplemented by the restrictions $\alpha_i/\beta_i = \alpha_j/\beta_j$ and $\alpha_k/\beta_k = \alpha_m/\beta_m$.

Estimation Procedures

For the purpose of estimation, the ALIDS model (with or without separability restrictions) can be written as a standard system of seemingly unrelated regressions:

$$(31) \qquad y_t = f(\theta;Z_t) + e_t \qquad\qquad t=1,2,\ldots,T$$

where y_t is a vector of $M \equiv (n-1)$ shares at time t,[18] θ is the vector of all coefficients to be estimated, Z_t is the vector of the corresponding exogenous variables at time t, and e_t is a vector of error terms that are assumed to be contemporaneously correlated but serially uncorrelated, in other words $E(e_t)=0$ and $E(e_t e_t') = \Omega$ for $\forall t$, and $E(e_t e_s) = 0$ for $t \neq s$. We assume further that the e_t's are multinormally distributed, then from the joint density of e_t we can recover the likelihood function, which for the whole sample is:

$$(32) \quad L(y;Z,\theta,\Omega) = (2\pi)^{-\frac{1}{2}MT} \times \prod_{t=1}^{T} |J_t| \times \prod_{t=1}^{T} \exp\left(-\frac{1}{2}[y_t - f(\theta,Z_t)]'\Omega^{-1}[y_t - f(\theta,Z_t)]\right)$$

[18] One of the shares is omitted because of the well known singularity problem of share equation systems (Barten, 1969).

Given that the Jacobian of the transformation from e_t to y_t is an identity matrix, the log-likelihood is (Chow, 1983):

$$(33) \qquad \mathcal{L}(\theta,\Omega) = -\frac{1}{2}MT\ln(2\pi) - \frac{1}{2}T\ln|\Omega| - \frac{1}{2}\sum_{t=1}^{T}[y_t - f(\theta,Z_t)]'\Omega^{-1}[y_t - f(\theta,Z_t)]$$

which is maximized by the maximum likelihood estimators θ^* and Ω^*. To compute these estimators, it is convenient to concentrate $\mathcal{L}(\theta,\Omega)$ with respect to Ω. The maximum likelihood estimator of the variance-covariance matrix is $\Omega^* \equiv T^{-1}[EE']$, where $E \equiv [e_1,\ldots,e_T]$ with $e_t = [y_t - f(\theta^*;Z_t)]$. Using this, it can be verified that the concentrated log-likelihood reduces to:

$$(34) \qquad \mathcal{L}(\theta) = k - \frac{1}{2}T\ln|\Omega(\theta)|$$

where $k = (-\frac{1}{2}MT\log(2\pi) - \frac{1}{2}MT)$ is a constant uninfluential for the maximization process.

Under the stated stochastic assumptions, the maximum likelihood estimators are known to be consistent, asymptotically normal, and asymptotically efficient. Moreover, as shown by Barten (1969), the maximum likelihood estimator is invariant with respect to which equation is omitted because of the singularity problem of share systems.

Equation (34) shows that the maximum likelihood estimator of θ minimizes the determinant of the variance-covariance matrix Ω. In some cases this turns out to create problems. When any one equation contains more parameters than observations, as is typically the case for the ALIDS model of equation (10) for moderate size models and moderate size time series, the maximum likelihood estimator is not feasible. This is because the log-likelihood function can be made arbitrarily large by making any one equation fit perfectly, a problem pointed out by Deaton and Muellbauer (1980a, p. 318) and others.[19] To deal with this problem, in this study we adopt a version of the minimum distance estimator originally analyzed by Malinvaud (1970).

The method of minimum distance chooses θ to minimize the least square deviations around a positive definite matrix S^{-1}, that is (Chow, 1983):

$$D(\theta;S) = T^{-1}\sum_{t=1}^{T}\left[y_t - f(\theta,Z_t)\right]' S^{-1}\left[y_t - f(\theta,Z_t)\right] \tag{35}$$

The minimum distance estimator is consistent and asymptotically normal. In addition, if S is a consistent estimator of Ω, the minimum distance estimator of θ is asymptotically efficient as well, thus sharing the same properties as the maximum likelihood estimator. It can be shown that minimizing the distance function of equation (35) boils down to minimizing the trace of the variance-covariance matrix. Hence, this estimator is desirable for large models with many parameters in all equations.[20]

A problem with the minimum distance estimator is that it may not be invariant of which share equation is omitted. However, as shown by Chavas and Segerson (1987), invariance can be achieved by a careful choice of the variance-covariance matrix. The crucial issue is that of finding an estimate of the variance-covariance matrix that treats all equations in a symmetric fashion. Although several possibilities are open, in this study we will adopt the

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[19] Note that this is not necessarily a degrees of freedom problem because of the presence of cross-equations restrictions.

[20] Under some general conditions, these two estimators can be made to converge to the same numerical value by iterating the minimum distance estimator and replacing S at each iteration with the inverse of the variance-covariance estimator based on the residuals of the previous iteration (Phillips, 1976). Hence, the maximum likelihood estimator can be viewed as an iterated minimum distance estimator (determinant minimization as an iterated trace minimization).

following two-step procedure. First, choose a (n-1)x(n-1) matrix S by deleting one row and one column from the matrix S_0 defined as:

$$S_0 = I_n - \frac{1}{n}\left[\iota_n \iota_n'\right] \tag{36}$$

where I_n is an nxn identity matrix, and ι_n is a nx1 vector of ones. Conditional on this matrix, the system of equations is estimated to find a vector of parameters $\tilde{\theta}$ and of estimated residuals $\tilde{e}_t = y_t - f(\tilde{\theta}, Z_t)$. These residuals are used to construct a consistent estimator of Ω, say $\tilde{\Omega}$ with typical element:

$$\tilde{\Omega}_{ij} = \frac{\sum_{t=1}^{T} \tilde{e}_{it}\tilde{e}_{jt}}{T} \tag{37}$$

The second step sets $S = \tilde{\Omega}$, and minimizes the distance function conditional on this matrix.

While this minimum distance estimator may be preferable to the maximum likelihood estimator for the reasons explained above, in large demand systems it still requires one to estimated an unmanageably large number of variance-covariance parameters. For example, if n=20, the variance-covariance matrix entails 190 parameters which need to be estimated, over and above the structural parameters of the model. Hence, in these cases it may be desirable to consider more parsimonious alternatives. In this paper we adapt to minimum distance estimation the procedure described by de Boer and Harkema (1986). The first step of this two-step procedure is exactly identical to that for the minimum distance estimator just illustrated. The second step, on the other hand, chooses S by deleting one row and one column from the matrix:

$$S_1 = D_n - \frac{1}{\delta}\left[d_n d_n'\right] \tag{38}$$

where:

(39)
$$D_n \equiv \begin{bmatrix} \delta_1 & 0 & \dots & 0 \\ 0 & \delta_2 & \dots & 0 \\ . & \dots & \dots & . \\ 0 & \dots & 0 & \delta_n \end{bmatrix}$$

(40)
$$d_n' \equiv [\delta_1, \delta_2, \dots, \delta_n]$$

(41)
$$\delta \equiv \sum_{i=1}^{n} \delta_i$$

and where the parameters δ_i's solve the nonlinear system of equations:

(42)
$$\delta_i - \frac{\delta_i^2}{\delta} = \frac{\sum_{t=1}^{T} \tilde{e}_{it}^2}{T} \qquad i = 1, \dots, n$$

given the estimated $\tilde{e}$ residuals from the first step.

For large systems, the equations in (42) may be very difficult to solve for standard nonlinear algorithms, but fortunately de Boer and Harkema (1986) present a very efficient algorithm which relies on finding the unique real root of an equation in only one variable. Note that the diagonal elements of the matrix S_1 in (38) are identical to those of the matrix $\tilde{\Omega}$. The restrictive features of this covariance matrix pertain to the off-diagonal elements, which are uniquely implied by the diagonal elements. This allows a considerable saving of degrees of freedom. For the example of n=20 discussed above, the (n-1)x(n-1) matrix obtained by deleting one row and one column from (38) entails only 19 parameters, as compared to 190 for the unrestricted minimum distance estimator!

To test hypotheses concerning the parameters one can rely on the Quasi Likelihood Ratio (QLR) test. For example, consider the null hypothesis is H_0: $g(\theta)=0$, where the function $g(\theta)$ is (possibly) vector valued. Let $\hat{\theta}$ denote the unrestricted minimum distance estimator and let $\tilde{\theta}$ denote the minimum distance estimator obtained under the restrictions $g(\theta)=0$, where both estimators must be obtained conditional on the same matrix $\hat{S}$ (the estimated covariance matrix from the first-step of the unrestricted model). Denote the minimized distance for the two cases as $D(\hat{\theta},\hat{S})$ and $D(\tilde{\theta},\hat{S})$. Then the QLR defined as:

$$QLR = T\left[D(\hat{\theta}, \hat{S}) - D(\tilde{\theta}, \hat{S})\right] \tag{43}$$

is asymptotically distributed as χ^2 with r degrees of freedom under the null hypothesis, where r is the number of restrictions imposed on θ (Gallant and Jorgenson, 1979).

To implement the minimum distance estimator described above, we will rely on the algorithm implemented in TSP version 4.2A. This package runs on 386 or 486 microcomputers, and uses extended memory such that large econometric problems can be handled without a mainframe computer.

Data

To estimate a food demand system for Canada, we need data on consumption and prices or, equivalently, on dollar expenditures and prices, for each category of goods that is to be treated individually in the demand system. It is important to stress that these data must be at the retail level. The theory that underlies demand system specification, and that we reviewed briefly in this report, applies to final consumption. Specifically, the symmetry restrictions of demand equations, which is the real hallmark of the system approach to demand analysis, applies only if prices and quantities are measured at the retail level. Arbitrarily scaling some prices, say by expressing them in wholesale units, would have no effect on estimated elasticities in a single equation framework, but would have dramatic effects in a system framework because of the cross equation restrictions.

We have explored five data sets made available by Agriculture Canada, which will be labeled DATA-1 to DATA-5 in what follows. The data sets are:

DATA-1. Quarterly expenditures on broad aggregates of consumer goods and services, plus Canadian population, for the period 1947(1) to 1991(2).

DATA-2. Annual supply and disposition data for food items for the period 1960-89, and corresponding price indices (as published by Agriculture Canada in the **Handbook of food Expenditures, Prices and Consumption.**)

DATA-3. Quarterly per-capita consumption on meat and dairy products and quarterly price indices for major groups, for various periods.

DATA-4. Annual food expenditures from the system of national accounts of Statistics Canada, both in current and constant dollars.

DATA-5. Data on Family Food Expenditures, obtained from surveys conducted by Statistics Canada, for the years 1969, 1974, 1976, 1978, 1982, 1984, and 1986.

After careful analysis of the data at hand, in concert with Agriculture Canada, it was concluded that the annual food expenditures from the system of national accounts of Statistics Canada (DATA-4) provided the most useful data base. Such data provides both current and constant consumer expenditures for fairly disaggregated food categories consumed at home. The list of the food categories available is reported in Appendix A.[21] These food expenditure data

[21] As is clear from Appendix A, the commodity specification changed in 1988. In fact, the constant and current dollar expenditures for that year were available with a different commodity specification.

were supplemented with corresponding food away from home data, and nonfood expenditure data, from DATA-1 above.

Although these data were deemed to provide the best source for our purposes, they have a serious drawback in that they do not separate beef from pork and other meat. Because for policy analysis it may be desirable to separate beef from pork, a procedure was devised to allocate the available meat expenditures. This procedure, described in detail in Appendix B, relies on Family Food Expenditure data (DATA-5), quantity disappearances for meat products (DATA-2), and meat price indices (DATA-3). The consumer expenditure data also do not breakdown poultry into chicken and turkey. We tried to adapt the procedure described in Appendix B to this problem, but were not successful. First, chicken quantity data for 1961 and 1962 are not available in DATA-2. More important, it seems that a crucial assumption underlying our procedure (that the consumption mix of the two meats to be disaggregated is the same at home and away from home) is not very appropriate for chicken and turkey.

As mentioned, the data used provide current and constant dollar expenditures and therefore allow the construction of implicit price indices. Because the constant price expenditures are essentially fixed-weights or Laspeyers quantity indices, the implicit price obtained by dividing current by constant price expenditures is essentially a variable-weights (Paasche) index. In addition, the base year of the constant dollar expenditures changed a few times in the period of interest.[22] To construct implicit price indices it was necessary to link constant dollar expenditures such that they are all expressed in terms of the same base year. The procedure we used is that of mechanically scaling the data

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[22] The base years were 1961, 1971, 1981, and 1986 for the periods 1961-71, 1972-81, 1982-86, and 1987-88, respectively.

as described in Appendix C. Although this scaling procedure is consistent with what is done by Statistics Canada (Catalogue Number 13-549), and indeed is the only choice available with the data at hand, it should be kept in mind that movements in the resulting price index may also reflect changes in the composition of the weights due to changes in the base year. The entire data set used, including both current and constant expenditures rescaled at 1986 prices, is reported in Appendix D.

Commodity Specification

The main objective of this study is that of estimating one or more specifications of a disaggregated complete demand system emphasizing food. Consistent with this priority, the definition of the commodities of our demand system is highly disaggregated for food items, and highly aggregated for nonfood consumption. Keeping the food sector as disaggregated as possible is desirable because the estimated system will prove versatile as an instrument of policy analysis. Aggregating the nonfood sector is a practical necessity to obtain a system that can be estimated with the information at hand, in view of the desire to keep the food sector disaggregated. Although the extreme aggregation assumption about the nonfood sector may be viewed as too restrictive, a full system with such restrictive feature is still preferable to a system that ignores the nonfood sector. Moreover, a complete demand system yields unconditional demand elasticities that, unlike those obtained from conditional demand systems, are typically more suitable for policy and welfare analysis.[23]

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[23] To illustrate this concept with an example, consider the hypothetical problem of determining the demand consequences of a decrease in poultry price due to trade liberalization. Relying on conditional elasticities from a meat demand system would lead to the wrong answer because it would assume that total meat expenditure is unaffected by the price change. In fact, total meat expenditure

Given these considerations, and the constraints of the data at hand, we considered at first 25 distinct categories of goods. Specifically, the groupings considered were: Beef, Pork, Poultry, Other meat, Fish and Seafood, Milk, Butter, Other dairy products, Eggs, Bread and rolls, Other bakery products, Fresh fruits, Processed fruits, Nuts, Fresh vegetables, Processed vegetables, Condiments and spices, Sugar and sugar preparations, Coffee and tea, Fats and oils, Other foods, Non-alcoholic beverages, Food consumed away from home, and Nonfood consumption. This commodity grouping is illustrated in Table 1, which reports data for 1988, the most recent year in our sample. Specifically, Table 1 reports aggregate food and nonfood expenditures, per capita expenditures, and shares of the individual commodities on both total food expenditures and total personal expenditures. Total home food consumption amounted to 39,001 million dollars, or $ 1,505 per person (about 11 percent of personal expenditures on goods and services).

Preliminary analysis with this commodity grouping indicated real difficulties in maintaining this level of disaggregation with the data at hand (annual observation for the period 1961-1988). Hence, we settled on a 20-good disaggregation, with commodities organized as in Table 2. Relative to the disaggregation reported in Table 1, the grouping of Table 2 puts other meats with the beef group, aggregates bread and bakery products into a single group, and enlarges the other food group to include coffee, condiments, nuts, and the original other food group.

Over the sample period, the 'real income' of Canadian consumers has increased continuously, with the exception of 1982 (Figure 1). As one would expect from the typical consumption patterns of developed countries, food

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is likely to decline because of a poultry price decreases (it would increase if meats were luxuries). By using unconditional elasticities, on the other hand, one would account automatically for this meat expenditure effect.

Table 1. Canadian Personal Expenditures in 1988

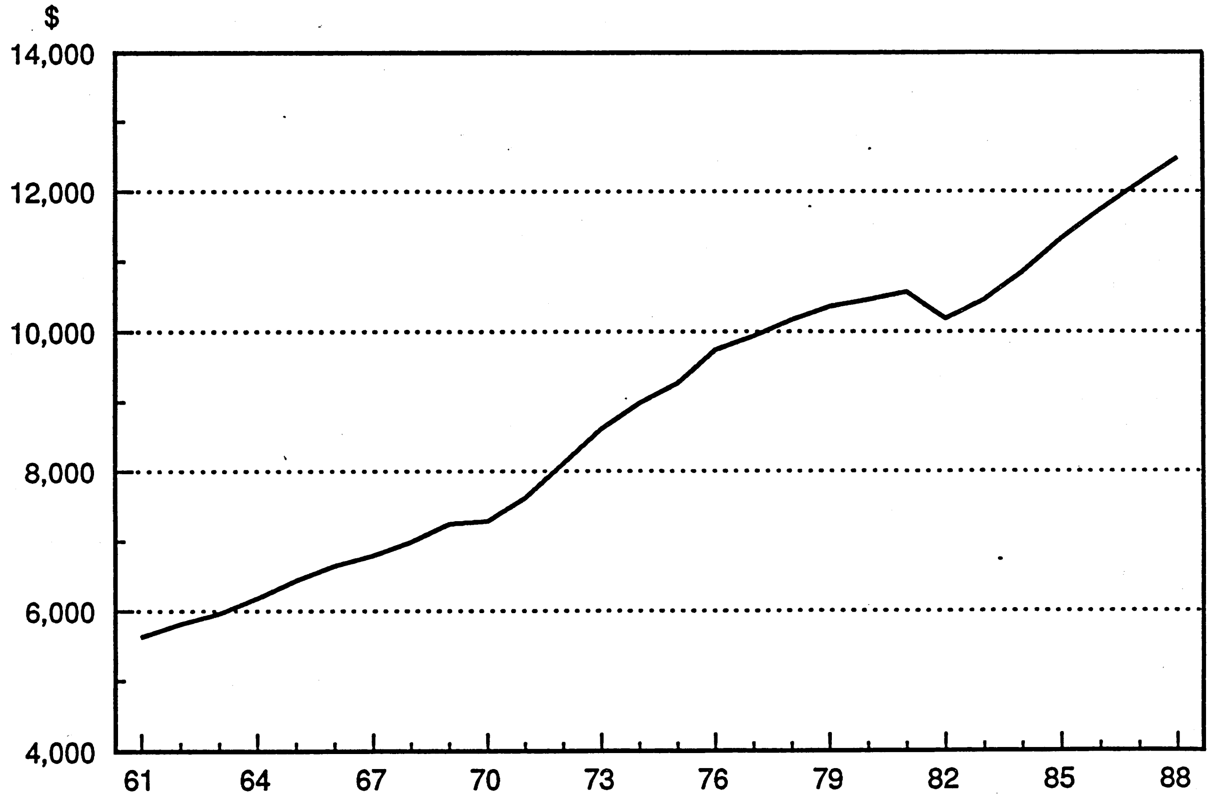
	aggregate millions $	per capita $	-- share of -- total	food
Meat	7,985	308	0.0229	0.205
beef	3,916	151	0.0112	0.100
pork	2,377	92	0.0068	0.061
poultry	1,602	62	0.0046	0.041
other	91	3	0.0003	0.002
Fish	1,339	52	0.0038	0.034
Dairy Products	6,221	240	0.0178	0.160
milk	2,110	81	0.0060	0.054
butter	463	18	0.0013	0.012
cheese	2,093	81	0.0060	0.054
other	1,556	60	0.0045	0.040
Eggs	468	18	0.0013	0.012
Bakery	4,829	186	0.0138	0.124
bread and rolls	1,597	62	0.0046	0.041
other bakery products	3,232	125	0.0092	0.083
Fruits	3,301	127	0.0094	0.085
fresh	1,759	68	0.0050	0.045
processed	1,542	60	0.0044	0.040
Nuts	280	11	0.0008	0.007
Vegetables	3,283	127	0.0094	0.084
fresh	1,953	75	0.0056	0.050
processed	1,330	51	0.0038	0.034
Condiments	1,151	44	0.0033	0.030
Sugar and sugar prep	2,459	95	0.0070	0.063
Coffee and Tea	1,074	41	0.0031	0.028
Fats and Oils	527	20	0.0015	0.014
Other Foods	3,879	150	0.0111	0.099
Beverages	2,205	85	0.0063	0.057
Total food at home	39,001	1,505	0.1116	1.000
Food away from home	16,615	642	0.0475	
Nonfood expenditure	293,840	11,341	0.8409	
TOTAL PERSONAL EXPENDITURES	349,456	13,488	1.0000	

Source: Statistics Canada.

Table 2. Commodity Aggregation used in Demand Systems

symbol	group	label
q_1	beef	BF
q_2	pork	PK
q_3	poultry	CK
q_4	fish	FI
q_5	eggs	EG
q_6	milk	MK
q_7	cheese	CH
q_8	other dairy	OD
q_9	butter	BT
q_{10}	other fats and oils	FO
q_{11}	fresh fruits	FF
q_{12}	processed fruits	PF
q_{13}	fresh vegetables	FV
q_{14}	processed vegetables	PV
q_{15}	bread & bakery products	BB
q_{16}	sugar & sugar preparations	SP
q_{17}	other food	OF
q_{18}	beverages	BE
q_{19}	food away from home	FA
q_{20}	non food	NF

Figure 1. 'Real' Income
Per-Capita Total Expenditures in 1986 Dollars



consumption constitutes a small and decreasing component of income allocation (Figure 2). Because the increased purchasing power is devoted mostly to the consumption of goods other than food, the share of total expenditures devoted to food consumption has been steadily decreasing over the period considered (Figure 3). This trend is particularly evident for at-home food and beverages consumption, whereas food away from home shows an increasing trend, although clearly not enough to offset the decline in at-home consumption.

The allocation of food expenditures to individual food categories is illustrated in Figure 4 (meat and fish), Figure 5 (dairy products), Figure 6 (eggs, butter, and fats and oils), Figure 7 (fruits and vegetables), Figure 8 (bread and bakery), and Figure 9 (sugar and beverages). These Figures show some interesting trends, notable among which is the decline of milk share, the increase of other dairy share, the sharp decline of eggs and butter shares, the increase of the share of other foods and the decline of bread and bakery share.

Clearly, these trends display both a quantity and a price effect, and disentangling such effects is an important task of our analysis. A pictorial glimpse of the direct price effects can be captured by Figures 10 to 29, which report the quantity index (per capita expenditure in 1986 dollars) and the price index (deflated by the nonfood price index) of all the consumption categories identified in Table 2. These Figures suggest that real prices matter in food demand, and offer interesting perspectives on the price and quantity trends of some food items. A more rigorous analysis of the price effects on food demand, however, must rely on econometric analysis, and this is the objective of the following sections.

Figure 2
Allocation of Personal Consumption Expenditures

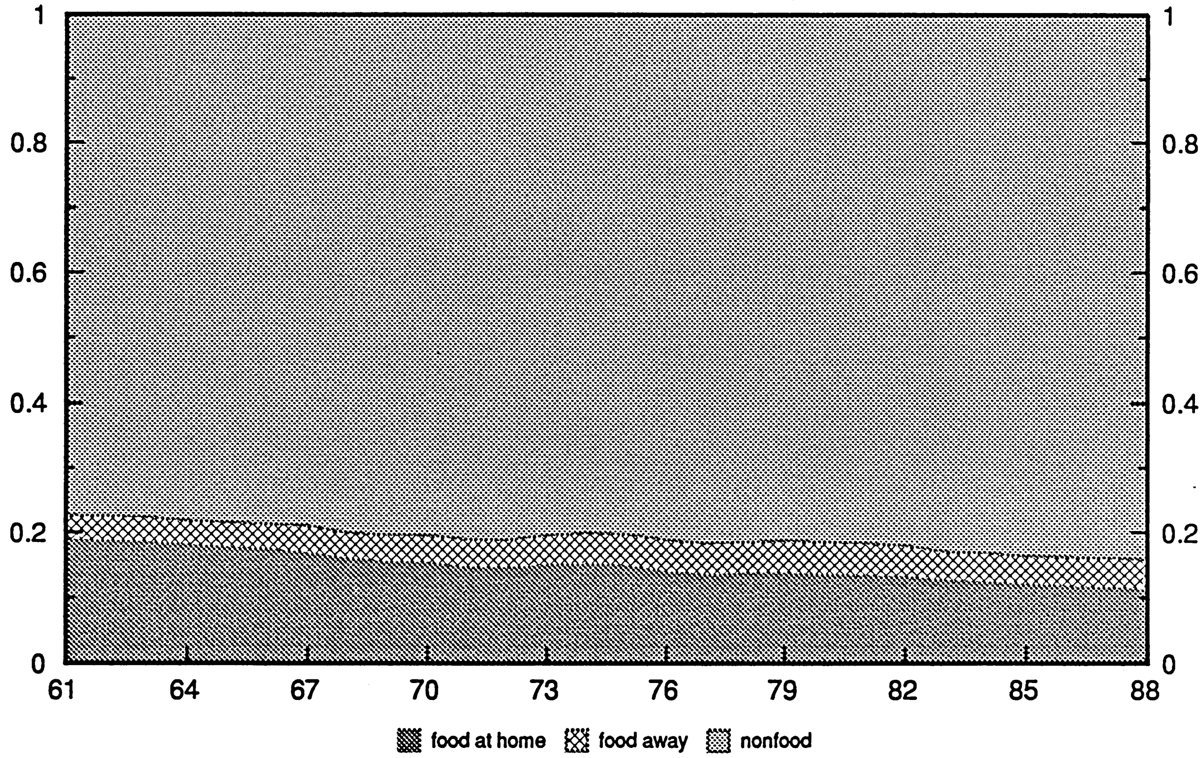


Figure 3
Allocation of Total Food Expenditures

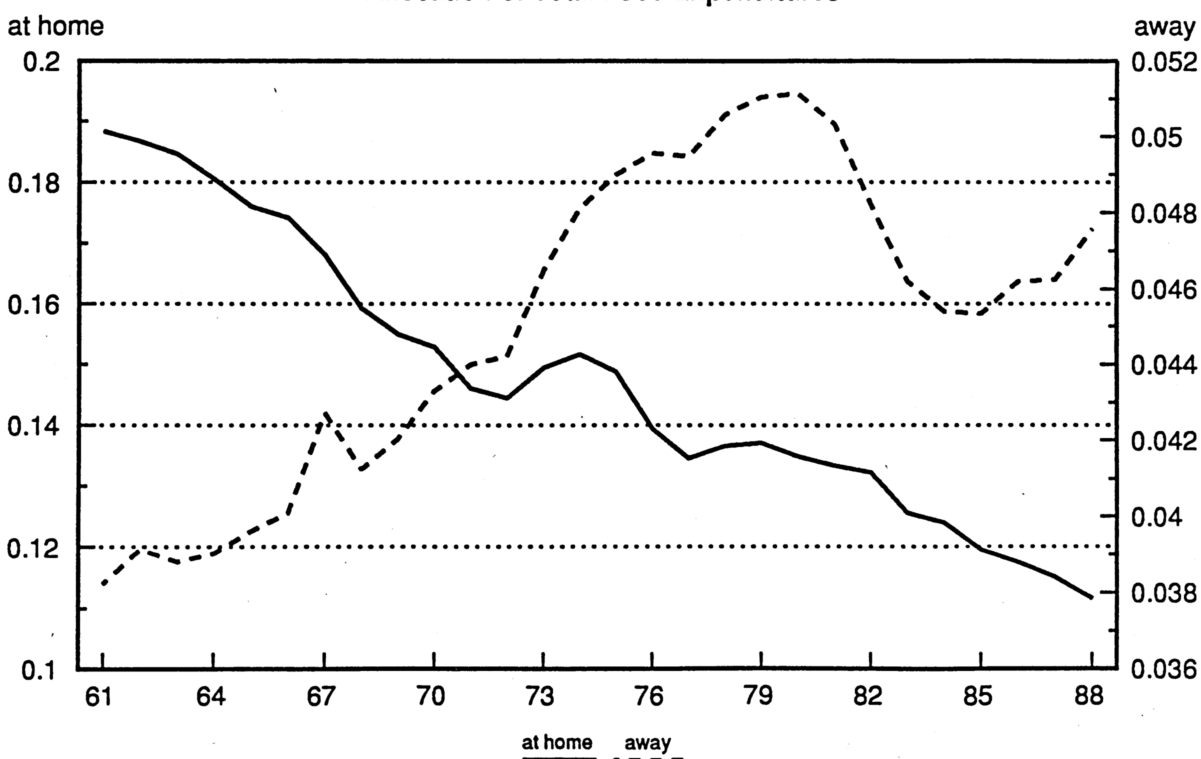


Figure 4. Meat and Fish
Shares of Food Expenditure

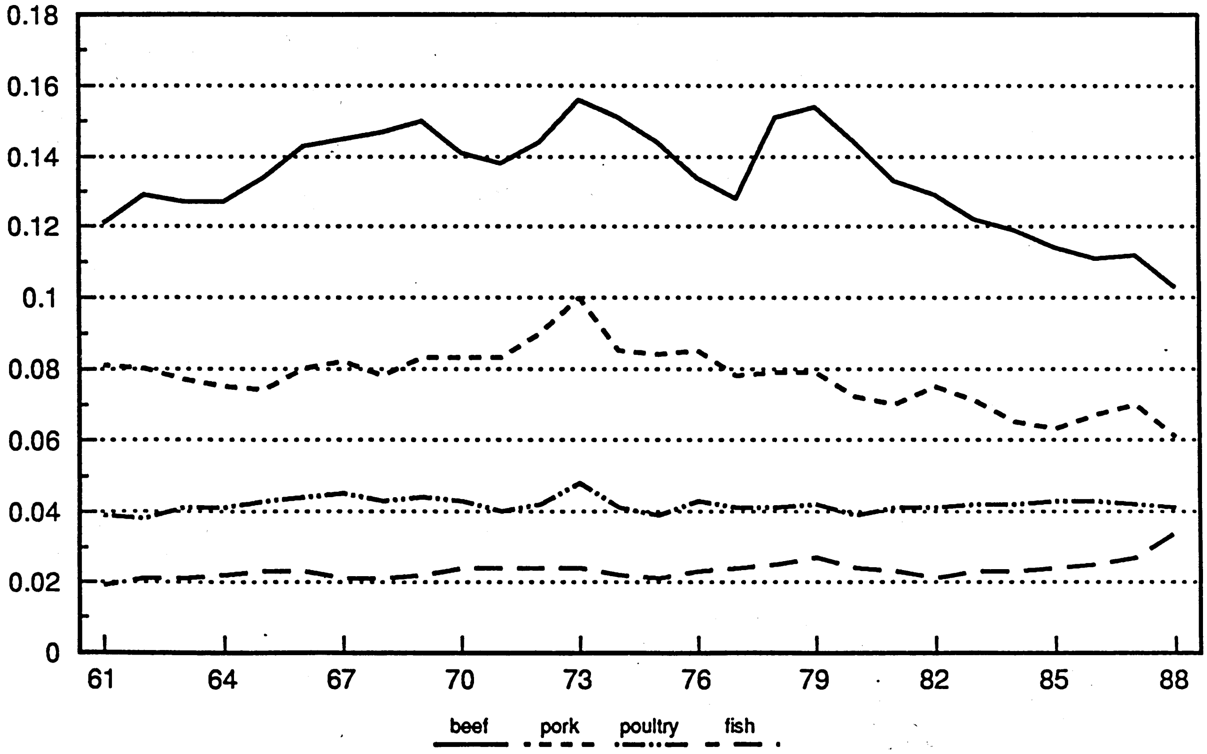


Figure 5. Dairy Products
Shares of Food Expenditure

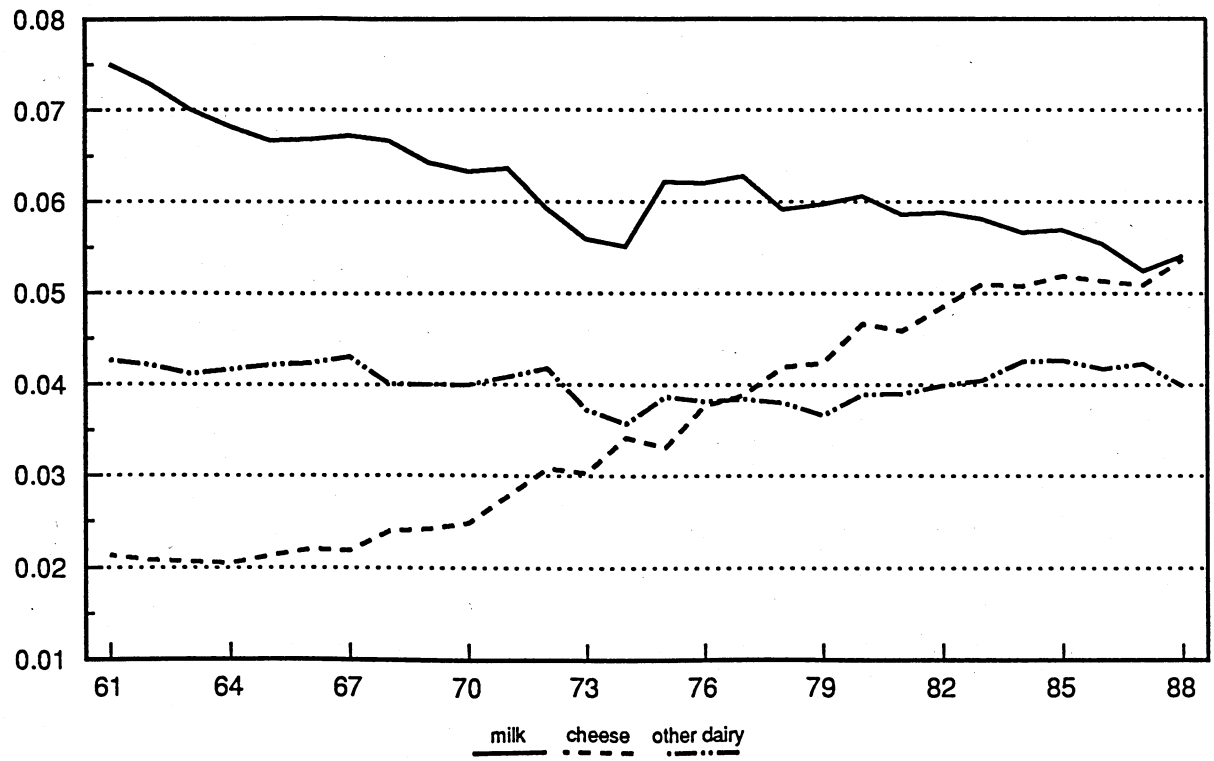


Figure 6. Eggs, Butter, and Fats & Oils
Shares of Food Expenditure

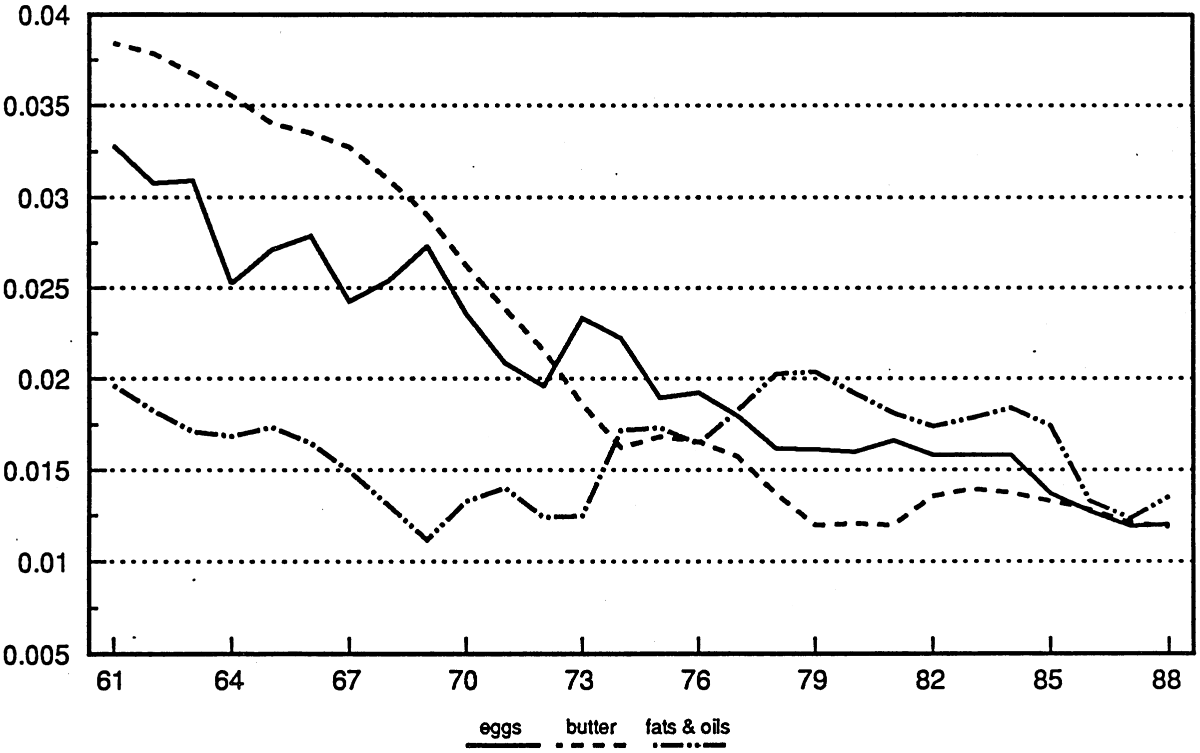


Figure 7. Fruits and Vegetables
Shares of Food Expenditure

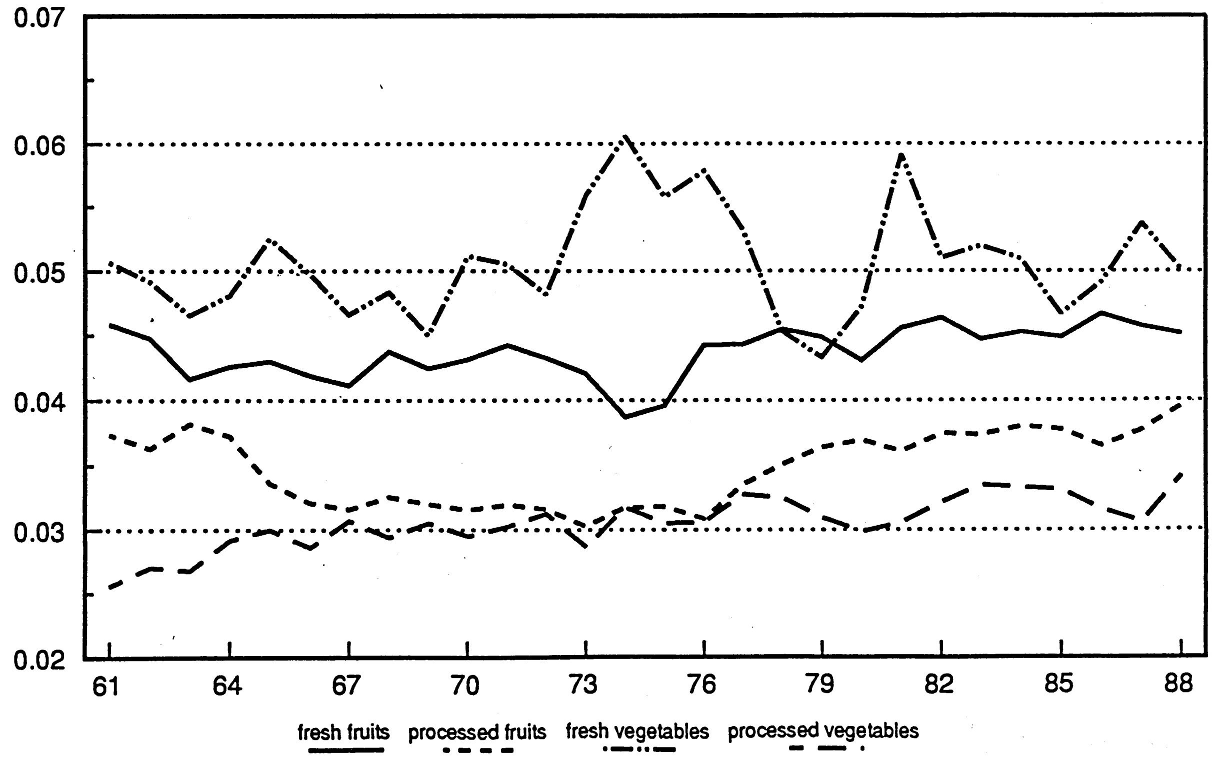


Figure 8. Bread & Bakery and Other Foods Shares of Food Expenditure

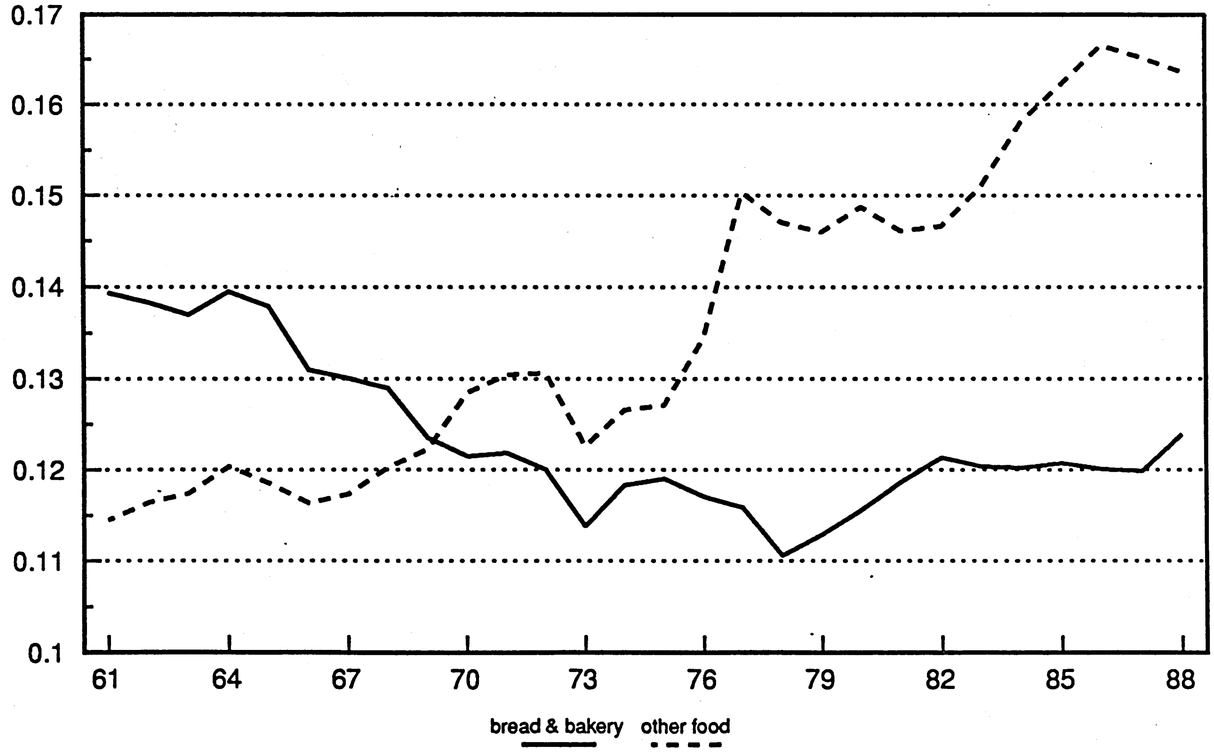


Figure 9. Sugar and Beverages Shares of Food Expenditure

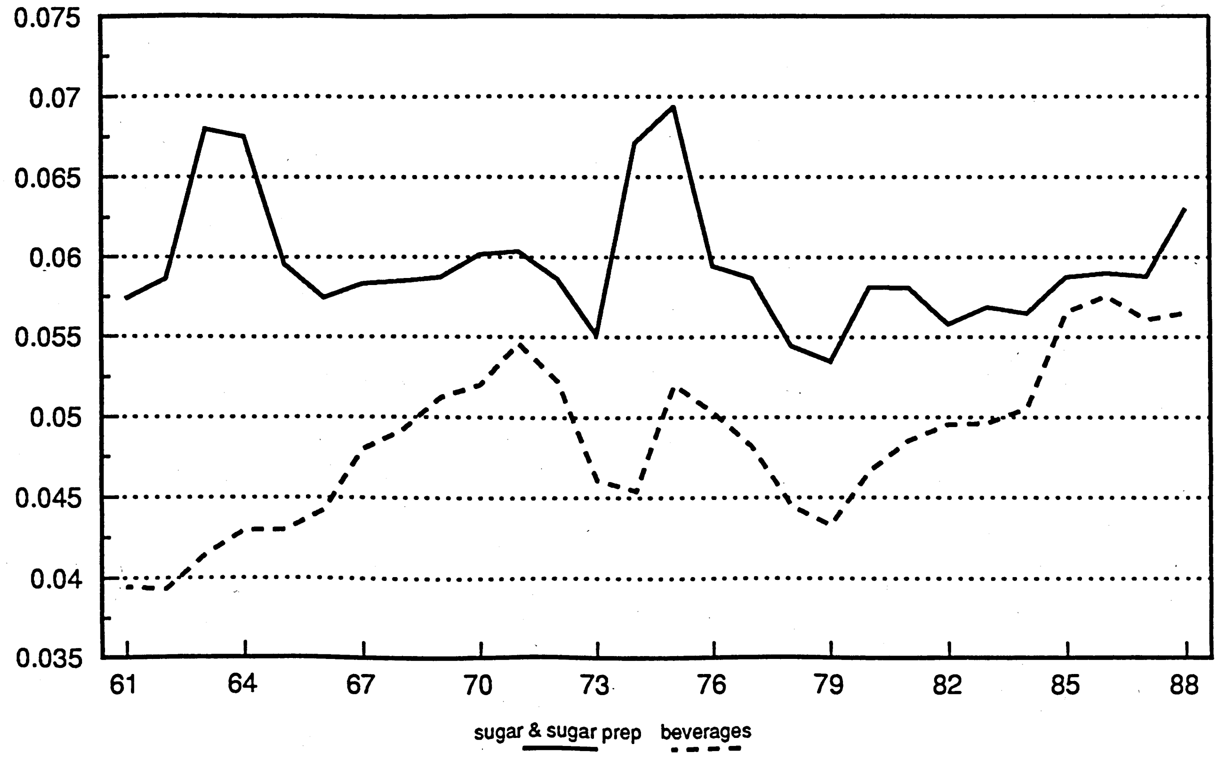
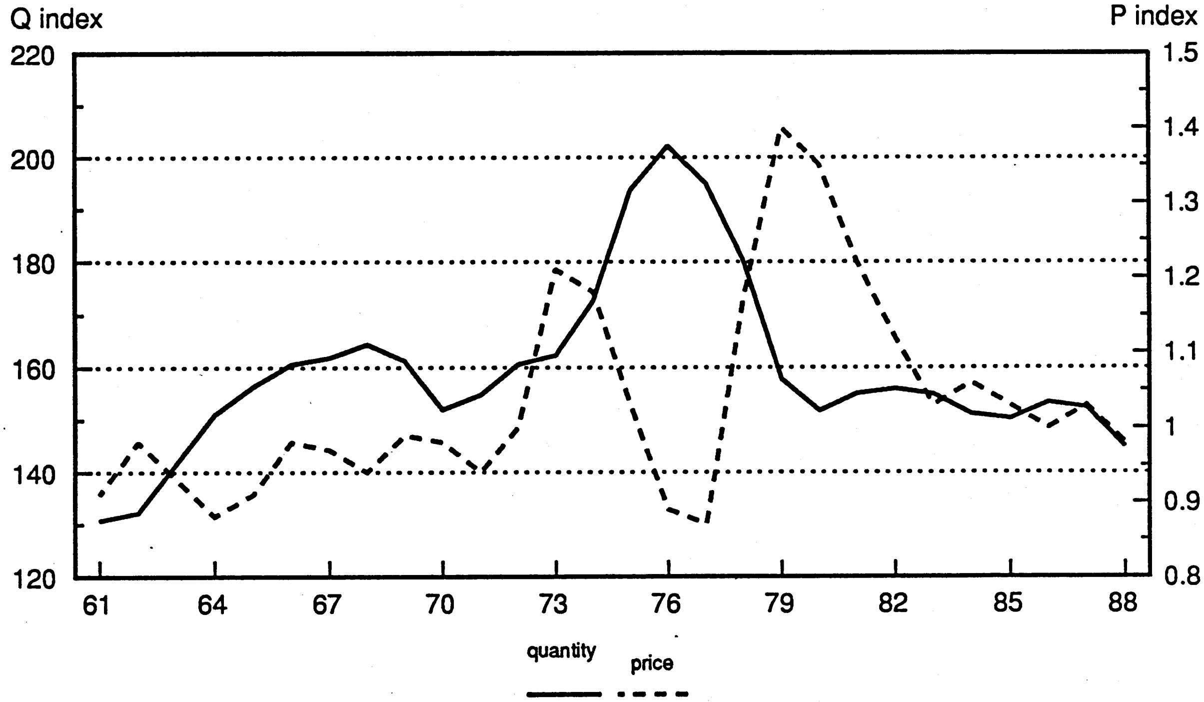
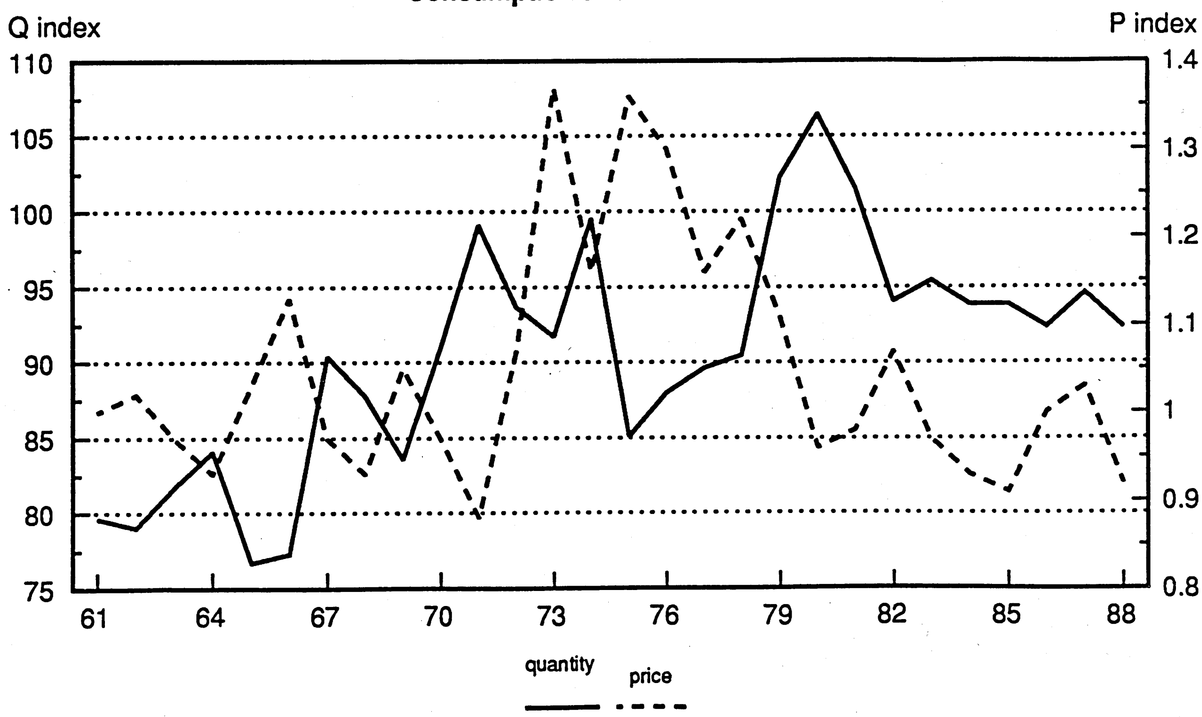


Figure 10. Beef
Consumption and Price Indices



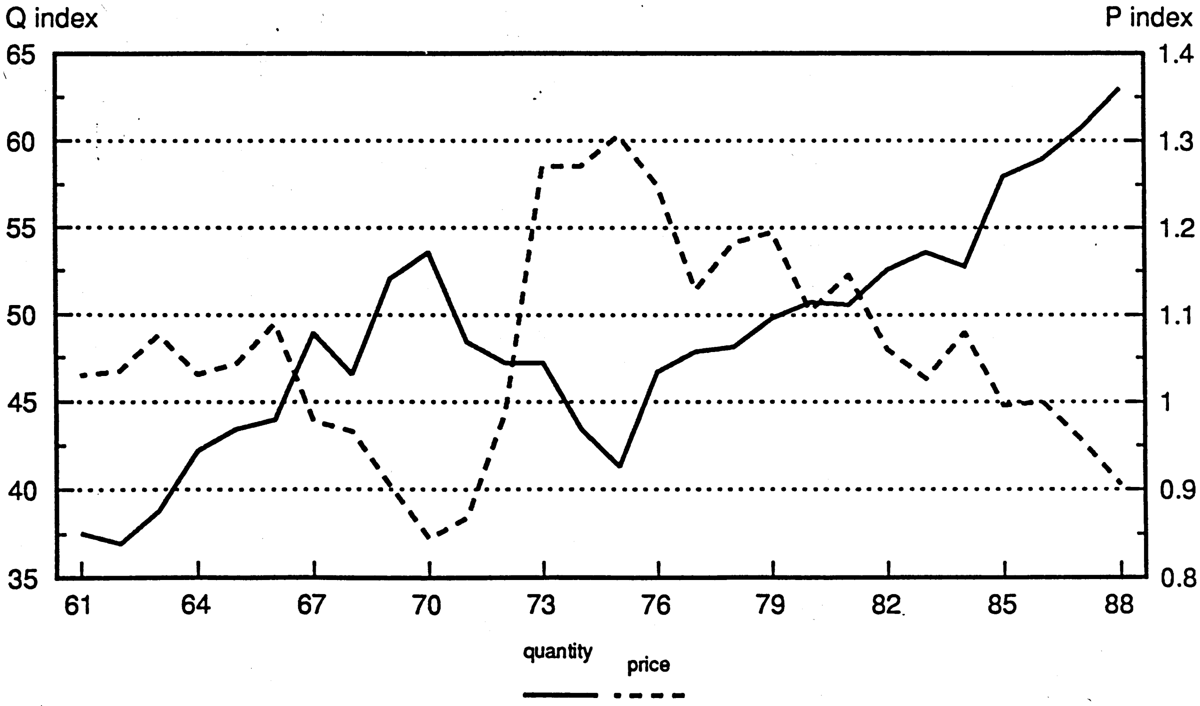
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 11. Pork
Consumption and Price Indices



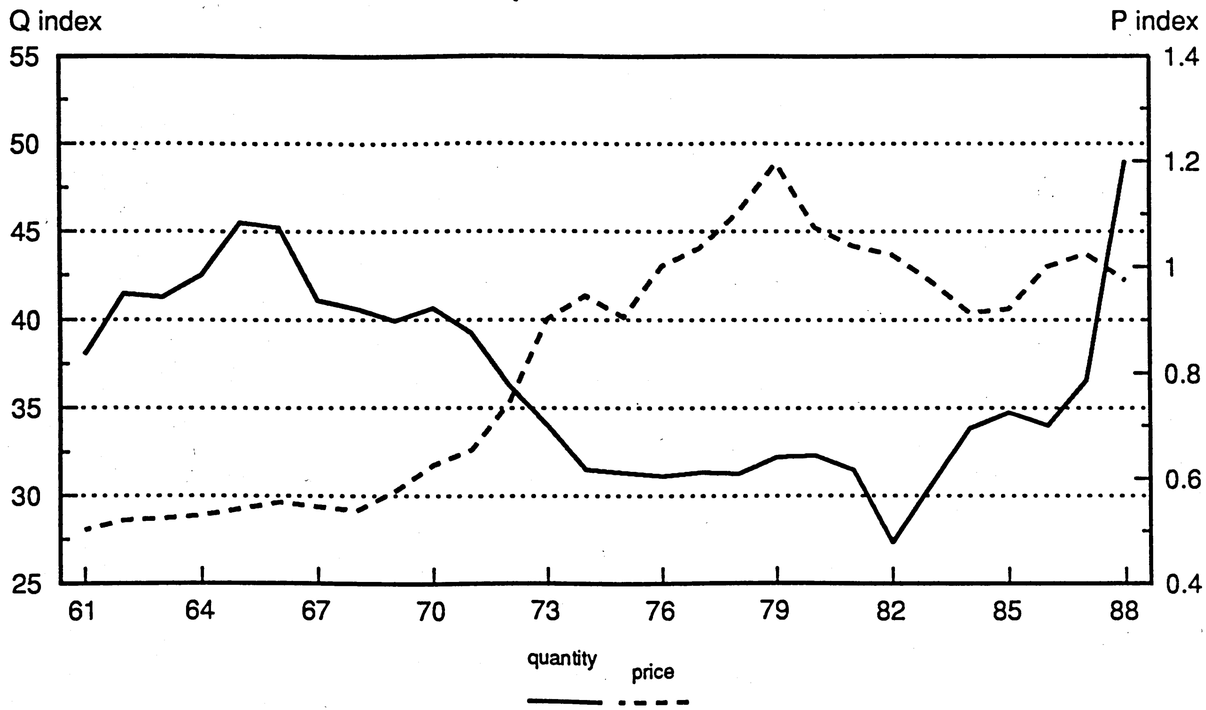
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 12. Poultry
Consumption and Price Indices



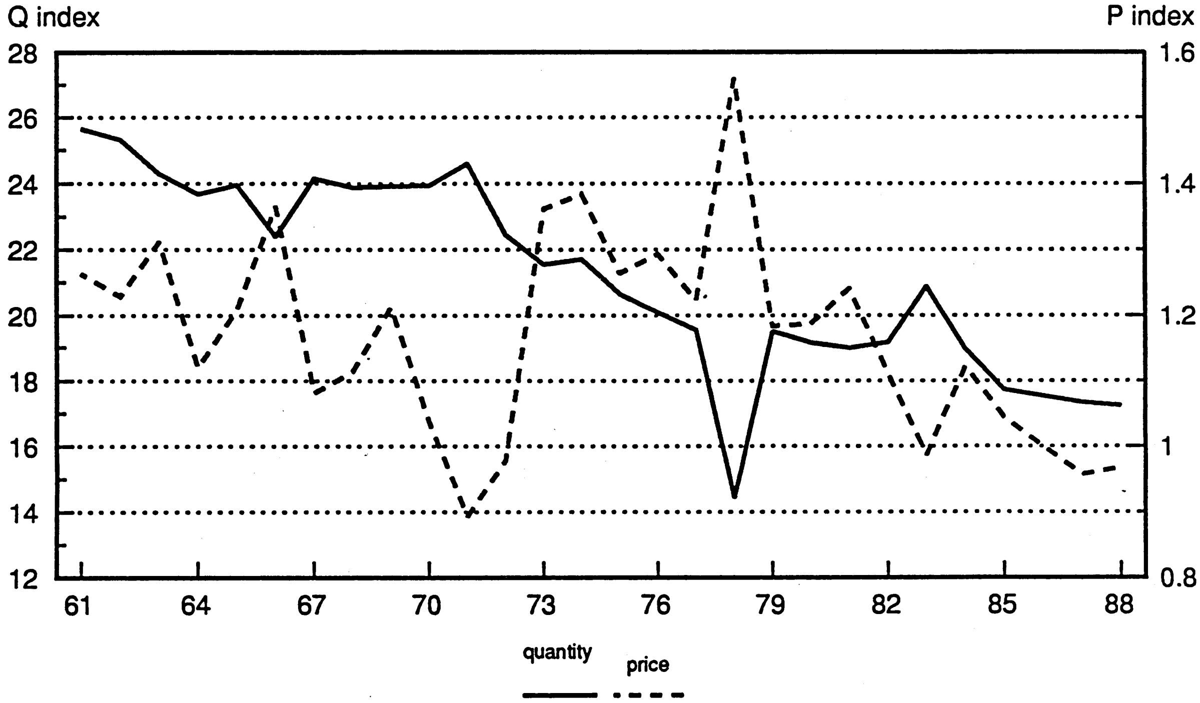
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 13. Fish
Consumption and Price Indices



quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 14. Eggs
Consumption and Price Indices

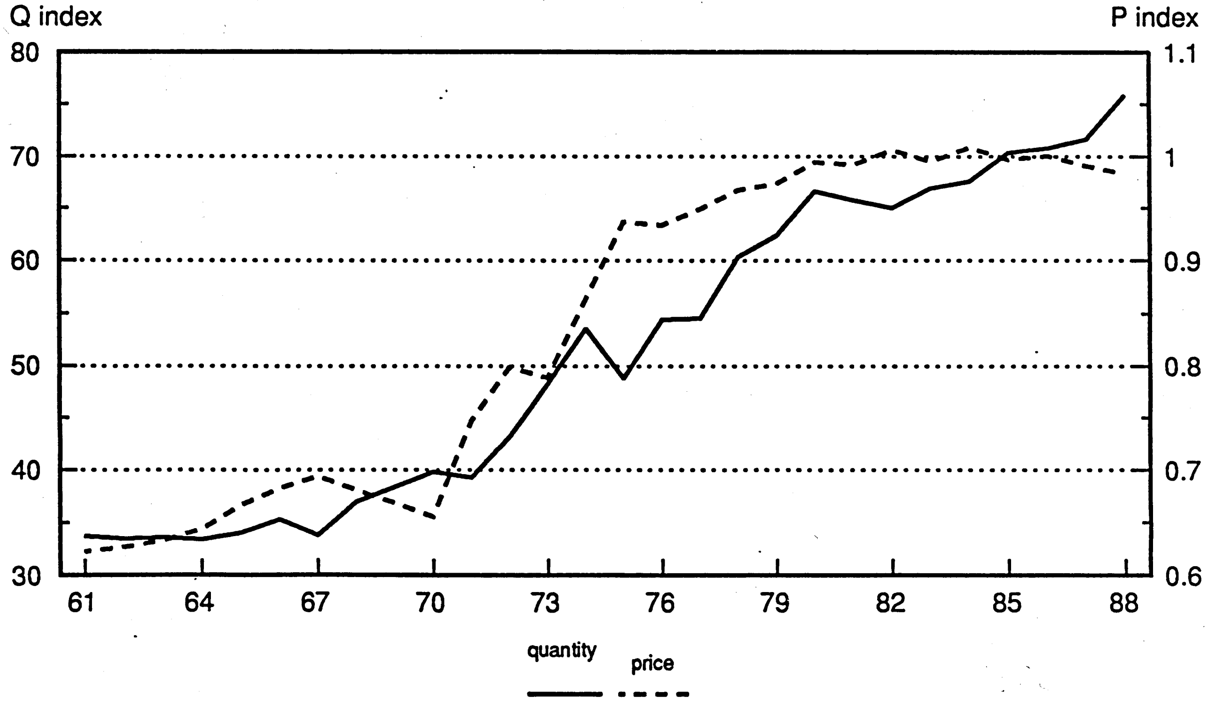


quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 15. Milk
Consumption and Price Indices

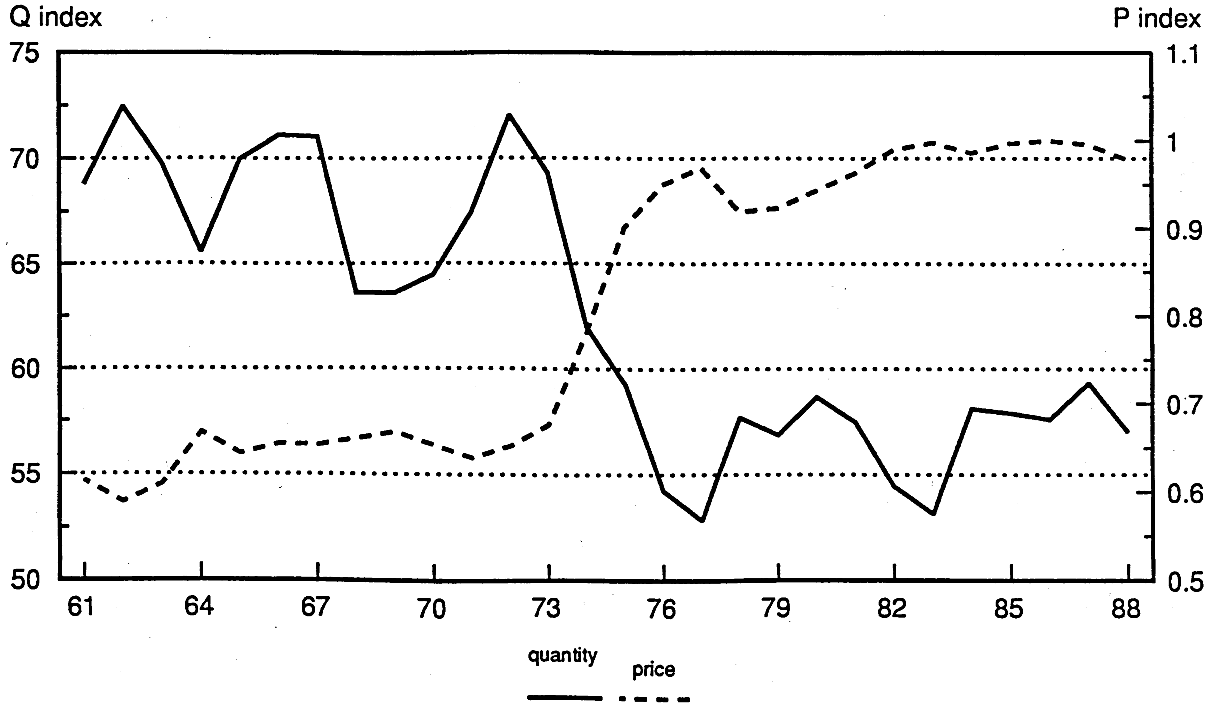
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 16. Cheese
Consumption and Price Indices



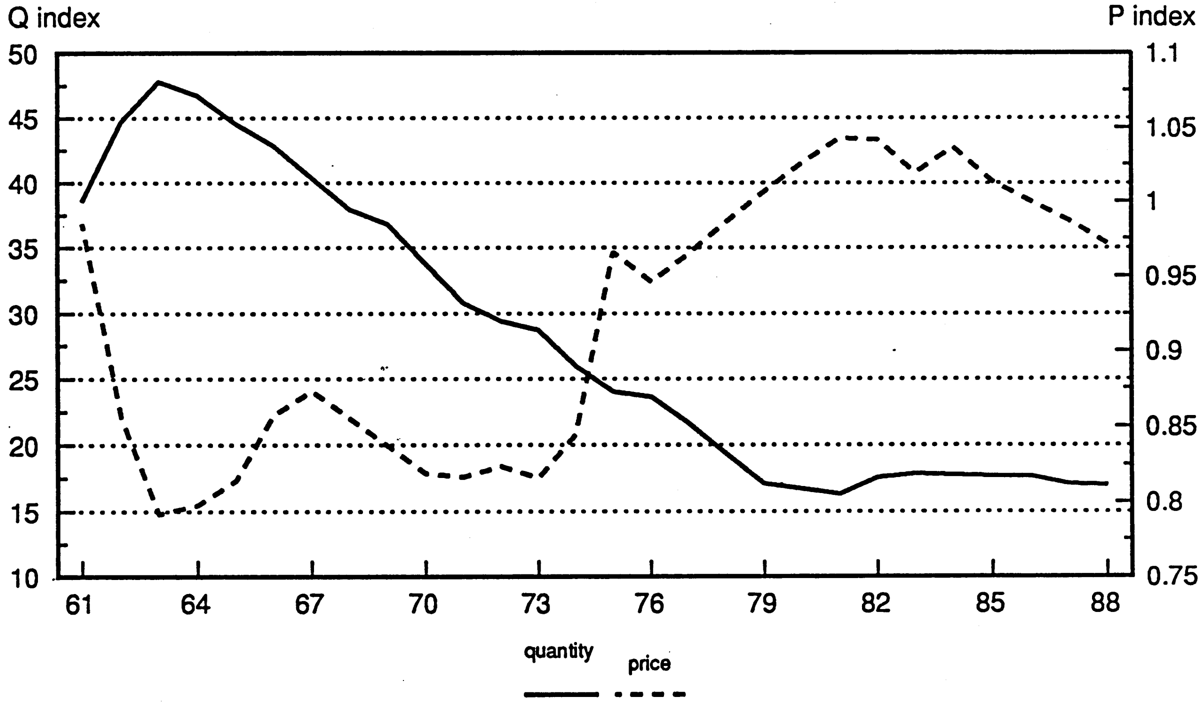
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 17. Other Dairy Products
Consumption and Price Indices



quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 18. Butter
Consumption and Price Indices

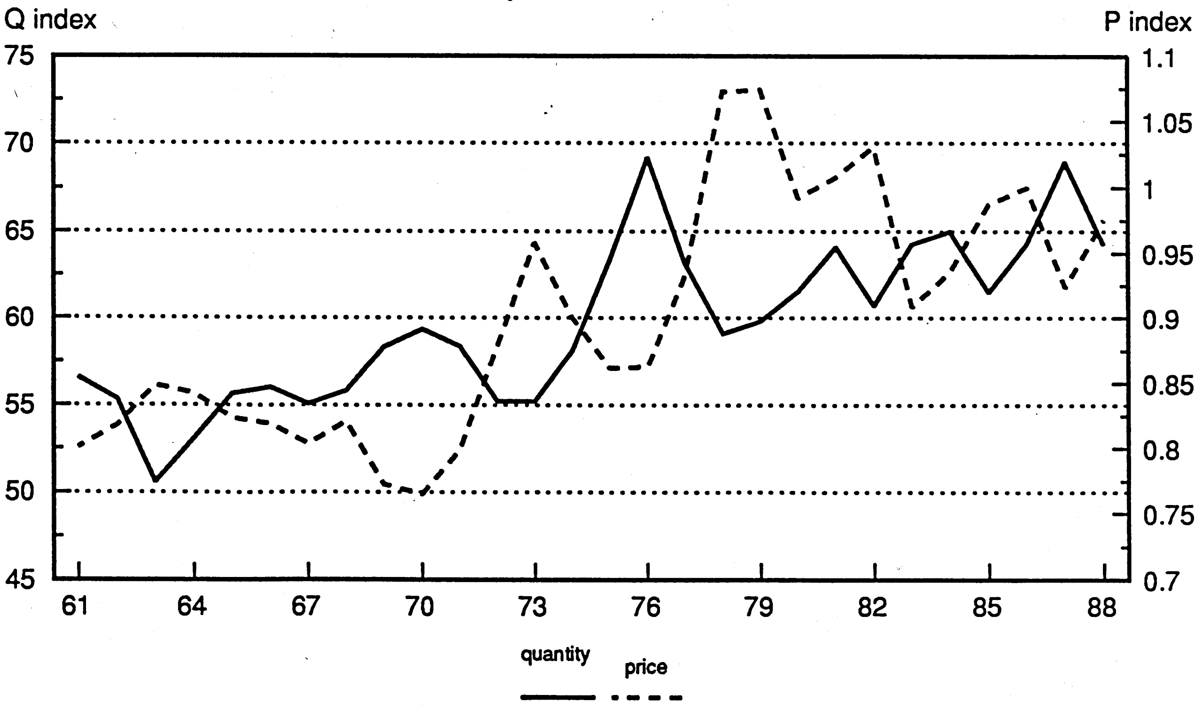


quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 19. Fats and Oils
Consumption and Price Indices

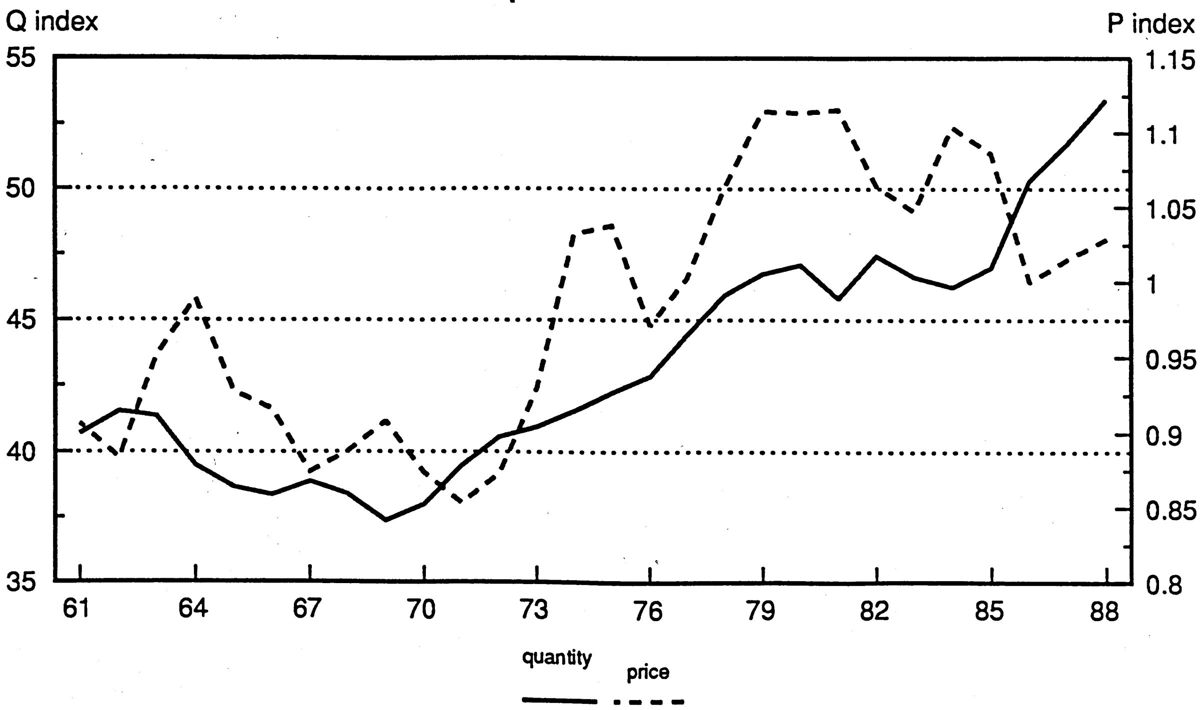
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 20. Fresh Fruits
Consumption and Price Indices



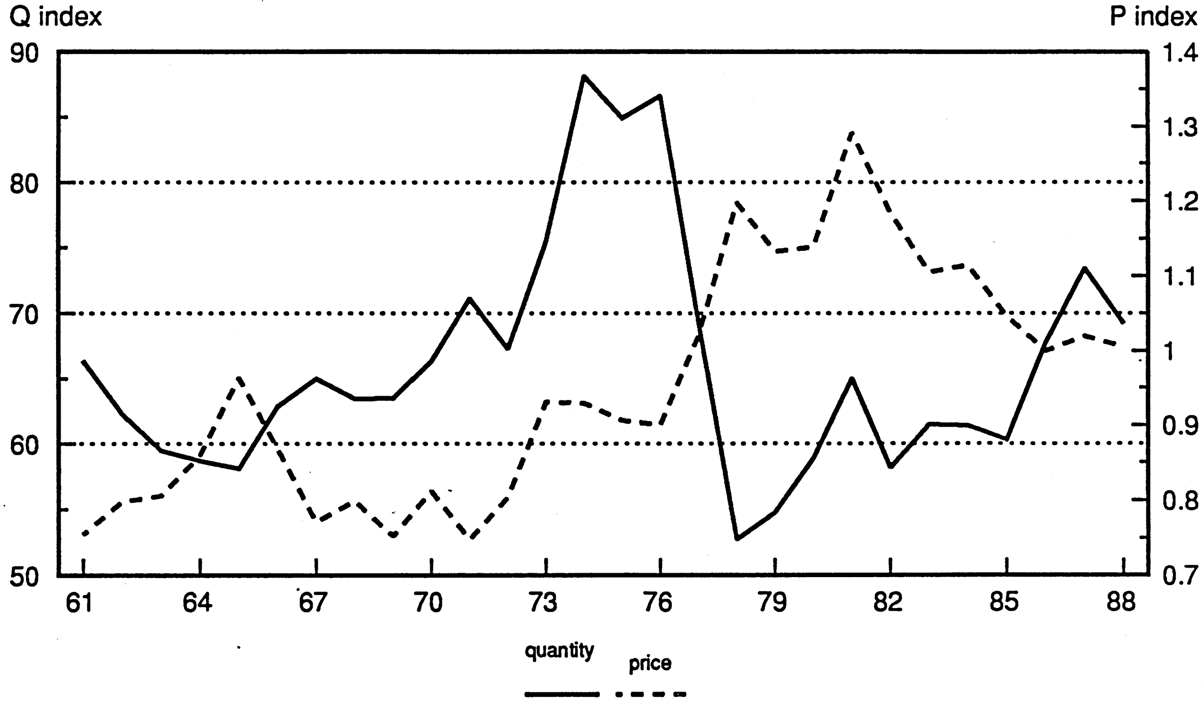
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 21. Processed Fruits
Consumption and Price Indices



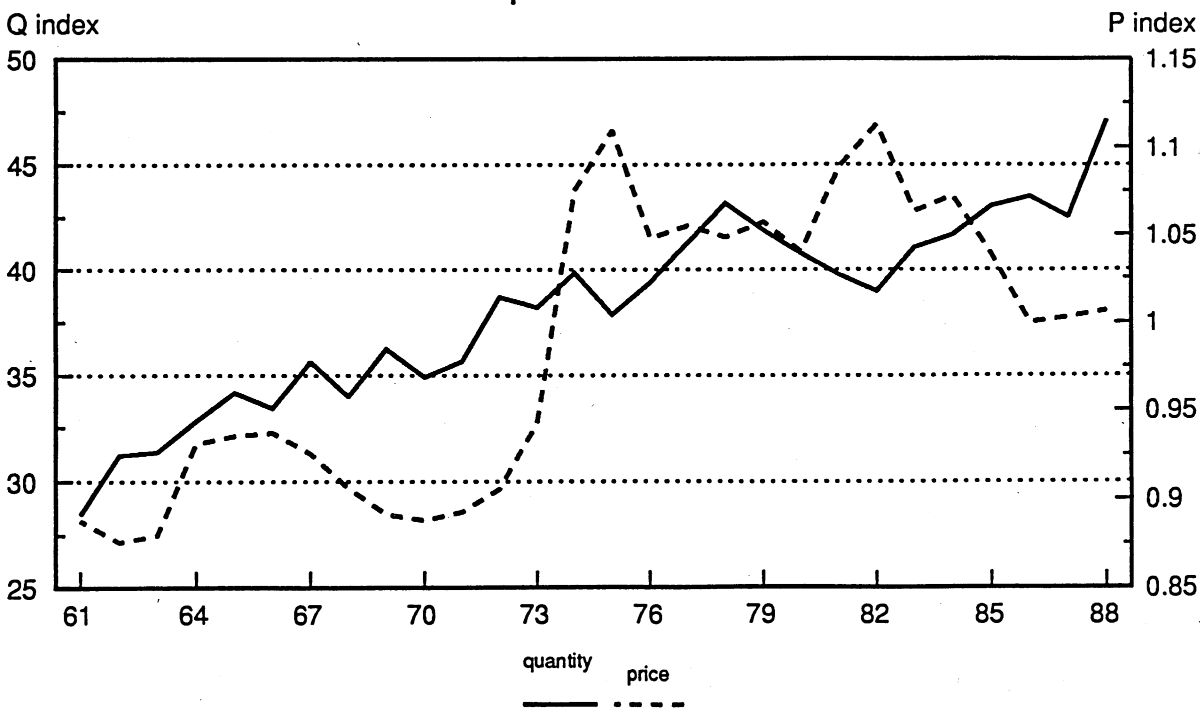
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 22. Fresh Vegetables
Consumption and Price Indices



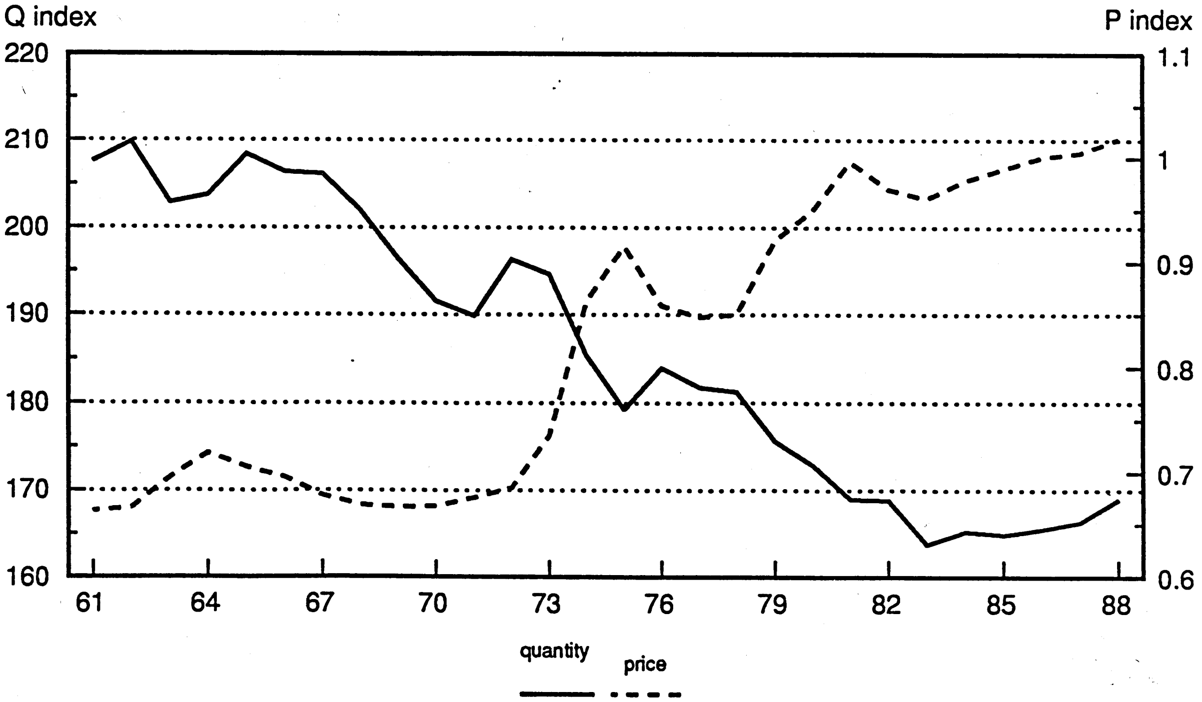
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 23. Processed Vegetables
Consumption and Price Indices



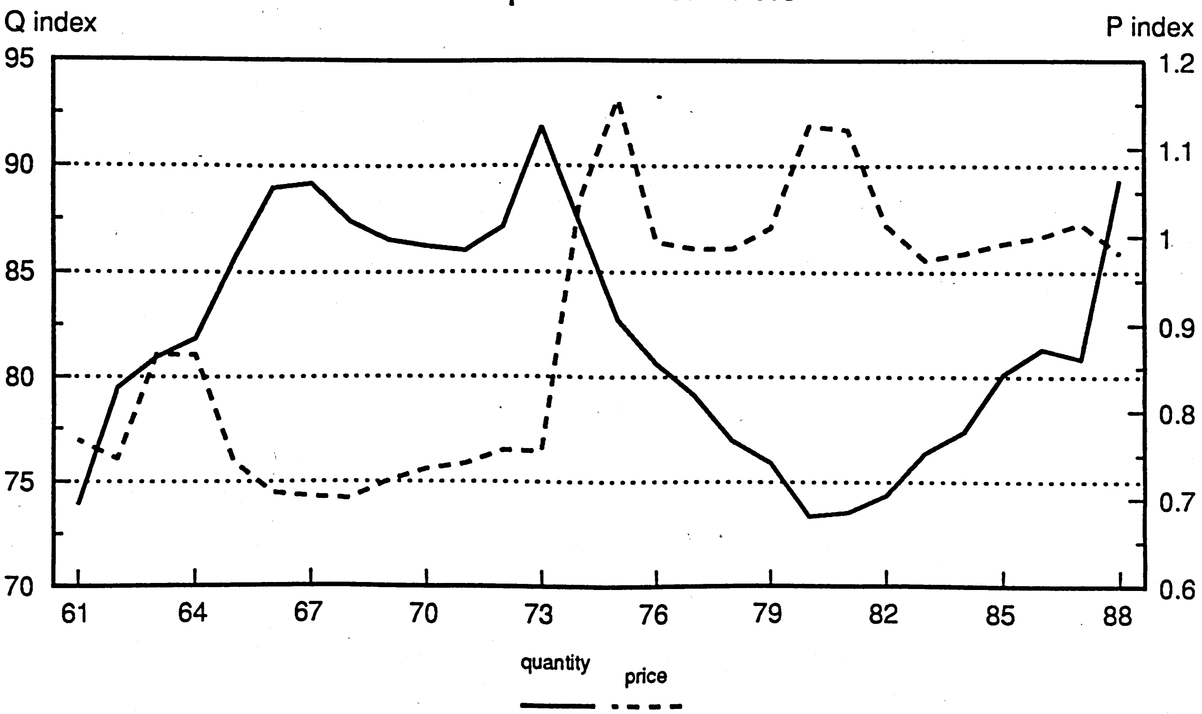
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 24. Bread and Bakery Products Consumption and Price Indices



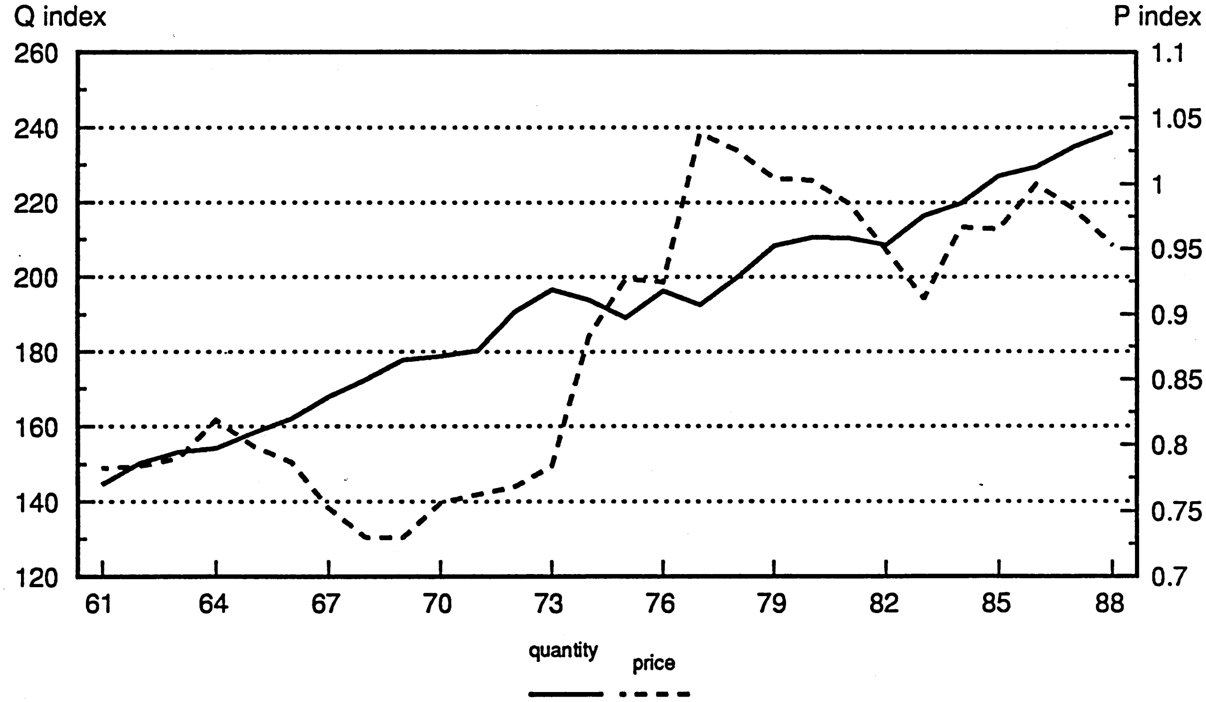
quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 25. Sugar and Sugar Preparations Consumption and Price Indices



quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Figure 26. Other Foods
Consumption and Price Indices



quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

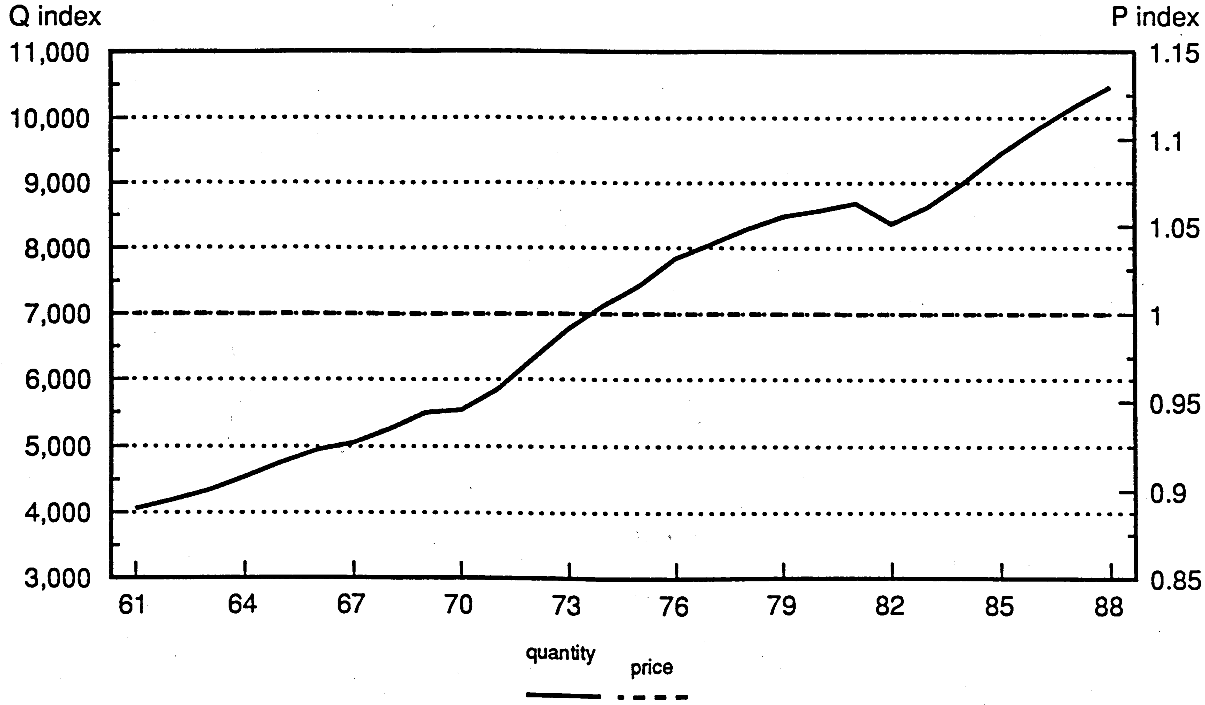
Figure 27. Beverages
Consumption and Price Indices

quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

**Figure 28. Food Away from Home
Consumption and Price Indices**

quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

**Figure 29. Nonfood
Consumption and Price Indices**



quantity = per-capita real expenditures (1986 $)
price = 1 in 1986 (deflated by nonfood index)

Separable Trees

As discussed at length earlier, the large number of goods considered here entails a severe degrees of freedom problem. To deal with this problem, our strategy is to appeal to separability to restrict the parameter space. Because of the implication of direct separability for the existence of conditional demand functions and consumer budgeting, some general priors can be used to group commodities together for the purpose of postulating the structure of utility functions. Such introspection, of course, does not lead very far, and one is left with a large number of possible structures. Choosing the 'best' structure is a problem beyond the scope of this research.[24] However, we have postulated 3 alternative structures, and we have tested them to see whether they are acceptable from a statistical point of view. The utility trees associated with these structures are reported in Figures 30 to 32. The separable tree A of Figure 30 postulates that food at home is a separable group from the other goods, with beverages (at home), food away from home, and nonfood making up the remaining recursive asymmetric separable structure. In other words, the postulated utility function of the representative consumer is:

$$U(q) = U_A\Big(h\Big[g\big(f(q_1, q_2, \ldots, q_{17}), q_{18}\big), q_{19}\Big], q_{20}\Big) \tag{44}$$

The separable tree B illustrated in Figure 31 maintains the recursive structure for the last three goods, but puts more structure within the food-at-home group. Specifically, it identifies 6 groups for food at home: meat and fish (made up of 4 commodities), dairy, eggs, and fats (with 6 goods), fruits and vegetables (with 4 goods), bread and bakery (1 good), sugar (1 good), and other foods (1 good).

[24] Pudney (1981) proposed a method based on cluster analysis to discriminate among separable structures.

Figure 30. Expenditure Allocation, Separable Tree A

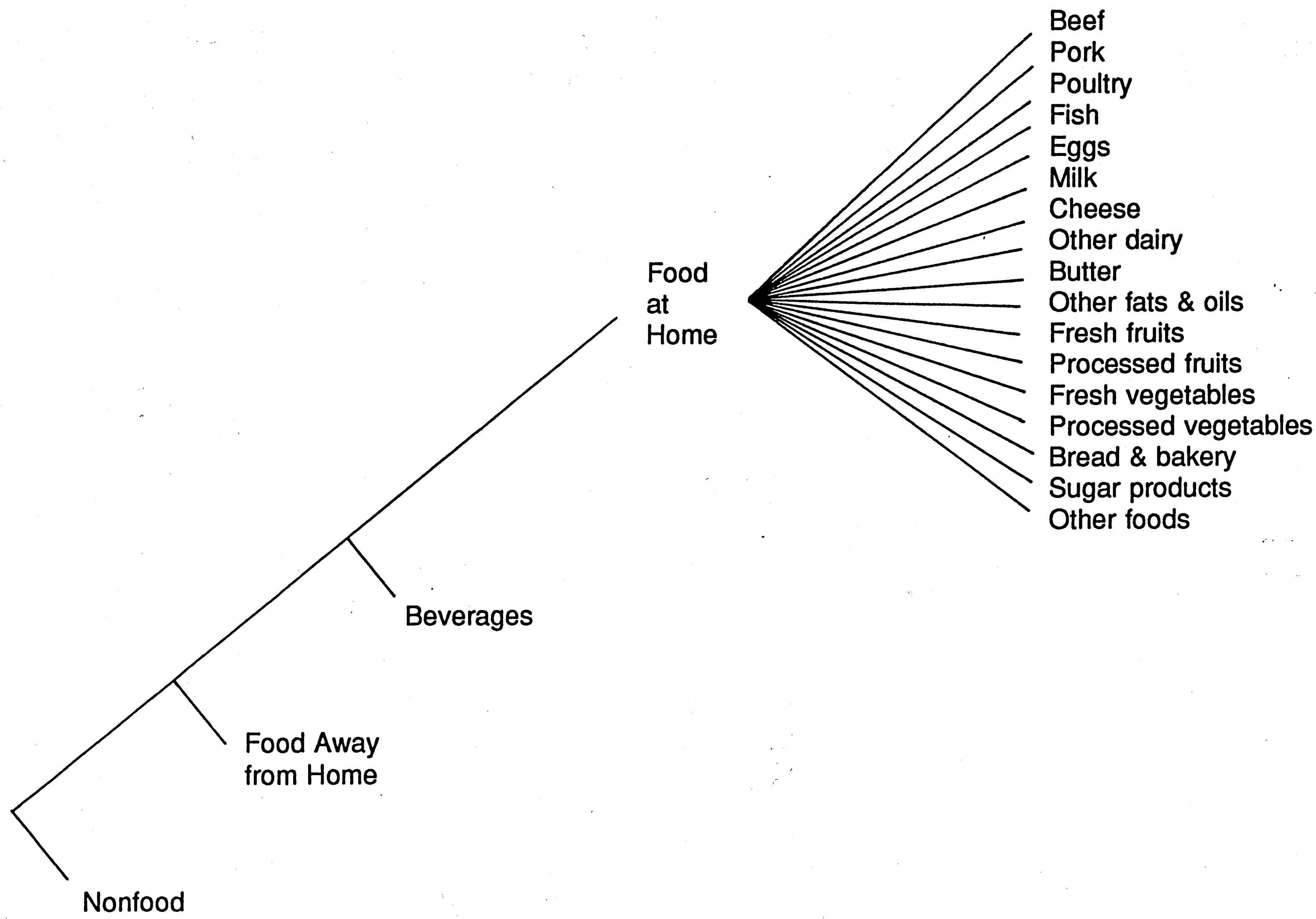
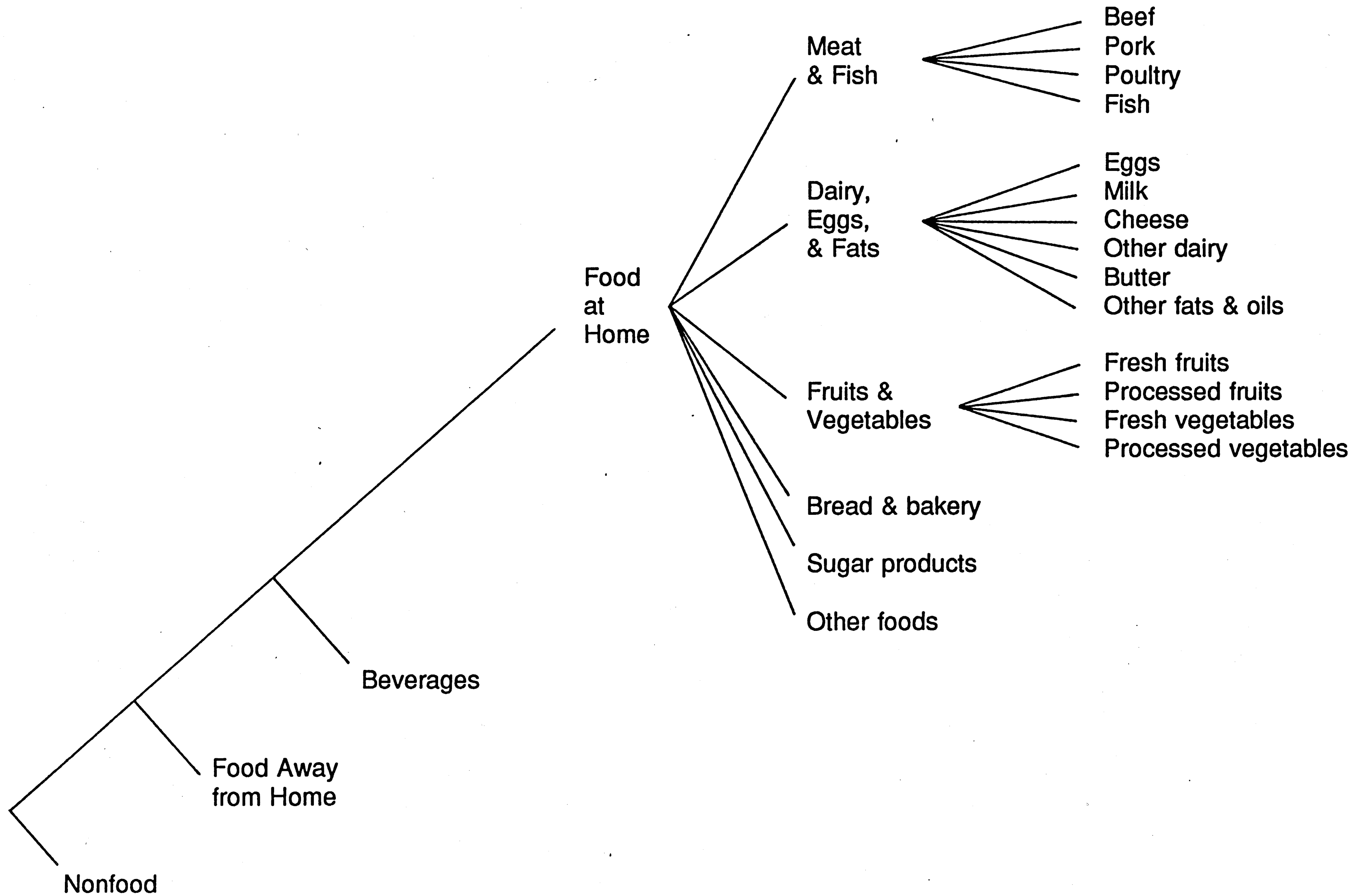


Figure 31. Expenditure Allocation, Separable Tree B



Such utility function can be written as:

$$U(q) = U_B\Big(h\Big[g\big(f(m(q_1,\ldots,q_4),d(q_5,\ldots,q_{10}),f(q_{11},\ldots,q_{14}),q_{15},q_{16},q_{17}),q_{18}\big),q_{19}\Big],q_{20}\Big)$$

(45)

Similarly, the separable tree C illustrated in Figure 32 maintains the recursive structure for the last three goods, but puts more structure within the food-at-home group. Specifically, the utility function has the structure:

$$U(q) = U_C\Big(h\Big[g\big(f(m(q_1,q_2,q_3),q_4,q_5,d(q_6,q_7,q_8),b(q_9,q_{10}),f(q_{11},\ldots,q_{14}),q_{15},q_{16},q_{17}),q_{18}\big),q_{19}\Big],q_{20}\Big)$$

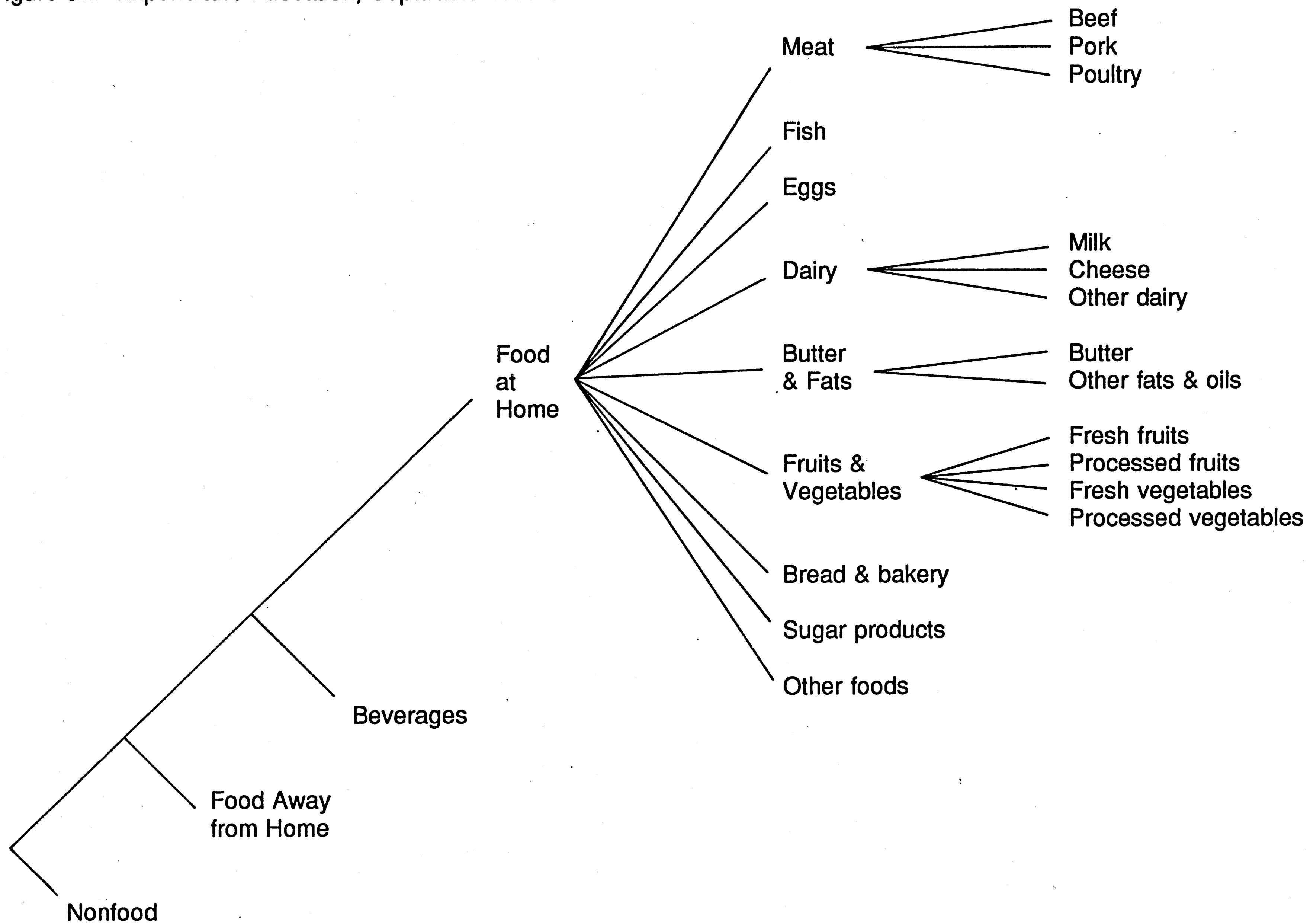
(46)

These three separable structures were estimated, by the restricted minimum distance estimator described earlier, using a first difference version of the linear ALIDS model. The choice of the first-difference version of the model was suggested by some preliminary analysis showing serious serial correlation in the residuals. The first-difference ALIDS was first introduced by Deaton and Muellbauer (1980), who pointed out its close parametric similarity with the absolute price version of Theil's (1976) Rotterdam model. Later we will provide evidence that the first-difference model is considerably better than the model in levels. Specifically, the model estimated is of the form:

(47) $$\Delta w_{it} = \mu_i \Delta \log(t) + \sum_{j=1}^{n} \gamma_{ij} \Delta \log(p_{jt}) + \beta_i \Delta \log\left(\frac{x_t}{P_t^*}\right) + e_{it}$$

where Δ is the first-difference operator (i.e., $\Delta z_t \equiv z_t - z_{t-1}$) and $P_t^* = \Sigma_i w_{it} \log(p_{it})$ is the Stone price index. The trend variable term $\mu_i \Delta\log(t)$ allows for some drift of consumption shares over time for reasons other than prices and income. Such drift may account for possible consumers' preference change or may reflect functional form (or other) misspecifications. The parametric form chosen

Figure 32. Expenditure Allocation, Separable Tree C



entails a logarithmic trend in the model in levels, which should be preferable to a linear trend (especially if the model is to be used for forecasting) given that shares are constrained to lie in the (0,1) interval.[25]

The parameters in (47) are restricted by adding-up, homogeneity, and symmetry. With those restrictions the system has a total of 228 free structural parameters. Imposing the restrictions of the separable structure A (at a point, in our case the mean point) reduces the number of parameters to 177. Similarly, the separable structures B and C entail a total number of parameters of 83 and 90, respectively. Because the three models A, B, and C are nested into the unrestricted ALIDS model of equation (47), these separable structures can be tested. The test results, using the quasi-likelihood-ratio criterion, are reported in Table 3. It is apparent that the three separable structures cannot be rejected by the data. The separable structure A, although of some interest, still entails too many parameters. Of the remaining two structures, separable tree B seems to do slightly better, while entailing 7 fewer parameters. For this reason, the remaining analysis will focus on model B.

An analysis of the properties of the estimated demand system of separable tree B showed that, whereas the model was reasonably well behaved at the mean point, it tended to violate the curvature conditions when evaluated at more recent prices and expenditure. The problem, it seems, is that the flexible functional form used is not 'flexible enough.' During the period covered in this sample, the share of income allocated to individual food items has decreased

---

[25] Whereas there is only one linear trend, there are many logarithmic trends depending on the initialization of the trend variable (Watts and Quiggin, 1984). Having recognized that, this non-invariance simply means that one has the choice of many possible paths of the trend variables, with the linear trend being one of the possibilities. In our model we set $t = 1$ in 1961, $t = 2$ in 1962, and so on.

Table 3. Structural separability tests

model	number of parameters	d.o.f.	QLR test	critical values 0.05	0.01
unrestricted	228				
separable A	177	51	56.1	68.7	77.4
separable B	83	145	140.3	174.1	187.5
separable C	90	138	143.1	166.4	179.6
separable B*	83	145	140.8	174.1	187.5

considerably. This is due to the fact that as income has expanded, a diminishing share of it has been allocated to food consumption (recall Figure 6). For example, for the three years 1962-64, at-home food and beverages accounted for 18.4 % of total expenditures, whereas for the period 1986-88 they accounted for only 11.4 %. This fact, which is quite consistent with well known results about the behavior of Engel curves for food, is further amplified when analyzing individual food items. For instance, between the two periods 1962-64 and 1986-88, the share of total expenditures allocated to eggs changed from 0.5 % to 0.1 % (a fivefold drop).

Because of the great variability of shares in the sample period, it is not surprising that a parametric specification such as ALIDS, which has only local approximation properties (like most other flexible functional forms), does not perform well everywhere in the range of the data. Again, this problem is caused mainly by the downward trend in the food share of total expenditure, as individual food items' shares of food expenditures remain much more stable over this period. Our solution has been to break down the parametric specification into two models. This leads to the 2-stage model described in detail in what follows.

A Two-Stage Model for a Complete Demand System

The hallmark of the separability approach discussed earlier is that all demand equations are estimated jointly and simultaneously. As we discussed, this has obvious advantages from the point of view of internal consistency. The drawback that we have uncovered in this application is that, for a complete demand system, the functional form chosen is not flexible enough. To deal with this problem, we have chosen to model the separable structure in two distinct stages. At the first stage expenditures are allocated to nonfood, food away from home, and at-home food and beverages. At the second stage the at-home food and beverages expenditures are allocated to the 18 goods involved. The second stage is allocated consistent with the structure of utility tree B (Figure 31).

To keep the first-stage income allocation manageable, we wish to represent the second-stage prices by a single index. From Gorman (1959), it is known that this is possible if either of two conditions hold: the second stage subutility is homothetic or the second stage subutility has the structure of what has come to be known as the Generalized Gorman Polar Form (GGPF) type and the utility function is additive in the second stage subutility.[26] The first of these two possibilities is highly undesirable because it would entail that all food items have the same income elasticity. Hence, we will appeal to the second condition.

Specifically, we assume that the at-home food and beverages constitutes a strongly separable group from the remaining goods. In other terms, utility is written as:

$$U(q) = U_F(q_F) + U_N(q_{19}, q_{20}) \tag{48}$$

where $q_F \equiv [q_1, q_2, \ldots, q_{18}]$ is the vector of at-home food and beverages goods. Moreover, we assume that the subutility function $U_F(q_F)$ represents preferences of the GGPF type. Hence, the conditional demand of this set of goods can be modeled by ALIDS because the indirect utility function of this system can be expressed as that of a GGPF type (Lewbel, 1987). Specifically, these 18 goods are represented as:

[26] A utility function is said to be of the GGPF type if it can be written as $V(p,x) = F(x/\Gamma(p)) + \Lambda(p)$.

(49) $$\Delta w_{it}^{F} = \mu_i \Delta \log(T_t) + \sum_{j=1}^{n_F} \gamma_{ij} \Delta \log(p_{jt}) + \beta_i \Delta \log\left(\frac{x_{Ft}}{P_{Ft}^{*}}\right) + e_{it}$$

where x_F is the at-home food and beverages expenditure, $w_{it}^F \equiv p_i q_i / x_F$ are shares of at-home food and beverages expenditure, and

(50) $$\log(P_{Ft}^{*}) = \sum_{i=1}^{18} w_{it}^{F} \log(p_{it})$$

is the Stone index for food and beverages at home. The cost function $C_F(p_F, U_F)$ underlying this ALIDS model has the PIGLOG structure:

(51) $$\log(C_F) = \log\left[A(p_F)\right] + U_F B(p_F)$$

where p_F is the vector of the at-home food and beverages prices, $\log[A(p_F)]$ is a translog price index and $B(p_F)$ is a Cobb-Douglas price index. Inverting this cost function, the indirect utility function dual to this structure can be represented, upon defining $u_F = \log(U_F)$, as:

(52) $$u_F = \log\left[\log\left(\frac{x_F}{A(p_F)}\right)\right] - \log(B(p_F))$$

which is the indirect utility function of a GGPF structure.

Letting $x_{19} \equiv p_{19}q_{19}$ and $x_{20} \equiv p_{20}q_{20}$ represent the expenditures on food away from home and nonfood expenditures, respectively, then the utility structure (48) can be represented in terms of what Blackorby, Primont, and Russell (1978, chapter 5) call the conditional indirect utility function, that is:

$$\tilde{U}\left(A(p_F), B(p_F), p_{19}, p_{20}, x_F, x_{19}, x_{20}\right) = U_N\left(\frac{x_{19}}{p_{19}}, \frac{x_{20}}{p_{20}}\right) + \log\left[\log\left(\frac{x_F}{A(p_F)}\right)\right] - \log(B(p_F))$$

(53)

Hence, our first stage income allocation can be represented as:

$$\text{(54)} \qquad \underset{x_F, x_{19}, x_{20}}{Max} \; \tilde{U}\left(A(p_F), B(p_F), p_{19}, p_{20}, x_F, x_{19}, x_{20}\right) \quad s.t. \quad x_F + x_{19} + x_{20} \leq x$$

From (54) it is clear that the price index $B(p_F)$ will drop out of the first order conditions, so that the first stage income allocations will depend only on three prices: the index $A(p_F)$, p_{19} and p_{20}. Because $\log[A(p_F)]$ is approximated by $\log(P_F^*)$ (the second-stage Stone price index), the first stage income allocation can be represented by a 3-good ALIDS model as follows:

$$\text{(55)} \qquad \Delta w_{st} = \mu_s \Delta \log(T_t) + \sum_{r=1}^{3} \phi_{sr} \Delta \log(p_{rt}) + \psi_s \log\left(\frac{x_t}{P_t^*}\right) + e_{st}$$

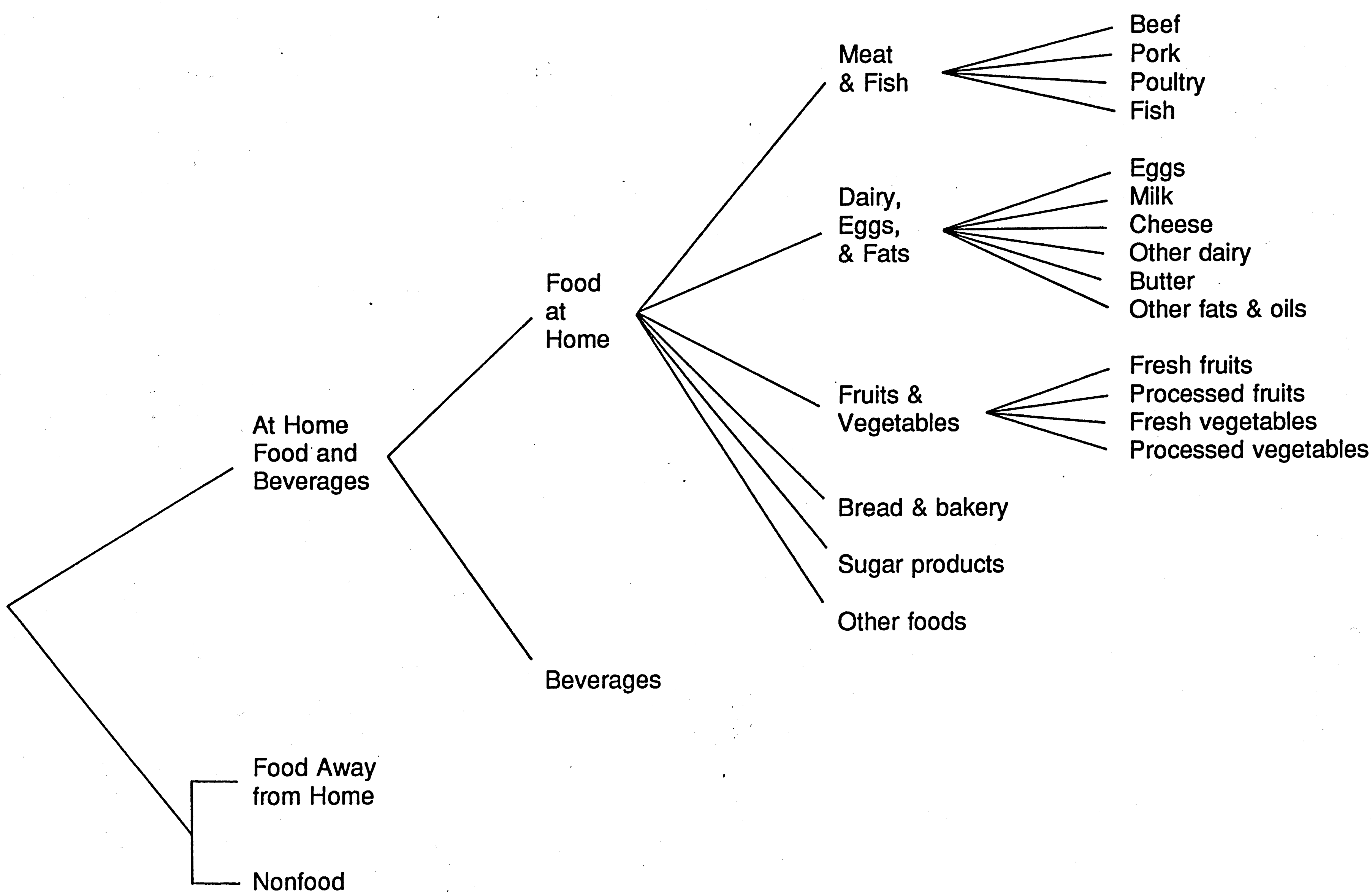
where $s=\{F,19,20\}$, $w_s \equiv x_s/x$, and $\log(p_r)$ is the second-stage Stone price index for $r=F$.

The parameters of the second-stage model were restricted to maintain the separable structure of tree B, at least for the at-home foods and beverages branch. To be consistent with the additional requirement of strong separability of equation (48), we modify the utility tree B as indicated in Figure 33. This modified tree, labeled B^*, corresponds to the following utility function:

$$U(q) = U_F\left[f\left(m(q_1,\ldots,q_4), d(q_5,\ldots,q_{10}), f(q_{11},\ldots,q_{14}), q_{15}, q_{16}, q_{17}\right), q_{18}\right] + U_N\left(q_{19}, q_{20}\right)$$
(56)

Hence, the main difference between tree B and tree B^* is that the latter has the additional assumption of strong separability between the first 18 goods and the last 2 goods (although it does not restrict the substitution between the last two goods).

Figure 33. Expenditure Allocation, Separable Tree B*



Estimation Results

The estimation results for the two-stage demand system are reported in Table 4 for the second stage, and in Table 5 for the first stage. The models estimated are those of equations (49) for the second stage, and equation (55) for the first stage. Homogeneity and symmetry are maintained for both stages. In addition, the first stage maintains the separability restrictions of tree B^* at the mean point. These model are estimated with the data described earlier, covering the period 1962-1988. Only the parameters actually estimated are reported in Tables 4 and 5; the omitted ones can be retrieved by the restrictions of homogeneity, adding-up, symmetry, and separability. A total of 84 parameters are estimated (77 parameters for the second-stage model and of 7 parameters for the first stage) with 19 equations (17 equations in the second stage, and 2 equation in the first stage).[27]

Validation

To gain insight into the statistical properties of the models estimated, we first look at the goodness of fit of the estimated equations. The measure of fit is an R^2 calculated independently for each equation as one minus the ratio of the residual variance over the variance of the left-hand-side (LHS). These measures of fit are reported in the first column of Table 6. These R^2s are reasonable, ranging from a high of 0.87 (for the sugar preparation equations) to a low of 0.04 (for the fresh fruit equation) . It should be kept in mind, however, that here we are measuring fit of changes in shares (the actual LHS used). Whereas

[27] The total number of parameters is one more than that indicated in table 3 for trees B and B^*. This is due to the fact that our first-stage ALIDS is unrestricted (it neglects that food away from home and nonfood are separable from at-home food and beverages, which would yield one additional restriction).

Table 4. Estimated Parameters of Second-Stage Income Allocation

Parameter	Estimate	Standard Error	t-ratio
$\gamma_{1,5}$	-0.00093	0.00126	-0.742
β_1	-0.00959	0.04062	-0.236
β_{10}	-0.02425	0.00785	-3.091
β_5	-0.00658	0.01011	-0.651
β_9	-0.01066	0.01069	-0.997
β_8	-0.02150	0.01289	-1.668
β_7	-0.02398	0.01454	-1.650
β_6	-0.03264	0.01591	-2.052
$\gamma_{1,11}$	-0.00587	0.00089	-6.583
β_{14}	0.00719	0.01837	0.392
β_{11}	0.02487	0.02526	0.985
β_{13}	0.14651	0.04449	3.293
β_{12}	-0.02433	0.01235	-1.970
$\gamma_{1,2}$	0.01179	0.00437	2.698
$\gamma_{1,3}$	0.00235	0.00410	0.574
$\gamma_{1,4}$	0.00069	0.00456	0.151
$\gamma_{1,15}$	-0.01550	0.00233	-6.641
$\gamma_{1,16}$	-0.00700	0.00183	-3.832
$\gamma_{1,17}$	-0.01459	0.00287	-5.091
$\gamma_{1,18}$	-0.00538	0.00076	-7.076
μ_1	0.00670	0.00396	1.694
β_2	-0.00018	0.02910	-0.006
β_{17}	-0.04006	0.03549	-1.129
β_{16}	-0.01668	0.02492	-0.669
β_{15}	-0.01505	0.02934	-0.513
$\gamma_{2,3}$	0.00517	0.00395	1.308
$\gamma_{2,4}$	-0.00109	0.00398	-0.274
μ_2	-0.00140	0.00281	-0.499
β_3	0.02149	0.02514	0.855
$C_{3,4}$	0.00160	0.00486	0.329
μ_3	0.00038	0.00205	0.186
β_4	0.02160	0.02828	0.764
μ_4	0.00088	0.00222	0.396
$\gamma_{5,11}$	-0.00111	0.00036	-3.127
$\gamma_{5,6}$	-0.00382	0.00218	-1.756
$\gamma_{5,7}$	0.00207	0.00253	0.820
$\gamma_{5,8}$	-0.00036	0.00195	-0.183
$\gamma_{5,9}$	0.00089	0.00190	0.471

(continue)

Table 4. continued

Parameter	Estimate	Standard Error	t-ratio
$\gamma_{5,10}$	-0.00046	0.00137	-0.332
$\gamma_{5,15}$	-0.00115	0.00154	-0.748
$\gamma_{5,16}$	-0.00123	0.00095	-1.297
$\gamma_{5,17}$	-0.00076	0.00181	-0.419
μ_{5}	-0.00295	0.00157	-1.885
$\gamma_{6,7}$	-0.01044	0.00644	-1.620
$\gamma_{6,8}$	0.00376	0.00547	0.688
$\gamma_{6,9}$	0.00632	0.00733	0.863
$\gamma_{6,10}$	0.00193	0.00224	0.861
μ_{6}	-0.00191	0.00180	-1.062
$\gamma_{7,8}$	0.01265	0.00530	2.388
$\gamma_{7,9}$	-0.00461	0.00635	-0.726
$\gamma_{7,10}$	0.00298	0.00263	1.132
μ_{7}	0.00202	0.00209	0.966
$\gamma_{8,9}$	0.00899	0.00494	1.819
$\gamma_{8,10}$	0.00010	0.00202	0.048
μ_{8}	0.00098	0.00158	0.616
$\gamma_{9,10}$	-0.00128	0.00206	-0.620
μ_{9}	-0.00310	0.00187	-1.653
μ_{10}	-0.00013	0.00110	-0.122
$\gamma_{11,12}$	0.00527	0.00263	2.006
$\gamma_{11,13}$	-0.00115	0.00503	-0.228
$\gamma_{11,14}$	0.00442	0.00358	1.234
$\gamma_{11,15}$	-0.00020	0.00245	-0.081
$\gamma_{11,16}$	-0.00153	0.00123	-1.251
$\gamma_{11,17}$	-0.00559	0.00193	-2.892
μ_{11}	-0.00283	0.00224	-1.264
$\gamma_{12,13}$	-0.00479	0.00243	-1.973
$\gamma_{12,14}$	-0.00042	0.00407	-0.104
μ_{12}	0.00023	0.00101	0.227
$\gamma_{13,14}$	-0.00197	0.00345	-0.570
μ_{13}	-0.00846	0.00358	-2.365
μ_{14}	0.00196	0.00147	1.334
$\gamma_{15,16}$	-0.00538	0.00633	-0.850
$\gamma_{15,17}$	-0.01116	0.00858	-1.300
μ_{15}	-0.00552	0.00212	-2.608
$\gamma_{16,17}$	-0.01177	0.00546	-2.156
μ_{16}	0.00321	0.00186	1.722
μ_{17}	0.00755	0.00269	2.812

Note: Minimized Distance Function: $TD(\hat{\theta},S) = 448.210$

Table 5. Estimated Parameters of First-Stage Income Allocation

Parameter	Estimate	Standard Error	t-ratio
μ_{20}	0.00075	0.00264	0.285
$\phi_{19,20}$	-0.02169	0.00731	-2.966
$\phi_{F,20}$	-0.09351	0.01060	-8.824
ψ_{20}	0.10187	0.01593	6.394
μ_{19}	0.00000	0.00114	-0.003
$\phi_{F,19}$	0.00116	0.00553	0.211
ψ_{19}	0.00245	0.00736	0.333

Note: Minimized Distance Function: $TD(\hat{\theta},S) = 53.5393$

Table 6. Goodness-of-fit for individual equations
rsq = 1 - var(error)/var(lhs)

	first difference model			model in levels	
	----- LHS expressed as -----			LHS expressed as	
Eqn	Δw	w	q	w	q
BF	0.78	0.93	0.92	0.68	0.57
PK	0.74	0.91	0.83	0.86	0.77
CK	0.50	0.22	0.91	0.10	0.89
FI	0.11	0.51	0.73	0.20	0.59
EG	0.47	0.94	0.73	0.96	0.82
MK	0.71	0.95	0.96	0.90	0.92
CH	0.19	0.98	0.98	0.95	0.92
OD	0.40	0.62	0.91	0.63	0.92
BT	0.14	0.99	0.98	0.99	0.98
FO	0.68	0.87	0.92	0.53	0.74
FF	0.04	0.23	0.73	0.50	0.83
PF	0.67	0.92	0.95	0.76	0.84
FV	0.46	0.37	0.77	0.00	0.59
PV	0.41	0.57	0.86	0.63	0.88
BB	0.68	0.96	0.97	0.95	0.97
SP	0.87	0.85	0.83	0.87	0.86
OF	0.78	0.99	0.99	0.95	0.96
BE	0.56	0.87	0.87	0.66	0.64
NF	0.69	0.99	1.00	0.98	1.00
FA	0.38	0.95	1.00	0.91	1.00
FH	0.76	0.99	1.00	0.99	1.00

that may be a useful indicator, it is not directly comparable to the R^2 of most models which are estimated in levels. To make comparison easier, we have computed the fitted values for share levels, $\hat{w}_{it} = \Delta\hat{w}_{it} + w_{it-1}$, and for quantity levels, $\hat{q}_{it} = \hat{w}_{it}x_t/p_{it}$. As the first part of Table 6 shows, the R^2 calculated with respect to these normalizations of the LHS used, given estimates from the first difference model, look much better (for example, the R^2 of the fresh fruits equation improves from 0.04 to 0.73).

To provide some indirect evidence about the desirability of using the first-difference version of ALIDS in our model, we have estimated the ALIDS model in levels, and the last two columns of Table 6 report the R^2 associated with each equation (the first one with respect to the shares that one gets directly from estimation, the last one with respect to quantity levels generated as described above). Comparison between R^2s from first difference model and from the model in levels shows that the first difference model generally provides an improved fit. Given that taking first differences affects the error terms directly, perhaps a more meaningful comparison between the two models is reported in Table 7 which contains the Durbin-Watson statistic for each equation of both models (computed independently for each equation given the estimated residuals). These statistics suggest that the serial correlation is much more of a problem for the model in levels, and that taking first-differences may be an efficient (albeit admittedly crude) way of ensuring desirable properties for the error terms.

Further validation statistics are reported in Tables 8 and 9, which report Root Mean Square Errors (RMSE) of predictions, together with Theil's (1966) U_1 statistics. If $\hat{Z}$ is a predictor of a variable Z, from a sample of N such predictions the RMSE is computed as:

Table 7. Durbin-Watson statistics for individual equations

Eqn	first difference model	model in levels
BF	1.34	0.23
PK	1.95	1.45
CK	2.12	1.56
FI	1.02	1.25
EG	2.57	1.85
MK	1.29	1.29
CH	1.44	0.75
OD	2.23	1.10
BT	0.38	1.60
FO	1.28	0.36
FF	2.06	1.48
PF	1.07	1.47
FV	1.72	1.12
PV	2.60	1.94
BB	2.19	0.95
SP	1.25	1.63
OF	0.96	0.58
BE	1.56	0.79
NF	1.77	0.66
FA	1.81	0.77
FH	1.50	0.54

Table 8. In-sample Validation Statistics

	LHS expressed as					
	share differences		shares		quantities	
	RMSE	U_1	RMSE	U_1	RMSE	U_1
BF	0.00378	0.47931	0.00378	0.02793	4.50740	0.02798
PK	0.00257	0.50309	0.00257	0.03302	3.07470	0.03370
CK	0.00170	0.71102	0.00170	0.04054	1.87592	0.03785
FI	0.00192	0.91270	0.00192	0.08098	2.85110	0.07717
EG	0.00143	0.68057	0.00143	0.06814	1.48137	0.06993
MK	0.00125	0.54424	0.00125	0.02027	1.76632	0.01986
CH	0.00172	0.84236	0.00172	0.04565	2.50120	0.04634
OD	0.00122	0.77949	0.00122	0.03026	1.91922	0.03076
BT	0.00118	0.80438	0.00118	0.05155	1.60664	0.05376
FO	0.00094	0.56521	0.00094	0.05789	0.97375	0.05767
FF	0.00170	0.98534	0.00170	0.03891	2.40919	0.04015
PF	0.00082	0.60747	0.00082	0.02358	1.05035	0.02407
FV	0.00341	0.73150	0.00341	0.06706	4.32695	0.06484
PV	0.00118	0.75366	0.00118	0.03852	1.49835	0.03876
BB	0.00173	0.58376	0.00173	0.01407	2.66259	0.01433
SP	0.00156	0.36439	0.00156	0.02607	2.15601	0.02617
OF	0.00229	0.48511	0.00229	0.01656	3.22284	0.01653
BE	0.00178	0.64872	0.00178	0.03623	2.64035	0.03584
NF	0.00205	0.46667	0.00205	0.00254	12.67505	0.00230
FA	0.00088	0.75904	0.00088	0.01924	6.31101	0.02010
FH	0.00158	0.37388	0.00158	0.01072	8.71465	0.01041

Table 9. Out-of-sample Validation Statistics

	LHS expressed as					
	share differences		shares		quantities	
	RMSE	U_1	RMSE	U_1	RMSE	U_1
BF	0.00420	0.70484	0.00420	0.03857	5.87450	0.03910
PK	0.00312	0.54114	0.00312	0.04726	4.66121	0.05006
CK	0.00128	1.73726	0.00128	0.03052	1.82844	0.03002
FI	0.00490	1.07949	0.00490	0.16955	6.97947	0.17277
EG	0.00039	0.53338	0.00039	0.03217	0.54772	0.03156
MK	0.00169	0.77826	0.00169	0.03128	2.36340	0.03154
CH	0.00172	1.04225	0.00172	0.03312	2.43247	0.03343
OD	0.00172	1.11394	0.00172	0.04168	2.44644	0.04225
BT	0.00042	0.82454	0.00042	0.03386	0.57999	0.03364
FO	0.00104	0.40731	0.00104	0.07965	1.43402	0.07759
FF	0.00225	1.84551	0.00225	0.04902	3.17205	0.04815
PF	0.00155	1.05475	0.00155	0.04075	2.12181	0.04094
FV	0.00406	1.11461	0.00406	0.07962	5.61184	0.07996
PV	0.00153	0.66960	0.00153	0.04762	2.11401	0.04759
BB	0.00065	0.28062	0.00065	0.00539	0.89329	0.00535
SP	0.00323	1.31804	0.00323	0.05362	4.57768	0.05455
OF	0.00104	0.37705	0.00104	0.00629	1.46263	0.00624
BE	0.00115	1.05046	0.00115	0.02022	1.61454	0.01999
NF	0.00193	0.98344	0.00193	0.00230	24.71759	0.00233
FA	0.00075	0.83491	0.00075	0.01617	9.94767	0.01686
FH	0.00134	0.49428	0.00134	0.01165	16.79075	0.01162

Note: Estimation period: 1962-1985; prediction period: 1986-1988.

$$RMSE = \left[\frac{1}{N}\sum_{i=1}^{N}\left(Z_i - \hat{Z}_i\right)^2\right]^{1/2} \tag{57}$$

whereas Theil's U_1 statistics is defined as:

$$U_1 = \frac{RMSE}{\left[\frac{1}{N}\sum_{i=1}^{N} Z_i^2\right]^{1/2}} \tag{58}$$

Hence, the U_1 statistic expresses the RMSE as a fraction of the quadratic mean of the variable to be predicted. This normalizes the unit-of-measurement dependency of RMSE by dividing it by the quadratic mean of the variable to be predicted, such that U_1 can be interpreted (somewhat loosely speaking) in percent terms.

Table 8 reports RMSE and U_1 statistics computed based on in-sample predictions of the estimated first-difference ALIDS models, again expressing the LHS and the predictions not only as share differences Δw_i, but also as shares w_i and quantities q_i. When the LHS is expressed in terms of shares or quantities, the U_1 statistics look fairly good, averaging 0.04 for the second-stage equations, and 0.01 for the first-stage equations.

These in-sample results can serve as a benchmark for the validation statistics computed for out-of-sample predictions and reported in Table 9. For these statistics, we have estimated the first-difference ALIDS models for both stages over the sample period 1962-1985, and have then used the estimated results to compute out-of-sample predictions for the three year period 1986-88. The out-of-sample predictive power of the model is only slightly worse than in-sample. In particular, when the LHS is expressed as shares or quantities the U_1 statistics averages 0.047 for the second-stage equations, and 0.01 for the first-stage equations.

Monotonicity and Concavity

Another way of considering the issue of validation is to check whether the estimated model satisfies the theoretical properties of demand systems. Homogeneity and symmetry were maintained at the estimation stage, but concavity of the Slutsky matrix and monotonicity were not. These last two properties involve inequality restrictions, and are much harder to maintain or test in econometric models. Because of the very large size of the system at hand, none of the methods to maintain concavity that we considered proved feasible.[28] It is therefore of some interest to verify whether the properties of concavity and monotonicity are satisfied by the estimated models.

It turns out that monotonicity was satisfied by the estimated model at all sample points, whereas concavity is satisfied at the mean point but not everywhere. To check concavity, Table 10 reports the eigenvalues of the Slutsky matrix Γ [whose typical elements are defined following equation (18)] for the food demand system. When evaluated at the sample mean points, the matrix is concave, with all the eigenvalues being negative (one is zero because of the homogeneity condition). Clearly, this condition cannot hold globally for ALIDS, and in fact, when evaluated at the mean of the first three years of the sample we find one violation, whereas when evaluated at the mean of the last three years we find three violations. In light of the size of the demand system being estimated, these results must be considered quite satisfactory.

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[28] We considered both the Cholesky decomposition method originally suggested by Lau (1978), and the 'Bayesian' approach of Chalfant, Gray, and White (1991). With our ALIDS functional form, the first method can impose concavity at a point, whereas the second method in principle can impose concavity at all sample points. However, we encountered severe convergence problems with both methods, and did not pursue these attempts any further.

Table 10. Eigenvalues of the Slutsky Matrix of Food-at-Home Demand System

	--------- evaluated at the mean of ---------		
	1962-64	1962-88	1986-88
1	-0.064759	-0.069287	-0.052439
2	-0.060644	-0.051848	-0.054937
3	-0.052890	-0.050693	-0.055518
4	-0.040143	-0.037598	-0.044629
5	-0.034758	-0.031555	-0.034017
6	0.006480	-0.026445	-0.026775
7	-0.023543	-0.024570	-0.023502
8	-0.024621	-0.018299	-0.017523
9	-0.017379	-0.013678	-0.016552
10	-0.018073	-0.007574	-0.011335
11	-0.013080	-0.011309	-0.017140
12	-0.009343	-0.011553	-0.008085
13	-0.007627	-0.009271	-0.006167
14	-0.001248	-0.003470	-0.003330
15	-0.002284	-0.002510	0.001952
16	-0.003670	-0.001058	0.000953
17	-0.005133	-0.000236	0.000424
18	0.000000	0.000000	0.000000

Trend Effects

The term $\mu_i \Delta\log(t)$ was included in the first difference ALIDS model to allow for possible systematic demand drift not due to changes in relative prices and income. A possible rationalization of such an effect postulates changes in consumers' preferences, although clearly this term could pick up misspecification effects correlated with trend. To see whether these trend effects are statistically significant in the estimated models, Table 11 reports the QLR test of the null hypotheses H_0 $\mu_i = 0$ $(\forall i)$ and H_0 $\mu_s = 0$ $(\forall s)$. Clearly, there is no indication of trend effects in the first-stage equations, whereas the null hypothesis of no trend effects is rejected for the second-stage model.

To get a more direct indication of what these estimated μ coefficients mean, we calculated the rates of changes of individual shares implied by these coefficients. The rate of change τ_i for the i^{th} share is defined as $\tau_i = \partial\log(w_i)/\partial t$, and therefore can be interpreted as the relative (percent) change in the share of good i associated with a unit (one year) change in t, other things equal. These statistics, computed as $\hat{\tau}_i = \hat{\mu}_i/(t\hat{w}_i)$, with t and $\hat{w}_i$ evaluated at the sample mean, are reported in Table 12. These estimated rates of changes are rather small, with the largest ones associated with eggs, butter, and fresh vegetables, all of which post an average decline in food share of 1 % per year. A significant increase seems to be associated with the consumption of other foods, which show an average increase of 0.4 % per year.

Elasticities

The economic implications of the estimated demand models are best expressed in terms of elasticities. Consider first the second-stage demand system. For this system, the formulae of elasticities for the linear ALIDS reported in

Table 11. Tests of Preference Change (autonomous trend)

model	QLR	d.o.f.	critical values 0.05	0.01
First stage	0.15	2	5.99	9.21
Second stage	36.94	17	27.59	33.41

Table 12. Annual Rates of Change from Trend (at the sample mean)

Equation	Estimate	Standard Error	t-statistic
BF	.0033	.0020	1.694
PK	-.0012	.0024	-.499
CK	.0006	.0033	.185
FI	.0025	.0063	.395
EG	-.0097	.0052	-1.884
MK	-.0021	.0020	-1.062
CH	.0037	.0039	.966
OD	.0016	.0026	.615
BT	-.0098	.0060	-1.653
FO	-.0006	.0045	-.122
FF	-.0043	.0034	-1.264
PF	.0004	.0019	.227
FV	-.0111	.0047	-2.364
PV	.0042	.0032	1.333
BB	-.0030	.0011	-2.607
SP	.0036	.0021	1.721
OF	.0037	.0013	2.811
BE	.0033	.0028	1.167
NF	.0000	.0002	.285
FA	-.0000	.0016	-.003
FH	-.0003	.0009	-.367

equations (12) and (15)-(17) apply directly upon substituting w_i^F for w_i and x_F for x. Let a superscripted 'c' denote the fact that these second-stage elasticities are conditional on the income allocation x_F. Then these conditional elasticities can be written as:

$$\epsilon_i^c = \frac{\beta_i}{w_i^F} + 1 \tag{59}$$

$$\epsilon_{ij}^c = \frac{\gamma_{ij}}{w_i^F} - \beta_i \frac{w_j^F}{w_i^F} - \delta_{ij} \tag{60}$$

$$\eta_{ij}^c = \frac{\gamma_{ij}}{w_i^F} + w_j^F - \delta_{ij} \tag{61}$$

$$\sigma_{ij}^c = \frac{\gamma_{ij}}{w_i^F w_j^F} + 1 - \frac{\delta_{ij}}{w_j^F} \tag{62}$$

where $(i,j) = (1,2,\ldots,18)$ are the goods modeled in the second-stage model.

Table 13 reports Marshallian elasticities, evaluated at the sample mean point. Virtually all of these food items are (conditionally) inelastic with respect to own price. Elasticities with respect to food expenditure show that all goods are normal, with the exception of fats and oils. Meat products seem somewhat more expenditure-elastic than dairy products, bread and bakery, sugar, and other foods. within the fruits and vegetable group there is a clear difference between fresh and processed products, with fresh fruits being clearly much more expenditure-elastic than processed fruits, and fresh vegetables being more expenditure-elastic than processed vegetables.

Cross elasticities are fairly small in absolute value; although the negative sign of many of them suggest complementarity relations, it should be borne in mind that these are gross relationships. When one looks at compensated relations, such as those reported in Table 14 (Hicksian conditional elasticities)

Table 13. Conditional Marshallian Elasticities for Food at Home at the Sample Mean (1962-88)

	prices																		
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	X_F
BF	-0.50	0.09	0.02	0.01	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	-0.04	-0.03	-0.05	-0.03	-0.11	-0.05	-0.10	-0.04	0.93
PK	0.15	-0.62	0.07	-0.01	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	-0.04	-0.03	-0.05	-0.03	-0.11	-0.05	-0.11	-0.04	1.00
CK	-0.01	0.08	-0.72	0.03	-0.01	-0.05	-0.04	-0.03	-0.02	-0.04	-0.07	-0.05	-0.08	-0.05	-0.17	-0.08	-0.16	-0.06	1.51
FI	-0.09	-0.12	0.03	-0.61	-0.01	-0.06	-0.04	-0.04	-0.02	-0.05	-0.08	-0.07	-0.10	-0.06	-0.22	-0.10	-0.20	-0.08	1.92
EG	0.00	0.00	0.02	0.02	-0.45	-0.17	0.11	0.00	0.05	-0.02	-0.04	-0.03	-0.07	-0.03	-0.02	-0.04	0.01	-0.03	0.68
MK	0.00	0.00	0.01	0.01	-0.05	-0.36	-0.15	0.08	0.11	0.04	-0.03	-0.02	-0.05	-0.02	-0.01	-0.03	0.00	-0.02	0.47
CH	0.00	0.00	0.01	0.01	0.07	-0.25	-0.41	0.38	-0.11	0.09	-0.02	-0.01	-0.03	-0.01	-0.01	-0.02	0.00	-0.01	0.33
OD	0.00	0.00	0.01	0.01	0.00	0.13	0.33	-1.03	0.23	0.01	-0.03	-0.02	-0.05	-0.02	-0.01	-0.03	0.00	-0.02	0.47
BT	0.00	0.00	0.01	0.01	0.05	0.33	-0.20	0.45	-0.92	-0.05	-0.03	-0.02	-0.05	-0.02	-0.01	-0.03	0.01	-0.02	0.49
FO	0.00	0.00	-0.01	-0.01	0.00	0.21	0.24	0.07	-0.05	-0.12	0.03	0.02	0.05	0.02	0.01	0.03	-0.01	0.02	-0.51
FF	-0.21	-0.12	-0.07	-0.04	-0.04	-0.11	-0.06	-0.07	-0.04	-0.02	-0.52	0.10	-0.06	0.08	-0.07	-0.07	-0.21	-0.06	1.57
PF	-0.04	-0.02	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	0.00	0.18	-0.16	-0.10	0.01	-0.01	-0.01	-0.04	-0.01	0.30
FV	-0.52	-0.30	-0.16	-0.09	-0.09	-0.27	-0.15	-0.17	-0.09	-0.05	-0.15	-0.19	-0.49	-0.13	-0.18	-0.17	-0.51	-0.15	3.89
PV	-0.17	-0.10	-0.05	-0.03	-0.03	-0.08	-0.05	-0.06	-0.03	-0.02	0.13	-0.02	-0.08	-0.34	-0.06	-0.05	-0.16	-0.05	1.23
BB	-0.11	-0.06	-0.03	-0.02	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	0.00	-0.02	0.08	0.00	-0.45	-0.04	-0.07	-0.03	0.88
SP	-0.08	-0.05	-0.02	-0.01	-0.02	-0.05	-0.03	-0.03	-0.02	-0.01	-0.01	-0.02	0.01	-0.01	-0.06	-0.14	-0.16	-0.03	0.72
OF	-0.07	-0.04	-0.02	-0.01	0.00	-0.01	-0.01	-0.01	0.00	-0.02	-0.03	-0.02	-0.03	-0.02	-0.05	-0.07	-0.28	-0.03	0.71
BE	-0.12	-0.07	-0.03	-0.02	-0.02	-0.06	-0.04	-0.04	-0.02	-0.02	-0.03	-0.04	-0.02	-0.03	-0.11	-0.06	-0.13	-0.24	1.08
share	0.135	0.077	0.042	0.024	0.020	0.061	0.036	0.040	0.021	0.016	0.044	0.035	0.051	0.031	0.123	0.060	0.137	0.049	

or Table 15 (Allen-Uzawa elasticities of substitution), it is clear that most goods are net substitutes for each other. The compensated cross-elasticities are small in absolute value, especially those between goods that belong to different separable groups. While there is little evidence to suggest that one would expect otherwise, this effects may also be accentuated by the separability restrictions implemented, a point also brought out by the Allen-Uzawa elasticities of substitution in Table 15.

Although it is common to use Allen-Uzawa elasticities to analyze the 'net' substitutability between goods, such procedure has come under much criticism because these elasticities are a poor measure the ease of substitution when more than two goods are involved. This point is emphasized by Blackorby and Russell (1989), who proposed the used of the Morishima elasticity of substitution which they define as $M^*_{ij} \equiv \eta_{ji} - \eta_{ii}$. Essentially, this elasticity measures the percentage change in the consumption ratio h_i/h_j due to a one percent change in the corresponding ratio p_i/p_j (with the ratio changing because p_i changes, such that all other price ratios do not change). Hence, the Morishima elasticity of substitution is a very natural measure of substitutability because, by focusing on price and quantity ratios, it reflects the curvature of indifference curves.

An alternative formulation, used for instance by Ball and Chambers (1982), defines the Morishima elasticity of substitution as:

$$M_{ij} = \eta_{ij} - \eta_{jj} \tag{63}$$

which is perhaps more natural because it measures the percent change in h_i/h_j associated to one percent change in p_i/p_j due to p_j changing.[29] These Morishima

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[29] The two versions of Morishima elasticities are obviously very similar; in fact, the matrix of elasticities $[M^*_{ij}]$ is just the transpose of the matrix of elasticities $[M_{ij}]$.

Table 14. Conditional Hicksian Elasticities for Food at Home at the Sample Mean (1962-88)

	prices																	
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE
BF	-0.38	0.16	0.06	0.03	0.01	0.03	0.01	0.02	0.01	-0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.01
PK	0.29	-0.54	0.11	0.01	0.01	0.03	0.01	0.02	0.01	-0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.01
CK	0.19	0.20	-0.66	0.06	0.02	0.05	0.02	0.03	0.02	-0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.05	0.01
FI	0.16	0.03	0.11	-0.56	0.03	0.06	0.02	0.04	0.02	-0.02	0.00	0.00	0.00	0.00	0.02	0.02	0.06	0.02
EG	0.09	0.05	0.04	0.03	-0.43	-0.13	0.14	0.02	0.07	-0.01	-0.01	0.00	-0.03	-0.01	0.07	0.00	0.10	0.01
MK	0.06	0.04	0.03	0.02	-0.04	-0.33	-0.13	0.10	0.12	0.05	-0.01	0.00	-0.02	0.00	0.05	0.00	0.07	0.00
CH	0.04	0.03	0.02	0.02	0.08	-0.23	-0.40	0.39	-0.11	0.10	-0.01	0.00	-0.02	0.00	0.03	0.00	0.05	0.00
OD	0.06	0.04	0.03	0.02	0.01	0.15	0.35	-1.01	0.24	0.02	-0.01	0.00	-0.02	0.00	0.05	0.00	0.07	0.00
BT	0.06	0.04	0.03	0.02	0.06	0.36	-0.18	0.47	-0.91	-0.04	-0.01	0.00	-0.02	0.00	0.05	0.00	0.07	0.00
FO	-0.07	-0.04	-0.03	-0.02	-0.01	0.18	0.22	0.05	-0.06	-0.13	0.01	0.00	0.02	0.00	-0.05	0.00	-0.07	0.00
FF	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	-0.01	0.00	0.00	-0.45	0.16	0.02	0.13	0.12	0.02	0.01	0.02
PF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	-0.15	-0.09	0.02	0.02	0.00	0.00	0.00
FV	0.00	0.00	0.00	0.00	-0.01	-0.03	-0.01	-0.02	-0.01	0.01	0.02	-0.06	-0.30	-0.01	0.29	0.06	0.02	0.04
PV	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.19	0.02	-0.01	-0.30	0.09	0.02	0.01	0.01
BB	0.01	0.01	0.00	0.00	0.01	0.02	0.01	0.01	0.01	-0.01	0.04	0.01	0.12	0.02	-0.34	0.02	0.05	0.01
SP	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.05	0.01	0.03	-0.10	-0.06	0.01
OF	0.03	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01	-0.01	0.00	0.00	0.01	0.00	0.04	-0.03	-0.19	0.01
BE	0.02	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.04	0.01	0.02	0.01	0.02	-0.19
share	0.135	0.077	0.042	0.024	0.020	0.061	0.036	0.040	0.021	0.016	0.044	0.035	0.051	0.031	0.123	0.060	0.137	0.049

Table 15. Conditional Allen-Uzawa Elasticities of Substitution for Food at Home at the Sample Mean (1962-88)

	prices																	
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE
BF	-2.82	2.13	1.42	1.22	0.66	0.46	0.32	0.45	0.48	-0.49	0.00	0.00	0.00	0.00	0.06	0.13	0.21	0.18
PK	2.13	-6.99	2.60	0.40	0.71	0.49	0.35	0.49	0.52	-0.53	0.00	0.00	0.00	0.00	0.07	0.14	0.22	0.20
CK	1.42	2.60	-15.73	2.62	1.07	0.74	0.53	0.74	0.78	-0.81	0.00	0.00	0.00	0.00	0.10	0.21	0.34	0.30
FI	1.22	0.40	2.62	-24.01	1.36	0.94	0.67	0.94	0.99	-1.02	0.00	0.00	0.00	0.00	0.13	0.26	0.43	0.38
EG	0.66	0.71	1.07	1.36	-21.30	-2.07	3.86	0.56	3.10	-0.40	-0.26	-0.05	-0.64	-0.20	0.54	-0.02	0.73	0.13
MK	0.46	0.49	0.74	0.94	-2.07	-5.41	-3.74	2.52	5.91	2.95	-0.18	-0.03	-0.44	-0.14	0.37	-0.02	0.50	0.09
CH	0.32	0.35	0.53	0.67	3.86	-3.74	-11.15	9.78	-5.13	6.17	-0.13	-0.02	-0.31	-0.10	0.26	-0.01	0.36	0.06
OD	0.45	0.49	0.74	0.94	0.56	2.52	9.78	-25.19	11.64	1.15	-0.18	-0.03	-0.44	-0.14	0.37	-0.02	0.50	0.09
BT	0.48	0.52	0.78	0.99	3.10	5.91	-5.13	11.64	-43.47	-2.79	-0.19	-0.04	-0.46	-0.15	0.39	-0.02	0.53	0.10
FO	-0.49	-0.53	-0.81	-1.02	-0.40	2.95	6.17	1.15	-2.79	-7.88	0.19	0.04	0.48	0.15	-0.40	0.02	-0.55	-0.10
FF	0.00	0.00	0.00	0.00	-0.26	-0.18	-0.13	-0.18	-0.19	0.19	-10.31	4.49	0.48	4.30	0.96	0.41	0.07	0.31
PF	0.00	0.00	0.00	0.00	-0.05	-0.03	-0.02	-0.03	-0.04	0.04	4.49	-4.42	-1.73	0.60	0.18	0.08	0.01	0.06
FV	0.00	0.00	0.00	0.00	-0.64	-0.44	-0.31	-0.44	-0.46	0.48	0.48	-1.73	-5.83	-0.27	2.39	1.02	0.16	0.76
PV	0.00	0.00	0.00	0.00	-0.20	-0.14	-0.10	-0.14	-0.15	0.15	4.30	0.60	-0.27	-9.88	0.76	0.32	0.05	0.24
BB	0.06	0.07	0.10	0.13	0.54	0.37	0.26	0.37	0.39	-0.40	0.96	0.18	2.39	0.76	-2.80	0.26	0.34	0.17
SP	0.13	0.14	0.21	0.26	-0.02	-0.02	-0.01	-0.02	-0.02	0.02	0.41	0.08	1.02	0.32	0.26	-1.69	-0.44	0.14
OF	0.21	0.22	0.34	0.43	0.73	0.50	0.36	0.50	0.53	-0.55	0.07	0.01	0.16	0.05	0.34	-0.44	-1.35	0.14
BE	0.18	0.20	0.30	0.38	0.13	0.09	0.06	0.09	0.10	-0.10	0.31	0.06	0.76	0.24	0.17	0.14	0.14	-3.80
share	0.135	0.077	0.042	0.024	0.020	0.061	0.036	0.040	0.021	0.016	0.044	0.035	0.051	0.031	0.123	0.060	0.137	0.049

elasticities, calculated from the conditional Hicksian elasticities, are reported in Table 16, and they are all positive. Hence, from this characterization of substitutability/complementarity in the many goods case, it appears that all the at-home food and beverages items are substitutes.

From an inspections of the elasticity formulae for the ALIDS model, it is apparent that they will change depending on the evaluation point (i.e., as the value of shares changes). It is therefore interesting to look at the elasticities implied by the estimated model at points other than the mean point. Specifically, we compute elasticities both at the mean of the first three years in the sample (1962-64), and at the mean of the last three years in the sample (1986-88). Marshallian elasticities for these two evaluation periods are reported in Tables 17 and 19, whereas Hicksian elasticities for the same periods are reported in Tables 18 and 20. It is apparent that the elasticities of goods whose share has changed considerably over the sample period are most affected. For example, a necessity good whose share has increased over the period (cheese) displays an increasing value of income elasticity, and an increasing absolute value of the own-price elasticity. The opposite holds true for a good which displays a decreasing trend in its share (e.g., eggs).

Such behavior of elasticity is clearly dictated by the functional form chosen. Although there is little ground to suspect that this may force the 'wrong' behavior on elasticities (indeed, the opposite argument can be made as far as the income elasticities of ALIDS are concerned), it is nevertheless important to recognize the constraints imposed by the functional form chosen. On the other hand, this restrictive feature is common to all flexible functional forms which, like ALIDS, can be considered a second-order approximation to the underlying preferences.

Table 16. Conditional Morishima Elasticities of Substitution for Food at Home at the Sample Mean (1962-88)

	prices																	
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE
BF	-	0.71	0.72	0.59	0.45	0.36	0.41	1.03	0.92	0.12	0.45	0.15	0.30	0.30	0.35	0.11	0.21	0.19
PK	0.67	-	0.77	0.57	0.45	0.36	0.41	1.03	0.92	0.12	0.45	0.15	0.30	0.30	0.35	0.11	0.22	0.20
CK	0.57	0.74	-	0.63	0.45	0.38	0.42	1.04	0.93	0.11	0.45	0.15	0.30	0.30	0.36	0.11	0.23	0.20
FI	0.54	0.57	0.77	-	0.46	0.39	0.42	1.05	0.93	0.11	0.45	0.15	0.30	0.30	0.36	0.12	0.24	0.20
EG	0.47	0.60	0.70	0.60	-	0.20	0.54	1.04	0.98	0.12	0.44	0.15	0.26	0.30	0.41	0.10	0.29	0.19
MK	0.44	0.58	0.69	0.59	0.39	-	0.27	1.12	1.04	0.17	0.44	0.15	0.27	0.30	0.39	0.10	0.25	0.19
CH	0.42	0.57	0.68	0.58	0.51	0.10	-	1.41	0.80	0.23	0.44	0.15	0.28	0.30	0.38	0.10	0.23	0.19
OD	0.44	0.58	0.69	0.59	0.44	0.49	0.75	-	1.16	0.15	0.44	0.15	0.27	0.30	0.39	0.10	0.25	0.19
BT	0.44	0.58	0.69	0.59	0.49	0.69	0.22	1.48	-	0.08	0.44	0.15	0.27	0.30	0.39	0.10	0.26	0.19
FO	0.31	0.50	0.62	0.54	0.42	0.51	0.62	1.06	0.85	-	0.46	0.15	0.32	0.31	0.29	0.10	0.11	0.18
FF	0.38	0.54	0.66	0.56	0.43	0.32	0.39	1.01	0.91	0.13	-	0.31	0.32	0.44	0.46	0.13	0.19	0.20
PF	0.38	0.54	0.66	0.56	0.43	0.33	0.40	1.01	0.91	0.13	0.65	-	0.21	0.32	0.37	0.11	0.19	0.19
FV	0.38	0.54	0.66	0.56	0.42	0.31	0.39	1.00	0.90	0.13	0.47	0.09	-	0.30	0.64	0.16	0.21	0.22
PV	0.38	0.54	0.66	0.56	0.43	0.32	0.40	1.01	0.91	0.13	0.64	0.17	0.28	-	0.44	0.12	0.19	0.20
BB	0.39	0.55	0.66	0.57	0.44	0.36	0.41	1.03	0.92	0.12	0.49	0.16	0.42	0.33	-	0.12	0.23	0.19
SP	0.40	0.55	0.67	0.57	0.43	0.33	0.40	1.01	0.91	0.13	0.47	0.16	0.35	0.31	0.38	-	0.13	0.19
OF	0.41	0.56	0.67	0.57	0.45	0.36	0.41	1.03	0.92	0.12	0.45	0.15	0.30	0.30	0.38	0.07	-	0.19
BE	0.40	0.56	0.67	0.57	0.43	0.34	0.40	1.02	0.91	0.13	0.46	0.15	0.33	0.31	0.36	0.11	0.20	-
share	0.135	0.077	0.042	0.024	0.020	0.061	0.036	0.040	0.021	0.016	0.044	0.035	0.051	0.031	0.123	0.060	0.137	0.049

Table 17. Conditional Marshallian Elasticities for Food at Home at the Mean of First Three Years (1962-64)

	prices																		
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	X_F
BF	-0.47	0.10	0.02	0.01	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	-0.04	-0.03	-0.05	-0.03	-0.11	-0.05	-0.11	-0.04	0.92
PK	0.15	-0.62	0.07	-0.01	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	-0.04	-0.03	-0.05	-0.03	-0.11	-0.05	-0.11	-0.04	1.00
CK	-0.01	0.09	-0.70	0.03	-0.01	-0.06	-0.03	-0.03	-0.02	-0.04	-0.07	-0.06	-0.08	-0.05	-0.19	-0.09	-0.16	-0.06	1.55
FI	-0.10	-0.13	0.04	-0.56	-0.02	-0.08	-0.04	-0.04	-0.04	-0.05	-0.09	-0.08	-0.11	-0.06	-0.26	-0.11	-0.21	-0.08	2.02
EG	0.00	0.00	0.01	0.01	-0.62	-0.11	0.08	0.00	0.04	-0.01	-0.03	-0.02	-0.05	-0.02	-0.01	-0.03	0.00	-0.02	0.78
MK	-0.01	0.00	0.01	0.01	-0.04	-0.44	-0.14	0.07	0.11	0.04	-0.02	-0.01	-0.04	-0.02	0.00	-0.02	0.00	-0.02	0.53
CH	-0.01	0.00	0.01	0.01	0.13	-0.40	-0.05	0.62	-0.17	0.16	-0.03	-0.02	-0.06	-0.02	0.00	-0.03	-0.01	-0.03	-0.09
OD	-0.01	0.00	0.01	0.01	0.01	0.13	0.32	-1.03	0.24	0.01	-0.03	-0.02	-0.05	-0.02	0.00	-0.03	0.00	-0.02	0.48
BT	0.00	0.00	0.01	0.01	0.03	0.20	-0.12	0.26	-0.95	-0.03	-0.02	-0.01	-0.03	-0.01	0.00	-0.02	0.00	-0.01	0.70
FO	-0.01	0.00	-0.02	-0.01	0.01	0.21	0.20	0.06	-0.02	-0.19	0.03	0.02	0.04	0.01	0.03	0.04	-0.03	0.01	-0.38
FF	-0.21	-0.12	-0.06	-0.04	-0.04	-0.11	-0.05	-0.07	-0.05	-0.02	-0.52	0.10	-0.05	0.09	-0.08	-0.07	-0.20	-0.06	1.57
PF	-0.04	-0.02	-0.01	-0.01	0.00	-0.01	-0.02	-0.01	0.00	0.00	0.17	-0.23	-0.10	0.01	0.00	-0.01	-0.05	-0.02	0.35
FV	-0.52	-0.31	-0.16	-0.09	-0.12	-0.30	-0.12	-0.19	-0.14	-0.06	-0.16	-0.21	-0.46	-0.12	-0.24	-0.19	-0.48	-0.14	4.02
PV	-0.18	-0.11	-0.06	-0.03	-0.03	-0.10	-0.05	-0.06	-0.04	-0.02	0.15	-0.03	-0.08	-0.27	-0.07	-0.06	-0.17	-0.05	1.26
BB	-0.10	-0.06	-0.03	-0.02	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	0.00	-0.02	0.07	0.00	-0.51	-0.03	-0.07	-0.03	0.89
SP	-0.08	-0.04	-0.02	-0.01	-0.01	-0.04	-0.03	-0.03	-0.01	-0.01	-0.01	-0.02	0.01	-0.01	-0.05	-0.21	-0.15	-0.03	0.74
OF	-0.08	-0.04	-0.02	-0.01	0.00	-0.01	-0.02	-0.01	0.00	-0.02	-0.03	-0.03	-0.03	-0.02	-0.05	-0.08	-0.18	-0.03	0.66
BE	-0.14	-0.08	-0.04	-0.02	-0.02	-0.07	-0.04	-0.05	-0.03	-0.02	-0.04	-0.04	-0.02	-0.03	-0.13	-0.07	-0.15	-0.11	1.09
share	0.126	0.077	0.039	0.021	0.029	0.070	0.022	0.041	0.036	0.018	0.044	0.038	0.048	0.028	0.137	0.064	0.119	0.042	

Table 18. Conditional Hicksian Elasticities for Food at Home at the Mean of First Three Years (1962-64)

	prices																	
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE
BF	-0.35	0.17	0.06	0.03	0.02	0.03	0.00	0.02	0.02	-0.01	0.00	0.00	-0.01	-0.01	0.01	0.01	0.00	0.00
PK	0.28	-0.54	0.11	0.01	0.02	0.04	0.00	0.02	0.03	-0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.00
CK	0.19	0.21	-0.64	0.06	0.03	0.05	0.00	0.03	0.03	-0.01	0.00	0.00	-0.01	-0.01	0.02	0.01	0.02	0.01
FI	0.16	0.03	0.11	-0.52	0.04	0.07	0.01	0.04	0.04	-0.02	0.00	0.00	-0.01	-0.01	0.02	0.02	0.03	0.01
EG	0.09	0.06	0.04	0.03	-0.59	-0.06	0.09	0.03	0.07	0.00	0.01	0.01	-0.01	0.00	0.10	0.02	0.09	0.01
MK	0.06	0.04	0.03	0.02	-0.03	-0.40	-0.13	0.09	0.13	0.05	0.00	0.01	-0.02	0.00	0.07	0.01	0.06	0.00
CH	-0.02	-0.01	0.01	0.01	0.12	-0.41	-0.06	0.62	-0.17	0.15	-0.04	-0.02	-0.06	-0.03	-0.01	-0.03	-0.02	-0.03
OD	0.05	0.04	0.03	0.02	0.02	0.16	0.33	-1.01	0.25	0.02	-0.01	0.00	-0.02	-0.01	0.06	0.01	0.05	0.00
BT	0.09	0.05	0.03	0.02	0.05	0.25	-0.11	0.29	-0.93	-0.02	0.01	0.02	0.01	0.01	0.09	0.03	0.08	0.02
FO	-0.06	-0.03	-0.03	-0.02	0.00	0.18	0.19	0.05	-0.04	-0.20	0.01	0.01	0.02	0.00	-0.02	0.01	-0.07	-0.01
FF	-0.01	0.00	0.00	0.00	0.00	0.00	-0.02	-0.01	0.01	0.00	-0.45	0.16	0.02	0.13	0.13	0.03	-0.01	0.01
PF	0.00	0.01	0.00	0.00	0.01	0.01	-0.01	0.00	0.02	0.00	0.18	-0.21	-0.08	0.02	0.04	0.01	-0.01	0.00
FV	-0.01	0.00	0.00	0.00	-0.01	-0.02	-0.03	-0.02	0.00	0.01	0.02	-0.06	-0.27	-0.01	0.32	0.07	0.00	0.03
PV	-0.02	-0.01	-0.01	0.00	0.00	-0.01	-0.02	-0.01	0.01	0.00	0.20	0.02	-0.02	-0.23	0.10	0.02	-0.02	0.00
BB	0.01	0.01	0.01	0.00	0.02	0.04	0.00	0.02	0.02	0.00	0.04	0.01	0.11	0.02	-0.39	0.03	0.04	0.01
SP	0.02	0.02	0.01	0.01	0.01	0.01	-0.01	0.00	0.02	0.00	0.02	0.01	0.05	0.01	0.05	-0.16	-0.06	0.00
OF	0.00	0.01	0.01	0.01	0.02	0.04	0.00	0.02	0.02	-0.01	0.00	0.00	0.00	-0.01	0.04	-0.03	-0.10	-0.01
BE	0.00	0.00	0.00	0.00	0.01	0.01	-0.02	0.00	0.01	0.00	0.01	0.00	0.03	0.00	0.02	0.00	-0.02	-0.07
share	0.126	0.077	0.039	0.021	0.029	0.070	0.022	0.041	0.036	0.018	0.044	0.038	0.048	0.028	0.137	0.064	0.119	0.042

Table 19. Conditional Marshallian Elasticities for Food at Home at the Mean of Last Three Years (1986-88)

	prices																		
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	X_F
BF	-0.41	0.11	0.02	0.01	-0.01	-0.04	-0.02	-0.02	-0.01	-0.03	-0.05	-0.04	-0.06	-0.03	-0.13	-0.06	-0.12	-0.04	0.91
PK	0.18	-0.56	0.08	-0.02	-0.01	-0.04	-0.03	-0.02	-0.01	-0.03	-0.05	-0.04	-0.06	-0.04	-0.13	-0.06	-0.12	-0.05	1.00
CK	0.00	0.09	-0.73	0.02	0.00	-0.04	-0.04	-0.03	-0.01	-0.04	-0.07	-0.05	-0.08	-0.05	-0.17	-0.08	-0.17	-0.06	1.51
FI	-0.07	-0.10	0.03	-0.64	0.00	-0.05	-0.05	-0.04	-0.01	-0.04	-0.08	-0.06	-0.09	-0.06	-0.20	-0.09	-0.21	-0.08	1.84
EG	-0.02	0.00	0.03	0.03	-0.09	-0.28	0.20	-0.01	0.08	-0.03	-0.07	-0.04	-0.11	-0.04	-0.03	-0.07	0.03	-0.04	0.47
MK	-0.02	0.00	0.01	0.01	-0.06	-0.28	-0.16	0.09	0.12	0.04	-0.03	-0.02	-0.05	-0.02	-0.01	-0.03	0.02	-0.02	0.40
CH	-0.01	0.00	0.01	0.01	0.05	-0.18	-0.58	0.27	-0.08	0.06	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	0.02	-0.01	0.53
OD	-0.01	0.00	0.01	0.01	0.00	0.12	0.33	-1.03	0.22	0.01	-0.03	-0.02	-0.04	-0.02	-0.01	-0.03	0.02	-0.01	0.49
BT	-0.02	-0.01	0.02	0.02	0.08	0.55	-0.33	0.75	-0.88	-0.09	-0.05	-0.03	-0.08	-0.03	-0.02	-0.05	0.03	-0.03	0.15
FO	-0.04	-0.02	-0.01	-0.01	-0.01	0.24	0.32	0.08	-0.07	0.06	0.04	0.03	0.06	0.03	0.01	0.04	0.04	0.04	-0.83
FF	-0.19	-0.11	-0.06	-0.04	-0.03	-0.10	-0.07	-0.07	-0.03	-0.02	-0.54	0.09	-0.05	0.08	-0.07	-0.07	-0.21	-0.06	1.54
PF	-0.05	-0.03	-0.01	-0.01	-0.01	-0.02	0.00	-0.01	-0.01	-0.01	0.17	-0.21	-0.10	0.01	-0.01	-0.01	-0.02	-0.01	0.34
FV	-0.45	-0.26	-0.16	-0.10	-0.07	-0.24	-0.19	-0.18	-0.07	-0.05	-0.15	-0.20	-0.51	-0.13	-0.18	-0.17	-0.58	-0.17	3.83
PV	-0.15	-0.09	-0.05	-0.03	-0.03	-0.08	-0.05	-0.05	-0.03	-0.02	0.13	-0.02	-0.07	-0.37	-0.06	-0.05	-0.16	-0.05	1.23
BB	-0.11	-0.06	-0.03	-0.02	-0.01	-0.03	-0.02	-0.02	-0.01	-0.02	0.00	-0.02	0.08	0.00	-0.44	-0.04	-0.07	-0.03	0.88
SP	-0.09	-0.05	-0.02	-0.01	-0.02	-0.05	-0.02	-0.03	-0.02	-0.01	-0.01	-0.02	0.02	-0.01	-0.06	-0.13	-0.15	-0.03	0.72
OF	-0.06	-0.03	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.04	-0.06	-0.40	-0.02	0.76
BE	-0.10	-0.06	-0.03	-0.01	-0.02	-0.05	-0.03	-0.03	-0.02	-0.02	-0.03	-0.03	-0.01	-0.02	-0.10	-0.05	-0.11	-0.34	1.07
share	0.112	0.067	0.042	0.026	0.012	0.055	0.051	0.042	0.013	0.013	0.046	0.037	0.052	0.032	0.121	0.059	0.165	0.056	

Table 20. Conditional Hicksian Elasticities for Food at Home at the Mean of Last Three Years (1986-88)

	prices																	
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE
BF	-0.31	0.17	0.06	0.03	0.00	0.01	0.02	0.02	0.00	-0.02	-0.01	0.00	-0.01	0.00	-0.02	0.00	0.03	0.01
PK	0.29	-0.49	0.12	0.01	0.01	0.02	0.02	0.02	0.00	-0.02	0.00	0.00	-0.01	0.00	-0.01	0.00	0.04	0.01
CK	0.17	0.19	-0.66	0.06	0.01	0.04	0.03	0.03	0.01	-0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.08	0.02
FI	0.14	0.02	0.10	-0.60	0.02	0.05	0.04	0.04	0.01	-0.02	0.01	0.00	0.01	0.00	0.02	0.02	0.09	0.03
EG	0.04	0.03	0.05	0.04	-0.09	-0.26	0.22	0.01	0.08	-0.02	-0.04	-0.02	-0.08	-0.03	0.03	-0.04	0.10	-0.01
MK	0.03	0.02	0.03	0.02	-0.06	-0.26	-0.14	0.11	0.13	0.05	-0.01	0.00	-0.03	-0.01	0.03	-0.01	0.09	0.01
CH	0.05	0.03	0.03	0.02	0.05	-0.15	-0.55	0.29	-0.08	0.07	0.01	0.01	0.01	0.01	0.06	0.02	0.10	0.02
OD	0.04	0.03	0.03	0.02	0.00	0.14	0.35	-1.01	0.23	0.02	0.00	0.00	-0.02	0.00	0.05	0.00	0.10	0.01
BT	-0.01	0.00	0.03	0.03	0.08	0.56	-0.32	0.76	-0.88	-0.09	-0.04	-0.02	-0.07	-0.03	0.00	-0.04	0.06	-0.02
FO	-0.13	-0.08	-0.05	-0.03	-0.02	0.20	0.28	0.05	-0.08	0.05	0.00	0.00	0.02	0.00	-0.09	-0.01	-0.09	-0.01
FF	-0.02	-0.01	0.00	0.00	-0.01	-0.01	0.01	0.00	-0.01	0.00	-0.47	0.15	0.03	0.13	0.12	0.03	0.04	0.02
PF	-0.01	-0.01	0.00	0.00	-0.01	-0.01	0.02	0.00	-0.01	0.00	0.19	-0.20	-0.08	0.02	0.03	0.01	0.04	0.01
FV	-0.02	-0.01	0.00	0.00	-0.02	-0.03	0.00	-0.01	-0.02	0.01	0.02	-0.06	-0.31	-0.01	0.29	0.06	0.05	0.04
PV	-0.02	-0.01	0.00	0.00	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.18	0.02	-0.01	-0.33	0.09	0.02	0.04	0.02
BB	-0.02	-0.01	0.00	0.00	0.00	0.02	0.02	0.02	0.00	-0.01	0.04	0.01	0.12	0.02	-0.34	0.01	0.07	0.02
SP	-0.01	0.00	0.01	0.01	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.02	0.00	0.05	0.01	0.03	-0.09	-0.04	0.01
OF	0.02	0.02	0.02	0.01	0.01	0.03	0.03	0.03	0.00	-0.01	0.01	0.01	0.02	0.01	0.05	-0.01	-0.27	0.02
BE	0.02	0.01	0.02	0.01	0.00	0.01	0.02	0.01	0.00	0.00	0.02	0.01	0.04	0.01	0.03	0.01	0.06	-0.28
share	0.112	0.067	0.042	0.026	0.012	0.055	0.051	0.042	0.013	0.013	0.046	0.037	0.052	0.032	0.121	0.059	0.165	0.056

The elasticities that we have just discussed are 'conditional' elasticities, in that they described the behavior of second-stage demand function given an expenditure allocation x_F for at-home food and beverages. For policy analysis, however, it is typically necessary to compute elasticities which account for the first stage allocation as well. For at-home food and beverages the Marshallian demand function satisfies $q_i(p,x) \equiv q_i^c(p_F, x_F(p,x))$, so that unconditional Marshallian elasticities for these goods can be found as:

(64) $$\epsilon_i = \epsilon_i^c \xi_{Fx}$$

(65) $$\epsilon_{ij} = \epsilon_{ij}^c + \epsilon_i^c \xi_{Fj}$$

where $\xi_{Fx} \equiv \partial\log(x_F)/\partial\log(x)$ and $\xi_{Fj} \equiv \partial\log(x_F)/\partial\log(p_j)$.

Similarly, the unconditional Marshallian elasticities of these goods with respect to the price of goods outside the group can be found as:

(66) $$\epsilon_{ik} = \epsilon_i^c \xi_{Fk}$$

where $\xi_{Fk} \equiv \partial\log(x_F)/\partial\log(p_k)$ and k=(19,20). On the other hand, unconditional elasticities for food away from home and nonfood can be computed directly, using formulae (12) and (15) on the coefficients estimated by the first-stage model of equation (55).

Unconditional Marshallian elasticities calculated as described above, and evaluated at the sample mean point, are reported in Table 21. A comparison of these elasticities with the conditional elasticities of Table 13 shows that the expenditure elasticities are the ones that have changed the most. As expected, taking into account first stage effects results in much lower expenditure elasticities owing to the fact that food as a whole is fairly inelastic with respect to changes in total expenditures. At the mean point, the weighted

Table 21. Marshallian Elasticities of Full System at the Sample Mean (1962-88), Two-Stage Model

	prices																				
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	FA	NF	X
BF	-0.41	0.15	0.05	0.02	0.01	0.01	0.00	0.01	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.00	0.00	0.04	-0.06	0.26
PK	0.25	-0.56	0.10	0.00	0.01	0.01	0.00	0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	0.00	0.04	-0.06	0.28
CK	0.14	0.17	-0.68	0.05	0.01	0.02	0.00	0.01	0.01	-0.02	-0.02	-0.01	-0.02	-0.01	-0.04	-0.01	-0.01	0.00	0.06	-0.09	0.43
FI	0.10	-0.01	0.09	-0.58	0.02	0.03	0.01	0.02	0.01	-0.02	-0.02	-0.02	-0.03	-0.02	-0.05	-0.01	-0.01	-0.01	0.08	-0.12	0.55
EG	0.06	0.04	0.04	0.03	-0.44	-0.14	0.13	0.02	0.06	-0.01	-0.02	-0.01	-0.04	-0.01	0.04	-0.01	0.08	0.00	0.03	-0.04	0.19
MK	0.04	0.03	0.03	0.02	-0.04	-0.34	-0.14	0.10	0.12	0.05	-0.01	-0.01	-0.03	-0.01	0.03	-0.01	0.05	0.00	0.02	-0.03	0.13
CH	0.03	0.02	0.02	0.01	0.08	-0.24	-0.40	0.39	-0.11	0.10	-0.01	0.00	-0.02	-0.01	0.02	-0.01	0.04	0.00	0.01	-0.02	0.09
OD	0.04	0.03	0.03	0.02	0.01	0.15	0.35	-1.02	0.24	0.02	-0.01	-0.01	-0.03	-0.01	0.03	-0.01	0.05	0.00	0.02	-0.03	0.13
BT	0.05	0.03	0.03	0.02	0.06	0.35	-0.19	0.46	-0.92	-0.05	-0.01	-0.01	-0.03	-0.01	0.03	-0.01	0.05	0.00	0.02	-0.03	0.14
FO	-0.05	-0.03	-0.03	-0.02	-0.01	0.19	0.23	0.05	-0.06	-0.12	0.01	0.01	0.03	0.01	-0.03	0.01	-0.06	0.00	-0.02	0.03	-0.14
FF	-0.06	-0.03	-0.02	-0.01	-0.01	-0.04	-0.02	-0.02	-0.01	0.00	-0.47	0.14	0.00	0.12	0.07	0.00	-0.05	-0.01	0.06	-0.10	0.45
PF	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.19	-0.16	-0.09	0.02	0.01	0.00	-0.01	0.00	0.01	-0.02	0.08
FV	-0.14	-0.08	-0.04	-0.02	-0.03	-0.09	-0.05	-0.06	-0.03	-0.01	-0.02	-0.10	-0.35	-0.04	0.17	0.00	-0.12	-0.01	0.16	-0.24	1.11
PV	-0.04	-0.03	-0.01	-0.01	-0.01	-0.03	-0.02	-0.02	-0.01	0.00	0.17	0.01	-0.03	-0.31	0.05	0.00	-0.04	0.00	0.05	-0.08	0.35
BB	-0.02	-0.01	-0.01	0.00	0.01	0.01	0.00	0.01	0.00	-0.01	0.03	0.00	0.11	0.02	-0.37	0.00	0.01	0.00	0.04	-0.05	0.25
SP	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.01	0.00	0.04	0.00	0.01	-0.11	-0.09	0.00	0.03	-0.05	0.20
OF	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	-0.01	-0.01	-0.01	0.00	0.00	0.02	-0.04	-0.21	0.00	0.03	-0.04	0.20
BE	-0.01	-0.01	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	-0.01	0.00	-0.01	0.02	0.00	-0.01	-0.01	-0.02	-0.20	0.04	-0.07	0.31
FA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.55	-0.52	1.05
NF	-0.02	-0.01	-0.01	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.01	0.00	-0.02	-0.01	-0.02	-0.01	-0.03	-0.96	1.13
share	0.020	0.011	0.006	0.003	0.003	0.009	0.005	0.006	0.003	0.002	0.006	0.005	0.007	0.004	0.018	0.009	0.020	0.007	0.045	0.809	

average of expenditure elasticities of at-home food and beverages is 0.26, whereas the expenditure elasticity of food away from home and nonfood are 1.05 and 1.13, respectively. Own price elasticities are also affected, with unconditional demands being more inelastic than conditional demands.

Given these unconditional Marshallian elasticities, one can use the Slutsky equation in elasticity terms, that is:

$$\eta_{ij} = \epsilon_{ij} + w_j \epsilon_i \tag{67}$$

to retrieve the unconditional Hicksian elasticities. These elasticites, computed at the sample mean point, are reported in Table 22. Interestingly, these elasticities are very similar to the conditional Hicksian elasticities of Table 14. Perhaps more important, these compensated elasticities are virtually identical to the Marshallian elasticities of Table 21. The reason is readily apparent, when one notes that the last term of the right-hand-side of equation (67) turns out to be negligible because it is the product of two small numbers (the expenditure share of individual food groups is very small, and their expenditure elasticity is also small due to the inelastic characteristic of food demand). This finding has useful implications for welfare analysis, as it suggests that approximate welfare measures based on Marshallian demand functions (such as consumer surplus) may be accurate, as long as one relies on unconditional demand functions.

Similar to the conditional elasticities, these elasticities for the full system are sensitive to the evaluation point. To see how they change as the value of shares changes, Tables 23 and 24 report elasticities evaluated at the mean of the first three years in the sample (1962-64), whereas Tables 25 and 26 report elasticities evaluated at the mean of the last three sample years (1986-

Table 22. Hicksian Elasticities for Full System at the Sample Mean (1962-88), Two-Stage Model

	prices																			
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	FA	NF
BF	-0.41	0.15	0.05	0.02	0.01	0.02	0.00	0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	0.00	0.00	0.00	0.05	0.16
PK	0.26	-0.56	0.10	0.00	0.01	0.02	0.00	0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.00	0.00	0.05	0.17
CK	0.15	0.17	-0.67	0.05	0.01	0.03	0.01	0.02	0.01	-0.02	-0.01	-0.01	-0.02	-0.01	-0.03	-0.01	0.00	0.00	0.08	0.25
FI	0.11	0.00	0.09	-0.57	0.02	0.03	0.01	0.02	0.01	-0.02	-0.02	-0.01	-0.02	-0.01	-0.04	-0.01	0.00	0.00	0.10	0.32
EG	0.07	0.04	0.04	0.03	-0.43	-0.14	0.13	0.02	0.06	-0.01	-0.02	-0.01	-0.04	-0.01	0.05	-0.01	0.08	0.00	0.04	0.11
MK	0.05	0.03	0.03	0.02	-0.04	-0.34	-0.14	0.10	0.12	0.05	-0.01	0.00	-0.03	-0.01	0.03	-0.01	0.05	0.00	0.02	0.08
CH	0.03	0.02	0.02	0.01	0.08	-0.23	-0.40	0.39	-0.11	0.10	-0.01	0.00	-0.02	-0.01	0.02	-0.01	0.04	0.00	0.02	0.06
OD	0.05	0.03	0.03	0.02	0.01	0.15	0.35	-1.02	0.24	0.02	-0.01	0.00	-0.03	-0.01	0.03	-0.01	0.05	0.00	0.02	0.08
BT	0.05	0.03	0.03	0.02	0.06	0.36	-0.19	0.46	-0.91	-0.05	-0.01	0.00	-0.03	-0.01	0.03	-0.01	0.06	0.00	0.03	0.08
FO	-0.05	-0.03	-0.03	-0.02	-0.01	0.19	0.22	0.05	-0.06	-0.12	0.01	0.01	0.03	0.01	-0.04	0.01	-0.06	0.00	-0.03	-0.08
FF	-0.05	-0.03	-0.01	-0.01	-0.01	-0.03	-0.02	-0.02	-0.01	0.00	-0.46	0.14	0.01	0.12	0.08	0.00	-0.04	0.00	0.08	0.26
PF	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.19	-0.16	-0.09	0.02	0.01	0.00	-0.01	0.00	0.02	0.05
FV	-0.12	-0.07	-0.04	-0.02	-0.03	-0.08	-0.04	-0.05	-0.03	-0.01	-0.02	-0.09	-0.34	-0.03	0.19	0.01	-0.10	0.00	0.21	0.65
PV	-0.04	-0.02	-0.01	-0.01	-0.01	-0.03	-0.01	-0.02	-0.01	0.00	0.18	0.01	-0.03	-0.31	0.06	0.00	-0.03	0.00	0.07	0.21
BB	-0.02	-0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.00	-0.01	0.03	0.00	0.11	0.02	-0.37	0.00	0.02	0.00	0.05	0.15
SP	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.01	0.00	0.04	0.01	0.01	-0.11	-0.08	0.00	0.04	0.12
OF	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	-0.01	0.00	0.00	0.00	0.00	0.02	-0.04	-0.21	0.00	0.04	0.12
BE	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	-0.01	0.00	-0.01	0.03	0.00	-0.01	-0.01	-0.01	-0.20	0.06	0.18
FA	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	-0.50	0.33
NF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-0.05
share	0.020	0.011	0.006	0.003	0.003	0.009	0.005	0.006	0.003	0.002	0.006	0.005	0.007	0.004	0.018	0.009	0.020	0.007	0.045	0.809

Table 23. Marshallian Elasticities for the Full System at the Mean of First Three Years (1962-64), Two-Stage Model

	prices																				
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	FA	NF	X
BF	-0.40	0.14	0.04	0.02	0.01	0.01	-0.01	0.00	0.01	-0.01	-0.02	-0.01	-0.02	-0.02	-0.04	-0.01	-0.04	-0.02	0.03	-0.06	0.40
PK	0.23	-0.57	0.09	0.00	0.01	0.01	-0.01	0.00	0.01	-0.01	-0.02	-0.01	-0.02	-0.01	-0.03	-0.01	-0.03	-0.01	0.03	-0.07	0.43
CK	0.11	0.16	-0.66	0.05	0.01	0.01	-0.01	0.00	0.01	-0.02	-0.03	-0.02	-0.04	-0.02	-0.06	-0.03	-0.05	-0.02	0.04	-0.10	0.67
FI	0.06	-0.04	0.08	-0.54	0.01	0.01	-0.01	0.01	0.01	-0.03	-0.04	-0.03	-0.05	-0.03	-0.09	-0.04	-0.06	-0.03	0.06	-0.14	0.87
EG	0.06	0.04	0.03	0.02	-0.60	-0.08	0.09	0.02	0.06	0.00	-0.01	0.00	-0.02	-0.01	0.06	0.00	0.06	0.00	0.02	-0.05	0.33
MK	0.04	0.03	0.02	0.02	-0.03	-0.41	-0.13	0.09	0.12	0.04	-0.01	0.00	-0.03	-0.01	0.04	0.00	0.03	-0.01	0.02	-0.04	0.23
CH	-0.02	0.00	0.01	0.01	0.12	-0.40	-0.05	0.62	-0.17	0.15	-0.03	-0.02	-0.06	-0.03	-0.01	-0.03	-0.02	-0.03	0.00	0.01	-0.04
OD	0.03	0.02	0.02	0.02	0.02	0.15	0.33	-1.02	0.25	0.02	-0.01	0.00	-0.03	-0.01	0.04	-0.01	0.03	-0.01	0.01	-0.03	0.21
BT	0.05	0.03	0.02	0.02	0.05	0.23	-0.11	0.28	-0.94	-0.02	0.00	0.01	-0.01	0.00	0.06	0.01	0.05	0.00	0.02	-0.05	0.30
FO	-0.04	-0.02	-0.02	-0.02	0.01	0.19	0.19	0.05	-0.03	-0.20	0.02	0.01	0.03	0.01	0.00	0.02	-0.06	0.00	-0.01	0.03	-0.16
FF	-0.09	-0.05	-0.03	-0.02	-0.01	-0.05	-0.03	-0.03	-0.01	-0.01	-0.48	0.14	-0.01	0.11	0.05	-0.01	-0.08	-0.02	0.04	-0.11	0.68
PF	-0.02	0.00	0.00	0.00	0.01	0.00	-0.01	0.00	0.01	0.00	0.18	-0.22	-0.09	0.01	0.03	0.00	-0.02	-0.01	0.01	-0.02	0.15
FV	-0.21	-0.13	-0.07	-0.04	-0.05	-0.13	-0.06	-0.08	-0.05	-0.02	-0.05	-0.12	-0.34	-0.06	0.10	-0.04	-0.19	-0.04	0.12	-0.27	1.74
PV	-0.09	-0.05	-0.03	-0.02	-0.01	-0.04	-0.03	-0.03	-0.01	-0.01	0.18	0.00	-0.05	-0.25	0.04	-0.01	-0.08	-0.02	0.04	-0.09	0.54
BB	-0.03	-0.01	-0.01	0.00	0.01	0.01	-0.01	0.00	0.01	-0.01	0.03	0.00	0.09	0.01	-0.43	0.00	0.00	-0.01	0.03	-0.06	0.38
SP	-0.02	-0.01	0.00	0.00	0.00	-0.01	-0.02	-0.01	0.01	0.00	0.01	0.00	0.04	0.00	0.01	-0.18	-0.10	-0.01	0.02	-0.05	0.32
OF	-0.03	-0.01	0.00	0.00	0.02	0.02	-0.01	0.01	0.02	-0.02	-0.01	-0.01	-0.01	-0.01	0.01	-0.05	-0.13	-0.02	0.02	-0.04	0.29
BE	-0.06	-0.03	-0.01	0.00	0.00	-0.02	-0.03	-0.02	0.00	-0.01	-0.01	-0.02	0.01	-0.01	-0.04	-0.02	-0.07	-0.09	0.03	-0.07	0.47
FA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.48	-0.60	1.06
NF	-0.02	-0.01	-0.01	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	-0.01	0.00	-0.02	-0.01	-0.02	-0.01	-0.03	-0.95	1.13
share	0.023	0.014	0.007	0.004	0.005	0.013	0.004	0.008	0.007	0.003	0.008	0.007	0.009	0.005	0.025	0.012	0.022	0.008	0.039	0.777	

Table 24. Hicksian Elasticities for the Full System at the Mean of First Three Years (1962-64), Two-Stage Model

	prices																			
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	FA	NF
BF	-0.39	0.15	0.05	0.02	0.01	0.01	-0.01	0.01	0.01	-0.01	-0.02	-0.01	-0.02	-0.01	-0.03	-0.01	-0.03	-0.01	0.04	0.25
PK	0.24	-0.56	0.09	0.00	0.01	0.02	-0.01	0.01	0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.02	-0.01	-0.02	-0.01	0.05	0.27
CK	0.13	0.17	-0.66	0.05	0.02	0.02	-0.01	0.01	0.01	-0.02	-0.02	-0.02	-0.03	-0.02	-0.05	-0.02	-0.04	-0.02	0.07	0.41
FI	0.08	-0.02	0.09	-0.53	0.02	0.02	-0.01	0.01	0.01	-0.03	-0.03	-0.02	-0.04	-0.02	-0.07	-0.03	-0.04	-0.02	0.09	0.54
EG	0.06	0.04	0.03	0.02	-0.60	-0.08	0.09	0.02	0.06	0.00	0.00	0.00	-0.02	0.00	0.06	0.01	0.06	0.00	0.04	0.21
MK	0.04	0.03	0.02	0.02	-0.03	-0.41	-0.13	0.09	0.12	0.04	-0.01	0.00	-0.02	-0.01	0.05	0.00	0.04	0.00	0.02	0.14
CH	-0.02	0.00	0.01	0.01	0.12	-0.40	-0.06	0.62	-0.17	0.15	-0.04	-0.02	-0.06	-0.03	-0.01	-0.03	-0.02	-0.03	0.00	-0.02
OD	0.04	0.03	0.02	0.02	0.02	0.15	0.33	-1.02	0.25	0.02	-0.01	0.00	-0.03	-0.01	0.04	0.00	0.03	-0.01	0.02	0.13
BT	0.06	0.04	0.03	0.02	0.05	0.23	-0.11	0.28	-0.93	-0.02	0.00	0.01	-0.01	0.00	0.06	0.01	0.06	0.01	0.03	0.19
FO	-0.04	-0.02	-0.03	-0.02	0.01	0.19	0.19	0.05	-0.03	-0.20	0.02	0.01	0.03	0.01	0.00	0.02	-0.06	0.00	-0.02	-0.10
FF	-0.07	-0.04	-0.02	-0.01	-0.01	-0.04	-0.03	-0.03	-0.01	0.00	-0.47	0.14	0.00	0.12	0.07	0.00	-0.07	-0.01	0.07	0.42
PF	-0.01	0.00	0.00	0.00	0.01	0.00	-0.01	0.00	0.01	0.00	0.18	-0.22	-0.08	0.01	0.03	0.01	-0.02	0.00	0.02	0.09
FV	-0.17	-0.10	-0.05	-0.03	-0.04	-0.11	-0.05	-0.07	-0.04	-0.01	-0.04	-0.11	-0.33	-0.05	0.14	-0.02	-0.15	-0.02	0.18	1.08
PV	-0.07	-0.04	-0.02	-0.01	-0.01	-0.03	-0.03	-0.03	0.00	0.00	0.19	0.01	-0.04	-0.25	0.05	-0.01	-0.07	-0.02	0.06	0.34
BB	-0.02	-0.01	-0.01	0.00	0.01	0.02	-0.01	0.01	0.01	-0.01	0.03	0.00	0.10	0.01	-0.42	0.01	0.00	-0.01	0.04	0.24
SP	-0.01	0.00	0.00	0.00	0.00	0.00	-0.02	-0.01	0.01	0.00	0.01	0.00	0.04	0.00	0.02	-0.17	-0.09	-0.01	0.03	0.20
OF	-0.02	-0.01	0.00	0.00	0.02	0.02	-0.01	0.01	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	-0.05	-0.13	-0.01	0.03	0.18
BE	-0.04	-0.02	-0.01	0.00	0.00	-0.02	-0.02	-0.02	0.00	-0.01	-0.01	-0.01	0.02	-0.01	-0.03	-0.02	-0.06	-0.08	0.05	0.29
FA	0.03	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.03	0.01	0.03	0.01	-0.44	0.22
NF	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	-0.07
share	0.023	0.014	0.007	0.004	0.005	0.013	0.004	0.008	0.007	0.003	0.008	0.007	0.009	0.005	0.025	0.012	0.022	0.008	0.039	0.777

Table 25. Marshallian Elasticities for Full System at the Mean of Last Three Years (1986-88), Two-Stage Model

	prices																				
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	FA	NF	X
BF	-0.31	0.17	0.06	0.03	0.00	0.01	0.02	0.01	0.00	-0.02	-0.01	-0.01	-0.01	-0.01	-0.03	-0.01	0.02	0.00	0.05	-0.05	0.07
PK	0.28	-0.50	0.12	0.01	0.00	0.01	0.02	0.01	0.00	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.03	0.01	0.05	-0.05	0.08
CK	0.15	0.18	-0.67	0.06	0.01	0.03	0.03	0.03	0.01	-0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.02	0.08	-0.08	0.12
FI	0.12	0.01	0.10	-0.60	0.02	0.04	0.03	0.03	0.01	-0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.02	0.10	-0.09	0.15
EG	0.03	0.03	0.05	0.04	-0.09	-0.26	0.22	0.01	0.08	-0.02	-0.05	-0.02	-0.09	-0.03	0.02	-0.04	0.10	-0.02	0.02	-0.02	0.04
MK	0.03	0.02	0.03	0.02	-0.06	-0.26	-0.14	0.11	0.13	0.05	-0.01	0.00	-0.03	-0.01	0.03	-0.01	0.08	0.00	0.02	-0.02	0.03
CH	0.04	0.03	0.03	0.02	0.05	-0.15	-0.55	0.29	-0.08	0.07	0.01	0.01	0.00	0.01	0.05	0.01	0.10	0.02	0.03	-0.03	0.04
OD	0.04	0.03	0.03	0.02	0.00	0.14	0.35	-1.01	0.23	0.02	0.00	0.00	-0.02	0.00	0.04	0.00	0.09	0.01	0.03	-0.03	0.04
BT	-0.01	0.00	0.03	0.02	0.08	0.56	-0.32	0.76	-0.88	-0.09	-0.04	-0.02	-0.07	-0.03	-0.01	-0.04	0.05	-0.02	0.01	-0.01	0.01
FO	-0.12	-0.07	-0.05	-0.03	-0.02	0.20	0.28	0.05	-0.08	0.05	0.01	0.00	0.02	0.00	-0.08	-0.01	-0.08	-0.01	-0.04	0.04	-0.07
FF	-0.03	-0.02	0.00	0.00	-0.01	-0.02	0.01	-0.01	-0.01	0.00	-0.48	0.15	0.02	0.12	0.10	0.02	0.02	0.02	0.08	-0.08	0.12
PF	-0.02	-0.01	0.00	0.00	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.19	-0.20	-0.08	0.02	0.02	0.01	0.03	0.01	0.02	-0.02	0.03
FV	-0.05	-0.03	-0.01	-0.01	-0.02	-0.05	-0.01	-0.03	-0.02	0.00	0.01	-0.07	-0.32	-0.02	0.25	0.04	0.00	0.03	0.20	-0.20	0.31
PV	-0.03	-0.01	0.00	0.00	-0.01	-0.02	0.01	-0.01	-0.01	0.00	0.18	0.02	-0.02	-0.33	0.08	0.01	0.02	0.02	0.06	-0.06	0.10
BB	-0.02	-0.01	0.00	0.00	0.00	0.01	0.02	0.01	0.00	-0.01	0.04	0.01	0.12	0.02	-0.35	0.01	0.06	0.01	0.05	-0.04	0.07
SP	-0.01	0.00	0.01	0.01	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.02	0.00	0.05	0.01	0.02	-0.10	-0.04	0.01	0.04	-0.04	0.06
OF	0.02	0.01	0.02	0.01	0.01	0.03	0.03	0.02	0.00	-0.01	0.01	0.01	0.01	0.01	0.05	-0.02	-0.28	0.02	0.04	-0.04	0.06
BE	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.01	-0.01	0.00	0.02	0.01	0.04	0.01	0.02	0.01	0.05	-0.28	0.06	-0.05	0.09
FA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.56	-0.52	1.05
NF	-0.01	-0.01	-0.01	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	-0.01	0.00	-0.01	0.00	-0.02	-0.01	-0.02	-0.01	-0.03	-0.96	1.12
share	0.013	0.008	0.005	0.003	0.001	0.006	0.006	0.005	0.001	0.002	0.005	0.004	0.006	0.004	0.014	0.007	0.019	0.006	0.046	0.841	

Table 26. Hicksian Elasticities for Full System at the Mean of Last Three Years (1986-88), Two-Stage Model

	prices																			
	BF	PK	CK	FI	EG	MK	CH	OD	BT	FO	FF	PF	FV	PV	BB	SP	OF	BE	FA	NF
BF	-0.31	0.17	0.06	0.03	0.00	0.01	0.02	0.01	0.00	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.02	0.00	0.05	0.01
PK	0.28	-0.49	0.12	0.01	0.00	0.01	0.02	0.01	0.00	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.03	0.01	0.06	0.02
CK	0.16	0.18	-0.67	0.06	0.01	0.03	0.03	0.03	0.01	-0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.02	0.08	0.02
FI	0.12	0.02	0.10	-0.60	0.02	0.04	0.03	0.03	0.01	-0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.07	0.02	0.10	0.03
EG	0.03	0.03	0.05	0.04	-0.09	-0.26	0.22	0.01	0.08	-0.02	-0.05	-0.02	-0.09	-0.03	0.02	-0.04	0.10	-0.02	0.03	0.01
MK	0.03	0.02	0.03	0.02	-0.06	-0.26	-0.14	0.11	0.13	0.05	-0.01	0.00	-0.03	-0.01	0.03	-0.01	0.08	0.00	0.02	0.01
CH	0.04	0.03	0.03	0.02	0.05	-0.15	-0.55	-0.29	-0.08	0.07	0.01	0.01	0.00	0.01	0.05	0.01	0.10	0.02	0.03	0.01
OD	0.04	0.03	0.03	0.02	0.00	0.14	0.35	-1.01	0.23	0.02	0.00	0.00	-0.02	0.00	0.04	0.00	0.09	0.01	0.03	0.01
BT	-0.01	0.00	0.03	0.02	0.08	0.56	-0.32	0.76	-0.88	-0.09	-0.04	-0.02	-0.07	-0.03	-0.01	-0.04	0.05	-0.02	0.01	0.00
FO	-0.12	-0.07	-0.05	-0.03	-0.02	0.20	0.28	0.05	-0.08	0.05	0.01	0.00	0.02	0.00	-0.08	-0.01	-0.08	-0.01	-0.05	-0.01
FF	-0.03	-0.01	0.00	0.00	-0.01	-0.02	0.01	-0.01	-0.01	0.00	-0.48	0.15	0.02	0.12	0.10	0.02	0.03	0.02	0.09	0.02
PF	-0.02	-0.01	0.00	0.00	-0.01	-0.01	0.02	0.00	-0.01	0.00	0.19	-0.20	-0.08	0.02	0.02	0.01	0.03	0.01	0.02	0.01
FV	-0.05	-0.03	-0.01	0.00	-0.02	-0.05	-0.01	-0.03	-0.02	0.00	0.01	-0.07	-0.32	-0.01	0.25	0.04	0.01	0.03	0.22	0.06
PV	-0.03	-0.01	0.00	0.00	-0.01	-0.02	0.01	-0.01	-0.01	0.00	0.18	0.02	-0.01	-0.33	0.08	0.01	0.03	0.02	0.07	0.02
BB	-0.02	-0.01	0.00	0.00	0.00	0.01	0.02	0.01	0.00	-0.01	0.04	0.01	0.12	0.02	-0.34	0.01	0.06	0.01	0.05	0.01
SP	-0.01	0.00	0.01	0.01	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.02	0.00	0.05	0.01	0.02	-0.10	-0.04	0.01	0.04	0.01
OF	0.02	0.01	0.02	0.01	0.01	0.03	0.03	0.02	0.00	-0.01	0.01	0.01	0.01	0.01	0.05	-0.02	-0.28	0.02	0.04	0.01
BE	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.01	0.00	0.00	0.02	0.01	0.04	0.01	0.02	0.01	0.05	-0.28	0.06	0.02
FA	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.02	0.01	0.02	0.01	-0.51	0.37
NF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-0.02
share	0.013	0.008	0.005	0.003	0.001	0.006	0.006	0.005	0.001	0.002	0.005	0.004	0.006	0.004	0.014	0.007	0.019	0.006	0.046	0.841

88). The pattern is the same as that discussed for conditional elasticities, with food items in general becoming more inelastic towards the end of the sample. The weighted average of the expenditure elasticites of the 18 at-home food and beverages drops to 0.09 when evaluated at the mean of the last three years. Similarly, own price elasticities become smaller in absolute value, with one of them actually changing sign (for fats and oils). Again, this pattern is dictated by the functional form chosen, and therefore it is not entirely clear whether the elasticities evaluated at the mean of the last three years are more useful for policy analysis than the elasticities evaluated at the sample mean.

Conclusion

The purpose of our analysis was to specify and estimate a complete demand system for Canada emphasizing food consumption. We have specified and estimated a 20-equation, two-stage model relying on explicit separability assumptions within the parametric form of the Almost Ideal Demand System. The first difference version of this model was estimated using data on consumption of individual food items at-home, food away from home, and nonfood from the national account data of Statistics Canada. The statistical and economic implications of the model were analyzed extensively. The results portray a system of food demand that is generally inelastic to both own-price and total expenditures, with cross-elasticity effects. As a final summary, Table 27 reports the own-price and expenditure Marshallian elasticities for the full system at the three evaluation points considered. These elasticities are the ones most likely to be of interest for policy analysis.

Future work on Canadian food demand may improve the present study in a number of ways. First, it may be desirable to enhance the data base, especially

Table 27. Summary of Marshallian Elasticities
Full System, Two-stage Model

good	own-price elasticities evaluated at the mean of			expenditure elasticities evaluated at the mean of		
	62-64	62-88	86-88	62-64	62-88	86-88
BF	-0.40	-0.41	-0.31	0.40	0.26	0.07
PK	-0.57	-0.56	-0.50	0.43	0.28	0.08
CK	-0.66	-0.68	-0.67	0.67	0.43	0.12
FI	-0.54	-0.58	-0.60	0.87	0.55	0.15
EG	-0.60	-0.44	-0.09	0.33	0.19	0.04
MK	-0.41	-0.34	-0.26	0.23	0.13	0.03
CH	-0.05	-0.40	-0.55	-0.04	0.09	0.04
OD	-1.02	-1.02	-1.01	0.21	0.13	0.04
BT	-0.94	-0.92	-0.88	0.30	0.14	0.01
FO	-0.20	-0.12	0.05	-0.16	-0.14	-0.07
FF	-0.48	-0.47	-0.48	0.68	0.45	0.12
PF	-0.22	-0.16	-0.20	0.15	0.08	0.03
FV	-0.34	-0.35	-0.32	1.74	1.11	0.31
PV	-0.25	-0.31	-0.33	0.54	0.35	0.10
BB	-0.43	-0.37	-0.35	0.38	0.25	0.07
SP	-0.18	-0.11	-0.10	0.32	0.20	0.06
OF	-0.13	-0.21	-0.28	0.29	0.20	0.06
BE	-0.09	-0.20	-0.28	0.47	0.31	0.09
FA	-0.48	-0.55	-0.56	1.06	1.05	1.05
NF	-0.95	-0.96	-0.96	1.13	1.13	1.12

as it relates to the disaggregation of meat expenditures. Also, it would be nice to be able to break down demand for food away from home into specific components. Second, the use of separability for the specification of a large demand system may be improved by considering other notions of separability and devising methods for choosing among alternative separable structures. Finally, and most important, the model estimated in this study needs to be used for analyzing specific policy problems. Such applications undoubtedly will be better than anything else in uncovering existing limitations, documenting the need for specific improvements, and suggesting the directions for further advancements.

APPENDIX A. FINAL DEMAND COMMODITY AGGREGATION LEVEL OF PERSONAL EXPENDITURES ON FOOD & NON-ALCOHOLIC BEVERAGES, STATISTICS CANADA

Table 1A. Current and Constant $ Expenditures, 1961 to 1987

code	food group	code	food group
00100	CATTLE AND CALVES	08000	SOUPS CANNED
00200	SHEEP AND LAMBS	08100	INFANT&JUNIOR FOODS,CANNED
00300	HOGS	08200	PICKLES,RELISHES,OTHER SAUCES
00400	POULTRY	08300	VINEGAR
00900	MILK,WHOLE,FLUID,UNPROCESSED	08400	OTHER FOOD PREPARATIONS
01000	EGGS IN THE SHELL	09000	WHEAT FLOUR
01100	HONEY AND BEESWAX	09100	MEAL&FLOUR OF OTHER CEREALS&VE
01200	NUTS,EDIBLE,NOT SHELLED	09200	BREAKFAST CEREAL PRODUCTS
01300	FRUITS,FRESH, EX.TROPICAL	09300	BISCUITS
01400	VEGETABLES,FRESH	09400	BREAD & ROLLS
01800	OIL SEEDS,NUTS AND KERNELS	09500	OTHER BAKERY PRODUCTS
02900	FISH LANDINGS	09600	COCOA & CHOCOLATE
04400	SALT	09700	NUTS,KERNELS & SEEDS PREPARED
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	09800	CHOCOLATE CONFECTIONERY
05300	HORSE MEAT FRESH,CHILLED,FROZE	09900	OTHER CONFECTIONERY
05400	MEAT,CURED	10100	SUGAR
05500	MEAT PREP. COOKED NOT CANNED	10200	MOLASSES,SUGAR REFINERY PROD.
05600	MEAT PREP. CANNED	10600	MALT,MALT FLOUR&WHEAT STARCH
05700	ANIMAL OILS & FATS & LARD	10700	MAPLE SUGAR&SYRUP
05800	MARGERINE,SHORTENING&LIKE PROD	10800	PREPARED CAKE & SIMILAR MIXES
06500	POULTRY,FRESH,CHILLED,FROZEN	10900	SOUPS,DRIED&SOUP MIXES&BASES
06600	POULTRY,CANNED	11000	COFFEE,ROASTED,GROUND,PREPARED
06700	MILK,WHOLE,FLUID,PROCESSED	11100	TEA
06800	CREAM,FRESH	11200	POTATO CHIPS&SIMILAR PRODUCTS
06900	BUTTER	11300	MISC.FOOD NES
07000	CHEESE,CHEDDAR & PROCESSED	11400	SOFTDRINK CONCENTRATES&SYRUPS
07100	MILK EVAPORATED	11500	CARBONATED BEV.,SOFT DRINKS
07200	ICE CREAM	41000	VEG. OILS,OTH.THAN CORN OIL,RE
07300	OTHER DAIRY PRODUCTS	51600	ICE
07400	MUSTARD MAYONNAISE	59200	GREEN COFFEE
07500	FISH PRODUCTS	59300	TROPICAL FRUIT
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	59600	COMMODITY INDIRECT TAXES
07700	FRUITS & PREPARATIONS CANNED		
07800	VEGET.FROZEN,DRIED & PRESERVED		
07900	VEGETABLES&PREPARATIONS CANNED		

Table 2A. Current $ Expenditures, 1988

code	food group	code	food group
0010	CATTLE & CALVES	0800	SOUPS IN AIRTIGHT CONTAINERS
0030	HOGS	0810	INFANT & JUNIOR FOODS, CANNED
0040	POULTRY	0820	SAUCES, PICKLES, ETC.
0059	OTHER LIVE ANIMALS	0830	VINEGAR
0090	FLUID MILK, UNPROCESSED	0841	MINERAL WATER & FRUIT DRINKS
0100	EGGS IN THE SHELL	0842	PASTA PRODUCTS
0110	HONEY & BEESWAX	0843	PRECOOKED & FROZEN FOOD PRODUC
0130	FRESH FRUIT, EXCL TROPICAL	0900	WHEAT FLOUR
0141	POTATOES, FRESH OR CHILLED	0919	STARCHES
0142	OTHER VEGETABLES, FRESH OR CHI	0929	BREAKFAST CEREAL PRODUCTS
0180	SOYBEANS, CANOLA & OTH OIL SEE	0930	BISCUITS
0291	FISH, FRESH, CHILLED	0940	PLAIN BREAD & ROLLS
0440	SALT	0951	OTHER BAKERY PRODUCTS
0521	BEEF, FRESH, CHILLED, FROZEN	0952	FOOD SNACKS
0522	PORK, FRESH, CHILLED, FROZEN	0960	COCOA & CHOCOLATE
0523	OTHER MEAT, FRESH, CHILLED, FR	0979	NUTS
0524	EDIBLE OFFAL, FRESH, CHILLED,	0989	CHOCOLATE CONFECTIONERY
0540	CURED MEAT	0999	OTHER CONFECTIONERY
0559	PREPARED MEAT PRODUCTS	1010	SUGAR
0570	ANIMAL FAT & LARD	1069	OTHER FLOURS & PROCESSED GRAIN
0580	MARGARINE & SHORTENING	1071	MAPLE SUGAR & SYRUP
0650	POULTRY, FRESH, CHILLED, FROZE	1072	OTHER SYRUP
0679	FLUID MILK, PROCESSED	1089	PREPARED CAKE & OTHER MIXES
0680	FRESH CREAM	1090	DEHYDRATED SOUP MIXES & BASES
0690	BUTTER	1100	ROASTED COFFEE
0700	CHEESE	1110	TEA
0719	EVAPORATED & CONDENSED DAIRY P	1120	POTATO CHIPS & FLAKES
0720	ICE CREAM	1131	SPICES
0731	POWDER DAIRY PRODUCTS	1132	PEANUT BUTTER
0732	OTHER DAIRY PRODUCTS	1133	FOOD & DRINK POWDERS
0740	MAYONNAISE, SALAD DRESSING & M	1134	OTHER FOOD PRODUCTS
0751	FISH & SEAFOOD, FRESH,CHILLED,	1135	INFANT & JUNIOR FOODS, EXCL CA
0752	OTHER FISH & SEAFOOD PRODUCTS	1136	DRY PASTA
0761	FROZEN FRUIT & JUICE	1140	SOFT DRINK CONCENTRATES
0762	OTHER FRUIT JUICE	1150	CARBONATED SOFT DRINKS
0763	OTHER FRUIT PRODUCTS	4109	REFINED VEGETABLE OILS
0770	FRUIT & JAM IN AIRTIGHT CONT.	5920	COFFEE, NOT ROASTED
0781	FROZEN POTATOES	5930	TROPICAL FRUIT
0782	OTHER FROZEN VEGETABLES	5960	COMMODITY INDIRECT TAXES
0783	OTHER PRESERVED VEGETABLES		
0790	VEGETABLES & JUICE AIRTIGHT CO		

Table 3A. Constant $ Expenditures, 1988

code	food group	code	food group
001	CATTLE & CALVES	080	SOUPS IN AIRTIGHT CONTAINERS
003	HOGS	081	INFANT & JUNIOR FOODS, CANNED
004	POULTRY	082	SAUCES, PICKLES, ETC
005	OTHER LIVE ANIMALS	083	VINEGAR
009	FLUID MILK, UNPROCESSED	084	PRE-COOKED & FROZEN PRODUCTS,
010	EGGS IN THE SHELL	090	WHEAT FLOUR
011	HONEY & BEESWAX	091	STARCHES
013	FRESH FRUIT EXCL TROPICAL	092	BREAKFAST CEREAL PRODUCTS
014	VEGETABLES, FRESH OR CHILLED	093	BISCUITS
018	SOYBEANS, CANOLA & OTH OIL SEE	094	PLAIN BREAD & ROLLS
029	FISH & SEAFOOD, FRESH, CHILLED	095	OTHER BAKERY PRODUCTS
044	SALT	096	COCOA & CHOCOLATE
052	MEAT, FRESH, CHILLED, FROZEN	097	NUTS
054	CURED MEAT	098	CONFECTIONERY
055	PREPARED MEAT PRODUCTS	101	SUGAR
057	ANIMAL FAT & LARD	106	OTHER FLOURS & PROCESSED GRAIN
058	MARGARINE & SHORTENING	107	MAPLE SUGAR, SYRUP & OTH SYRUP
065	POULTRY, FRESH, CHILLED, FROZE	108	PREPARED CAKE & OTHER MIXES
067	MILK & OTHER DAIRY PRODUCTS	109	DEHYDRATED SOUP MIXES & BASES
068	FRESH CREAM	110	ROASTED COFFEE
069	BUTTER	111	TEA
070	CHEESE	112	POTATO CHIPS & FLAKES
072	ICE CREAM	113	OTHER FOOD PREPARATIONS & ICE
074	MAYONNAISE, SALAD DRESSING & M	114	SOFT DRINK CONCENTRATES
075	FISH PRODUCTS	115	CARBONATED SOFT DRINKS
076	FRUIT & PRODUCTS, FROZEN, PRES	410	REFINED VEGETABLE OILS
077	FRUIT & JAM IN AIRTIGHT CONT.	592	COFFEE, NOT ROASTED
078	VEGETABLES, FROZEN, PRESERVED	593	TROPICAL FRUIT
079	VEGETABLES & JUICE, AIRTIGHT C	596	COMMODITY INDIRECT TAXES

APPENDIX B. DISAGGREGATING MEAT EXPENDITURES

The task is that of disaggregating meat expenditures from DATA-4. We observe that the **Handbook of Food Expenditures, Prices and Consumption** published by Agriculture Canada contains data on quantity disappearance for individual meats (beef, veal, pork, and lamb). If we had nominal prices corresponding to these retail sales we could compute consumer expenditures for the individual meat categories, and the resulting meat shares could be used to allocate the meat expenditure data reported by Statistics Canada. Unfortunately, a standard problem with analyzing Canadian meat demand is that no nominal price series for individual meats are available from official statistical sources. This situation is unlike that, for example, of the United States, where U.S.D.A. publishes series of retail prices for beef, pork, and chicken. Clearly there is no fully satisfactory method that can overcome this informational deficiency. The method of Moschini and Vissa (1993) seems promising, and is adapted here to suit our problem.

Because Statistics Canada publishes Consumer Price Indices for meat categories, one could infer a nominal price series if one could match the index with a dollars figure for at least one year. This is the approach taken by Van Kooten (1987). Here we follow Moschini and Vissa (1993), who provide a somewhat more general framework. Specifically, we computed average prices for beef and veal, pork, and lamb from the Family Food Expenditure surveys of Statistics Canada (DATA-5), for each of the 7 years for which data were available within the sample of interest, that is 1969, 1974, 1976, 1978, 1982, 1984, and 1986. For each of these years we also collected the appropriate CPIs from Statistics

Canada. These data are reported in Table 1B.[30] Regressing nominal prices on the corresponding CPI (through the origin) produced the following results:

$$P_{BF} = \underset{(0.0022)}{0.0585}\ CPI_{BF} \qquad R^2 = 0.92$$

$$P_{PK} = \underset{(0.0010)}{0.0510}\ CPI_{PK} \qquad R^2 = 0.97$$

$$P_{LA} = \underset{(0.0014)}{0.0501}\ CPI_{LA} \qquad R^2 = 0.96$$

where standard errors are reported under the corresponding estimated coefficient, and the R^2 is computed as 1 minus the ratio of appropriate variances.

Multiplying these estimated coefficients for the whole series of CPIs yields estimated series for retail prices of beef and veal, pork, and lamb. Multiplying such prices by the corresponding quantity disappearances (in retail weight) yields estimated expenditures for each of the three meat categories. From these data we then computed the shares of meat expenditures for the three categories of interest: beef and veal, pork, and lamb. These shares were then used to allocate Statistics Canada's meat consumer expenditures. It must be stressed that the quantities used to come up with these shares are total disappearances (i.e., consumed either at home or in restaurants), whereas the expenditures we want to allocate are for food consumed at home. Hence, our procedure is accurate only if the three meat categories are consumed roughly in the same proportion both at home and in restaurants. On the other hand, the nominal prices computed from the family food expenditure surveys pertain to meat consumed at home, and therefore the price series estimated as discussed above should reflect the appropriate price movement for our purposes.

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[30] Specifically, the CPI series were obtained by aggregating the quarterly series furnished by Agriculture canada in DATA-3. CPIs for beef and veal, and pork, are equal to 100 in 1986, whereas the CPI for lamb is equal to 100 in 1981.

Table 1B. Meat prices and price indices

year	----- price indices -----			---- prices, $/Kg ----		
	beef	pork	lamb	beef	pork	lamb
69	32.2	34.4	37.0	1.81	1.66	1.60
74	44.3	43.7	58.1	2.96	2.48	2.94
76	39.3	57.7	64.3	2.91	3.04	3.37
78	61.1	64.1	75.4	3.96	3.51	3.95
82	88.9	85.3	114.8	4.98	4.16	5.18
84	95.5	83.9	104.9	5.73	4.33	5.50
86	100.0	100.0	104.4	5.31	4.92	5.45

Source: see text.

APPENDIX C. CHANGING THE BASE OF REAL EXPENDITURES

The available constant dollar expenditures were expressed in terms of several base years. Specifically, the constant dollar expenditures were expressed in 1961 prices for the period 1961-1971, in 1971 prices for the period 1972-1981, in 1981 prices for the period 1982-1986, and in 1986 prices for the period 1987-1988. To express all the constant dollar expenditure in 1986 prices we proceed as follows. Let $X^k_{t,s}$ denote the constant expenditures at time t evaluated at the prices of base year s, and X^c_s is the current dollar expenditure for time s. Then the constant dollar expenditures in 1986 dollars are calculated as:

$$X^k_{t,86} = X^k_{t,86} \qquad t = 87, 88$$

$$X^k_{t,86} = X^k_{t,81} \frac{X^c_{86}}{X^k_{86,81}} \qquad t = 82, \ldots, 86$$

$$X^k_{t,86} = X^k_{t,71} \frac{X^c_{81}}{X^k_{81,71}} \frac{X^c_{86}}{X^k_{86,81}} \qquad t = 72, \ldots, 81$$

$$X^k_{t,86} = X^k_{t,61} \frac{X^c_{71}}{X^k_{71,61}} \frac{X^c_{81}}{X^k_{81,71}} \frac{X^c_{86}}{X^k_{86,81}} \qquad t = 61, \ldots, 71$$

APPENDIX D. PERSONAL CONSUMPTION EXPENDITURE DATA

Table 1D. Personal Expenditures on Final Demand, Food & Non-Alcoholic Beverages (thousands of dollars)

code	commodity groups	year									
		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
00100	CATTLE AND CALVES	22191	23858	23700	23744	24042	26152	26322	26519	30997	30384
00200	SHEEP AND LAMBS	369	355	347	341	337	344	324	313	318	332
00300	HOGS	15364	14859	13562	13586	14817	15005	11940	11441	13121	10950
00400	POULTRY	8695	9126	8361	6681	7273	6354	6429	4813	4515	3261
00900	MILK,WHOLE,FLUID,UNPROCESSED	31733	30238	30486	30054	27784	22498	21359	21488	21490	21495
01000	EGGS IN THE SHELL	162137	160602	170124	145951	165650	184323	167540	181192	207762	186704
01100	HONEY AND BEESWAX	5921	6632	7088	8482	11495	11351	11717	10718	12316	12121
01200	NUTS,EDIBLE,NOT SHELLED	2713	3372	3583	3726	3844	3958	3973	3407	2902	3117
01300	FRUITS,FRESH, EX.TROPICAL	111385	116406	118199	122055	133733	148025	153481	175132	180798	191339
01400	VEGETABLES,FRESH	250323	256579	256160	277726	320470	328756	321691	345081	341981	405064
01800	OIL SEEDS,NUTS AND KERNELS	205	210	215	235	250	260	269	284	310	330
02900	FISH LANDINGS	13874	15236	15265	16008	15588	13400	12146	11785	13079	21287
04400	SALT	8206	8786	9314	9433	9486	10261	10386	11676	12641	14138
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	616180	678612	707986	733507	802030	959152	1037569	1073134	1163678	1171587
05300	HORSE MEAT FRESH,CHILLED,FROZE	2032	2599	2238	2334	2360	2340	2399	2714	2826	2664
05400	MEAT,CURED	155384	167653	175558	172418	184721	194158	196579	195676	227985	226573
05500	MEAT PREP. COOKED NOT CANNED	141898	151048	155153	164433	178095	203907	214621	221524	246953	252766
05600	MEAT PREP. CANNED	43538	48788	49001	53741	62895	72730	75067	75689	82072	83047
05700	ANIMAL OILS & FATS & LARD	9608	9605	8345	8613	9030	9160	9071	8346	7228	10269
05800	MARGERINE,SHORTENING&LIKE PROD	82114	80505	80048	83203	91312	93937	86523	76278	68338	83136
06500	POULTRY,FRESH,CHILLED,FROZEN	179727	183211	210759	228098	246334	275763	293671	294567	325059	329409
06600	POULTRY,CANNED	4786	4977	4254	4893	6103	7051	7107	7066	7613	7421
06700	MILK,WHOLE,FLUID,PROCESSED	338983	350167	355366	363902	379382	418923	442792	454388	467091	479770
06800	CREAM,FRESH	27387	28755	28767	30076	30609	33452	36446	38540	41482	42323
06900	BUTTER	189803	197535	202187	205296	207730	221402	225946	221062	220866	208061
07000	CHEESE,CHEDDAR & PROCESSED	105016	108463	113558	118412	129773	145180	150571	171224	183695	196240
07100	MILK EVAPORATED	41169	42932	43301	43961	43595	46073	46786	43730	48758	49076
07200	ICE CREAM	75937	79940	82688	87906	99944	102797	103065	110648	117648	123693
07300	OTHER DAIRY PRODUCTS	66133	68349	72124	78910	83388	97890	111167	93213	96102	101198
07400	MUSTARD MAYONNAISE	21194	21382	22086	23427	25769	27350	27576	30498	32002	34243
07500	FISH PRODUCTS	81580	96032	100290	108220	125503	137781	131865	137214	151203	169911
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	75305	77120	81920	84549	73634	77857	82937	95729	104385	110489
07700	FRUITS & PREPARATIONS CANNED	109044	112338	128225	130472	131512	133932	135106	136490	138453	139059
07800	VEGET.FROZEN,DRIED & PRESERVED	16246	19804	20261	28872	29501	36843	48137	43779	64280	63869
07900	VEGETABLES&PREPARATIONS CANNED	110065	121241	127173	139481	153444	152026	163514	166009	167203	169395

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Table 1D. continued

code	commodity groups	year 1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
08000	SOUPS CANNED	56521	65984	72157	72552	78121	79357	80709	77861	89129	91855
08100	INFANT&JUNIOR FOODS,CANNED	34059	37086	38235	42072	42433	41469	42013	38202	39036	42124
08200	PICKLES,RELISHES,OTHER SAUCES	47535	52721	55087	58596	63318	69137	69772	73830	81282	84116
08300	VINEGAR	6195	5933	6138	6325	6299	6407	7329	7043	7787	7297
08400	OTHER FOOD PREPARATIONS	27796	28761	38550	38786	42688	55477	58182	63330	73387	81130
09000	WHEAT FLOUR	45168	46481	48764	50124	47262	47603	47285	43554	43603	43058
09100	MEAL&FLOUR OF OTHER CEREALS&VE	12135	12281	12207	12307	12299	12666	13791	14070	14563	15253
09200	BREAKFAST CEREAL PRODUCTS	46742	52239	52884	58532	62178	65427	70016	72622	77087	81447
09300	BISCUITS	114136	118565	127543	135774	144260	147849	152583	159548	166880	171807
09400	BREAD & ROLLS	283095	294885	307038	327650	334701	343302	358126	363086	367016	376629
09500	OTHER BAKERY PRODUCTS	155854	162090	166885	180610	199319	205016	210065	213678	215840	218681
09600	COCOA & CHOCOLATE	8483	8119	8301	8307	7969	8092	8466	7285	6964	6684
09700	NUTS,KERNELS & SEEDS PREPARED	23690	24707	24640	27002	27934	28882	29962	33178	37769	41409
09800	CHOCOLATE CONFECTIONERY	115145	120978	130824	140737	151566	168229	177425	183794	188176	197252
09900	OTHER CONFECTIONERY	77433	88717	105766	112940	117887	119801	134086	142648	155857	170162
10100	SUGAR	62609	63964	100881	103414	69054	62571	63682	65116	83698	92389
10200	MOLASSES,SUGAR REFINERY PROD.	16215	17447	23423	19304	12148	11606	15754	13515	10582	6625
10600	MALT,MALT FLOUR&WHEAT STARCH	10971	15081	15993	17968	18378	18861	20058	24797	23686	23820
10700	MAPLE SUGAR&SYRUP	12064	15028	13191	13385	13051	17231	11434	12331	8229	10085
10800	PREPARED CAKE & SIMILAR MIXES	20547	20682	23166	23050	23549	24707	25499	29090	29881	31246
10900	SOUPS,DRIED&SOUP MIXES&BASES	13301	16890	14550	14935	15807	17666	18674	22298	22536	24977
11000	COFFEE,ROASTED,GROUND,PREPARED	113763	120859	124485	152535	154732	157963	156070	158436	170253	195394
11100	TEA	47997	48965	50172	50981	51048	51003	51416	51827	54369	54245
11200	POTATO CHIPS&SIMILAR PRODUCTS	38325	41170	47788	51027	50952	59225	69893	83785	91627	102464
11300	MISC.FOOD NES	109739	115945	123513	126389	130982	139953	162734	183853	194286	221270
11400	SOFTDRINK CONCENTRATES&SYRUPS	4312	4685	5202	5355	5448	5614	5748	5114	5425	5797
11500	CARBONATED BEV.,SOFT DRINKS	190409	200497	223033	242804	256884	286481	325431	345725	384118	406059
41000	VEG. OILS,OTH.THAN CORN OIL,RE	4926	5035	5442	5139	5357	5441	7093	8268	8926	11340
51600	ICE	329	413	491	592	697	708	786	851	897	942
59200	GREEN COFFEE	19	15	11	7	3	2	2	2	3	3
59300	TROPICAL FRUIT	115188	117294	111017	124047	128625	128692	130458	137201	141823	150269
59600	COMMODITY INDIRECT TAXES	4900	6800	7800	8800	10000	11800	15300	17400	19800	21400

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Table 1D. continued

code	commodity groups	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
00100	CATTLE AND CALVES	31940	38151	54954	41041	37093	49368	48669	70443	99113	91748
00200	SHEEP AND LAMBS	277	325	404	428	445	455	552	754	932	931
00300	HOGS	9191	9542	17206	12719	11852	19275	17953	21059	18576	15546
00400	POULTRY	2030	2202	3261	3101	3014	2927	2821	2638	3054	2912
00900	MILK,WHOLE,FLUID,UNPROCESSED	21500	21525	21545	21608	24934	25965	26719	27032	29652	28884
01000	EGGS IN THE SHELL	171234	178207	251053	283564	274794	299046	298732	302792	338474	371617
01100	HONEY AND BEESWAX	12541	18160	24337	31746	33579	34421	36147	39066	43929	47079
01200	NUTS,EDIBLE,NOT SHELLED	3122	3280	3663	3857	5070	6914	6958	7412	9792	13370
01300	FRUITS,FRESH, EX.TROPICAL	202481	227871	285612	307940	352716	431312	463524	555092	592875	618406
01400	VEGETABLES,FRESH	414967	438313	600808	773150	808802	898323	884701	850325	909469	1096734
01800	OIL SEEDS,NUTS AND KERNELS	347	362	375	595	460	419	505	519	576	594
02900	FISH LANDINGS	22203	24027	27499	31370	35439	38870	44321	52976	58967	60417
04400	SALT	15920	16407	20108	23175	24495	30638	33613	35086	37638	38051
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	1199262	1400363	1869217	2068049	2260230	2299919	2284890	2981671	3445362	3513332
05300	HORSE MEAT FRESH,CHILLED,FROZE	3419	3383	3500	5016	5154	5158	5766	8504	4059	3906
05400	MEAT,CURED	230712	265932	314827	358060	418708	422857	445195	514191	515687	541762
05500	MEAT PREP. COOKED NOT CANNED	254728	317855	381923	412334	446756	475589	494820	587187	684552	726682
05600	MEAT PREP. CANNED	84043	85807	109219	122108	130791	126576	129391	136414	136236	138486
05700	ANIMAL OILS & FATS & LARD	13777	13996	19863	22494	21999	24332	27045	33687	38105	38650
05800	MARGERINE,SHORTENING&LIKE PROD	86653	84559	95500	159415	190600	197927	238027	298242	347169	365436
06500	POULTRY,FRESH,CHILLED,FROZEN	319057	368841	502205	509509	557548	661634	663589	753338	858406	899451
06600	POULTRY,CANNED	6896	6893	7631	8294	6875	8290	8910	10184	11212	14009
06700	MILK,WHOLE,FLUID,PROCESSED	501449	517821	580216	682068	876847	938718	1017415	1083278	1226235	1379820
06800	CREAM,FRESH	45235	46457	50168	46722	55371	60954	80188	92097	101674	116193
06900	BUTTER	195950	196084	200328	206896	243692	257116	261201	256204	251819	280207
07000	CHEESE,CHEDDAR & PROCESSED	228700	279380	325413	436459	480774	585631	646510	786752	891354	1084036
07100	MILK EVAPORATED	51690	59013	58267	62916	81551	87527	93509	114010	114703	117182
07200	ICE CREAM	131366	147743	152256	181991	226186	241097	260457	268804	294027	337994
07300	OTHER DAIRY PRODUCTS	107251	127494	140137	165106	199227	203707	205628	238804	259469	333903
07400	MUSTARD MAYONNAISE	39347	42442	47185	66787	81287	85746	95990	113734	130232	148730
07500	FISH PRODUCTS	177886	195034	234520	249669	262346	320361	360817	410743	506559	507734
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	121517	138242	157702	194114	219462	235150	311585	395440	466898	536529
07700	FRUITS & PREPARATIONS CANNED	140815	148848	167715	210924	241566	243961	245397	262971	297510	322017
07800	VEGET.FROZEN,DRIED & PRESERVED	65604	65476	80816	120010	131978	143395	175925	214101	229449	235842
07900	VEGETABLES&PREPARATIONS CANNED	182650	218704	227050	284555	309880	331856	368353	395677	420366	457996

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Table 1D. continued

code	commodity groups	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
		year									
08000	SOUPS CANNED	95489	102656	109684	124753	148507	159033	165372	178123	192711	210222
08100	INFANT&JUNIOR FOODS,CANNED	42583	50662	53604	57083	62547	72697	77439	74413	74128	74063
08200	PICKLES,RELISHES,OTHER SAUCES	84764	97368	107798	126765	158107	180226	203471	226750	248552	277992
08300	VINEGAR	7811	8395	8581	9322	9671	14517	15477	16425	17862	19494
08400	OTHER FOOD PREPARATIONS	84598	133614	161040	184197	196947	228700	233487	287650	344270	397352
09000	WHEAT FLOUR	41246	40921	48035	52015	54935	57782	59715	59819	81547	97109
09100	MEAL&FLOUR OF OTHER CEREALS&VE	17869	21268	23490	27942	28621	29947	31059	30201	31971	35082
09200	BREAKFAST CEREAL PRODUCTS	88593	106109	123272	149903	182349	200213	210431	220165	249788	284957
09300	BISCUITS	174732	183283	193625	246767	294519	300609	316719	347303	362119	411037
09400	BREAD & ROLLS	385184	401366	456543	549896	595831	637674	680452	738337	850984	937883
09500	OTHER BAKERY PRODUCTS	234638	276256	305486	384918	454401	466172	494295	529438	618533	709069
09600	COCOA & CHOCOLATE	6051	5980	5667	5824	4702	10447	14172	26430	40436	41071
09700	NUTS,KERNELS & SEEDS PREPARED	44335	47568	53650	61211	66511	71963	87162	96644	112737	138890
09800	CHOCOLATE CONFECTIONERY	203370	220743	250564	336203	404778	398718	454851	474752	522061	604383
09900	OTHER CONFECTIONERY	173125	176386	190314	255622	326343	331121	355765	380272	416029	447064
10100	SUGAR	102740	110891	125203	236193	230779	152137	126571	124479	133528	216999
10200	MOLASSES,SUGAR REFINERY PROD.	6907	7951	6619	2269	4958	5833	7037	6831	8783	7246
10600	MALT,MALT FLOUR&WHEAT STARCH	25047	26696	38133	51436	52927	53586	56902	57715	71806	86896
10700	MAPLE SUGAR&SYRUP	9843	17579	20373	26252	39919	36055	31500	35210	43393	75203
10800	PREPARED CAKE & SIMILAR MIXES	33537	35427	35792	47838	63179	73433	76974	91932	105378	126207
10900	SOUPS,DRIED&SOUP MIXES&BASES	25648	28307	31726	39496	44919	51318	62192	66973	72676	83537
11000	COFFEE,ROASTED,GROUND,PREPARED	198399	205160	215684	257796	286013	393832	616734	653352	696840	776442
11100	TEA	56216	55745	57798	62382	73744	75378	105051	118263	120523	121332
11200	POTATO CHIPS&SIMILAR PRODUCTS	112558	119648	130740	170464	185816	206954	231428	240299	281987	326933
11300	MISC.FOOD NES	241059	252050	286035	389967	460088	465917	512438	577698	642882	741175
11400	SOFTDRINK CONCENTRATES&SYRUPS	6225	6301	6377	6756	7817	8050	6921	6040	5911	6477
11500	CARBONATED BEV.,SOFT DRINKS	442262	468855	489307	572604	746904	773676	793291	828160	903180	1078239
41000	VEG. OILS,OTH.THAN CORN OIL,RE	14292	13987	18595	36413	37840	32555	37778	47531	41634	41551
51600	ICE	1065	1172	1304	1352	1400	1552	1540	1355	1158	1343
59200	GREEN COFFEE	3	3	4	5	5	9	18	18	18	19
59300	TROPICAL FRUIT	161099	165610	166623	185885	221357	256132	272648	299013	349500	381560
59600	COMMODITY INDIRECT TAXES	22800	26300	35500	43400	44800	55400	60700	61200	68000	72800

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Table 1D. continued

code	commodity groups	1981	1982	1983	1984	1985	1986	1987	1988	(notes for 1988)
		year								
00100	CATTLE AND CALVES	89249	89402	92218	97681	105748	112026	120518	125950	
00200	SHEEP AND LAMBS	1279	1776	2484	3165	3482	3865	4263	4549	
00300	HOGS	16078	22763	19036	19879	21114	26391	27351	29188	
00400	POULTRY	8126	8239	8307	9549	10142	10756	11586	12364	
00900	MILK,WHOLE,FLUID,UNPROCESSED	28813	23873	18984	15083	16020	16989	17300	18462	
01000	EGGS IN THE SHELL	434251	438648	458485	493216	448829	444101	441749	468149	
01100	HONEY AND BEESWAX	54346	61104	62972	63002	57370	58123	62362	60531	
01200	NUTS,EDIBLE,NOT SHELLED	16109	15479	14347	14552	15456	18842	23554	0	(included with 09700)
01300	FRUITS,FRESH, EX.TROPICAL	756162	788191	820891	879114	928289	1016340	1066459	1160886	
01400	VEGETABLES,FRESH	1546734	1418573	1509844	1587513	1530476	1718127	1994391	1952780	
01800	OIL SEEDS,NUTS AND KERNELS	610	600	688	799	849	900	969	1034	
02900	FISH LANDINGS	62878	65529	68539	77906	86764	87752	101393	135455	
04400	SALT	42163	46512	47143	49592	52372	57585	62029	65965	
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	3634977	3870592	3743987	3793031	3804286	4076009	4393637	4125613	
05300	HORSE MEAT FRESH,CHILLED,FROZE	4096	3007	2380	1837	2324	2469	3646	0	(included with 05200)
05400	MEAT,CURED	653680	689524	712676	732308	747090	806623	851014	714462	
05500	MEAT PREP. COOKED NOT CANNED	779615	848429	883464	944596	986996	1051494	1180779	1383601	
05600	MEAT PREP. CANNED	139132	146644	143845	145347	146623	148448	183042	0	(included with 05500)
05700	ANIMAL OILS & FATS & LARD	40592	41212	41356	44977	36306	26651	30708	32771	
05800	MARGERINE,SHORTENING&LIKE PROD	389382	398872	412050	463413	465720	363141	348338	410247	
06500	POULTRY,FRESH,CHILLED,FROZEN	1047147	1125609	1197168	1294299	1371995	1463838	1513389	1589416	
06600	POULTRY,CANNED	13362	14396	16625	17823	18493	19690	21081	0	(included with 06500)
06700	MILK,WHOLE,FLUID,PROCESSED	1502981	1611149	1669413	1750164	1852497	1918075	1929874	2091794	
06800	CREAM,FRESH	130527	147292	154979	167730	177896	190890	203619	216645	
06900	BUTTER	313101	377024	404814	427438	434656	447782	449362	462543	
07000	CHEESE,CHEDDAR & PROCESSED	1201651	1347711	1479799	1581467	1701310	1794212	1890118	2092698	
07100	MILK EVAPORATED	120569	137212	145088	153821	134982	113249	135972	86389	
07200	ICE CREAM	363190	394653	423935	473753	505762	533069	557383	620390	
07300	OTHER DAIRY PRODUCTS	406338	431381	453760	533846	581179	622081	675983	632325	
07400	MUSTARD MAYONNAISE	171868	190245	209666	248565	269048	284762	334505	375283	
07500	FISH PRODUCTS	539023	510253	593567	639453	688763	774887	895976	1203914	
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	602690	682502	720770	779352	813727	838846	939244	1071637	
07700	FRUITS & PREPARATIONS CANNED	339467	358049	363868	404618	424460	436412	459996	470579	
07800	VEGET.FROZEN,DRIED & PRESERVED	257516	292486	354015	390964	415248	417812	444526	611163	
07900	VEGETABLES&PREPARATIONS CANNED	540697	601322	617107	646115	669745	685474	691683	719293	

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Table 1D. continued

code	commodity groups	1981	1982	1983	1984	1985	1986	1987	1988	(notes for 1988)
		year								
08000	SOUPS CANNED	232327	250153	269287	290619	303561	313347	340473	391452	
08100	INFANT&JUNIOR FOODS,CANNED	86506	100644	110339	113838	129409	137625	145145	171805	
08200	PICKLES,RELISHES,OTHER SAUCES	326336	379373	431964	472023	504494	535045	600869	668925	
08300	VINEGAR	25921	30637	32384	33634	35723	37643	39969	40474	
08400	OTHER FOOD PREPARATIONS	442275	461346	522021	621353	718912	803754	920032	821500	
09000	WHEAT FLOUR	106706	110190	114115	123058	130702	145610	151617	158802	
09100	MEAL&FLOUR OF OTHER CEREALS&VE	37346	38037	39858	46183	47052	48020	49223	50211	
09200	BREAKFAST CEREAL PRODUCTS	338171	382603	406935	437167	468647	496472	519288	599480	
09300	BISCUITS	476933	489735	513342	550270	585948	597583	635236	696521	
09400	BREAD & ROLLS	1058702	1186618	1191870	1265423	1310633	1414400	1502238	1596843	
09500	OTHER BAKERY PRODUCTS	832805	892950	937050	1008172	1074993	1142829	1216307	1303353	
09600	COCOA & CHOCOLATE	56084	59710	66003	70792	74691	74019	75655	94138	
09700	NUTS,KERNELS & SEEDS PREPARED	160757	175355	192851	215991	219763	237830	235146	280267	
09800	CHOCOLATE CONFECTIONERY	668921	724287	769870	816549	901103	918965	960156	1033791	
09900	OTHER CONFECTIONERY	539128	562693	604509	656624	747617	837256	890434	1052963	
10100	SUGAR	202393	166401	177516	167740	145899	152465	176536	206295	
10200	MOLASSES,SUGAR REFINERY PROD.	4108	4218	4831	5666	6018	6382	6963	0	(included with 10100)
10600	MALT,MALT FLOUR&WHEAT STARCH	99513	101201	109982	128300	142355	143838	147442	176831	
10700	MAPLE SUGAR&SYRUP	105048	94162	96230	113829	127033	146712	150998	166438	
10800	PREPARED CAKE & SIMILAR MIXES	152417	173068	183244	189340	198101	206785	229817	246688	
10900	SOUPS,DRIED&SOUP MIXES&BASES	91657	95528	97487	108681	131201	148055	175422	180534	
11000	COFFEE,ROASTED,GROUND,PREPARED	735497	750866	763308	864085	895320	1058141	915512	922719	
11100	TEA	124901	125604	133091	152595	164141	158765	148724	151521	
11200	POTATO CHIPS&SIMILAR PRODUCTS	360183	373684	386713	448764	504264	549861	604239	621673	
11300	MISC.FOOD NES	895091	960310	1042163	1158190	1240932	1340579	1447407	1537215	
11400	SOFTDRINK CONCENTRATES&SYRUPS	6194	6510	6854	7424	8326	8838	9523	10112	
11500	CARBONATED BEV.,SOFT DRINKS	1263460	1371328	1434955	1568389	1846951	2002883	2072729	2194494	
41000	VEG. OILS,OTH.THAN CORN OIL,RE	43608	42385	63607	64089	68362	72523	78117	82985	
51600	ICE	1495	1645	2209	2513	3842	4387	4693	0	(included with 11300)
59200	GREEN COFFEE	16	16	16	18	19	20	22	23	
59300	TROPICAL FRUIT	434915	501278	477319	531454	543966	613784	630457	597716	
59600	COMMODITY INDIRECT TAXES	83500	115500	132400	144900	0	0	0	0	

Source: Statistics Canada.

Table 2D. Constant Dollar Personal Expenditures on Final Demand, Food & Non-Alcoholic Beverages, (thousands of 1986 dollars)

code	commodity groups	year									
		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
00100	CATTLE AND CALVES	82150	77678	82535	88699	84605	82324	79030	79814	85634	81565
00200	SHEEP AND LAMBS	2164	2023	1906	1847	1642	1583	1466	1390	1278	1261
00300	HOGS	48629	45884	43758	45217	40960	37513	35221	34161	32828	30429
00400	POULTRY	23430	23120	20970	17604	18458	15351	16540	12021	11379	8760
00900	MILK,WHOLE,FLUID,UNPROCESSED	185025	175608	174442	166098	147271	115476	101827	99594	96387	94515
01000	EGGS IN THE SHELL	467992	470413	459459	456680	470572	448324	491848	494362	502374	509553
01100	HONEY AND BEESWAX	27534	30180	30920	35700	49855	47972	48925	45401	50344	47865
01200	NUTS,EDIBLE,NOT SHELLED	7874	9235	9848	10344	9993	10861	9334	7810	6551	7622
01300	FRUITS,FRESH, EX.TROPICAL	584259	595138	585691	598081	643527	659798	661975	716349	735290	757247
01400	VEGETABLES,FRESH	1210180	1156836	1125702	1131595	1141578	1257379	1324389	1312661	1333352	1413160
01800	OIL SEEDS,NUTS AND KERNELS	535	537	519	545	571	558	634	707	746	816
02900	FISH LANDINGS	94624	95572	92980	90341	80929	70330	63715	61737	62323	96315
04400	SALT	22113	23743	25554	27128	28814	31129	30930	31005	34829	39830
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	2373482	2391821	2622606	2842555	2929928	3128018	3313195	3351514	3244700	3243067
05300	HORSE MEAT FRESH,CHILLED,FROZE	12878	15166	13588	14792	14133	12491	12479	13981	12992	12289
05400	MEAT,CURED	557412	590505	646406	648795	592284	558352	649179	652562	670459	684048
05500	MEAT PREP. COOKED NOT CANNED	595491	622383	639744	686193	702778	717407	791364	826297	844611	867688
05600	MEAT PREP. CANNED	164442	180955	183912	206510	212334	223211	254137	257684	247868	252434
05700	ANIMAL OILS & FATS & LARD	29193	31007	26428	24207	21937	22448	27744	29415	20789	25748
05800	MARGERINE,SHORTENING&LIKE PROD	231840	240728	250666	243537	239788	243286	229107	211681	187360	210935
06500	POULTRY,FRESH,CHILLED,FROZEN	642911	644757	699276	779408	814303	842842	956656	928472	1056166	1105731
06600	POULTRY,CANNED	17865	18373	14651	17395	21001	22572	24118	23285	25629	25779
06700	MILK,WHOLE,FLUID,PROCESSED	1674558	1732637	1757267	1758403	1811799	1897117	1859000	1824529	1785173	1811330
06800	CREAM,FRESH	127033	135772	132984	137845	139608	144047	151955	158389	170073	173065
06900	BUTTER	702925	830454	904415	901612	875662	857652	821876	785346	773550	719458
07000	CHEESE,CHEDDAR & PROCESSED	614925	622508	635976	644150	668556	706313	688834	764306	806021	847905
07100	MILK EVAPORATED	265722	281858	280554	276837	267271	273364	264096	247766	269556	263896
07200	ICE CREAM	343765	366119	374616	393684	449922	452960	449424	476011	493196	513164
07300	OTHER DAIRY PRODUCTS	518411	563108	532137	456178	517415	552314	581843	434048	402066	422643
07400	MUSTARD MAYONNAISE	93049	93448	96416	102338	111997	120282	118578	131135	135112	135376
07500	FISH PRODUCTS	598946	674801	688611	730203	813261	834897	773740	779092	775972	769415
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	250898	263152	250011	252820	233776	248495	276542	296829	305425	334265
07700	FRUITS & PREPARATIONS CANNED	491153	508643	532335	508769	525448	519191	515255	497743	479050	474708
07800	VEGET.FROZEN,DRIED & PRESERVED	60149	73296	73226	98331	95740	117169	149883	134119	195626	191217
07900	VEGETABLES&PREPARATIONS CANNED	458665	506305	520474	535163	575248	551874	576068	569218	565350	552332

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Table 2D. continue

code	commodity groups	year 1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
08000	SOUPS CANNED	215797	248506	272887	273880	296952	291313	289179	275716	321223	319165
08100	INFANT&JUNIOR FOODS,CANNED	130745	143927	145370	158464	161696	153762	151597	132714	132549	139144
08200	PICKLES,RELISHES,OTHER SAUCES	224243	252788	258378	261293	285192	307496	311199	329149	341787	335437
08300	VINEGAR	26819	26005	24174	23793	23758	23000	27412	24503	27009	24723
08400	OTHER FOOD PREPARATIONS	104474	108507	139899	139922	157222	205051	211703	225347	257611	261524
09000	WHEAT FLOUR	250638	235068	255988	251565	249501	246421	226472	214459	212561	205913
09100	MEAL&FLOUR OF OTHER CEREALS&VE	43050	40975	40673	40666	38889	38442	41418	39793	39275	40379
09200	BREAKFAST CEREAL PRODUCTS	237449	252517	250510	270952	278079	290632	296697	297602	300797	309255
09300	BISCUITS	685479	720235	726343	733868	786732	798971	792257	810220	810082	813860
09400	BREAD & ROLLS	1639037	1672090	1618611	1663209	1681938	1663261	1701322	1646575	1636900	1636564
09500	OTHER BAKERY PRODUCTS	819120	857576	819877	848331	937473	969654	1014138	1020639	973254	917748
09600	COCOA & CHOCOLATE	49339	49839	48844	46407	46169	47134	47454	37794	34856	30273
09700	NUTS,KERNELS & SEEDS PREPARED	120577	121437	116495	126562	127774	129861	131795	141582	147370	149268
09800	CHOCOLATE CONFECTIONERY	583768	623445	644875	655106	713374	797042	822827	805270	788022	787596
09900	OTHER CONFECTIONERY	395449	469807	528696	541780	599545	602895	620381	637189	683637	716904
10100	SUGAR	242116	241455	247782	272353	263869	262291	257426	260211	277334	279767
10200	MOLASSES,SUGAR REFINERY PROD.	80545	84763	63825	64491	61535	61451	80893	67978	42982	23093
10600	MALT,MALT FLOUR&WHEAT STARCH	31892	40398	45209	49735	48535	48866	52878	68982	66971	66677
10700	MAPLE SUGAR&SYRUP	45627	57177	46697	45067	43652	56927	36096	38819	25215	29084
10800	PREPARED CAKE & SIMILAR MIXES	79003	80380	82391	71471	72329	73674	75328	82599	84948	88739
10900	SOUPS,DRIED&SOUP MIXES&BASES	43599	55393	46146	47897	51912	57160	65925	89739	76634	83681
11000	COFFEE,ROASTED,GROUND,PREPARED	750899	783189	817875	850073	865696	871247	902673	904554	923332	915728
11100	TEA	178234	178327	181383	181109	182594	187102	190823	198112	204236	205480
11200	POTATO CHIPS&SIMILAR PRODUCTS	83911	89497	105169	110969	110857	132104	154465	187322	204997	209803
11300	MISC.FOOD NES	555748	572207	576102	573696	592008	621325	721294	803938	828778	899131
11400	SOFTDRINK CONCENTRATES&SYRUPS	23924	25833	27769	25644	27619	27930	28268	24251	24956	25960
11500	CARBONATED BEV.,SOFT DRINKS	988722	1029977	1087029	1109201	1263739	1406318	1516879	1583282	1650527	1690645
41000	VEG. OILS,OTH.THAN CORN OIL,RE	10525	11136	12858	11309	11046	10901	14933	18060	19601	23645
51600	ICE	2635	3340	3884	4557	5382	5070	5414	5462	5062	5238
59200	GREEN COFFEE	175	138	102	55	18	18	18	18	28	18
59300	TROPICAL FRUIT	447413	432680	371337	425992	449320	461419	460009	439330	489463	506892

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Table 2D. continue

code	commodity groups	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
00100	CATTLE AND CALVES	81321	87116	96228	73795	74246	105626	97264	97104	98036	92771
00200	SHEEP AND LAMBS	1108	1240	1176	1088	1028	1008	1044	1092	1064	1124
00300	HOGS	32946	23525	28332	22525	15439	25916	25196	25203	23988	21665
00400	POULTRY	5276	5196	5544	4868	4650	4333	4151	3626	3880	3571
00900	MILK,WHOLE,FLUID,UNPROCESSED	87477	81468	72326	56319	50298	50619	49170	47966	47201	40524
01000	EGGS IN THE SHELL	530635	489420	475162	485401	468865	461536	454808	338997	463275	460086
01100	HONEY AND BEESWAX	49139	56952	57066	56439	57380	58888	60949	59013	57090	52380
01200	NUTS,EDIBLE,NOT SHELLED	8446	7215	6926	6744	8530	11278	9414	8267	13372	11733
01300	FRUITS,FRESH, EX.TROPICAL	726462	656672	697379	765677	888573	938146	850460	846506	888544	910674
01400	VEGETABLES,FRESH	1534974	1467064	1663378	1970494	1926867	1991719	1614207	1240117	1300696	1415532
01800	OIL SEEDS,NUTS AND KERNELS	814	821	516	621	525	530	488	513	525	553
02900	FISH LANDINGS	95306	85789	76990	85433	90734	84982	91112	84085	74715	85669
04400	SALT	42452	42796	45783	46994	47175	49217	50215	51201	52409	51012
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	3308816	3362504	3546728	3924201	4266179	4573572	4470527	4274743	4115565	4126671
05300	HORSE MEAT FRESH,CHILLED,FROZE	15686	11598	9547	14208	13025	12465	12167	15507	4643	3455
05400	MEAT,CURED	849061	777809	705681	811011	713214	719334	774552	781029	786380	822607
05500	MEAT PREP. COOKED NOT CANNED	905411	1008251	929990	971609	980114	997943	1008088	951953	951078	951665
05600	MEAT PREP. CANNED	281736	267830	278688	266697	262980	235002	233024	222947	192967	187141
05700	ANIMAL OILS & FATS & LARD	37470	38397	30698	28848	32327	35528	34081	36643	34840	39442
05800	MARGERINE,SHORTENING&LIKE PROD	215947	211204	218626	226269	282197	334164	354407	387039	417285	423662
06500	POULTRY,FRESH,CHILLED,FROZEN	1016405	1005007	1019116	949946	920648	1056156	1094795	1112609	1162729	1195541
06600	POULTRY,CANNED	22733	19295	16057	16100	11943	13931	15484	15807	15968	19802
06700	MILK,WHOLE,FLUID,PROCESSED	1835906	1851975	1909163	1961419	1947298	2003300	2041629	2046641	2131892	2116369
06800	CREAM,FRESH	180607	163662	165331	135570	133314	135039	169595	186145	190784	194114
06900	BUTTER	663976	640175	632839	580301	544288	542394	504273	453628	405115	401269
07000	CHEESE,CHEDDAR & PROCESSED	846254	940918	1063309	1197392	1107261	1251494	1268149	1419823	1482117	1601359
07100	MILK EVAPORATED	257757	276093	249036	222013	229748	232460	233887	259797	215586	186529
07200	ICE CREAM	528067	574463	556825	531295	542631	540749	575344	552101	554670	546120
07300	OTHER DAIRY PRODUCTS	487831	555326	556304	497046	439499	338231	250122	358226	388778	483010
07400	MUSTARD MAYONNAISE	149772	156296	165458	169957	178080	195449	199693	219410	238831	249051
07500	FISH PRODUCTS	751325	705296	672487	618813	620012	631121	637764	650815	690788	691210
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	381126	409730	425365	453257	475603	486258	548694	595511	628785	674762
07700	FRUITS & PREPARATIONS CANNED	469871	474516	477422	475897	482761	498567	485517	485173	481600	457154
07800	VEGET.FROZEN,DRIED & PRESERVED	193353	187983	218284	268730	264556	266690	309647	355135	348745	326673
07900	VEGETABLES&PREPARATIONS CANNED	575868	655415	623697	621919	594622	638623	650764	660135	646250	652801

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Table 2D. continue

code	commodity groups	year 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
08000	SOUPS CANNED	318417	337181	353747	345344	342796	345944	336814	343410	339145	334123.
08100	INFANT&JUNIOR FOODS,CANNED	133474	151049	151801	141241	134956	151008	150848	139241	121861	105897
08200	PICKLES,RELISHES,OTHER SAUCES	322205	355363	369074	367709	362479	391140	422146	445797	448625	453236
08300	VINEGAR	25039	26751	27896	22299	20677	29034	28954	29611	29101	28572
08400	OTHER FOOD PREPARATIONS	270529	426337	488541	457045	432349	478675	456921	530333	566996	567530
09000	WHEAT FLOUR	177841	168092	144024	122953	141821	153618	151608	139699	131188	138212
09100	MEAL&FLOUR OF OTHER CEREALS&VE	44958	50204	51709	54738	49022	48793	48881	45039	46350	45361
09200	BREAKFAST CEREAL PRODUCTS	328188	383622	416010	410234	417373	439322	454817	453854	469313	467083
09300	BISCUITS	808070	812047	778981	736254	727727	768169	723033	716059	655203	647360
09400	BREAD & ROLLS	1614708	1620401	1620456	1627289	1551002	1585913	1575609	1594658	1526520	1486776
09500	OTHER BAKERY PRODUCTS	964130	1085099	1120769	1029056	1012370	1031423	1060675	1076602	1095972	1117643
09600	COCOA & CHOCOLATE	26993	26159	21448	15234	9288	23594	24816	38832	53330	45586
09700	NUTS,KERNELS & SEEDS PREPARED	164100	173953	186571	175729	179645	191749	173642	176444	188540	189909
09800	CHOCOLATE CONFECTIONERY	803414	856142	924802	833640	810585	799966	784515	785756	783749	763103
09900	OTHER CONFECTIONERY	717787	717493	781736	829366	800957	806799	818893	779315	776151	747688
10100	SUGAR	285405	257528	257451	235424	194775	177838	170512	175974	168193	151706
10200	MOLASSES,SUGAR REFINERY PROD.	22467	24107	14469	3019	7491	9755	11622	9986	11248	6558
10600	MALT,MALT FLOUR&WHEAT STARCH	65628	68549	69956	70658	68046	71445	80788	83738	89650	91670
10700	MAPLE SUGAR&SYRUP	26017	43826	46374	50046	63893	59712	55758	57973	62606	94136
10800	PREPARED CAKE & SIMILAR MIXES	92665	92134	88473	92797	100805	130643	134611	152228	155207	162286
10900	SOUPS,DRIED&SOUP MIXES&BASES	86458	92074	100626	109505	106211	113203	128554	129869	129029	133540
11000	COFFEE,ROASTED,GROUND,PREPARED	903154	901138	916274	936172	915309	954003	869518	934760	1025968	1119252
11100	TEA	206330	194523	194615	191513	197378	195775	181280	186210	189619	180814
11200	POTATO CHIPS&SIMILAR PRODUCTS	229938	242550	265244	296168	299549	329938	362127	361927	413096	444397
11300	MISC.FOOD NES	946933	962630	977514	991110	993604	990018	1019998	1041949	1077527	1095082
11400	SOFTDRINK CONCENTRATES&SYRUPS	25872	26059	27854	20801	18195	19646	16354	13628	12015	11558
11500	CARBONATED BEV.,SOFT DRINKS	1757328	1700567	1783029	1715428	1705073	1731330	1732772	1695958	1663466	1644807
41000	VEG. OILS,OTH.THAN CORN OIL,RE	29310	29498	34998	40552	44807	47241	49850	51064	42908	42933
51600	ICE	5791	6932	4980	4295	3115	3088	2980	2191	1675	1870
59200	GREEN COFFEE	18	18	18	25	18	25	25	25	25	25
59300	TROPICAL FRUIT	532488	546966	519822	533764	548982	652562	620272	543624	532198	569429

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Table 2D. continue

code	commodity groups	year 1981	1982	1983	1984	1985	1986	1987	1988
00100	CATTLE AND CALVES	94054	95851	99190	99402	110085	112026	110213	116354
00200	SHEEP AND LAMBS	1612	2320	3336	3890	3822	3865	3979	4520
00300	HOGS	19149	22498	22140	22526	25426	26391	28139	38507
00400	POULTRY	8593	8753	8888	9319	10496	10756	12268	12664
00900	MILK,WHOLE,FLUID,UNPROCESSED	35699	27012	21247	15905	16230	16989	17180	17994
01000	EGGS IN THE SHELL	462013	471149	517734	473264	445870	444101	443739	446475
01100	HONEY AND BEESWAX	54743	55029	57480	62276	64344	58123	71835	71844
01200	NUTS,EDIBLE,NOT SHELLED	15017	13623	13556	13694	14670	18842	21529	0
01300	FRUITS,FRESH, EX.TROPICAL	971053	928529	1005725	1065334	1030588	1016340	1123650	1192273
01400	VEGETABLES,FRESH	1581545	1430060	1523529	1533574	1517149	1718127	1881133	1793818
01800	OIL SEEDS,NUTS AND KERNELS	509	519	555	540	663	900	1024	802
02900	FISH LANDINGS	85498	84321	84985	90465	98389	87752	80823	109515
04400	SALT	51889	53100	52456	53630	53968	57585	61171	66660
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ	4133706	4149778	4159870	4019696	3995617	4076009	4082155	3966561
05300	HORSE MEAT FRESH,CHILLED,FROZE	3565	2378	1996	1722	2494	2469	3021	0
05400	MEAT,CURED	884872	783125	814990	822120	829650	806623	817632	724370
05500	MEAT PREP. COOKED NOT CANNED	937262	923228	943813	993521	1022284	1051494	1107597	1295614
05600	MEAT PREP. CANNED	167845	165250	158901	156182	154050	148448	175056	0
05700	ANIMAL OILS & FATS & LARD	40084	38349	38033	32794	28559	26651	28821	29146
05800	MARGERINE,SHORTENING&LIKE PROD	435784	421114	425058	412206	419145	363141	353482	380694
06500	POULTRY,FRESH,CHILLED,FROZEN	1206251	1267439	1301040	1290617	1429610	1463838	1522271	1619126
06600	POULTRY,CANNED	16173	16305	17684	17900	18879	19690	20556	0
06700	MILK,WHOLE,FLUID,PROCESSED	2001089	1950320	1950759	1901418	1908464	1918075	1875430	2606640
06800	CREAM,FRESH	191028	186672	182971	182510	185116	190890	195640	199645
06900	BUTTER	396481	431647	442919	443898	444828	447782	437677	439424
07000	CHEESE,CHEDDAR & PROCESSED	1600179	1598706	1659353	1688958	1770242	1794212	1834184	1964318
07100	MILK EVAPORATED	171649	173549	171387	170020	139498	113249	133534	0
07200	ICE CREAM	514757	509821	509363	526929	532282	533069	531710	578833
07300	OTHER DAIRY PRODUCTS	521294	468263	453164	571722	599336	622081	658485	0
07400	MUSTARD MAYONNAISE	257497	257280	260717	266978	276552	284762	313838	327109
07500	FISH PRODUCTS	679688	586943	674169	755614	776182	774887	855824	1160132
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE	682076	755095	748209	735984	751710	838846	874155	943501
07700	FRUITS & PREPARATIONS CANNED	432726	410816	407234	418659	430873	436412	450888	440240
07800	VEGET.FROZEN,DRIED & PRESERVED	301359	307094	367564	388581	409432	417812	434733	593278
07900	VEGETABLES&PREPARATIONS CANNED	666727	650691	650546	652514	673867	685474	654604	626847

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Table 2D. continue

code	commodity groups	1981	1982	1983	1984	1985	1986	1987	1988
		year							
08000	SOUPS CANNED	318997	311609	314064	320965	317483	313347	323243	348139
08100	INFANT&JUNIOR FOODS,CANNED	110028	113451	116384	119092	134422	137625	136987	147847
08200	PICKLES,RELISHES,OTHER SAUCES	457892	459749	486324	500973	515412	535045	595832	644352
08300	VINEGAR	33448	34736	36105	37168	37067	37643	38504	37434
08400	OTHER FOOD PREPARATIONS	565298	535339	584831	681086	751603	803754	850365	715937
09000	WHEAT FLOUR	133197	136631	137921	141695	141557	145610	145120	149907
09100	MEAL&FLOUR OF OTHER CEREALS&VE	42309	42618	42439	46597	47892	48020	47965	51416
09200	BREAKFAST CEREAL PRODUCTS	477685	495435	490946	517862	500667	496472	495448	531930
09300	BISCUITS	642892	603909	598977	609467	616065	597583	613076	652343
09400	BREAD & ROLLS	1417917	1462463	1391432	1381618	1393848	1414400	1423950	1446334
09500	OTHER BAKERY PRODUCTS	1134165	1118747	1094236	1112562	1116587	1142829	1151593	1150988
09600	COCOA & CHOCOLATE	64224	73251	83678	77396	80118	74019	77312	107770
09700	NUTS,KERNELS & SEEDS PREPARED	169866	202557	233837	248509	253106	237830	211732	290218
09800	CHOCOLATE CONFECTIONERY	757051	786117	808231	845681	913647	918965	903489	0
09900	OTHER CONFECTIONERY	765662	766846	782203	789972	804769	837256	858428	1971423
10100	SUGAR	134877	144007	170432	149844	147369	152465	153824	183522
10200	MOLASSES,SUGAR REFINERY PROD.	3246	4107	4786	5707	6146	6382	6645	0
10600	MALT,MALT FLOUR&WHEAT STARCH	94903	102864	109642	121703	131938	143838	152831	148817
10700	MAPLE SUGAR&SYRUP	128706	126208	127169	140833	143578	146712	148204	159070
10800	PREPARED CAKE & SIMILAR MIXES	169359	186061	193612	194575	199602	206785	230748	245543
10900	SOUPS,DRIED&SOUP MIXES&BASES	127873	108831	97302	108735	129787	148055	168944	171891
11000	COFFEE,ROASTED,GROUND,PREPARED	1145642	1183785	1219446	1108810	1116805	1058141	1074615	1152051
11100	TEA	178759	163836	169094	149282	153000	158765	139506	143093
11200	POTATO CHIPS&SIMILAR PRODUCTS	460184	444378	449960	507047	534172	549861	544645	536091
11300	MISC.FOOD NES	1109864	1114784	1184471	1231685	1281949	1340579	1384385	1424363
11400	SOFTDRINK CONCENTRATES&SYRUPS	9858	9215	8558	8489	8930	8838	9039	9665
11500	CARBONATED BEV.,SOFT DRINKS	1681657	1712756	1640235	1714149	1892357	2002883	2036787	2141964
41000	VEG. OILS,OTH.THAN CORN OIL,RE	39881	41111	60764	46649	54319	72523	82983	80666
51600	ICE	2006	2012	2598	2756	3894	4387	4798	0
59200	GREEN COFFEE	25	25	26	26	28	20	36	38
59300	TROPICAL FRUIT	589473	563665	587620	558065	516220	613784	642664	472804

Source: Statistics Canada data, converted to the same base year using the procedure of Appendix C.

Table 3D. Total Personal Consumption Expenditures, millions of dollars

year	-- current dollar --			---- 1986 dollars ----			population (thousand)
	food		total	food		total	
	home	away		home	away		
1961	4946	1003	26240	22755	5981	102669	18238
1962	5228	1095	27985	23594	6420	108009	18583
1963	5513	1158	29846	24137	6541	112802	18931
1964	5785	1251	32042	25069	6740	119203	19291
1965	6116	1375	34714	25717	7183	126425	19644
1966	6619	1521	37952	26242	7404	133092	20015
1967	6916	1754	41068	27299	7913	138425	20378
1968	7155	1849	44842	27425	8035	144642	20701
1969	7622	2063	49093	28066	8456	152075	21001
1970	7942	2244	30853	28919	8621	155116	21297
1971	8240	2475	56271	29650	9106	164327	21568
1972	9123	2785	63021	30282	9520	176672	21802
1973	10794	3349	72069	31042	10077	189897	22043
1974	12811	4051	84231	31822	10265	200889	22364
1975	14553	4777	97566	32244	10582	210369	22697
1976	15597	5523	111500	34129	11338	224105	22993
1977	16685	6108	123555	33442	11673	231190	23273
1978	18824	6946	137427	33024	12400	239063	23517
1979	21085	7828	153390	32722	12434	245965	23747
1980	23316	8814	172416	32625	12829	251344	24043
1981	26240	9867	196191	32823	13092	257129	24342
1982	27928	10140	210509	32680	12187	250316	24583
1983	29183	10688	231452	33232	12135	258904	24787
1984	31324	11418	251645	33699	12451	270854	24978
1985	32806	12446	274503	34488	13038	284923	25165
1986	34942	13743	297478	34942	13743	297478	25353
1987	37148	14923	322769	35543	14323	310453	25617
1988	39001	16615	349456	36522	15248	323324	25909

Source: Statistics Canada.

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