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FOOD DEMAND AND CONSUMPTION BEHAVIOR

Edited By

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Abstract

Over the past few years the S-216 Regional Project has devoted one day of the two-day annual meeting for a symposium. This year's symposium incorporated presentations by scholars from a number of fields: economics, agricultural economics, anthropology and social psychology. The latter two fields were represented by Mahadev L. Apte and David Brinberg who elucidated the perspectives of their respective disciplines and enhanced our understanding of how those disciplines conceptualize and empirically study food demand and consumption behavior. Prof. Apte's paper is included as the first in this proceedings volume. Because Prof. Brinberg's work on the role of and means for measuring the effect of attitudes on food consumption decisions (the basis for his presentation) has been published elsewhere, no paper is included in this volume. The second paper in this volume reflects the presentation of the economist, Geoffry Paulin, which addressed the changing food at home budget between 1980 and 1992. The third and final paper, by agricultural economists Parke E. Wilde and Christine K. Ranney and presented by Mr. Wilde, explored the utilization of experimental data to analyze the effects of the Food Stamp Program on food expenditures.

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Food Consumption--A View from Anthropology

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Introduction

Food production, distribution, and consumption are the most fundamental activities of human existence and have been the focus of academic research from a variety of perspectives. Anthropologists have traditionally been interested in these activities and have accumulated and analyzed substantial culture-specific and cross-cultural data concerning food habits, also called foodways or diet in the literature, and have, in the process, developed various theoretical frameworks. Before discussing these theoretical perspectives and contributions to food research, I would like to present a brief background of the disciplinary orientations of anthropology.

Disciplinary Orientations of Anthropology

Anthropologists are interested in investigating individual societies and cultures in all parts of the world with the goal of developing broad theoretical generalizations concerning human biocultural existence. Towards this end, they routinely engage in conducting ethnographic research through fieldwork. Fieldwork involves actually living among the people to be studied and doing participant observation. Normally, ethnographers, i.e. anthropologists in field situations, spend anywhere from three months to a year or more among the people they study and thereafter continue to visit them. The primary objective of ethnographic fieldwork is to analyze and describe individual sociocultural systems. Toward this end anthropologists have traditionally analyzed family and kinship structures, ecology, religious systems, economy, political organizations, technology, indigenous concepts and categories, symbols, ideas, attitudes, values, and the worldviews of the target population groups.

Anthropologists have traditionally been engaged in studying mostly non-Western, preliterate, small-scale, and fairly homogeneous societies. This focus began to shift in the sixties when anthropologists started studying their own cultures, i.e. industrialized societies of Europe and North America (Messerschmidt 1981). Even within industrialized societies the emphasis is still on identifiable small groups such as rural communities (Fleming 1979), professional groups and organizations (Applebaum 1981, Gamst 1980, Pilcher 1972), immigrants and ethnic groups (Wong 1982), and neighborhoods in urban areas (Williams 1981). The traditional focus on preliterate, small-scale societies and cultures in various parts of the world still remains.

The research methodology and techniques of anthropologists are primarily qualitative and naturalistic (Agar 1980; Naroll and Cohen 1970; Pelto and Pelto 1978; Williams 1967), especially in the context of ethnographic fieldwork. However, small-scale surveys are routinely undertaken for accumulating such quantitative data as the number of households and of members in individual families, the amount of land owned or cultivated by someone, types and amounts of crops produced annually, or number of rituals performed. Territorial mapping of villages and/or

communities in terms of residential patterns is also carried out. For example, ethnographic studies of villages in India routinely provide maps of the residential patterns indicating where the various caste groups are located within the village boundaries along with indications of cultivated land, grazing pastures, village wells, shops, roads joining the village to a nearby market town or urban center and so on.

Data-gathering is primarily done through participation and/or observation and by keeping extensive notes of daily work routines and leisure activities as well as community-wide special events such as rituals, festivals, ceremonial exchanges, hunting, fishing, tool-making, and agricultural work. Extensive interviews of people of different age, sex, social status, and occupational background are also carried out. The process is one of checking, rechecking, and revising field notes by additional interviews and verification, and of raising new questions and issues for which additional materials are gathered. Tentative analysis of collected material is also undertaken. This is a continuous and constant process. The end result of ethnographic fieldwork is an analytically descriptive text. Such published texts are commonly referred to as ethnographies. In general, ethnographies are micro studies in which large-scale quantitative data are rarely collected or used.

Anthropologists also undertake cross-cultural/comparative studies (Naroll and Cohen 1970). For this purpose they often use accumulated ethnographic data on individuals societies. The objectives in cross-cultural/comparative studies are to develop general conceptual and theoretical frameworks regarding the diverse aspects of human biocultural existence with the emphasis on both cross-cultural similarities and variations. Such theories are used as etic (broad conceptual and theoretical) frameworks for new ethnographic studies. In general, analyses in ethnographies combine the etic (from outside the culture, universal) and the emic (culture-specific or from within the culture) perspectives.

Cultural relativism and holism are two fundamental axioms which have traditionally been emphashized and constitute the epistemological orientation of anthropological research. Cultural relativism implies that the adequacy and/or effectiveness of culture-specific behavior patterns, social institutions, customs, norms, etc., are to be evaluated by intra-cultural criteria rather than by external standards and value judgments, typically those of the investigator. Holism emphasizes that any single aspect of a sociocultural system cannot be adequately understood without considering other attributes since all are inextricably interwoven and mutually affective, making the system a coherent whole. Anthropologists believe that kinship systems, gender roles, ecology, religion, language, economy, political organization, ideology and worldview are all interrelated parts of the total system. A fundamental belief of anthropology is the functional unity of sociocultural systems.

The axiom of holism was perhaps more relevant in the early days of sociocultural anthropology when small-scale homogeneous preliterate societies were studied. These can be compared to population groups that are labeled communities in contemporary nation-states. Despite the fact that anthropologists are increasingly interested in studying complex societies, their methodological and epistomological orientation leads them to the study of identifiable groups or communities. They primarily conduct small-scale intensive studies since the qualitative techniques

of observing and recording naturally occurring phenomena in the real world are better suited for such studies than those in which controlled experimental techniques are used. This is also the case in anthropological studies of foodways as indicated by several small-scale studies conducted in the U.S. and elsewhere. Some examples are food habits and gender relations in a small Melanesian community (Kahn 1986); food cooperative in San Francisco (Zimmer 1981); the dietary practices of a rural community in North Carolina; the foodways of the Hindu sect Hare Krishna in the U.S.; the Italian-Americans in Philadelphia; the Mormons in Utah; Native American groups such as the Seminoles and Oglala; a Mexican peasant community; a Guatemalan plantation; and a village in Belize.[1]

While the traditional aim of ethnographic research has been to study whole sociocultural systems anthropologists have also conducted problem-oriented research, especially in collaboration with development and other aid-related projects undertaken by various state and national agencies, governments, and international organizations. The focus is on assisting agencies and governments through anthropological research and analysis in finding solutions to real or potential problems in specific cultures arising due to externally induced technological or other types of changes. Research in the sub-discipline labeled applied anthropology is generally oriented in this direction.

In the context of research on food consumption, the principle of holism implies that food consumption cannot be systematically analyzed without taking into consideration food production and distribution within the framework of other relevant sociocultural factors. Such relationships are generally investigated and analyzed at the micro level of domestic units of family and household and at the macro level of community and its environment.

Early Anthropological Studies of Food

Anthropological research on foodways has had its beginnings immediately after the first world war. The earliest attempt to analyze foodways was by anthropologist Clark Wissler (1917) who studied the native American population groups. Wissler divided the whole of aboriginal North and South America into eight "food areas," his principal criterion being food procuring activities such as hunting, fishing, gathering, horticulture and agriculture, and the staple foods thus accumulated. Each area included several cultural groups all of which shared common foods. Environmental adaptation was seen in terms of particular staple foods readily available in the natural environments. Thus Wissler's food areas were labeled as salmon (northeast), caribou (central Canadian plains), wild seeds (Southern California area), manioc (much of Amazon basin) and so on.

During the decade of the thirties, British social anthropologists began to emphasize the social, economic and cultural patterns of food production and consumption and their nutritional functions following the lead of anthropologist Malinowski. These studies were prompted by the

[1]There exist several edited volumes which are collection of anthropological analyses of the foodways of small communities. See Douglas (1984), Sharman et al. (1991) and Brown and Mussell (1985).

colonial concerns regarding such practical issues in African colonies as poverty, health, land tenure, taxation and governance. Ethnographic studies by Bell (1931-32), Richards (1932, 1939) and Firth (1934) focused on the social and nutritional aspects of food consumption among the populations in Polynesia and Africa. Richards' two publications *Hunger and Work in a Savage Tribe* (1932) and Land, Labour, and Diet in Northern Rhodesia: An Economic Study of the *Bemba Tribe* (1939) were the first full-fledged ethnographies devoted to food research. They analyzed the native views on food categories, food symbolism, the sharing and distribution of food, environmental adaptation, and the methods of food production. These early studies were functional in their orientation.

During the second world war in the forties attention was focused on the U.S., again with practical implications, namely, how to improve the diet of the soldiers fighting in the war, the question of equity in food subsistence under the New Deal Liberalism of FDR, and the problem of how to adequately feed the nation under food rationing (Montgomery et al 1979). The Committee on Food Habits (CFH) was constituted within the National Research Council of the National Academy of Sciences of several sociologists and anthropologists including Margaret Mead. Conferences were held and several brief reports on the food habits of ethnic Americans were published. About the same time a group of sociologists at the University of Chicago under W. Lloyd Warner's leadership were engaged in extended field research on food habits in the Southwest U.S. and later on in Southern Illinois. Local variations in diets were examined among the ethnic and economic status groups over a period of time.

Those engaged in this research were interested in learning the "patterns" of culture as expressed in food habits. Culture was considered to be the primary determinant of food habits and the approach was typically holistic. Any changes in food habits were to be seen as a part of the overall changes in the system and were to be explained in relation to family structure and authority, gender roles, education, occupation, participation in community life, and so on.

Towards the end of the forties research interest in food habits among anthropologists waned except for Margaret Mead who continued to be involved in food research into the sixties. But there were no sustained research efforts in the fifties. The decade of sixties witnessed a revival of interest in food research with new theoretical inputs from structural linguistics, ecological studies, and ethnosemantics. Foodways as a reflection of ecological adaptation is the focus of two major works, one by Clifford Geertz (1963) and the other by Rappaport (1968).

Rappaport demonstrated in his book *Pigs for the Ancestors* how the ritual feast venerating the ancestors among a small tribal population in New Guinea coincided with the high population growth in domesticated pigs hindering horticultural activities. When the pig population grew beyond a manageable size, a ritual of ancestor worship was undertaken. A major part of this ritual was a community-wide feast during which many pigs were slaughtered and consumed. The event also had the functions of settling inter-tribal warfare in addition to ancestor worship. The pig population was reduced in this fashion, social and religious obligations were fulfilled, and the seasonal cycle of gradual increase in pig population and the onset of garden activity started all over again. Also in late sixties a structural and semantic approach to food research was being

developed which focused on delineating linkages between structural-semantic categories of food and dietary patterns.

From the seventies onward, structural, symbolic, evolutionary, ecological, biological, and nutritional approaches have been ariously pursued in anthropological research on foodways. During the International Ethnological Congress held in Chicago in 1972, a whole session was devoted to anthropological food research (Arnott 1975). During the last twenty-five years there has developed a growing emphasis on investigating changes in foodways at the family and household level and also at the community level linking them to accelerated sociocultural changes brought about by such factors as land reform, modernization and rapid technological inputs introduced from the outside in so-called traditional societies, cash cropping, spread of mass education, impact of urban markets, and developmental projects implemented through government planning and international aid. Equally important is the focus on changes in the structure and function of domestic units of family and household due to educational impact, women's increasing participation in income-generating activities, and migration to urban areas.

Contemporary Theoretical Perspectives in Anthropological Food Research

Anthropological research not only analyzes and describes patterns of foodways but also focuses on the reasons for their occurrence. Biological, material, social, and cultural explanations are sought for existing foodway patterns in terms of their relationship to the biophysiological and nutritional needs as well as to the structural and functional attributes of social organization and ideology. In short, the goal is to provide answers to what, where, when, how, and why food is prepared, distributed, and consumed within the overall context of social structures and cognitive and symbolic systems of individual societies. Explanations are sought from both the synchronic and diachronic perspectives.

Researchers in all anthropology sub-disciplines (social and cultural anthropology, linguistic anthropology, physical and biological anthropology, and archaeology) study foodways from a variety of perspectives with a strong ethnographic orientation. There is no single dominant theoretical paradigm for food research in anthropology. Instead, there are approaches emphasizing the biological, ecological, psychological, nutritional, structural, semiotic, and symbolic orientations in food research. Many anthropologists are eclectic and combine various theoretical frameworks to explain the dietary practices of the populations they study. This approach stems from the holistic perspective discussed earlier in that anthropologists believe that the various dimensions of food systems are closely interrelated.

Anthropologists have also collaborated with researchers from various other disciplines in their investigations of foodways. As a result, the anthropological literature on food research is quite extensive (Messer 1984, 1990).

Studies of foodways conducted by sociocultural anthropologists have generally been conducted at both the micro and macro levels. However, the common practice is to inductively generalize about foodways at the macro level, generally those of small communities (Kahn 1986), from the data and analysis carried out at the micro level of families and households.

Anthropologists examine the daily routine of food-related activities within the unit of family and household. The focus of such studies traditionally has been on small-scale homogeneous societies such as hunter-gatherers, pastoralists, and village peasant and fishing communities in which the range of interhousehold variation in food production, distribution, and consumption is minimal. Therefore, it is possible to generalize about the food habits of the whole society from the analysis of the household food consumption patterns. Any variation, if found, seems to occur on the occasions of special community-wide events, most often rituals accompanied by feasts which can be readily observed by the ethnographers.

Specifically, anthropologists observe and seek information through interviews regarding the following aspects of foodways: 1)The daily, weekly, and seasonal cycles of food preparation, if any, and the ways in which they are determined; 2) the process of negotiations that takes place among family and household members in determining these food cycles; 3) the final authority, if any, in deciding what is to be cooked; 4) the type and quantity of food consumed by different members of family and household and any qualitative and quantitive differences among them, e.g., food consumed by men versus women or by children versus adults; 5) the frequency and times during a twenty-four hour cycle when food is served and consumed and the manner in which it consumed; 6) the various methods of cooking and the types of equipment used; 7) the arrangement and order in which food is served and consumed; 8) Identification and kinship status of individuals who share the tasks of buying ingredients, cooking, and feeding family and household members. The emphasis is generally on discerning any patterns that may exist.

In addition to analyzing and describing foodways of individual cultures in ethnographic accounts, anthropologists also conduct cross-cultural/comparative studies of the foodways of societies around the world. Their objectives are to develop low to high order theoretical propositions, and to explain the range of variation that exists among various cultures. Anthropologists also seek the evolutionary multilinear paths to food consumption through various stages of human sociocultural development.

In exploring the linkages between foodways and other aspects of sociocultural systems, anthropologists' goals are to develop middle-range and general theories about the nature of linkages between food consumption and aspects of social structure and cultural patterns. They examine the ways in which human beings everywhere have exploited the natural environment in their quest for potential food resources. Anthropologists explore the ways in which foodways are associated with status, roles, and interpersonal, intersex, and intergroup relationships. They investigate the significance of foodways in religious practices, examine food exchanges for social, economic, and political alliances; analyze how food is categorized through linguistic categories; and focus on cultural ideologies and values that lie behind food taboos and preferences.

Within this broad cross-cultural and comparative framework anthropological studies have proposed some broad theoretical propositions. For example, anthropological studies demonstrate that most societies observe some taboos concerning consumption of certain types of food. Such taboos can be temporary in which case they are connected with the duration of temporary changes in the body state such as pregnancy, lactation or menstruation. They are also linked to occasions of life-cycle rites signifying such biological and sociocultural transitions as birth, menarchy,

marriage, initiation of sexual intercourse, old age, and death. Such taboos are often linked to etiological explanations of biological processes and bodily substances, religious ideologies, and putative consequences of eating certain foods during illness and altered body states.

Many ethnographic studies have focused on how food, as an agent, can generate and transform many aspects of social life. Food can emphasize kinship ties; it can instill power or prestige; it can effect social control and can create social relationships. For example, studies have demonstrated that food exchange and feast-giving are often associated with social prestige. In many cultures of Melanesia and Polynesia chiefs are obligated to demonstrate their generosity for maintaining their social prestige by giving feasts to the whole community. Thus competition and one-upmanship for prestige is manifested through displays of lavish feasts (Strathern 1971, Young 1971). Similar practices reflected in the social institution known as potlatch among the Northwest coast Native Americans have been extensively discussed in anthropological literature (Adams 1973; Farb and Armelagos 1980:148-50; Codere 1956; Piddocke 1969).

Notions of loyalty, friendship, trust and dependence are often associated with commensality so that those who share food also share social bonds and comparable status. Among the Hindus in Indian villages, for instance, who accepts what kind of food from whom often determines the caste ranking (Marriott 1968). Those at the lowest level accept food from everyone while those at the highest level accept it only from members of their own castes. Members of the middle level castes manipulate food exchange to compete for higher ranking. Thus food exchange and commensality are considered significant behavioral manifestations of social hierarchy in Hindu society.

Anthropological studies have also focused on culture-specific food taxonomies and have explored the types of criteria used. For instance, in many cultures food is dichotomized into hot and cold categories based on the perceived impact of such foods on the body (Anderson 1982; Beck 1969). Other dichotomies based on symbolic, political, textural, sexual, visual and other criteria in different cultures are male and female, heavy and light, yin-yang, smooth and rough, raw and cooked, pure and polluted, prescribed and proscribed and so on.

In a similar vein anthropologists have explored cultural ideologies and values for explaining special dietary practices as vegetarianism, which in many cultures seem rooted in religious beliefs. It has been argued that in modern times such specialized and/or restrictive dietary practices, often labeled by the mass media and population at large as "food fads," reflect alternate life styles and worldviews espoused by charismatic individuals or leaders of new social movements and religious cults (Apte and Katona-Apte 1986; Hufford 1971).

Changes in food habits due to evolution, cultural contact, immigration, and technology, have also been the focus of anthropological research. Issues of the relationship between ethnicity and food habits and between acquisition of new foods and the process of assimilation have been studied. The ways in which immigrant populations adjust to the new foodways of the dominant population while retaining their traditional food practices as indicators of their ethnic identities have been analyzed (Katona-Apte and Apte 1980; Theodaratus 1981; Van Esterik 1982).

The various cross-cultural and comparative issues raised above and the references cited should indicate the broad spectrum of anthropological research topics with varying theoretical orientations. In the remainder of this paper I want to discuss two theoretical perspectives in anthropological food research: a) cultural materialist and b) ideological-structural.

The Cultural Materialist Perspective

The cultural materialist perspective emphasizes biocultural explanations and takes into consideration evolutionary, ecological, economic, and nutritional orientations. Anthropologist Marvin Harris has been the chief exponent of this viewpoint. Harris has argued in many of his publications, both academic and popular (1966, 1974, 1977, 1979, 1986, 1987) that such factors as environment, demography, technology, and political and economic systems exert a powerful influence on food consumed by any human population.

In addition, shifts in basic modes of production also affect consumption patterns as demonstrated by human biocultural evolution. In general, the emphasis of the cultural materialist theoretical framework is on explaining foodways in terms of ecological adaptation and innate biological needs and tendencies. The basic premise is that the foodways of specific human populations are the end result of cultural evolutionary developments, and that cultural groups develop strategies of food production and consumption in meeting their nutritional needs. These strategies in turn are significantly influenced by biopsychological, environmental, demographic, technological, and politico-economic factors.

Theories are developed to explain the nature of interaction between behavior and environment as mediated by specific human populations and their cultural apparatus. In other words, the content and structure of, and change in foodways are seen as the consequences of ecological adaptation. This approach is best illustrated in the analysis and theoretical explanation of presumed cannibalism practiced by the Aztecs in fifteenth century Mexico under the guise of human sacrifice (Harner 1977) and the development of the sacred cow complex in South Asia (Harris 1966, 1974, 1979). Ecological adaptation also emphasizes the optimization-selection process whereby not all potential foods in an environmental niche are exploited. Some will be neglected in order to optimize the cost benefits of production and the maintenance of nutritional standards.

Another theoretical offshoot with a cultural-materialist perspective is political economy which combines history and economics to explain global dietary changes induced by the introduction of new food substances and/or the global mass production and dissemination of certain foods. World historical events and developments such as the industrial revolution, colonization by the European nations, political power, world wars, green revolution, and global political economy are considered as significant factors influencing the taste and consumption of certain foods by various population groups. For example, by analyzing the events of the last three hundred years in his book *Sweetness and Power: The Place of Sugar in Modern History* (1985) anthropologist Mintz has theorized that the transformation of sugar for the commoners in England from being a rare foreign luxury item to being an everyday necessity was due to the cumulative

effect of such world historical events as colonization, plantation economy, slavery, industrial revolution, and world capitalism. The book evoked a symposium review in the journal *Food and Foodways (2(2),1987)* in which several anthropologists critically evaluated Mintz's central thesis. Similar arguments have been put forward concerning the effects of colonialism on dietary patterns due to the dissemination of many localized crops and animals as well as those from the new world such as chocolate, tea, coffee, pine apples, peppers, maize, tomatoes, sweet potatoes, and groundnuts (Franke 1987).

Others have expanded the theoretical framework of Harris to link food preferences by a majority of human societies to the innate biophysiological needs for foods that provide the body with the necessary energy and nutrients to remain healthy and productive, for instance, animal fats and proteins (Abrams 1979, 1980; Hamilton and Busse 1978). Similar arguments have been put forward regarding preferences for certain tastes, for example, strong taste preference for sweet items which, it is claimed, is evident prenatally and is reinforced by the sweet taste of mother's milk which is high in lactose. Such a preference and aversion to bitter or irritant tastes may be an important factor in the course of human evolution (Rozin and Rozin 1981).

The evolutionary perspective which is integral to the cultural materialist theoretical approach (Harris and Ross 1987) analyzes the kinds of changes in food consumption that have taken place cross-culturally from prehistoric periods as a result of sociocultural evolution. In general, the following evolutionary stages are recognized pertaining to food production and consumption practices and their linkages to other sociocultural attributes: a) Hunting-gathering; b) pastoralism and nomadism; c) Horticulture or garden agriculture in which slash and burn techniques are used for planting; d) agriculture; and e) industrialization.

Extensive ethnographic research has been carried out among cultures in the first three stages, i.e., hunting-gathering, nomadic-pastoralist, and horticulturalist populations to better understand the evolutionary pathways in the production and consumption of food. These populations are seen as being able to meet their nutritional requirements (Hades and Vaqueros 1982; Hakes et al 1982; Kate 1982; Lee 1979; Sweet 1969; Struever 1971; Piddocke 1969).

The groups extensively studied among these populations are the !Kung Bushmen of the Kalahari desert in Botswana (Lee 1969, 1979), the Eskimos (Damas 1972), Northwest coast native Americans(Paddock 1969), the Australian aborigines, and others (Lee and Devore 1968). The primary traditional food activity of such population groups has been the gathering of nuts, roots, and fruits which constitute the staple and this diet is occasionally supplemented by meat of small and large animals and fish. Meat and fish are perceived as a luxury and prestige foods.

Recent theoretical developments in the subdiscipline identified as medical and nutritional anthropology (Fitzgerald 1976; Greene 1977; Haas and Harrison 1977; Jerome, Kandel, and Pelto 1980) are closely linked with the materialist approach but with much more emphasis on analyzing the nutritional needs of specific cultures. The focus here is on studying the "nutritional wisdom" in that this approach evaluates the health and nutritional out comes of survival strategies adopted by members of specific cultures and examines the outcomes of food habits in terms of physical

growth and work performance, the proper growth and functioning of the neurological system, reproduction, and intellectual ability. Traditional foodways are identified as nutritionally beneficial and/or protecting from or curing nutritional and other health problems (Kate 1982; Etkin and Ross 1983). Other studies however, link culture-specific traditional food restrictions on pregnant and lactating women and child feeding practices to protein energy malnutrition, and vitamin A deficiencies (Katona-Apte 1977; Manderson and Mathews 1981; Cassidy 1980).

The Ideological-Structural Perspective

The ideological-structural perspective emphasizes the influence of culture and social organization on foodways of different populations. The focus is not so much on adaptation, but rather on how social structure, and emic cognitive categories along with ideology and worldview affect dietary patterns. A meal is seen as symbolizing the cultural order (Douglas 1966) and cross-cultural differences in foodways are seen as representing varying symbolic systems with differential meanings. Food is viewed not only as satisfying the biological and nutritional needs, but also as the marker of prestige, indicater of gender roles and sexual division of labor, ethnic identity, and signifier of social relations and their meanings. The oft-quoted expression in this context is "Food is not only good to eat but good to think!"

Sensory, cognitive, semiotic, and symbolic studies of food ways are a part of this theoretical perspective (Urban 1981). Foodways are seen as symbolic systems or as communication codes (Douglas 1972; Douglas and Nicod 1974). Their structure is seen as the microcosm of the broad structure of the sociocultural system as a whole. Social structure and cultural values as reflected in language, symbols, and worldview, and in social institutions such as family, kinship, religion, and rituals influence food selection, classification, and dietary norms.

Several studies within this framework (Douglas 1966, 1984; Leach 1964; Lehrer 1972; Levi-Strauss 1966, 1969; Tambiah 1969; Urban 1981) have analyzed the manner in which a "food code" is a reflection, a mirror image, of other aspects of the cultural system. The emphasis is on correlating oppositional food categories to comparable categories in the realms of social relations, natural environment, residence and so on.

The objective has been to demonstrate that structural parallelisms exist between food categories on the one hand and cultural categories pertaining to natural environment, animals, living space in the household, gender, and kinship on the other. Acceptable versus tabooed foods have a parallel in oppositional kinship categories indicative of incest taboo versus preferred sexual relationship or space frequented by all members of the family versus space restricted for usage for only certain members and space considered totally private. Food taboos are also shown to be related to the ambiguous and /or anomalous nature of potential food items since they do not neatly fit into cultural categories, as reflected in Jewish dietary rules (Douglas 1966). On the other hand, preferred foods are shown to be the mark of felicitous coming together of symbolically significant substances as defined by religious ideology (Regelson 1981). The structural arrangements of meals are shown to be linked to the ranking of foods on religious and ritual criteria (Apte and Katona-Apte 1975).

Content analyses of myths, folktales, and legends have been carried out to explain the auspicious or inauspiciousness of food items and also as justifications for food preferences and avoidances (Apte and Katona-Apte 1981; Moreno 1992). Studies of food exchange and distribution in intra-caste and intercaste interaction in Hindu society (Babb 1970, Khare 1976; Marriott 1968) have demonstrated how food is indicative of social status and how the nature of food exchange--either reciprocal or unilinear--can be manipulated to elevate social status. In the same context, food hierarchy has been shown to have its origins in the religious-ritual ideas of purity and pollution (Apte and Katona-Apte 1988).

The visual, sensory (smell, color, texture, taste, shape, and overall appearance), and aesthetic aspects of food have also been analyzed in anthropological studies within the ideological-structural paradigm. While studies of taste per se have not received much attention, the association of taste categories, e.g. sweet, sour, bitter, etc., with personal qualities have been explored for their metaphorical significance to individuals in evaluating physical and mental attributes of others in social relationships and interactions. Food metaphors and their significance in sexual relationships and gender stereotypes in specific cultures and across cultures have also been explored (Farb and Armelagos 1980:97-111; Ingham 1971; McKnight 1973; Meigs 1984). Studies have analyzed specific food symbolisms in life cycle rituals as representations of tradition, modernity, ethnic identity, or acculturation (Edwards 1982; Katona-Apte and Apte 1980; Van Esterik 1982; Theodaratus 1981).

Conclusions

This somewhat cursory overview of anthropological perspectives in food research is indicative of the broad disciplinary interests. What is crucial to note is that by its very nature, the discipline spans a wide spectrum. Interdisciplinary approaches and borrowing theoretical and conceptual frameworks from related disciplines in social sciences and humanities is a common practice in anthropology. At the same time the focus on ethnographic orientation and naturalistic data collection methods mark the fundamental disciplinary perspective. While adequate attention has not been paid to informant accuracy regarding the data accumulated through interviews (distinguishing, for example, between what informants say they do and what they actually do or the ideal and presumed versus the actual behavior) there is considerable emphasis on observation and participation in food related events. By their very nature such methodological techniques force anthropologists to undertake analyses of foodways in small-scale societies.

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THE CHANGING FOOD AT HOME BUDGET: 1980 AND 1992 COMPARED

by

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NOTE: All material contained herein is solely the responsibility of the author. Any opinions expressed in this paper are those of the author and do not constitute policy of the Bureau of Labor Statistics.

The Changing Food at Home Budget: 1980 and 1992 Compared

Geoffrey Paulin

Introduction

It seems that every decade has had its own prescription for good health. In the 1960's, it was wheat germ and yoga. In the 1970's, it was granola and jogging. In the 1980's, it was oat bran and aerobics. In the 1990's, the news is continually full of findings from medical studies that link foods with health conditions, either good or bad. For instance, consumption of cruciferous vegetables has been linked to reduced risk of certain types of cancer. Polyunsaturated fats have been associated with lower levels of total blood cholesterol. Evidence is also mounting that monounsaturated fats lower "bad" cholesterol while not reducing "good" cholesterol.[1] But saturated fats have been found to be villains that rob us of healthy hearts, so the typical American is advised to substitute poultry (preferably with the skin removed) for red meats, and to increase the amount of fiber and complex carbohydrates consumed by eating more breads, rice, pasta, and fresh fruits and vegetables.

But are consumers following this advice? Evidence from the U.S. Department of Agriculture[2] suggests that some changes in dietary patterns have occurred recently. For instance, per capita consumption of red meat fell 10 percent between 1980 and 1992, while per capita consumption of poultry rose 48 percent over the same period.[3] Per capita consumption also increased for fish (19 percent), flour and cereal products (29 percent), dairy products (4 percent),[4] fresh fruits (14 percent), and fresh vegetables (18 percent).[5] The 15 percent increase in per capita consumption of fats and oils from 1980 (57.2 pounds) to 1992 (65.6 pounds) was due to a 23 percent increase in consumption of vegetable fats (44.8 pounds to 55.2 pounds) combined with a 15 percent decrease in consumption of animal fats (12.3 to 10.4 pounds per capita).

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[1] "Try These New Secrets: Live Longer and Love Every Day", *Prevention* Magazine, August 1993, p. 73.

[2] Judith Jones Putnam and Jane E. Allshouse, *Food Consumption, Prices, and Expenditures, 1970-92,* U.S. Department of Agriculture, Statistical Bulletin No. 867, September 1993.

[3] These and the figures that follow are taken from Putnam and Allshouse, Table 1--Major foods: Per capita consumption, 1970-92, p. 27.

[4] Unlike the other foods described here, whose trends are more or less steady up or down from 1980 through 1992, per capita dairy product consumption reached its low for the period in 1981 (543.2 pounds), rose from 1982 (554.6 pounds) through 1987 (601.2 pounds), and then dropped sharply in 1988 (565.2 pounds), the approximate level at which it remained until 1992 (564.6 pounds); even so, per capita consumption in 1992 was 4 percent higher than in 1981.

[5] Both fresh fruit and vegetable consumption dropped from 1989-91, probably due to the sharp increases in prices after the 1988 drought. Per capita fresh fruit consumption increased strongly from 1991 (86.6 pounds) to 1992 (95.3 pounds), but fresh vegetables declined slightly over the same time (110.4 pounds to 109.3 pounds).

Table 1: Changes in Food Purchases, All Consumer Units, 1980 and 1992.

Item	All Consumer Units			
	1980	1992	Percent Change in CPI: 1980-92	Share Index
Number of Consumer Units[1]	85,188	100,082	N/A	N/A
Income Before Taxes[2]	$17,985	$33,407	N/A	N/A
Average Number of Persons	2.7	2.5	N/A	N/A
Age of Reference Person	46.1	47.4	N/A	N/A
Number in Consumer Unit:				
Persons Under 18	0.8	0.7	N/A	N/A
Earners	1.4	1.4	N/A	N/A
Food at Home[3]	$33.22	$49.99	N/A	N/A
Share of Food at Home (%):				
Food at Home	100.0	100.0	54.8	N/A
Cereal and Bakery	12.9	15.8*	80.6	1.05
Cereal/Cereal Products	4.2	5.4*	82.1	1.09
Bakery Products	8.7	10.4*	79.5	1.03
Meat/Poultry/Fish/Eggs	34.4	26.4*	42.3	0.83
Beef	13.2	8.1*	34.5	0.71
Pork	7.3	6.0*	56.0	0.82
Other Meats	4.6	3.6*	41.3	0.86
Poultry	4.5	4.7	40.2	1.15
Fish and Seafood	2.8	2.9	73.4	0.92
Eggs	1.9	1.1*	22.2	0.73
Dairy Products	13.5	11.6*	41.4	0.94
Fresh Milk and Cream	7.1	5.1*	36.4	0.82
Other Dairy Products	6.4	6.5	48.3	1.06
Fruits and Vegetables	14.8	16.5	89.3	0.91
Fresh Fruits	4.3	4.9*	117.2	0.81
Fresh Vegetables	4.2	4.9*	99.9	0.90
Processed Fruits	3.5	3.9*	67.7	1.03
Processed Vegetables	2.8	2.9	55.0	1.03
Other Food at Home	24.4	29.7*	43.9	1.31
Sugar and Other Sweets	3.6	3.9*	47.1	1.14
Fats and Oils	2.9	2.8	45.4	1.03
Miscellaneous Foods	8.8	14.8*	67.6	1.55
Nonalcoholic Beverages	9.2	8.2*	25.1	1.10

[1]In thousands
[2]Complete income reporters only.
[3]Average weekly expenditures.
*Change in shares is statistically significant at the 95 percent confidence level.

But there are limitations to the data cited. Because the figures cited rely on food disappearance estimates, they may not accurately reflect changes in actual food intake. For example, the report overstates turkey consumption, since an increasing amount of the turkey supply is used for pet foods.[6] Similarly, consumption of fats and oils may not be accurately measured, because the figures include waste grease from restaurants.[7] Furthermore, it is not clear from these figures how Americans are consuming these foods. The increase in fresh vegetable consumption may be in part due to the proliferation of salad bars in grocery stores, and fast-food and other restaurants.[8] And changes in fat consumption may also be due to changes at fast-food establishments, and the use of salad oils at salad bars.[9] Although any improvement in diet is good, it is more important to look at patterns in food at home for several reasons. Most families eat more meals at home (where the family has more control over the ingredients used) than at restaurants.[10] Furthermore, the figures cited above do not make clear who is purchasing these foods: Are changes observed generally in the population, or only for certain segments? As the report says, "Data from the periodic NFCS [Nationwide Food Consumption Survey] and Consumer Expenditures Survey (sic) conducted by the Bureau of Labor Statistics are more useful for measuring the effect of socioeconomic and demographic characteristics on food consumption behavior."[11] Since the NFCS is conducted only about once every ten years, most recently in 1987-88, data from the continuing Consumer Expenditure Surveys (CE) are an attractive alternative.

Examined here are data from the Diary portion of the 1980 and 1992 CE. First, shares of total food spending for several demographic groups are analyzed for differences over time. An index is described that accounts for the influence of price changes on shares, and that estimates the change in quantities of specific foods consumed relative to all food consumed. Second, logistic regressions are performed to see if the probability of purchasing certain types of food has changed for different groups. The demographic characteristics examined include age of reference

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[6] Putnam and Allshouse, p. 3.

[7] Ibid., p. 3. The authors write that after deep-frying, the waste grease is used in animal and pet food, industrial operations, and sold for export, amounting to about 9 percent of the 1992 disappearance of added fats and oils.

[8] "Fruit and Vegetable Consumption", *Family Economics Review,* 1993 6(2), p. 24.

[9] Putnam and Allshouse, p. 18.

[10] In 1980, the Consumer Expenditure Diary Survey shows that 88 percent of all families reported expenditures for food at home, compared to 73 percent for food away from home. In 1992, 90 percent reported expenditures for food at home, compared to 74 percent for food away from home.

[11] Putnam and Allshouse, p. 3.

person,[12] family income level,[13] race, and marital status of the reference person.

The Data

The Diary component of the CE is comprised of reports from more than 5,000 consumer units[14] annually. Participating families receive a diary for two consecutive one-week periods in which they record expenditures for many different items. Purchases of food for home consumption are documented in great detail. In 1980, a total of 10,433 diaries are available for study; in 1992, a total of 11,713 diaries are available. Each observation represents one family's response for one week. Dividing the number of observations by two yields an approximate count of unique families.[15] All observations are treated independently. The results are weighted to represent the total population of about 85 million families (including single persons) in 1980 and 100 million families in 1992. Unless otherwise specified, the sample described includes all families included in the 1980 and 1992 surveys.

Shares analysis

Food Groups. In this section five major food groups are considered: cereal and bakery products; meat, poultry, fish, and eggs; dairy products; fruits and vegetables; and other food at home. Subcomponents of each major food group are also shown in tables 1 through 5. A detailed breakdown of the subcomponents appears in the appendix.

The Share index. The Diary survey results do not include quantities of food purchased--only the level of expenditure for each item is available. Since it is not possible to directly compare quantities purchased over time using these results, alternative methods must be used to ascertain whether food purchasing habits have changed over time. One way is to examine how the total food budget is allocated. Although a t-test on the shares might seem appropriate at first, the t-test does not conclusively indicate that food purchases are changing. For example, if the price of butter doubles, and the average family purchases half the quantity as a result, then the

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[12] The reference person is the first member mentioned by the respondent when asked to "Start with the name of the person or one of the person who owns or rents the home." It is with respect to this person that the relationship of other family members is determined.

[13] The income groups include complete income reporters only. To be classified as a complete income reporter, the family must have reported at least one major source of income (wage and salary, self-employment, railroad retirement or social security, or supplemental security) for at least one of its members, although even complete reporters may not provide a full accounting of income for all levels and sources.

[14] Consumer units are the basic unit of comparison for the CE. They are defined as a single person living alone or sharing a household with others but who is financially independent; members of a household related by blood, marriage, adoption, or other legal arrangement; or two or more persons living together who share responsibility for at least two out of three major types of expenses--food, housing, and other expenses. For convenience, the terms "consumer unit" and "family" are used interchangeably throughout the text.

[15] Although an attempt is made to keep all participating families in the sample for both weeks, some families are only available for one week. Thus dividing by two underestimates the number of unique families participating.

share of the food budget spent on butter does not change, assuming there are no changes in other food prices or quantities purchased. So price changes must be incorporated into the analysis. In order to do this, a share index is proposed to measure relative changes in the amount of food purchased. The index compares shares over time after adjustment using the Consumer Price Index (CPI),[16] which measures price changes in detail for many goods and services, including food at home. Therefore, price changes for specific food items can be compared to the change in overall food-at-home prices (figure 1). If the share of total food expenditures for a particular food item in 1992 is different from the share found in 1980, and if that share difference cannot be accounted for by price changes alone, then at least relative to total food purchased, the amount of the specific food item purchased must have changed over time.

The share index is easy to interpret. If it is greater than one, the quantity purchased of the specific item has risen relative to total food. If it is less than one, the quantity purchased of the specific item has fallen relative to total food. The level of the index minus one also shows by what percent the specific quantity has changed relative to all food. Thus, as shown in figure 2, the food group consisting of meat, poultry, fish, and eggs comprises about 17 percent less of total food in 1992 than it does in 1980. Cereal and bakery products, with a share index of 1.05, increase 5 percent relative to total food quantities purchased over the same period. It is worth emphasizing that the index does not measure absolute changes in quantities. For example, if the average family purchases twice as much meat, poultry, fish, and eggs in 1992 than in 1980, but three times as much of all other foods, the index value is less than one. Still, the measure is important in that it shows how the family purchases certain items relative to all food. And because it controls for price changes, it eliminates false interpretations that might arise from looking at changes in the shares of total food alone--for example, the share the average family devotes to fruits and vegetables rises almost 2 percent from 1980 to 1992, but the quantity of fruits and vegetables relative to all food purchased actually declines about 9 percent. For ease in analysis, terms relating to food "purchases" and "consumption" are used interchangeably to denote relative changes as described by the share index. Changes of 5 percent or more as indicated by the share index are considered to be analytically significant.

Overview. The tables show that for most demographic groups, the share index for cereal and bakery products and for other food at home indicates an increase in relative purchases of these products between 1980 and 1992, while for all other food items (meat, poultry, fish, and eggs; dairy products; and fruits and vegetables) the index indicates a relative drop in purchases. In most cases the index for cereal and cereal products is larger than the index for bakery products; similarly, the index for other food at home seems to derive its large magnitude from strong increases in miscellaneous foods, probably because miscellaneous foods includes frozen meals, which proliferate in the 1980's. More varieties become available during that period, including meals that are marketed as being gourmet style foods or low in calories. Also, the increasing

[16] The CPI-U, which measures price changes in urban areas, is used. Although the CE data include both urban and rural consumers, most families (86 percent) in the 1980 and 1992 Diary surveys live in urban areas.

Figure 1

Changes in CPI Food Price Indices, 1980-1992

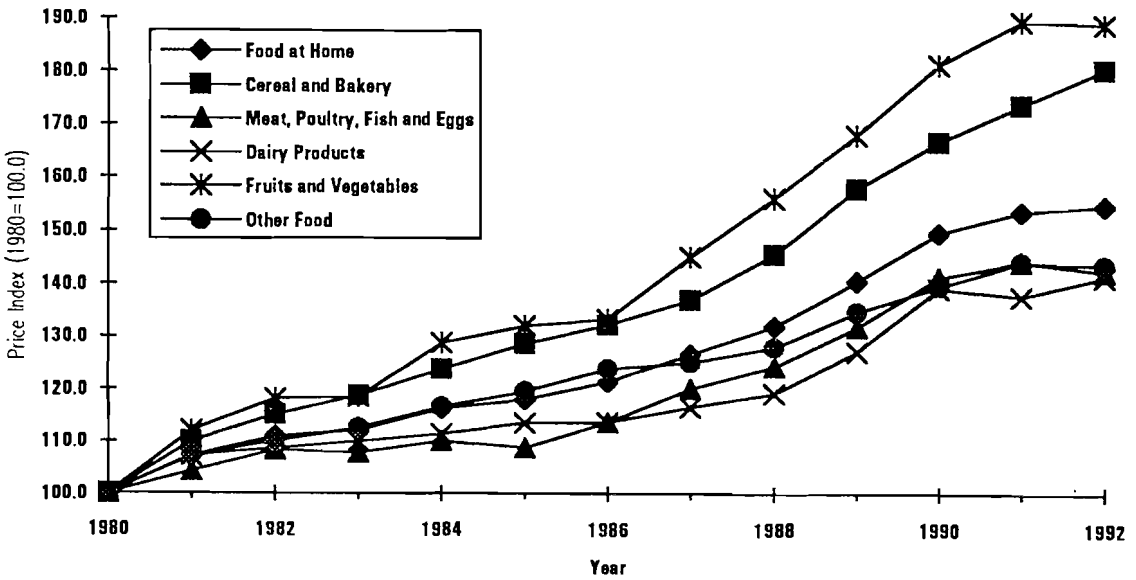
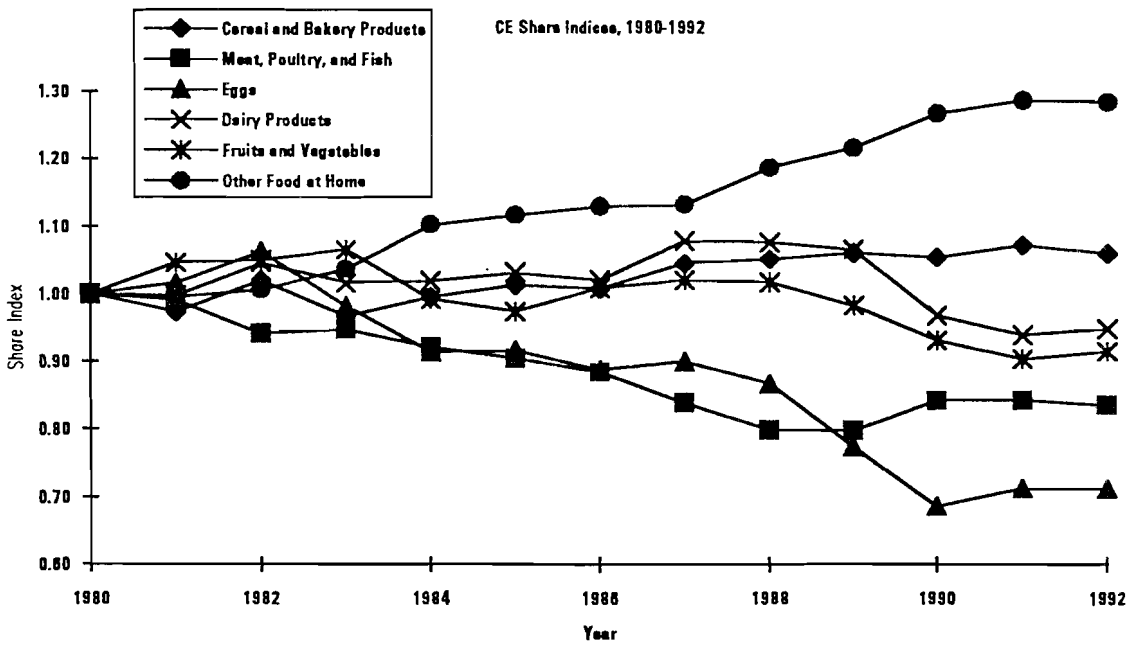


Figure 2

CE Share Indices, 1980-1992



ownership of microwave ovens[17] and an increase in dual-income families (making leisure time more valuable and prepared foods more affordable)[18] coincide during this period, making frozen meals a time-saving, convenient, and therefore attractive option for many families. Finally, the share of the food budget allocated for eggs is cut about in half for most groups between 1980 and 1992. This is consistent with results from the Department of Agriculture, which reports that "U.S. per capita egg consumption has declined steadily since the end of World War II from an all-time recorded high of 403 eggs in 1945,"[19] to (a preliminary estimate of) 234 eggs in 1992.[20]

Although most of these changes are in more healthful directions, consumption patterns in two food groups decline unexpectedly for most demographic groups. These are fish and seafood, and fruits and vegetables. The percentage of all families reporting fish and seafood expenditures is fairly stable around its mean of 28 percent from 1980 through 1990. However, the percent reporting falls from 28.2 percent in 1990 to 24.9 percent in 1992, perhaps due to an increase in prices over this period. Fish and seafood prices increased 3.4 percent, compared to 2.7 percent for beef, and decreases for pork (1.5 percent) and poultry (0.8 percent). Since poultry and fish are probably strong substitutes, it makes sense that families would purchase less fish and seafood and more poultry given an increase in fish prices and a decrease in poultry prices. Evidence from other surveys also shows declining purchases of fish and seafood from 1990 through 1992. Results from the Personal Consumption Expenditure Survey, which measures expenditures of individuals and nonprofit institutions; *Supermarket Business*'s annual survey of food manufacturers, packers, wholesalers, and retailers; and *Progressive Grocer*'s study of stores with annual food sales of at least $2 million all show decreasing real weekly expenditures from 1990 to 1992 (9.8 percent, 8.3 percent, and 15.2 percent, respectively).[21] The Department of Agriculture data show that fish and seafood consumption was 12.4 pounds per capita in 1980, peaked in 1987 at 16.1 pounds per capita, dropping to 14.7 pounds in 1992.

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[17] Maureen Boyle Gray, "Consumer spending on durables and services in the 1980's", *Monthly Labor Review,* May 1992, p. 20.

[18] Eva Jacobs, Stephanie Shipp, and Gregory Brown, "Families of working wives spending more on services and nondurables", *Monthly Labor Review,* February 1989, p. 16.

[19] Putnam and Allshouse, p. 16.

[20] Ibid., Table 10--Eggs: Per capita consumption, 1970-92, p. 37. Per capita egg consumption declines at a fairly steady rate from 1980 (271 eggs) to 1987 (254 eggs), at which point it declines sharply until 1990 (233 eggs), where it stabilizes.

[21] The Division of Consumer Expenditure Surveys routinely compares results of the Diary survey to other surveys. Ratios of 1991 CE data to other sources are published in "Consumer Expenditure Survey, 1990-91," U.S. Department of Labor, Bulletin 2425, September 1993, p. 11. Ratios are also found in internal reports, including a table entitled "Ratios of Consumer Expenditure Diary survey to alternative sources, 1989-92," completed by Maureen Gray on January 4, 1994. The CE data for fish and seafood are divided by the appropriate ratio in the table to convert them to values found by the other sources described. These values are then divided by the CPI for fish and seafood in each year to convert the values into real dollars for 1990, 1991, and 1992. The change from 1990 to 1992 can then be calculated for each source. For more information on the other sources, see Guiseman, Raymond, "The Consumer Expenditure Survey: Quality Control by Comparative Analysis," *Monthly Labor Review*, March 1987, pp. 8-14.

Fruits and vegetables are more intriguing. The share index for total fruit and vegetables (including processed fruits and vegetables) indicates a decrease in purchases for all demographic characteristics examined, although the percentage of all families reporting fruit and vegetable expenditures increased from slightly from 1980 (75 percent) to 1992 (78 percent). The share index for fresh fruits and vegetables declines in every case examined, although the increase in percent reporting for all families is about 7 percent for fresh fruits and fresh vegetables alike. However, the share indices agree with data from the NFCS. The NFCS data show a decrease in average annual household food use per 21-meal equivalent person. Fresh fruits decrease from about 150 in 1977/78 to about 147 in 1987/88. Fresh vegetables (including potatoes for consistency with CE) decrease from about 214 to 185 over the same period.[22] How can percent reporting increase, yet amounts consumed decrease? To explain this phenomenon, families can be defined as "new" purchasers and "continuing" purchasers. "New" purchasers are those who were not likely to purchase fresh fruits and vegetables in 1980, but who are more likely to purchase in 1992. "Continuing" purchasers are those who were likely to purchase regardless of year. Two factors are undoubtedly at work. The new purchasers are induced to purchase due to a greater awareness of the relationship of fresh fruit and vegetable consumption to health. Continuing purchasers react to the fact that prices of fruits and vegetables have increased faster than any other food prices (figure 1) buy cutting back on fruit and vegetable purchases. If the new purchasers are a small fraction of all purchasers, then their average purchase must be large to counteract even a small decrease in average purchases by continuing purchasers, or average purchases will decline for the population. Evidence from the CE data shows that this is indeed what happened. The real mean weekly expenditure for fresh fruits in 1980 is $1.70, compared to $1.33 in 1992. Only bananas show an increase in real mean expenditures, from $0.26 to $0.36. This is not so surprising, because that the price increase for bananas (53 percent) was by far the smallest of all fresh fruits. (Oranges had the largest increase--143 percent). Fresh vegetables showed a similar decline in real mean weekly expenditures, from $1.78 in 1980 to $1.54 in 1992. Although expenditures for potatoes only decreased $0.01, expenditures for lettuce decreased $0.06, tomatoes $0.05, and other fresh vegetables $0.14. When real mean weekly expenditures are divided by the percentage of consumer units reporting an expenditure to find the average real expenditure for those who actually purchased fresh fruits or vegetables, the results are even more convincing. The average expenditures for those reporting fresh fruits decline from $3.35 in 1980 to $2.29 in 1992, while fresh vegetable expenditures decrease from $3.28 to $2.52. Even bananas show a small decrease in weekly expenditure ($0.03) when values for those reporting expenditures are compared. The fact that percent reporting increases while average expenditures decrease for fruits and vegetables underscores the importance of using both a share index and logistic regression to get a fuller picture of how purchases are changing.

Age. Age is expected to have a strong relationship to food expenditures, although which group is expected to eat more foods that are currently described as healthful is not clear *a priori*. Older persons have different health concerns than younger persons, and so may be more inclined

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[22] Lutz, Steven M.; Smallwood, David M.; Blaylock, James R.; Hama, Mary Y. "Changes in Food Consumption and Expenditures in American Households During the 1980's," U.S. Department of Agriculture, Statistical Bulletin No. 849, Table 2--Household size: Average annual food use (per 21-meal equivalent person), p. 20.

to eat carefully. But older persons also may find that life-long eating habits are difficult to change. Surprisingly, when the share indices are examined by age (table 2), few differences in the direction of change are found. In almost every case, if the index indicates change in one direction for one group, it indicates change in the same direction for all three groups. For example, purchases of beef, pork, fish, and eggs decline for all age groups while purchases of poultry increase. One notable exception is the share index for fats and oils, which indicates a 9 percent decrease in relative consumption for the youngest group, and an increase of 6 percent for the oldest group.

Income. The level of income[23] is also related to food expenditures. Families with lower incomes have less flexibility than higher income families to adjust their food expenditure patterns should prices of foods change. Reference persons for families with lower incomes also have lower average levels of education, and so they may not be as informed about health issues.[24]

In almost every case, the share indices for the highest income group indicate change in a more healthful direction (table 3)--for example, the largest increase in cereal and cereal product purchases (22 percent) is associated with this group. Although each group shows a decrease in the share index for meat, poultry, fish, and eggs, the share index is smallest for the high income group (0.76), followed by the middle (0.82) and low income groups (0.94). The indices for beef and pork indicate a substantial drop in consumption for the high and middle income groups, and a much lesser decline for the low income group. Similarly, poultry consumption rises for each group, but most for the high group. The fish and seafood index indicates the smallest drop for the high income group (2 percent), but the largest for the middle group (23 percent). And while egg purchases decrease more than one-fourth for the low and middle income groups, they decrease by one-third for the high income group. The index for fresh milk and cream shows the largest decrease in consumption for the high group while the index for other dairy products shows purchases increase least for the high income group. The index for fresh fruit indicates decreased consumption for all groups, with the highest income group showing the smallest decline; the index for fresh vegetables decreases more than one-eighth for the low and middle income groups, but shows virtually no change for the high income group.

Gender and Race. Because gender and race characteristics can be broken into two groups (male/female, black/white and other) these groups can be compared easily within a year, as well as across years. It is assumed that each group faces the same prices within the same year;

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[23] To classify families by income group, the complete income reporters are sorted by their total reported income and numbered consecutively, with the lowest income reported receiving a value of one. These values are then all divided by the value associated with the highest income family, so that the lowest income family has a rank close to zero, and the highest is exactly one. Families whose rank is less than 1/3 are counted in the lowest group. Those whose value is between 1/3 and 2/3 are placed in the middle group. The remaining families are placed in the highest group.

[24] In 1980, about 27 percent of the low income families have a reference person with at least some college education compared to 54 percent of high income families. In 1992, about 30 percent of low income families have a reference person with at least some college education compared to 66 percent of high income families. Differences in level of education are controlled for in the logistic regressions which follow.

Table 2: Comparison of Food Purchases, Age of Reference Person, 1980 and 1992.

Item	Under 35 Years		35 to 64 Years		65 and Over		Share Index		
	1980	1992	1980	1992	1980	1992	Under 35	35 to 64	65 and Over
Number of Consumer Units[1]	29,092	28,716	39,568	49,713	16,528	21,654	N/A	N/A	N/A
Income Before Taxes[2]	$16,975	$28,50	$22,45	$42,80	$9,108	$19,624	N/A	N/A	N/A
Average Number of Persons	2.5	2.5	2.5	2.9	1.7	1.7	N/A	N/A	N/A
Age of Reference Person	26.8	27.6	46.5	47.2	73.0	74.1	N/A	N/A	N/A
Number in Consumer Unit:									
Persons Under 18	0.9	0.9	1.0	0.9	0.1	0.1	N/A	N/A	N/A
Earners	1.4	1.4	1.7	1.7	0.5	0.5	N/A	N/A	N/A
Food at Home[3]	$27.91	$41.70	$39.86	$58.30	$26.65	$41.92	N/A	N/A	N/A
Share of Food at Home (%):									
Food at Home	100.0	100.0	100.0	100.0	100.0	100.0	N/A	N/A	N/A
Cereal and Bakery	112.6	15.7*	13.0	15.7*	12.8	16.2*	1.07	1.04	1.08
Cereal/Cereal Products	4.4	5.9*	4.1	5.3*	4.1	5.2*	1.14	1.10	1.08
Bakery Products	8.2	9.8*	8.9	10.4*	8.7	11.1*	1.03	1.01	1.10
Meat/Poultry/Fish/Eggs	33.9	25.6*	34.8	26.7*	33.9	26.6*	0.82	0.83	0.85
Beef	13.9	8.2*	13.2	8.2*	12.2	7.5*	0.68	0.72	0.71
Pork	6.9	5.6	7.6	6.0*	7.2	6.5	0.81	0.78	0.90
Other Meats	4.4	3.4*	4.8	3.7*	4.2	3.5	0.85	0.84	0.91
Poultry	4.4	4.7	4.4	4.7	5.0	4.7	1.18	1.18	1.04
Fish and Seafood	2.4	2.6	3.0	3.1	3.1	3.0	0.97	0.92	0.86
Eggs	1.8	1.0*	1.9	1.0*	2.1	1.2*	0.07	0.67	0.72
Dairy Products	14.0	11.7*	13.4	11.6*	12.7	11.3*	0.91	0.95	0.97
Fresh Milk and Cream	7.4	5.5*	7.1	5.0*	6.5	5.3*	0.84	0.80	0.93
Other Dairy Products	6.6	6.3	6.3	6.7	6.2	6.1	1.00	1.11	1.03
Fruits and Vegetables	13.8	15.3	14.7	16.2*	17.3	19.1*	0.91	0.90	0.90
Fresh Fruits	3.5	4.2	4.4	4.8	5.5	6.0	0.86	0.78	0.78
Fresh Vegetables	3.9	4.7	4.3	4.8*	4.8	5.4	0.93	0.86	0.87
Processed Fruits	3.5	3.6	3.2	3.7*	4.3	4.7	0.95	1.07	1.01
Processed Vegetables	2.9	2.8	2.7	2.9	2.7	2.9	0.96	1.07	1.07
Other Food at Home	25.7	31.7*	24.1	29.8*	23.4	26.8*	1.33	1.33	1.23
Sugar and Other Sweets	3.5	3.7	3.6	3.9*	3.6	4.2*	1.11	1.14	1.23
Fats and Oils	2.8	2.4	2.9	2.8	3.2	3.2	0.91	1.03	1.06
Miscellaneous Foods	10.5	16.9*	8.4	14.8*	7.0	12.0*	1.49	1.63	1.58
Nonalcoholic Beverages	8.8	8.7	9.3	8.3*	9.6	7.3*	1.22	1.10	0.94

[1]In thousands
[2]Complete income reporters only.
[3]Average weekly expenditures.
*Change in shares is tatistically signficant at the 95 percent confidence level.

Table 3: Comparison of Food Purchases, Family Income, 1980 and 1992.

Item	Low Income		Middle Income		High Income		Share Index		
	1980	1992	1980	1992	1980	1992	Low	Middle	High
Number of Consumer Units[1]	22,642	26,148	22,894	26,184	21,731	26,209	N/A	N/A	N/A
Income Before Taxes[2]	$5,270	$9,232	$15,59	$26,14	$33,74	$64,784	N/A	N/A	N/A
Average Number of Persons	2.0	1.9	2.8	2.5	3.4	3.1	N/A	N/A	N/A
Age of Reference Person	50.7	51.5	41.8	45.8	42.6	44.4	N/A	N/A	N/A
Number in Consumer Unit:									
Persons Under 18	0.5	0.5	0.9	0.7	1.1	0.9	N/A	N/A	N/A
Earners	0.7	0.7	1.4	1.4	2.0	2.0	N/A	N/A	N/A
Food at Home[3]	$23.42	$35.61	$34.78	$49.29	$47.19	$67.38	N/A	N/A	N/A
Share of Food at Home (%):									
Food at Home	100.0	100.0	100.0	100.0	100.0	100.0	N/A	N/A	N/A
Cereal and Bakery	13.5	15.6*	13.0	15.7*	12.5	16.1*	0.99	1.04	1.10
Cereal/Cereal Products	4.9	5.6	4.5	5.5*	3.7	5.3*	0.97	1.04	1.22
Bakery Products	8.6	9.9*	8.5	10.2*	8.8	10.8	0.99	1.04	1.06
Meat/Poultry/Fish/Eggs	32.2	27.9*	34.6	26.2*	35.5	24.9*	0.94	0.82	0.76
Beef	10.1	8.2*	13.8	8.3*	14.9	7.6*	0.93	0.69	0.59
Pork	7.4	7.0	7.2	6.1	7.5	5.1*	0.94	0.84	0.67
Other Meats	4.5	3.5*	4.6	3.8*	4.4	3.4*	0.85	0.90	0.85
Poultry	5.3	5.1	4.4	4.4	4.0	4.6	1.06	1.10	1.27
Fish and Seafood	2.6	2.6	2.8	2.4	3.0	3.3	0.89	0.77	0.98
Eggs	2.3	1.3*	1.9	1.1*	1.7	0.9*	0.72	0.73	0.67
Dairy Products	13.6	11.9*	13.3	11.9	13.5	11.3*	0.96	0.98	0.92
Fresh Milk and Cream	7.7	5.8*	7.3	5.5*	6.7	4.6*	0.86	0.86	0.78
Other Dairy Products	5.9	6.1	6.0	6.4	6.8	6.7	1.08	1.11	1.03
Fruits and Vegetables	15.6	17.1	14.2	16.0	14.2	16.5*	0.90	0.92	0.95
Fresh Fruits	4.6	4.9	3.9	4.8*	4.2	5.0*	0.76	0.88	0.85
Fresh Vegetables	4.4	4.9	4.3	4.6	3.9	5.0*	0.86	0.83	0.99
Processed Fruits	3.7	4.1	3.2	3.8*	3.5	3.8	1.02	1.10	1.00
Processed Vegetables	3.0	3.2	2.8	2.8	2.6	2.7	1.07	1.00	1.04
Other Food at Home	25.0	27.5	25.0	30.2*	24.3	31.2*	1.18	1.30	1.38
Sugar and Other Sweets	3.8	3.9	3.6	3.9	3.6	4.2*	1.08	1.14	1.23
Fats and Oils	3.3	2.8*	3.0	3.0	2.7	2.6	0.90	1.06	1.03
Miscellaneous Foods	8.2	12.7*	8.9	14.9*	9.2	16.0*	1.43	1.55	1.61
Nonalcoholic Beverages	9.6	8.1*	9.5	8.5	8.9	8.3	1.04	1.11	1.15

[1]In thousands
[2]Complete income reporters only.
[3]Average weekly expenditures.
*Change in shares is tatistically signficant at the 95 percent confidence level.

therefore, a t-test is useful in comparing the groups within a year. For comparison within a group across years, the share index is useful.

Gender. In families it is not clear that the reference person is making the decisions about grocery purchases for the family, nor even if the reference person exerts a great deal of influence in those decisions. Furthermore, changes in family composition over time may influence purchasing decisions. Since the single person is the sole decision maker for his or her "family", differences in purchases by gender are likely the result of differences in tastes or other influences that vary by gender. However, regression analysis is still necessary for the greatest certainty that gender is an influencing factor in food consumption, since incomes and other demographics may differ for single men and women.

Table 4 shows differences in expenditure shares for single males compared to single females. The t-statistics show there are few statistically significant differences in expenditure shares by gender in 1980, and none in 1992. Yet, when comparing t-statistics across time (not shown), single women have significant changes in shares for cereal and bakery products (which increased), meat, poultry, fish, and eggs (which decreased), and other food at home (which increased), while single men have no significant changes in shares over time for any major food category. This paradox can be resolved by considering the variances of expenditures for single men and women. If single women have a lower variance in expenditures than single men do, then smaller changes in shares over time for women will be statistically significant than will be for men. And when compared by gender in the same time period, the larger variance in shares for men means that the difference in shares by gender must also be large to register statistical significance. These facts suggest that in both 1980 and 1992, the average single person, regardless of gender, follows certain dietary habits, but that single men are more likely to deviate from those habits than are single women.

Nevertheless, there are some interesting differences in shares indices when single men and women are compared. Both sexes exhibit a decrease in purchases of meat, poultry, fish, and eggs, but the share index for women (0.84) is 10 points lower than for men (0.94). This is due in part to the fact that women have cut back on all meat purchases, while men have increased consumption of poultry and other meats. The index for fruits and vegetables is the same for both sexes (0.82), but men have cut back less on fresh fruits and more on fresh vegetables, while women have done the opposite. Similarly, women have increased their purchases of sugar and sweets while consumption of fats and oils is unchanged, while men have decreased sugar and sweet purchases and increased consumption of fats and oils.

Race. Although only singles are examined by gender of the reference person, families can be examined by race of the reference person. Table 5 shows that except for beef and other meats, shares spent for meat, poultry, fish, and eggs differ significantly by race regardless of year. Blacks spend larger shares than whites and others on pork, poultry, fish and seafood, and eggs in either year. However, both groups consumed less of most meat products in 1992 than in 1980, with two exceptions; whites and others increased their consumption of poultry, and blacks increased their consumption of fish and seafood. Changes in consumption of other foods are not

Table 4: Comparison of Food Purchases, Single Persons, 1980 and 1992.

Item	Single Persons: 1980			Single Persons: 1992			Share Index	
	Men	Women	t-statistic	Men	Women	t-statistic	Men	Women
Number of Consumer Units[1]	9,289	13,556	N/A	11,799	17,089	N/A	N/A	N/A
Income Before Taxes[2]	$11,932	$7,462	N/A	$21,29	$16,31	N/A	N/A	N/A
Average Number of Persons	1.0	1.0	N/A	1.0	1.0	N/A	N/A	N/A
Age of Reference Person	41.3	53.2	N/A	42.9	55.6	N/A	N/A	N/A
Number in Consumer Unit:								
Persons Under 18	0.0	0.0	N/A	0.0	0.0	N/A	N/A	N/A
Earners	0.8	0.5	N/A	0.8	0.5	N\A	N\A	N/A
Food at Home[3]	$12.55	$13.90	N/A	$22.75	$24.93	N/A	N/A	N/A
Share of Food at Home (%):								
Food at Home	100.0	100.0	N/A	100.0	100.0	N/A	N/A	N/A
Cereal and Bakery	12.5	12.4	-0.09	15.3	15.9	0.43	1.05	1.10
Cereal/Cereal Products	3.5	3.7	0.35	4.9	4.9	0.03	1.19	1.13
Bakery Products	10.7	8.6	-1.71	10.4	11.0	0.52	0.84	1.10
Meat/Poultry/Fish/Eggs	29.9	30.5	0.18	25.8	23.5	-0.95	0.94	0.84
Beef	10.2	9.6	-0.35	8.1	6.4	-1.81	0.91	0.77
Pork	6.5	5.8	-0.43	5.0	5.6	0.78	0.76	0.96
Other Meats	3.3	4.2	1.51	3.7	3.1	-1.22	1.23	0.81
Poultry	4.1	5.8	2.08	5.0	4.6	-0.52	1.35	0.88
Fish and Seafood	3.6	3.2	-0.47	3.0	2.6	-0.83	0.74	0.73
Eggs	2.1	2.0	-0.20	1.1	1.4	1.31	0.66	0.89
Dairy Products	13.0	13.4	0.30	12.4	11.8	-0.46	1.04	0.96
Fresh Milk and Cream	6.9	5.9	-1.30	5.9	4.7	-1.47	0.97	0.90
Other Dairy Products	6.1	7.5	2.01	6.5	7.0	0.73	1.11	0.97
Fruits and Vegetables	17.0	19.5	0.98	17.1	19.6	1.40	0.82	0.82
Fresh Fruits	4.1	6.5	3.57	5.1	6.1	1.50	0.89	0.67
Fresh Vegetables	6.0	5.6	-0.18	4.7	5.7	1.64	0.61	0.79
Processed Fruits	4.2	4.5	0.39	4.4	4.6	0.23	0.97	0.94
Processed Vegetables	2.7	2.9	0.54	2.9	3.2	0.65	1.07	1.10
Other Food at Home	27.6	24.2	-1.31	29.5	29.2	-0.10	1.15	1.30
Sugar and Other Sweets	3.9	3.7	-0.24	3.2	4.1	1.88	0.86	1.17
Fats and Oils	2.0	3.1	2.68	2.4	2.9	1.33	1.28	1.00
Miscellaneous Foods	9.3	7.8	-1.33	14.6	14.2	-0.29	1.45	1.68
Nonalcoholic Beverages	12.4	9.5	-2.08	9.3	8.1	-1.23	0.93	1.06

[1]In thousands
[2]Complete income reporters only.
[3]Average weekly expenditures.
*Change in shares is tatistically signficant at the 95 percent confidence level.

Note: Because singles in the same time period face the same prices, we know automatically that a significant difference in a share means a significant difference in quantity. Therefore, for those, the percent change in CPI and the Share Index are unnecessary. This is true of all two-way comparisons (e.g., race of reference person).

Table 5: Comparison of Food Purchases, Race of Reference Person, 1980 and 1992.

Item	Race of Reference Person: 1980			Race of Reference Person: 1992			Share Index	
	White and Other	Black	t-statistic	White and Other	Black	t-statistic	White and Other	Black
Number of Consumer Units[1]	76,163	9,026	N/A	88,754	11,328	N/A	N/A	N/A
Income Before Taxes[2]	$18,601	$12,86	N/A	$34,486	$24,61	N/A	N/A	N/A
Average Number of Persons	2.6	2.9	N/A	2.5	2.7	N/A	N/A	N/A
Age of Reference Person	46.3	44.4	N/A	47.6	45.6	N/A	N/A	N/A
Number in Consumer Unit:								
Persons Under 18	0.7	1.1	N/A	0.7	0.9	N/A	N/A	N/A
Earners	1.4	1.3	N/A	1.4	1.3	N/A	N/A	N/A
Food at Home[3]	$33.81	$28.17	N/A	$51.02	$42.00	N/A	N/A	N/A
Share of Food at Home (%):								
Food at Home	100.0	100.0	N/A	100.0	100.0	N/A	N/A	N/A
Cereal and Bakery	12.9	12.7	0.15	15.9	15.4	0.56	1.06	1.04
Cereal/Cereal Products	4.1	4.9	-1.29	5.4	6.1	-1.81	1.12	1.06
Bakery Products	8.8	7.8	1.25	10.5	9.2	1.99	1.03	1.02
Meat/Poultry/Fish/Eggs	33.7	41.1	-2.20	25.7	33.7	-5.26	0.83	0.89
Beef	13.5	11.1	1.74	8.0	8.9	-1.49	0.68	0.92
Pork	7.0	10.9	-3.38	5.7	8.6	-4.59	0.81	0.78
Other Meats	4.6	5.0	-0.65	3.5	4.1	-0.75	0.83	0.90
Poultry	4.2	7.8	-4.41	4.6	6.1	-3.49	1.21	0.86
Fish and Seafood	2.8	3.8	-2.07	2.8	4.6	-3.70	0.89	1.08
Eggs	1.8	2.6	-2.98	1.0	1.3	-3.08	0.70	0.63
Dairy Products	13.8	10.4	2.59	11.9	8.8	5.84	0.94	0.93
Fresh Milk and Cream	7.2	6.0	1.36	5.3	3.9	4.09	0.84	0.74
Other Dairy Products	6.5	4.4	3.74	6.6	4.9	4.90	1.06	1.16
Fruits and Vegetables	14.9	14.4	0.28	16.4	16.8	-0.39	0.90	0.95
Fresh Fruits	4.4	3.8	1.17	4.9	4.9	-0.07	0.79	0.92
Fresh Vegetables	4.3	4.2	0.07	4.9	4.6	1.01	0.88	0.85
Processed Fruits	3.5	3.7	-0.47	3.8	4.0	-0.45	1.00	1.00
Processed Vegetables	2.8	2.8	0.03	2.8	3.3	-1.44	1.00	1.18
Other Food at Home	24.7	21.3	1.63	30.1	25.4	3.35	1.31	1.28
Sugar and Other Sweets	3.5	3.7	-0.26	4.0	3.5	1.95	1.20	1.00
Fats and Oils	2.9	2.8	0.35	2.8	2.8	-0.01	1.03	1.06
Miscellaneous Foods	8.9	6.9	2.27	15.1	11.7	4.02	1.57	1.57
Nonalcoholic Beverages	9.3	8.0	1.50	8.3	7.5	1.51	1.10	1.16

[1]In thousands
[2]Complete income reporters only.
[3]Average weekly expenditures.
*Change in shares is tatistically signficant at the 95 percent confidence level.

clearly related to race. The indices indicate changes in the same direction and similar in magnitude for most items, even at the subcomponent level.

Logistic Regression Results

Share analysis, even when accompanied by the share index, does not give a complete picture of changes in food consumption patterns. Changes in one segment of a group can change the average share, even though all members of that group are not changing their patterns. For example, suppose that in 1980, families whose reference person is under 35 eat mostly meat and a few vegetables at every meal, while single persons under 35 eat only meat and no vegetables. In 1992, families under 35 eat less meat and more vegetables, while singles under 35 continue to eat only meat. In the absence of price changes, the share for consumers under 35 should rise for vegetables and fall for meat. Yet in this example, only families reap the benefits of the inclusion of more vegetables in the diet, not singles. Logistic regression (Logit) is used to determine the probability that a particular family will purchase a certain type of food, given the family's characteristics.[25] If such an analysis were performed on a group of data described in the example, the results would likely predict a higher probability of purchasing vegetables for families whose reference person is under 35, and no change in probability for singles. Whether the predicted probability of vegetable purchases for families would *actually* increase is an open question. The reason is that it does not matter how much a family purchases--all positive expenditures on vegetables are recorded as a "yes", the family purchased vegetables. So if the family in 1980 purchases a small amount of vegetables every week, and in 1992 purchases a large amount of vegetables every week, the probability of purchasing vegetables does not change, even though quantity purchased does. Still, Logit analysis offers some insight into food purchasing patterns. The way the data are collected, an increase in the probability of purchase indicates that more families are reporting purchases of the good, and is thus a good indicator of whether consumption is increasing due to an increase in number of families that purchase rather than an increase in number of purchases by families that already consume the food regularly.

Because the Logit procedure is a form of regression analysis, several demographic characteristics can in effect be held constant, and predictions can be made for specific families; e.g., the probability that a family in the middle income group whose reference person is 35 to 64 years old and black purchases fruits and vegetables can be predicted. The characteristics examined here are family income, composition, size, food stamp participation, whether or not the family lives in an urban area, month in which the family was interviewed (since some food items, such as fresh fruits, may only be available seasonally, or like poultry, may be purchased more frequently at holiday time regardless of other characteristics), and age, race, and education of the reference person. Number of adults and children (i.e., persons less than 18 years old) are included separately as continuous variables, while all other variables are binary. A variable for number of children squared is also included to account for potential quadratic relationships between number of children and probability of purchasing a particular food. For example, if milk

[25] For a detailed description of the Logit procedure, see Peter Kennedy, *A Guide to Econometrics*, 3rd Edition, Cambridge: The MIT Press, chapter 15, especially pp. 228-230, and 241-242.

is deemed a good food for children but not so important for adults, then a husband/wife family with one child is expected to have a much higher probability of purchasing dairy products than a family consisting only of a husband and wife. But a husband and wife with two children is not expected to have a substantially higher probability of purchasing milk than a family with one child.

Using these characteristics, a "standard" or "control" family can be described. The control family is one against which other families can be compared. For example, if the effect of age on the probability of purchase is the characteristic to be isolated, one can compare the control family to another family with identical characteristics except for age. In this way the impact of age on probability can be more carefully measured. For these purposes the control group is defined as a family:

consisting of a husband, wife, and one child;
in the middle income group;
living in an urban area;
not participating in the food stamps program;
participating in the Diary survey in the spring (April, May, or June);
whose reference person is 35 to 64 years old, not black, and never attended college.

Tables 7 through 9 show the probability that the control family makes a purchase in 1980 and 1992. The percent change in probability for each characteristic is also shown for each year. For example, table 7 shows that the probability that a family in the control group purchases cereal and bakery products in 1980 is 95.3 percent. A family whose reference person is under 35 but is otherwise identical is 2.7 percent less likely to purchase cereal and bakery products (that is, the probability of purchase is 92.6 percent). In 1992, the control group probability is virtually unchanged (95.4 percent), but the family whose reference person is under 35 has a slightly higher probability of purchase (94.0 percent) than in 1980 (92.6 percent). Presenting the results in this manner facilitates comparisons across time and demographic groups.

The results take into account family composition. For example, a single person has no children and no spouse, while the control family consists of a husband and wife with one child. Therefore, the probability for the single person is calculated taking these differences into account before being compared to the family. Similarly, the addition of a child changes the equation both through the change in number of children and number of children squared.[26] Calculations are made accordingly.

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[26] Children are defined here as persons less than 18 years old. Hence, when considering the addition of an adult to the husband/wife family with one child, the interpretation is that the spouses have two children living at home, one who is at least 18 and the other under 18. Otherwise, it is necessary to include the parameter estimate for other family in the probability equation, and thus complicate the comparison. Furthermore, the percent change from adding one child over 18 can be compared to the percent change of adding one child under 18 to see if age of the older child affects probability of purchase, thus adding more flexibility to the analysis without further complicating the model.

The five major food groups considered in the previous section are too restrictive in some cases for the present purpose. For example, meat, poultry, fish, and eggs contains a mix of items that nutritionists would not consider to be equal in health benefit (e.g., poultry and many varieties of fish and seafood are lower in fat than comparable servings of beef or pork). Eggs are high in fat and cholesterol, and are consumed in different ways than other meat products. They may be eaten for their own sake (hard-boiled or scrambled), in conjunction with other foods (a spinach soufflé or quiche), or as an ingredient in other goods (cakes or egg noodles). If kept at the aggregate level, substitutions within the meat, poultry, fish, and eggs group would be missed. So if families are eating less red meat and more poultry instead, it would appear that the probability of purchasing meat, poultry, fish, and eggs have not changed much, even though the probability of purchasing red meat declines and the probability of purchasing poultry increases. For these reasons, the major food groups analyzed are cereal and bakery products; beef, pork, and other meats; poultry; fish and seafood; eggs; dairy products; fruits and vegetables; fats and oils; and other foods (defined the same way as other food at home minus fats and oils).

Before Logits are run, families that do not report purchase of groceries (about 11 percent) are omitted from the sample. This is to avoid bias--if no one in the family buys groceries in the first place, then the probability that the family buys any specific food item is zero. Also omitted are families for whom no diary placement date could be found (less than 3 percent of the total sample). Table 6 shows the characteristics of the average family included in the sample for each year.

Tables 7 through 9 show parameter estimates for each characteristic. Only two parameter estimates (coincidentally, both from 1992) are not statistically significant (fish and seafood, number of children squared; fats and oils, low income). The remaining estimates are significant at the 99 percent confidence level. However, caution must be taken when interpreting the standard errors, since weighting appears to reduce the estimates substantially. Nevertheless, weighting does not appear to substantially alter the predicted probabilities, which are of primary interest in the analysis. Therefore, to keep the tables to an acceptable length, standard errors for parameter estimates are not shown.[27]

Cereal and Bakery Products. The probability of purchasing cereal and bakery products is virtually unchanged from 1980 to 1992 (95 percent) for the control group, and few other groups reported economically significant changes. The exception is single persons, whose probability of purchase increased about 8 percent. Single females are more likely to purchase cereal and bakery products in 1992 (88 percent) than single males (85 percent). Although singles and families have different probabilities of purchase, composition of families makes little difference. Compared to the control group, families are from 2.6 to 4.0 percent less likely to purchase cereal and bakery products, regardless of year. Adding one more child to the family increases the probability of purchase only about 1 percent in each year.

[27] Figures are available from the author on request.

Table 6: Characteristics of Families Included in Logistic Regressions

Variable	1980	1992
Number:		
Sample	9,055	10,186
Population (000's)	74,893	86,739
Adults	1.9	1.9
Persons less than 18	0.8	0.7
Percent:		
Age:		
Under 35	33.0	27.4
65 and over	19.7	21.9
Income Group:		
Low Income	26.8	25.2
High Income	27.3	27.1
Incomplete Reporters	17.7	20.2
Family Type:		
Single Male	9.2	10.4
Single Female	14.5	15.9
Husband and Wife Only	22.3	21.8
Single Parent	5.5	5.5
Other Family	12.9	15.8
Race:		
Black	10.3	11.0
Education:		
Some College	20.0	22.8
College Graduate	18.3	24.1
Degree Urbanization:		
Rural	17.9	13.8
Food Stamps:		
Participant	7.6	7.5
Month Surveyed:		
Jan/Feb/Mar	25.3	25.7
July/Aug/Sept	23.7	24.4
Oct/Nov/Dec	25.6	25.2

Table 7: Probabilities of Purchase, 1980 and 1992: Cereal and Bakery Products; Beef, Pork, and Other Meats; Poultry

Logistic Regression Results	Cereal and Bakery Products				Beef, Pork, and Other Meats				Poultry			
All Consumer Units	Parameter Estimates		Percent Change in Probability		Parameter Estimates		Percent Change in Probability		Parameter Estimates		Percent Change in Probability	
Characteristics	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Control Group:	3.0075	0.0161	95.3	95.4	1.9552	-0.2946	87.6	84.0	-0.2342	-0.0975	44.2	41.8
Intercept[1]	2.5387	-0.4187	0.04	0.04	1.4460	-0.6881	0.11	0.13	-0.4951	-0.2609	0.25	0.24
Age (35 to 64)												
Under 35	-0.4868	0.2016	-2.7	-1.4	-0.4463	0.0715	-5.7	-5.7	-0.2537	0.1458	-6.1	-2.6
65 and Over	0.4611	-0.2098	1.7	1.0	0.1781	-0.1481	1.8	0.4	0.2418	-0.1859	6.0	1.4
Income (Middle Group)												
Lowest Group	-0.1732	-0.2202	-0.8	-2.1	-0.1981	0.1509	-2.3	-0.6	-0.0576	0.1305	-1.4	1.8
Highest Group	-0.1527	-0.0076	-0.7	-0.8	0.1045	-0.1623	1.1	-0.8	-0.0292	0.1021	-0.7	1.8
Incomplete Reporter	-0.4807	0.3030	-2.7	-0.9	-0.3155	0.2303	-3.9	-1.2	0.0248	0.1627	0.6	4.6
Family Composition (Husband/Wife/Children)												
Single Male	-1.4405	0.6795	-18.8	-10.7	-1.1198	0.8880	-24.5	-14.4	-0.7150	0.0327	-19.8	-19.8
Single Female	0.2386	0.0611	-14.8	-7.2	0.2665	-0.4921	-18.6	-19.4	0.2916	-0.1730	-14.0	-17.7
Husband/Wife Only	-0.1612	-0.1612	-2.6	-3.0	-0.1908	0.2535	-3.4	-3.4	-0.0887	-0.0491	-4.7	-5.2
Single Parent	-0.4399	0.3053	-3.0	-2.7	-0.4293	0.1378	-8.7	-9.6	-0.2209	0.1153	-7.2	-6.5
Other Family	-0.4453	-0.2144	-2.5	-4.0	-0.3270	0.2034	-4.0	-1.7	0.0705	-0.2686	1.7	-4.7
Family Size (Two Adults, One Child)												
Number of Adults	0.0824	0.2675	0.4	1.3	0.2083	0.0945	2.1	3.7	0.0772	0.0942	1.9	4.2
Number of Children[2]	0.3331	-0.1218	1.0	0.8	0.1169	0.2219	0.5	2.7	0.1219	-0.0400	1.9	2.0
Children Squared	-0.0291	0.0216	N/A	N/A	-0.0243	-0.0174	N/A	N/A	-0.0154	0.0150	N/A	N/A
Race (White and Other)												
Black	-0.1534	-0.1534	-0.7	-1.6	0.1593	-0.1026	1.6	0.7	0.7946	-0.4531	19.5	8.5
Education (No College)												
Some College	0.0900	0.0900	0.4	0.7	-0.1230	-0.1230	-1.4	-3.6	-0.1080	0.0408	-2.6	-1.6
College Graduate	-0.0620	-0.0620	-0.3	-0.6	-0.1607	-0.1607	-1.9	-4.8	0.0395	-0.0414	1.0	0.0
Degree Urbanization												
Rural	0.0618	0.1919	0.3	1.0	-0.1211	-0.1211	-1.4	-3.5	-0.1340	0.0656	-3.3	-1.7
Food Stamps												
Participates	0.4111	-0.6836	1.5	-1.4	0.0683	-0.0603	0.7	0.1	0.0590	0.0072	1.5	1.6
Month Surveyed												
Jan/Feb/Mar	0.2067	-0.1838	0.8	0.1	-0.0901	0.0744	-1.0	-0.2	0.0278	0.0702	0.7	2.4
July/Aug/Sep	0.2224	-0.2382	0.9	-0.1	0.0579	0.0204	0.6	1.0	0.0115	0.2122	0.3	5.5
Oct/Nov/Dec	-0.0778	0.1235	-0.4	0.2	-0.1351	0.0749	-1.5	-0.8	-0.0036	0.1121	-0.1	2.7

1 Change in probability if intercept parameter estimate increases by 0.01.
2 Change in number of children affects number of children and children squared, so total change in probability is shown here.

Table 8: Probabilities of Purchase, 1980 and 1992: Fish and Seafood; Eggs; Dairy Products

Logistic Regression Results	Fish and Seafood				Eggs				Dairy Products			
All Consumer Units	Parameter Estimates		Percent Change in Probability		Parameter Estimates		Percent Change in Probability		Parameter Estimates		Percent Change in Probability	
Characteristics	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Control Group:	-0.4816	-0.4784	38.2	27.7	0.3850	-0.5852	59.5	45.0	2.7861	-0.4777	94.2	91.0
Intercept[1]	-0.6655	-0.7765	0.24	0.20	0.1465	-1.1509	0.24	0.25	2.1167	-0.7050	0.05	0.08
Age (35 to 64)												
Under 35	-0.2190	0.0331	-5.0	-3.6	-0.3326	0.1016	-8.2	-5.6	-0.4533	0.3045	-3.0	-1.3
65 and Over	0.1865	-0.1391	4.5	1.0	0.1907	-0.1214	4.5	1.7	0.2983	0.0587	1.4	2.5
Income (Middle Group)												
Lowest Group	-0.1478	-0.1478	-3.4	-5.5	-0.0240	0.0251	-0.6	0.0	-0.2224	-0.0123	-1.3	-2.1
Highest Group	0.0138	0.0833	0.3	2.0	0.1098	-0.1207	2.6	-0.3	0.1247	-0.0836	0.6	0.3
Incomplete Reporter	-0.0902	0.1906	2.1	2.1	-0.1232	0.2703	-3.0	3.7	-0.2159	0.1943	-1.3	-0.2
Family Composition (Husband/Wife/Children)												
Single Male	-0.6776	0.2332	-16.4	-12.2	-0.7451	0.4270	-23.6	-19.5	-1.1498	0.6575	-19.0	-14.0
Single Female	0.1320	-0.0493	-14.0	-11.1	-0.0355	0.1990	-24.4	-16.2	0.2649	-0.0331	-14.4	-10.2
Husband/Wife Only	-0.1824	0.2004	-5.3	-1.7	-0.0933	0.2382	-7.1	-3.8	-0.1145	0.1331	-3.4	-2.9
Single Parent	-0.2731	-0.0418	-7.7	-8.9	-0.2990	0.2837	-7.9	-6.5	-0.0971	0.4174	-1.5	0.3
Other Family	-0.2021	0.0313	-4.6	-3.3	-0.0688	0.0032	-1.7	-1.6	-0.4462	0.0966	-3.0	-3.3
Family Size (Two Adults, One Child)												
Number of Adults	0.0674	0.1208	1.6	3.9	0.0214	0.2308	0.5	6.3	0.1425	0.1425	0.7	2.1
Number of Children[2]	0.0590	0.0568	0.7	1.7	0.2226	0.1197	3.4	5.4	0.4487	-0.0844	1.3	1.9
Children Squared	-0.0099	-0.0003*	N/A	N/A	-0.0269	-0.0156	N/A	N/A	-0.0643	0.0267	N/A	N/A
Race (White and Other)												
Black	0.2058	0.0404	5.0	5.2	0.0341	0.0576	0.8	2.3	-0.8176	0.1144	-6.4	-7.7
Education (No College)												
Some College	0.1108	-0.0971	2.6	0.3	0.0075	-0.1429	0.2	-3.3	0.0498	-0.3339	0.3	-2.6
College Graduate	0.2244	0.0398	5.4	5.6	0.0459	-0.2721	1.1	-5.5	0.0653	-0.2305	0.3	-1.5
Degree Urbanization												
Rural	-0.4512	0.3768	10.0	-1.5	-0.2962	0.2517	-7.3	-1.1	-0.2103	0.2387	-1.3	0.2
Food Stamps												
Participates	0.1841	-0.1404	4.4	0.9	0.2019	0.0631	4.8	6.6	0.1666	-0.5424	0.8	-3.6
Month Surveyed												
Jan/Feb/Mar	0.1601	0.0052	3.8	3.4	0.1450	-0.1442	3.4	0.0	0.1218	0.0093	0.6	1.0
July/Aug/Sep	-0.0502	0.1051	-1.2	1.1	0.0356	0.0468	0.9	2.0	0.1331	0.0709	0.7	1.5
Oct/Nov/Dec	-0.1072	0.1207	-2.5	0.3	0.1124	0.0155	2.7	3.2	0.1238	-0.1411	0.6	-0.1

* Standard error is 0.0002.
See Table 7 for additional information.

Table 9: Probabilities of Purchase, 1980 and 1992: Fruits and Vegetables; Fats and Oils; Other Foods

Logistic Regression Results	Fruits and Vegetables				Fats and Oils				Other Foods			
All Consumer Units	Parameter Estimates		Percent Change in Probability		Parameter Estimates		Percent Change in Probability		Parameter Estimates		Percent Change in Probability	
Characteristics	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Control Group:	1.9661	0.2733	87.7	90.4	0.2032	-0.0388	55.1	54.1	2.5048	0.5784	92.4	95.6
Intercept[1]	1.1890	0.4097	0.11	0.09	-0.4281	0.2548	0.25	0.25	1.4655	0.8437	0.07	0.04
Age (35 to 64)												
Under 35	-0.5506	0.1168	-7.3	-4.5	-0.2371	-0.1717	-5.9	-10.2	-0.1230	0.0622	-0.9	-0.3
65 and Over	0.4828	0.2552	4.3	4.8	0.2930	-0.1439	7.1	3.7	0.0634	0.0071	0.4	0.3
Income (Middle Group)												
Lowest Group	-0.1570	-0.0632	-1.8	-2.1	-0.1649	0.0016*	-4.1	-4.1	-0.0861	-0.2758	-0.6	-1.8
Highest Group	0.3320	-0.0651	3.2	2.1	0.0666	-0.0471	1.6	0.5	0.1872	-0.3647	1.2	-0.8
Incomplete Reporter	-0.1180	0.0183	-1.3	-0.9	-0.1845	0.1409	-4.6	-1.1	-0.5775	0.1044	-5.2	-2.5
Family Composition (Husband/Wife/Children)												
Single Male	-0.7576	-0.0451	-20.3	-16.5	-0.8617	0.1878	-29.5	-22.1	-0.4582	-0.1533	-13.0	-8.6
Single Female	0.5959	0.0826	-8.8	-5.6	0.5023	-0.2831	-18.9	-17.1	-0.0327	-0.0327	-13.5	-9.3
Husband/Wife Only	0.0216	-0.0431	-1.9	-1.6	-0.0564	0.2059	-6.1	0.0	-0.0968	-0.0262	-3.8	-2.5
Single Parent	0.0655	-0.1230	-2.7	-3.0	-0.3953	0.1287	-15.2	-9.0	-0.5651	0.2793	-9.3	-2.6
Other Family	-0.1585	-0.0125	-1.8	-1.6	-0.2239	0.0401	-5.6	-4.6	-0.5001	0.3559	-4.3	-0.6
Family Size (Two Adults, One Child)												
Number of Adults	0.2948	-0.0512	2.8	1.9	0.2206	-0.1267	5.4	2.3	0.3448	-0.1355	2.1	0.8
Number of Children	0.2112	-0.0401	1.4	1.0	0.2029	-0.0274	4.0	2.4	0.3879	0.0336	1.7	0.8
Children Squared[2]	-0.0237	0.0061	N/A	N/A	-0.0128	-0.0128	N/A	N/A	-0.0382	-0.0279	N/A	N/A
Race (White and Other)												
Black	-0.2473	0.1929	-2.9	-0.5	-0.2177	-0.2177	-5.4	-10.8	-0.2756	-0.2095	-2.2	-2.5
Education (No College)												
Some College	0.1836	-0.3663	1.8	-1.7	0.0144	-0.1770	0.4	-4.1	0.0892	-0.0805	0.6	0.0
College Graduate	0.2694	-0.0341	2.6	1.9	0.0202	-0.0933	0.5	-1.8	0.0172	0.1613	0.1	0.7
Degree Urbanization												
Rural	-0.2328	0.3464	-2.7	0.9	0.1130	0.1518	2.8	6.5	-0.1414	0.5652	-1.0	1.5
Food Stamps												
Participates	-0.2175	-0.0946	-2.5	-3.1	-0.1131	0.1135	-2.8	0.0	0.0078	-0.1081	0.1	-0.4
Month Surveyed												
Jan/Feb/Mar	0.1790	-0.2341	1.8	-0.5	0.2248	-0.2262	5.5	0.0	0.0779	-0.0911	0.5	-0.1
July/Aug/Sep	0.2057	-0.1083	2.0	0.8	0.1460	-0.0515	3.6	2.3	0.2042	-0.2670	1.3	-0.3
Oct/Nov/Dec	0.1517	-0.2607	1.5	-1.0	0.0078	0.0757	0.2	2.1	0.1688	-0.2093	1.1	-0.2

1 Change in probability if intercept parameter estimate increases by 0.01.
2 Change in number of children affects number of children and children squared, so total change in probability is shown here.

Beef, Pork, and Other Meats. The probability of purchasing beef, pork, and other meats has decreased about 4 percent for the control group. Single males show a substantial increase (about 7 percent) in probability, while single females show a moderate decrease (over 4 percent). Although single males have a 6 percent lower probability of purchasing beef, pork, and other meats than single females in 1980, by 1992 single males are 6 percent more likely than single females to purchase these items.

Age of reference person is positively correlated with purchase. Younger families are 6 percent less likely than the control group to purchase in both 1980 and 1992, while older families are a little more likely to purchase than the control group. Even so, older families have a lower probability of purchase in 1992 (84 percent) than in 1980 (89 percent).

Income is also related to probability of purchase of beef, pork, and other meats. The highest income group has the highest probability of purchase in 1980 (89 percent) and the lowest probability of purchase in 1992 (83 percent), while low income families report little change (less than 1 percent) in probability. Similarly, college graduates report the largest decline (about 7 percent) over time, followed by those with some college (about 6 percent).

Poultry. The probability of purchasing poultry is lower in 1992 than 1980 for almost every type of family. The probability drops over 2 percent for the control group and single males, but 6 percent for single females. The smallest drop by family composition occurs for single parents (under 2 percent); the largest is for other families (nearly 9 percent).

Although younger families exhibit a slight increase (1 percent) in probability of poultry purchase, older families exhibit a noticeable decrease (7 percent). Income level makes little difference, although the control group shows a larger decrease than the higher or lower income groups. Most other demographic groups exhibit changes similar to the control group as well.

Perhaps the most interesting change is by race. In both 1980 and 1992, black families are more likely to purchase poultry than white and other families. However, the difference in probability across years is cut more than half--from 19.5 percent in 1980 to 8.5 percent in 1992. The net effect is that the probability of purchase has decreased for black families from 63.7 percent in 1980 to 50.3 percent in 1992, a difference of 13.4 percent. This is the largest change for any type of family.

Fish and Seafood. The probability of purchasing fish and seafood declined markedly for control group families, from 38 percent in 1980 to 28 percent in 1992. This decrease is second only to the decrease in probability of purchasing eggs. On the other hand, singles are more likely to purchase fish and seafood in 1992 than in 1980. Single males report a 6 percent increase while single females report an 8 percent increase. Married couples show a smaller decrease (7 percent) in probability of purchase than the control group, as do other families (9 percent). Single parents show a slightly larger decline (12 percent). Each of these groups has a smaller probability of purchase than the control group in both 1980 and 1992.

Each age group reports a decrease in probability of purchase, the largest for the oldest group (14 percent), and the smallest for the youngest group (9 percent). However, in each year, the oldest group has the highest probability of purchase, and the youngest group has the lowest probability. Similarly, the highest income group has the highest probability of purchase in each year, and the lowest group the lowest probability. However, the highest income group has the smallest change in probability (9 percent), and the lowest group the largest change (13 percent).

Other demographics are also interesting. Families whose reference person is either college educated or black have about a 5 percent greater probability of purchase than the control group regardless of year. Families receiving food stamps show the largest decrease in probability of purchasing fish and seafood, dropping from nearly 43 percent in 1980 to 29 percent in 1992. Rural families show the smallest drop (2 percent), but start out with a 10 percent lower probability than the control group in 1980.

Eggs. As expected, the probability of purchasing eggs decreases for all demographic groups. The control group is about 15 percent less likely to purchase in 1992 than in 1980, the largest change in probability of purchase for any item purchased by the control group.

Older families show the largest decrease (17 percent) in probability of purchasing eggs, while younger families show the smallest (12 percent). However, older families are more likely to purchase eggs regardless of year (64 percent in 1980 and 47 percent in 1992) than the control group (60 percent vs. 45 percent) or younger families (51 percent vs. 39 percent). The difference probably reflects changes in medical and nutritional knowledge, since the older family members grew up when eggs were considered a quintessential part of any healthful breakfast, while the younger family members grew up hearing about the relationship of cholesterol to heart disease. Particularly if the younger families are raising their children to be concerned about egg consumption, the relationship of egg consumption to age will probably continue; that is, all families will decrease consumption, but older families will continue to purchase eggs more frequently than younger families, with the gap between older and younger families continuing to shrink. (The difference in probability between older and younger families is 13 percent in 1980, but only 8 percent in 1992.)

Dairy Products. Purchases of dairy products are relatively stable over time and across groups. The probability of purchase decreases about 3 percent for the control group. Single persons (including single parent families) show little change over time. Married couples and other families show changes similar to the control group.

There are few changes by age or income, although food stamp participants report a substantial decrease (8 percent) in probability of purchase over time. No other demographics appear to change substantially across time, although within each year, black families have a noticeably lower probability of purchase (6 percent in 1980 and 8 percent in 1992) than white and other families.

Fruits and Vegetables. For the control group the change in probability of purchasing fruits and vegetables increased by less than 3 percent. However, other differences within and across time are worth noting. For example, single males have a substantially lower probability of purchase than single females, regardless of year. In 1980, about 67 percent of males purchase, compared to nearly 79 percent of females. In 1992, 74 percent of males purchase compared to 85 percent of females. So although males in 1992 purchase fruits and vegetables more frequently than in 1980, they still have not caught up to the frequency of purchase of females in 1980. Meanwhile, married couples, single parents, and other families have lower probabilities of purchase in each year than control group families (the gap ranging from 1.6 to 3.0 percent), but each of these groups reports about the same increase in probability of purchase as the control group.

Like egg purchases, older families are more likely to purchase fruits and vegetables than younger families. Unlike egg purchases, this is an indication that older families are more likely to consume more healthful foods than younger families. In 1980, the difference in probability of purchase is nearly 12 percent. Although the gap narrows to 9 percent in 1992, it is still appreciable. Similarly, higher income families are more likely to purchase fruits and vegetables than low income families, although the gaps (6 percent in 1980, 4 percent in 1992) are not so wide by income. Food stamp participants are about 3 percent less likely than control group families to purchase, regardless of year.

Fats and Oils. For the control group the stability in purchases of fats and oils is second only to cereal and bakery products. The probability of purchase is nearly unchanged between 1980 and 1992. However, single persons (including single parents) show an increase in frequency of purchase, albeit a slight one for single females. For males, the probability increases from 26 percent to 32 percent; for females, the increase is from 36 percent to 37 percent; for single parents, the increase is from 40 percent to 45 percent. Frequency of purchase by married couples also increases 5 percent, while other family purchases are unchanged.

Probabilities decrease by age, with the largest change (5 percent) for younger families. Older families show a 3 percent decrease in probability, but still have the greatest probability (58 percent) of purchase in 1992. Income makes little difference across time, but within periods, low income families are about 4 percent less likely to purchase than the control group, while high income families have about the same probability as the control group. Like younger families, black families have a lower probability of purchase than the control group regardless of year, and show a 6 percent decrease in probability of purchase over time.

Other foods. Probability of purchase of other foods shows a modest increase (about 3 percent) between 1980 and 1992. Single males and females have similar probabilities of purchase in 1980 (about 79 percent), and report similar increases in probability of purchase (over 7 percent) over time. While other family types have lower probabilities of purchase than the control group in each year, the increase in probability for married couples is about the same as for the control group (over 4 percent). Single parents have the largest increase (10 percent), followed by other families (7 percent).

Conclusions

In an attempt to discover changes in food expenditure patterns over time, CE data are analyzed in two different ways. The first compares how shares of the food budget are allocated in 1980 and 1992 for families with different demographic characteristics, including how price changes account for the observed differences. The second uses logistic regressions to see if the frequency of purchase of specific food items has changed over time, and how frequency relates to demographic characteristics.

Some changes have occurred for the better. For example, it appears that consumers are substituting poultry for meats with higher fat content, and are reducing consumption of eggs. On the other hand, consumption of fruits and vegetables has also declined, although frequency of purchase has increased for most groups. Both consumption and frequency of purchase of fish and seafood have also declined for most groups.

Some interesting changes by demographic groups are also found. For example, single men consume relatively more poultry in 1992 than in 1980, while single women consume less; on the other hand, single women are more likely to purchase fruits and vegetables than single men regardless of year, although an increase in frequency of purchase is predicted for both groups. Some generational differences are also found. For example, families of all ages have decreased egg consumption, but families 65 and older are most likely (and families under 35 least likely) to purchase eggs regardless of year. Conversely, older families are most likely (and younger families least likely) to purchase fruits and vegetables. Substantial differences by income group are found when the shares indices are examined, with the high income group exhibiting relatively more healthful changes and the low income group exhibiting the least. However, when frequency of purchase is examined, gaps in probability are not generally large across income group. The largest is for fish and seafood in 1992, where the high income group is about 8 percent more likely to purchase than the low income group. Race appears to have little relationship to food consumption as measured by share indices, except for the meat group. Similarly, blacks are more likely to purchase poultry or fish and seafood than white and other families, and less likely to purchase dairy products or fats and oils, regardless of year.

Taken all together, these findings indicate that consumers are reacting to the ever-changing news about relationships of food to health, but that some demographic groups respond differently than others. Future work analyzing trends by demographic groups shall provide further insight into changing patterns.

APPENDIX

The following is a detailed list of food items contained in each food group.

Cereal and Bakery Products:

Cereal and Cereal Products

Flour; prepared flour mixes; ready-to-eat and cooked cereals; rice; pasta, cornmeal and other cereal products.

Bakery Products

White bread; bread other than white; cookies; crackers; frozen and refrigerated bakery products; biscuits and rolls; cakes and cupcakes; bread and cracker products; sweetrolls, coffee cakes, doughnuts; pies, tarts, and turnovers.

Meat, Poultry, Fish and Eggs:

Beef

Ground beef; chuck roast; round roast; other roast; round steak; sirloin steak; other steak; other beef.

Pork

Bacon; pork chops; ham, not canned; canned ham; sausage; other pork.

Other Meats

Frankfurters; bologna, liverwurst, salami; other lunchmeats; lamb and organ meats; mutton, goat, and game.

Poultry

Fresh whole chicken; fresh and frozen chicken parts; other poultry, including whole frozen chicken.

Fish and Seafood

Canned fish and seafood; fresh and frozen shellfish; fresh and frozen finfish.

Eggs

Dairy Products:

Fresh Milk and Cream

Whole milk; other milk and cream.

Other Dairy Products

Butter; cheese; ice cream and related products; miscellaneous dairy products.

Fruits and Vegetables:

Fresh Fruits

Apples; bananas; oranges; other fresh fruits.

Fresh Vegetables

Potatoes; lettuce; tomatoes; other fresh vegetables.

Processed Fruits

Frozen orange juice; other frozen fruits and juices; canned and dried fruits; fresh, canned or bottled fruit juices.

Processed Vegetables

Frozen vegetables; canned beans; canned corn; other canned and dried vegetables and juices.

Other Food at Home:

Sugar and Other Sweets

Candy and chewing gum; sugar; artificial sweeteners; jams, preserves, and other sweets.

Fats and Oils

Margarine; other fats, oils, and salad dressing; nondairy cream and imitation milk; peanut butter.

Miscellaneous Foods

Frozen prepared foods; frozen meals; other frozen prepared foods; canned and packaged soups; potato chips and other snacks; nuts; salt, spices, and other seasonings; olives, pickles, and relishes; sauces and gravies; baking needs and miscellaneous products; salads and desserts; baby food; miscellaneous prepared foods.

Nonalcoholic Beverages

Cola; other carbonated drinks; roasted coffee; instant and freeze dried coffee; non-carbonated fruit flavored drinks; tea; other non-alcoholic beverages.

TECHNICAL NOTES:

The t-test. When comparing means of two samples, a t-test is frequently used to see if observed differences are statistically significant. For large samples the formula for the standard t-test is:

$t = (M_1 - M_2)/SE_p$
where
M_1 is the mean of the first sample
M_2 is the mean of the second sample
SE_p is the pooled standard error of the samples.

The pooled standard error is calculated by squaring the standard errors of the first and second samples, adding the squares together, and taking the square root of the summed squares. If the value for t is greater than 1.96, the difference is said to be statistically significant at the 95 percent confidence level.

However, the equation above is not appropriate for testing differences in shares because, as defined in the text, t-statistics are calculated by dividing an average by an average. For example, if the average family in group 1 spends $2 on beef and $50 on total food at home, the share (S_{b1}) is 0.04. If the average family in group 2 spends $3 on beef and $25 on total food at home, the share (S_{b2}) is 0.12. Both the mean expenditure for beef and the mean expenditure for total food at home have their own associated standard errors, which most likely differ for groups 1 and 2. These facts must be taken into account before a t-test can be computed.

Fortunately, a formula is available for the comparison of shares. It uses the relative standard error of the mean (RSE) for each element of the share (beef and total food), where the RSE is defined as the standard error of the expenditure divided by the mean expenditure (i.e., SE_{b1}/M_{b1} equals RSE_{b1}, where b1 indicates beef expenditures for group 1). To calculate the pooled standard error for use in the shares test, the following formula is used:

$$(SE_{pb})^2 = S_{b1}^2[RSE_{b1}^2 + RSE_{f1}^2 - 2S_{b1}RSE_{b1}^2] + S_{b2}^2[RSE_{b2}^2 + RSE_{f2}^2 - 2S_{b2}RSE_{b2}^2]$$

where subscript 1 indicates 1980, subscript 2 indicates 1992, and subscript f indicates total food at home. To test whether the change in the beef share from 1980 to 1992 for a group of consumers is statistically significant, the following formula is used:

$$t_b = (S_{b1} - S_{b2})/SE_{pb}.$$

The Share Index. Table 1 shows that meat, poultry, fish, and eggs account for 34.4 percent of total food at home expenditures in 1980. That figure drops to 26.4 percent in 1992. During that time the price of meat, poultry, fish, and eggs rises 42.3 percent, compared to 54.8 percent for all food at home. This means that meat, poultry, fish, and eggs cost 1.423 times more in 1992 than they do in 1980, while all food at home costs 1.548 times more in 1992 than in 1980. If the quantities purchased of meat, poultry, fish, and eggs and of total food at home

remain constant, then the share in 1992 should be about 92 percent its level in 1980, since 1.423/1.548 equals 0.919. This means that if quantities remain unchanged, meat, poultry, fish and eggs should account for about 31.6 percent of the food budget in 1992. Since they only account for 26.4 percent, the quantity of meat, poultry, fish, and eggs purchased declines relative to total food consumption. In fact, the share (26.4 percent) is only about 83 percent of its expected value (31.6 percent); hence, the share index is shown as 0.83, or 26.4/31.6.

Logistic Regression. Logit is chosen for this study because it yields results that easily can be converted to probabilities, as shown by the following formula:

$P = \exp[a + bX]/(1 + \exp[a + bX])$
where
P is the probability of purchase
a is the intercept
bX is a vector of characteristics multiplied by their parameter estimates.

Thus, using the results from table 7, the probability that a single male who otherwise fits into the control group purchases cereal and bakery products in 1980 is calculated by adding the value of the intercept (2.5387), the parameter estimate for single males (-1.4405), and the parameter estimate for number of adults (0.0824), exponentiating the sum (i.e., exp[2.5387 - 1.4405 + 0.0824] = 3.2563), and dividing the exponentiation of the sum by one plus the value (i.e., 3.2563/[1 + 3.2563]). In this case, P is estimated to be 0.765, or about 77 percent. If the family consists of a husband and wife only, then the parameter estimate for married couples (-0.1612) is added instead of the value for single males, and the parameter estimate for number of adults is doubled, since there are two adults present.

Calculating results for 1992 is slightly more complicated. The parameter estimates for 1992 actually represent the *difference* between the expected estimate for 1980 and for 1992. Therefore, parameter estimates for 1992 must be added to their 1980 counterparts before a predicted probability for 1992 families can be made. Calculations for single females require an additional step, regardless of year. The parameter estimate for single females in either year represents the difference between the expected estimate for single males and single females. Therefore, if single females in 1980 are considered, the parameter estimates for single males in 1980 (-1.4405) and single females in 1980 (0.2386) must be added before predicting probability of purchase. If single females in 1992 are considered, the parameter estimates for single males in 1980 and 1992 must be added to the parameter estimates for single females in 1980 and 1992 before predicting probability.

USING EXPERIMENTAL DATA TO ANALYZE THE FOOD STAMP PROGRAM: A COMPARISON OF ECONOMIC THEORY AND EMPIRICAL EVIDENCE

by

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Using Experimental Data to Analyze the Food Stamp Program -- A Comparison of Economic Theory and Empirical Evidence

Parke E. Wilde and Christine K. Ranney

Introduction

Social experiments using random assignment have changed the way social programs are evaluated. This type of research design was pioneered in the Negative Income Tax experiments of the 1970s. In the 1980s, experimental evaluation methods overshadowed non-experimental methods in areas ranging from welfare and training programs to AIDS community education projects. Frequently, law-makers mandated experimental evaluations in the legislation authorizing changes to these programs.

Similar methods were applied more recently to studying the Food Stamp Program. In the early 1990s, four social experiments in three states investigated the effect of "cashing out" food stamp coupons, or replacing them with cashable checks for the same value. Two of these, in San Diego County and parts of Alabama, were "pure" cashout experiments: recipients were randomly assigned to receive either food stamp coupons or checks, and no other changes were made in program operation.

These experiments addressed an important question that economists have struggled with for years: do food stamps have a distinct impact on food spending? If not, then perhaps food stamps should be cashed out. If so, then a different dilemma arises. In this case, economic theory suggests the spending restrictions on food stamps make recipients worse off, compared with unrestricted transfers. However, the restrictions can be justified to constituencies in agriculture and in the anti-hunger community on the grounds that they do increase food spending.

Economists have found this simple policy question difficult to answer, because the two main tools we use to study this program have appeared to contradict each other. Neoclassical economic theory suggests that the current Food Stamp Program should have no distinct effect on food spending for most recipients. By contrast, twenty years of empirical studies on cross-sectional data reached the opposite conclusion.

The recent pure cashout experiments helped to settle the practical question of whether food stamps can have a distinct impact. Nevertheless, it is still worthwhile to try to reconcile the experimental results with earlier research and with economic theory. This paper will first review very briefly the relevant economic theory. Next, it will compare some of the non-experimental and experimental research on the Food Stamp Program. Then, it will describe one of the more theoretically satisfactory econometric models that has been used to address this question when only non-experimental data were available. This model can be tested against the experimental data to see if it solves the problem it was designed to solve. Finally, some conclusions will be proposed.

Economic Theory

Figure 1 is the illustration that economists have used to explain this problem ever since the original article by Herman Southworth during World War II (Southworth 1945). Area B is the budget set if the family has Y dollars of income and receives food stamp coupons with a face value of Yco. If utility is increasing in food and other goods, then a rational consumer will either choose the consumption bundle at the kink K or a point on the boundary to the right of the kink.

Consumers who locate to the right of the kink are called "unconstrained" because they are unaffected by the restriction that food stamp coupons can only be used to buy food. Consumers who locate at the kink are called "constrained," even though it is possible that some of them would have chosen exactly that bundle of goods anyway.

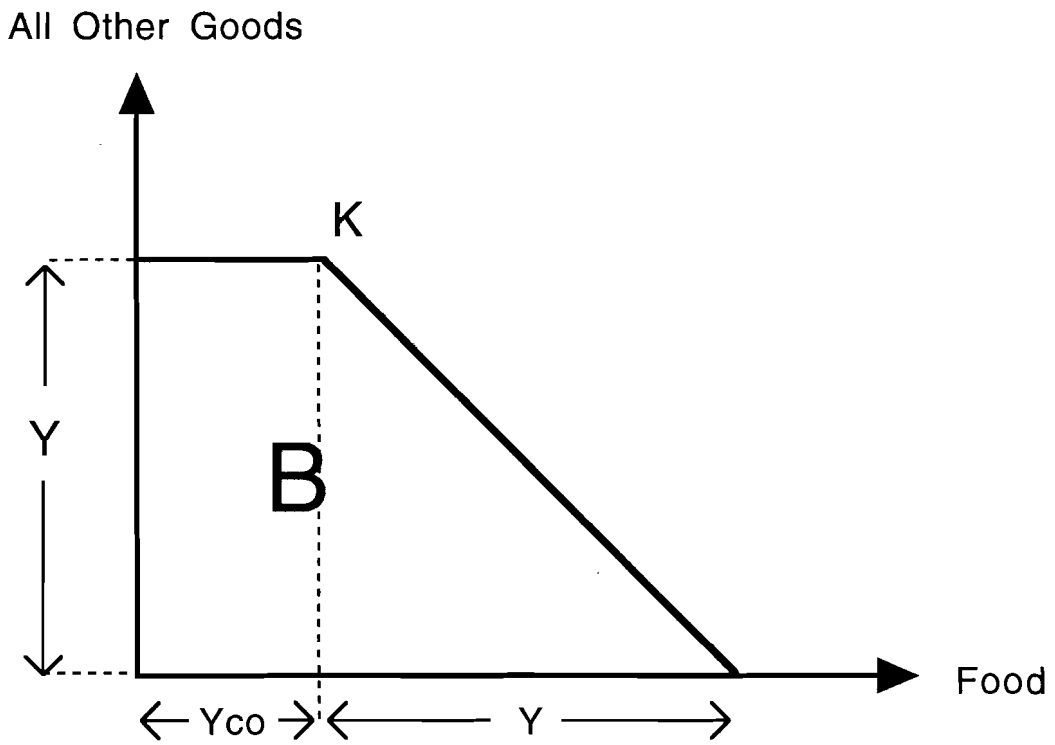
In either case, the policy conclusions of this model are unambiguous. Constrained families may consume less food if the Food Stamp Program is cashed out, but unconstrained families will be unaffected. Likewise, constrained families may prefer cash to coupons, but unconstrained families will be indifferent.

Non-experimental and Experimental Evidence

For empirical research, the problem presented by the kinked budget constraint in the Food Stamp Program is in some respects similar to the problem of selection bias in the evaluation of welfare and training programs, where this debate over experimental methods is more developed and quite heated. Just as selection bias makes conclusions from non-random comparison-group evaluations suspect, the kinked budget constraint makes it hard to interpret the results of simple regressions estimating the distinct impact of food stamp coupons.

In welfare and training programs, a major question has been whether non-experimental methods used to correct for selection bias can reproduce findings from more expensive experimental studies. In one widely-cited article, Thomas Fraker and Rebecca Maynard (1987) found that almost none of the commonly used selection-correction methods could reproduce experimental results from a supported work demonstration. In a rebuttal two years later, Heckman and Hotz (1989) argued that if the right kind of specification tests had been used, the right selection-correction methods would have been picked. Regardless of who was right in that exchange, it is worth noting that even Heckman and Hotz recommended using experimental methods as one of three kinds of tools for judging between alternative non-experimental methods.

When serious empirical research on the economics of the Food Stamp Program began in the early 1970s, the most common method was to estimate ordinary least squares regressions with food expenditure as the dependent variable and with both food stamp benefits and ordinary income among the explanatory variables. In this manner, the marginal propensity to consume food (or "MPC") out of income could be compared to the MPC out of food stamp coupons -- or rather, usually out of what was then the "bonus value" of food stamp coupons.



Legend:

Y	Income, including check benefits
Yco	Dollar value of coupon benefits
K	Kink point

The axes are scaled so that a unit of food or a unit of other goods each costs one dollar.

Figure 1. Piecewise Linear Budget Constraint

Almost always, this type of study found that coupons had a greater impact on food spending than ordinary income did. The studies in Table 1 were chosen because of interesting differences in the ways the authors approached the kinked-budget-constraint problem, but they are representative of many more. A review of 19 such studies by Thomas Fraker (1990) found that the MPC out of coupons generally ranged from .20 to .45 and the MPC out of ordinary income ranged much lower, from .05 to .10.

Without knowing what proportion of the samples for these studies is constrained, it is hard to say whether they are consistent or inconsistent with the Southworth theory. The authors of the early empirical studies were clearly aware of the possibility that food stamps would free up cash resources for unconstrained families, but they generally did not assume that unconstrained families treated coupons and cash as completely equivalent.

The next generation of studies tended to refer more explicitly to the Southworth Hypothesis. Especially after the elimination of the purchase requirement for food stamps in 1979, it became clear that only a minority of food stamp recipients were constrained. Smallwood and Blaylock (1985), for example, indicated that their empirical results were not agreeing with the economic theory.

Senauer and Young (1986) actually put the Southworth theory to a test. They used a Tobit model that accounted for the distinction between constrained and unconstrained families. Their results indicated that even after adjusting for the peculiar behavior of constrained families, food stamp coupons were still treated differently from ordinary income. From this, they concluded, "The empirical results demonstrate that the Southworth model is incomplete."

Using data from Puerto Rico, Robert Moffitt (1989) also estimated a model that distinguished between constrained and unconstrained families, and this time found no cashout effect. Moffitt's model was somewhat different from Senauer and Young's, so it is not clear whether the lack of cashout effect in his study was due to differences in the model or characteristics particular to the Puerto Rico sample.[1]

Without further information, it appears that either the empirical work or the theory could be responsible for the divergent results. On the one hand, the appearance of a distinct food stamp effect could be due to problems with the data, such as systematic underreporting of income, or problems with specification, such as incorrect functional form. Levedahl (1991) argued that earlier estimates overstated the likely cashout effect, because their functional forms were insufficiently flexible. On the other hand, it could be that unconstrained consumers really are affected by the form of benefits they get, in spite of what the theory predicts.

Moreover, Fraker pointed out that while most of the studies described here were interested in cashout policies, they were only able to compare food stamp coupons to ordinary income. If

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[1] The figures in Table 1 from Senauer and Young (1986) and Moffitt (1989) are actually from simpler least squares estimates that both studies obtained before estimating their final models.

Table 1. Estimated Marginal Propensity to Consume Food at Home, Selected Studies.

Study and Year	Marginal Propensity to Consume Food Out of: Food Stamps	Money Income
West and Price (1976)	.37	.05
Chavas and Yeung (1982)	.37	.13
Smallwood and Blaylock (1985)	.23	.10
Senauer and Young (1986)		
1978 Michigan PSID Data	.33	.05
1979 Michigan PSID Data	.26	.07
Moffit (1989)		
Linear Form	.16	.13
Logarithmic Form	.11	.12
Levedahl (1991)		
Linear Form	.48	.08
Semi-log Form	.50	.10
Double-log Form	.29	.09
Translog Form	.69	.19

Source: Condensed from Fraker; Moffitt; Levedahl.

checks from the food stamp office are treated differently from other kinds of income, that raises yet another complication.

The preceeding discussion indicates how confusing this topic appeared on the eve of the random-assignment cashout experiments. The full reports on these demonstrations, by Mathematica Policy Research, are available from the Food and Nutrition Service (Ohls et al. 1992; Fraker et al. 1992), but some key results can be summarized briefly. Table 2 reports the money value of food used at home per equivalent nutrition unit (ENU) per week for the check and coupon cohorts in San Diego and Alabama. In Alabama, there was no significant difference between the two cohorts, whether you look at purchased food or all food used at home. In San Diego, the check cohort spent on average 6.78 percent less on food, which is too large a difference to attribute to sampling variation.

Table 2. Effects of Cashout on the Money Value of Food Used at Home per ENU† per Week, in San Diego and Alabama.

	Mean Value		Difference	
Measure of Food Use	Check	Coupon	%	t-Stat.
Purchased Food	(in dollars)			
San Diego	33.28	35.70	-6.78	2.45**
Alabama	33.43	33.66	-0.68	0.31
Nonpurchased Food				
San Diego	2.67	1.93	38.34	2.06**
Alabama	2.82	2.75	2.55	0.29
All Food				
San Diego	35.95	37.63	-4.46	1.62*
Alabama	36.25	36.41	-0.44	0.26
Sample Size				
San Diego	542	536		
Alabama	1209	1080		

Source: Fraker et al. 1993; data from the San Diego and Alabama food stamp cashout demonstrations, household surveys (weighted tabulations for San Diego).

*Statistically significant at the 90 percent confidence level.
**Statistically significant at the 95 percent confidence level.

†Equivalent Nutrition Unit.

Besides the question of statistical significance, it is worth asking whether this difference in San Diego is economically important. Fraker (1993) has argued that it is. If the spending difference between the cohorts is measured as a proportion of food stamp benefit levels, which may be the right way of looking at it for policy reasons, the 6.78 percent reduction in food spending comes out to be 18 percent of food stamp benefits.

For purposes of comparison with the earlier non-experimental research, the San Diego and Alabama reports also contained some regression results from simple linear models. Table 3 contains estimated marginal propensities to consume food out of coupons, checks, and ordinary income, in San Diego and Alabama, and some differences between these estimated parameters. Again, there appeared to be no statistical difference between coupons and checks in Alabama. In

Table 3. Estimated Marginal Effects of Coupons, Checks and Income on the Money Value of Purchased Food Used at Home.

	San Diego		Alabama	
MPCf† Out of:	Estimate	t-Stat.	Estimate	t-Stat.
Coupons	0.277	2.64**	0.307	6.42**
Checks	0.108	1.08	0.311	6.56**
Ordinary Income	0.063	5.40**	0.073	6.21**
Differences:				
Coupons-Checks	0.170	2.41**	-0.004	0.14
Coupons-Income	0.214	2.05**	0.234	5.29**
Checks-Income	0.044	0.44	0.239	5.47**

Source: Fraker et al. 1992; Ohls et al. 1992.

*Statistically significant at 90 percent confidence level.
**Statistically significant at 95 percent confidence level.

Estimates are derived from a linear regression model that includes variables for check benefits, coupon benefits, ordinary income, other income in the household, race, education, age, presence of children, presence of elderly, and female head.

†Marginal propensity to consume food.

San Diego, the estimated MPC out of coupons was .277, and the MPC out of checks was .108, a difference which is statistically significant.

In light of the Southworth model, these experimental results must be considered surprising. In part because AFDC benefits are more generous in California, food stamp benefits are lower in San Diego than in Alabama. As a result, only a small fraction of San Diego participants can be described as constrained. Table 4 shows that only 4.6 percent of San Diego families spend less than or equal to the value of their food stamp coupons on food. Only 19 percent spend less than 150 percent of the value of their food stamp coupons on food. In Alabama, by contrast, at least 26 or 33 percent of participating families can be described as constrained or nearly constrained, respectively. Thus, there was a significant cashout effect in San Diego with a small number of constrained families, and no cashout effect in Alabama with a large number of constrained families.

Table 4. Percentage of Coupon Families in San Diego and Alabama That Can be Classified as "Constrained."

Comparison of Weekly Food Stamp Coupon Benefit (Yco) With Money Value of Purchased Food Used at Home	Percentage of Coupon Recipients	
	San Diego	Alabama
Money Value of Purchased Food Used at Home is:		
< = 100 percent of coupon benefits (Yco)	4.66%	25.83%
< = 110 percent of coupon benefits (1.1 Yco)	6.16%	32.77%
< = 150 benefits of coupon benefits (1.5 Yco)	18.66%	50.64%
Sample Size	*536*	*1080*

Source: The San Diego and Alabama food stamp cashout demonstrations, household surveys (weighted tabulations for San Diego).

In a subsequent article, the authors of the cashout studies offer several plausible explanations for the different conclusions (Fraker et al. 1993). The Alabama experiment had been in place for a shorter time before a food consumption survey was taken, so long run changes in food purchasing behavior may not have taken place yet. The Alabama food stamp checks were issued separately from other welfare benefits and clearly identified as originating with the food stamp office. In San Diego, by contrast, the food stamp check benefits were combined with AFDC benefits in a single check. Only an accompanying stub indicated how the benefits were broken down by program.

The San Diego results, taken by themselves, were considered less surprising. The demonstration report pointed out, "the majority of coupon households are not constrained, which is consistent with the relatively modest effects reported previously" (Ohls et al. 1992). However, there are some ways in which even the San Diego findings alone are hard to explain within the framework of the traditional theory. The number of constrained recipients seems too small to account for the whole cashout effect. More precisely, when the sample is broken down into constrained and unconstrained sub-groups, it appears that the behavior of the constrained sub-group cannot really be responsible for the observed cashout effect. Constrained coupon recipients actually spent slightly less on food than did the corresponding group of check recipients whose food spending was less than their benefit levels. That type of breakdown is in some sense unsatisfactory, because selection into the constrained or unconstrained sub-group is partly endogenous, but it at least indicates that the form of food stamp benefits somehow influences even unconstrained families, and it helps to motivate the hypothesis test described in the next section.

A Test of Whether Piecewise Linear Constraint (PLC) Models Are Consistent With Experimental Findings

A non-linear maximum likelihood technique was used to estimate several Engel functions for food expenditure, while taking explicit account of the kinked budget constraint. This model was chosen because of its consistency with the Southworth Hypothesis, not because it is the best of all possible models. The purpose of using this technique is to test whether the observed difference between coupons and checks in San Diego disappears when the kinked budget constraint is modeled in a manner that is consistent with economic theory.

This effort is similar to the third specification test that Heckman and Hotz suggested for judging between different selection-correction methods in the evaluation of welfare and training programs. In this case, we are using experimental data to check up on the kind of model that we might want to use when such data are not available or affordable.

The maximum likelihood estimation technique is similar to the Tobit model Senauer and Young (1986) used to test and reject the Southworth model, as mentioned earlier. In terms of notation, however, we more closely follow Moffitt's article on the Puerto Rico cashout, because that sets the stage for statistically more elaborate versions that he discusses (Moffitt 1989).

Following logically on the Southworth theory, the model postulates that for each family i, desired food spending (F^*_i) is a function of full income (FY_i) (which includes ordinary income plus program benefits), a vector of economic and demographic factors (X_i), and an element of random variation due to heterogeneity of food preferences (e_i):

(1) $$F^*_i = G(FY_i, X_i) + e_i.$$

For unconstrained families (identified by the dummy parameter value $D_i=0$), observed food spending (F_i) equals desired food spending. For constrained families ($D_i=1$), observed food spending equals the value of food stamp coupons (Yco_i). Thus,

(2) $$F_i = D_i\, Yco_i + (1-D_i)\,[G(FY_i, X_i) + e_i],$$

where $D_i = 1$ if $Yco_i \geq G(FY_i, X_i) + e_i$; else $D_i = 0$.

In his article on the Puerto Rico cashout, Moffitt appended a second term to his version of equation (2), to account for measurement error in the dependent variable. The main hazard of the "one-error" model used here, if there is measurement error, is that some observations could be missclassified as constrained or unconstrained. The one-error model was considered adequate for this application after a range of cutoff points for distinguishing constrained and unconstrained families was found to yield similar results.

Several assumptions have been required for econometric models of the type described here (Senauer and Young, Moffitt). Food is taken to be a good, so families have no reason to leave food stamp coupons unspent (the cross-sectional data did not permit a satisfactory consideration of possible savings behavior). The error term is taken to be independently and identically normally distributed. The log-likelihood function is therefore:

(3) $$Log\,[\,L\,(\alpha_0, \alpha_1, \beta_1, \ldots, \beta_k, \sigma_e \mid F, FY, Yco, X)\,] =$$

$$\sum_{\substack{all\\ obs}} [\,D1_i\,Log\,[\,\Phi\,(\frac{Yco_i - G\,(FY_i, X_i)}{\sigma_e})\,] + D2_i\,Log\,[\,\frac{1}{\sigma_e}\,\phi\,(\frac{F_i - G\,(FY_i, X_i)}{\sigma_e})\,]\,],$$

where Φ is the standard normal cumulative distribution function and ϕ is the standard normal density function. Maximization of this likelihood function over the domain of possible demand function parameters yields the model's estimates for σ_e and for the desired food spending parameters α_0, α_1, β_1, ..., β_k, defined in equation (4) below.

Due to the fragility of food demand estimates in the face of different presumed functional forms, reported by Levedahl, four forms for desired food expenditure were estimated:

(4a) Linear $$G\,(FY_i, X_i) = \alpha_0 + \alpha_1 FY_i + \beta X_i,$$

(4b) Semi-Log $$G\,(FY_i, X_i) = \alpha_0 + \alpha_1\,Log\,[\,FY_i\,] + \beta X_i,$$

(4c) Double-Log $$Log\,[\,G\,(FY_i, X_i)\,] = \alpha_0 + \alpha_1\,Log\,[\,FY_i\,] + \beta X_i,$$ and

(4d) Share $$\frac{G\,(FY_i, X_i)}{FY_i} = \alpha_0 + \alpha_1\,Log\,[\,FY_i\,] + \beta X_i,$$

If the presumed functional form for "G" is linear in the parameters, then the likelihood function can be recognized as that of a Tobit model, where desired food spending is a function of full income, and observed food spending is censored below. The model can be extended by adding a second error term, as Moffitt did, or by exploring non-linear functional forms for G. Also, if it turns out that the Southworth Hypothesis is rejected, the model can be extended by distinguishing between the different types of benefits and income that are currently added together in the full income variable.

If the Southworth Hypothesis is correct, then the underlying equation for desired food expenditure is the same, whether families receive coupons or checks. The only distinction between the two cohorts should be that observed food spending for coupon recipients is censored as described in Equation 2. In this case, the Tobit estimates for check and coupon families in the San Diego study should be equal, because the Tobit model has already accounted for the behavior of constrained coupon recipients. Thus, our null hypothesis is that a dummy parameter for families receiving checks equals zero in the Tobit model.

Because food demand estimates have been found to be sensitive to functional form, four versions were estimated: a linear model, a semi-log model, a double-log model, and a share model where food spending is measured as a proportion of full income. These functional forms each have their own particular strengths and weaknesses, but they were mainly chosen because they have been used many times before in the literature.

Three different cutoff points for the censoring in the Tobit model were used: the exact value of food stamp coupons (Yco), 1.1 times Yco, and 1.5 times Yco. The latter two versions can be seen as a rough way of accomodating the possibility that people sometimes spend some of their cash income on food even before their coupons are used up, due to budgeting difficulties. If the purpose of this estimation were simply to derive the best estimates for the Engel relationship, then using so many models might raise questions about pre-testing. At the very least, we would have to be careful about how we interpreted any t-tests or f-tests that resulted. For our purposes, however, we want to test a particular hypothesis, and having a number of models reduces the chance of wrongly rejecting the null hypothesis.

Each regression also included the same control variables that were used in the San Diego report: family size in ENU, other income in the household, and dummies for race, education, age, presence of children, presence of elderly, and female head.

In Table 5, the models are estimated without the dummy variable for membership in the check cohort. Since only a small proportion of the San Diego sample is constrained it is not too surprising that the estimated Tobit parameters for full income differ only slightly from the OLS estimate. No general pattern of increasing or decreasing parameter values could be discerned across the three cutoff points for the Tobit models.

Table 6 contains some goodness-of-fit measures for the models in Table 5. Each model has the same variables and the same number of observations, so comparisons across rows in Table 6 are meaningful. The R-squared is only reported for the OLS estimates, because the sum-of-squared-errors for the Tobit models do not partition neatly. The predicted values used in the mean squared residuals for the Tobit models were calculated as suggested by McDonald and Moffitt (1980): for each observation, the predicted value is the expected value conditional on being non-limit, weighted by the probability that the observation is indeed non-limit. The residuals in this table are based on the difference between this predicted value and the true observed value -- not the value imposed by the censoring process during estimation.

As is common with cross-sectional data, the R-squares for the OLS estimates are low (the higher R-square for the share model is a spurious consequence of having the income variable on both sides of the equation, and does not indicate a better fit). Correspondingly, the root mean squared errors for the various models are only slightly smaller than the standard deviation for the dependent variable. It is some small solace that the pattern in the root mean squared errors indicates that at least a little benefit was gained by running the Tobit models. For each functional form, the best fit comes from one of the Tobit models.

Table 5. A Comparison of Income Parameters from OLS and Tobit Estimation of Four Food Expenditure Models, San Diego

Model and Variable	OLS Estimate	Tobit Estimates		
		Yco	1.1 Yco	1.5 Yco
I. Linear				
Intercept	32.024	31.649	31.881	32.355
	(2.588)	*(2.619)*	*(2.629)*	*(2.721)*
Full Income	0.033 *	0.033 *	0.032 *	0.034 *
	(0.011)	*(0.011)*	*(0.011)*	*(0.012)*
II. Semi-Log				
Intercept	24.167	24.014	24.475	24.579
	(5.639)	*(5.695)*	*(5.715)*	*(5.928)*
Log(Full Income)	2.551 *	2.486 *	2.423 *	2.538 *
	(1.121)	*(1.131)*	*(1.135)*	*(1.175)*
III. Double-Log				
Intercept	3.046	3.094	3.114	3.139
	(0.184)	*(1.801)*	*(0.180)*	*(0.184)*
Log(Full Income)	0.101 *	0.089 *	0.086 *	0.085 *
	(0.037)	*(0.036)*	*(0.036)*	*(0.036)*
IV. Share				
Intercept	1.545	1.515	1.527	1.545
	(0.057)	*(0.060)*	*(0.060)*	*(0.063)*
Log(Full Income)	-0.257 *	-0.253 *	-0.255 *	-0.257 *
	(0.011)	*(0.012)*	*(0.012)*	*(0.012)*

Source: the San Diego food stamp cashout demonstration.

Estimated standard errors in parentheses. Each regression also included variables (not shown) for family size, other income in the household, race, education, age, presence of children, presence of elderly, and female head.

*Significantly different from zero at 95% confidence level.

Table 6. Goodness-of-fit and Likelihood Measures for Table 5, San Diego

Model and Variable	OLS Estimate	Tobit Estimates		
		Yco	1.1 Yco	1.5 Yco
I. Linear				
Log-Likelihood	-4395	-4331	-4308	-4109
Root Mean Squared Res.	14.415	14.383	14.385	14.439
R-squared	0.106			
II. Semi-Log				
Log-Likelihood	-4397	-4333	-4309	-4111
Root Mean Squared Res.	14.442	14.410	14.411	14.466
R-squared	0.103			
III. Double-Log				
Log-Likelihood	-710.2	-703.8	-703.4	-717.0
Root Mean Squared Res.	14.733	14.654	14.634	14.613
R-squared	0.103			
IV. Share				
Log-Likelihood	545.23	495.94	483.58	377.69
Root Mean Squared Res.	15.117	14.686	14.684	14.723
R-squared	0.347			

Standard Deviation for At-Home Food Spending per AME: 15.162

Source: the San Diego food stamp cashout demonstration.

With the introduction of the dummy variable for check recipients, the models in Table 7 permit the key hypothesis test. The Tobit model in this case is the one that uses 1.1 times Yco as the point of censoring. As in the older non-experimental studies, the significant negative parameter for the OLS check dummy does not by itself contradict the Southworth theory. After all, that difference would be expected if part of the sample is constrained. The real test is whether the "check" parameter in the Tobit model equals zero. For each functional specification, the null hypothesis that the "check" parameter equals zero was rejected. For three functional forms, this parameter is not greatly reduced in absolute value, compared with the corresponding parameter from OLS; and in the double-log specification, the "check" parameter is actually larger in absolute value using the Tobit estimation. Apparently, accounting for the kinked budget constraint explains little of the observed difference between checks and coupons in San Diego.

Of course, this conclusion only applies to the models tested here. It is possible that there exists some other functional form or statistical technique that could reconcile the Southworth Hypothesis with the experimental results. It is also possible that modest changes in the theory would suffice -- that a better treatment of how families spend their benefits over the course of a month, for example, would do the job.

Discussion and Conclusions

It seems more likely that the Southworth model puts too much burden on the behavior of constrained families to explain why food stamp coupons can be treated differently from cash. Recall the difficulties that face researchers who only have non-experimental data. From the San Diego demonstration, it now appears that unconstrained families do not always treat check benefits like coupons; and in Alabama, recipients did not even treat check benefits like ordinary income.

Furthermore, Fraker has pointed out that we cannot take for granted one of the Southworth model's clearest propositions: that all recipients should prefer checks to coupons or be indifferent. In the San Diego and Alabama surveys, most recipients did indeed prefer checks, but a substantial minority held the opposite view. A quotation from one male check recipient gives a flavor for just how complex such household decisions can be:

> (Checks are) a hassle in my family. I don't really care. My wife is the one who cares about it.... She's afraid I'm going to end up in some local beer joint drunker than hell from now on. We (used to) have a fight every month when the mailman comes, you know.... We're still getting used to it (but) we don't hardly argue about it any more because I just give her the checks and let her put it in the bank. We spend more in food than what the check amounts to anyway. She'd rather have food stamps, you know, than to get the check.

This quotation is interesting in several ways: this family seems to prefer coupons to checks and to display some intra-household dynamics that even game-theoretic models would be hard-pressed to capture. On the other hand, at the end of the quotation, when he says "we spend more

Table 7. A Comparison of OLS and Tobit Estimates for the Effect of "Cashing Out" Food Stamp Coupons, San Diego

Model Variable	OLS	Tobit	Model Variable	OLS	Tobit
I. Linear			**III. Double-Log**		
Constant	33.376	33.104	Constant	3.079	3.149
	(2.640)	*(2.681)*		*(0.184)*	*(0.180)*
Check	-2.160 *	-1.903 *	Check	-0.066 *	-0.071 *
	(0.882)	*(0.891)*		*(0.029)*	*(0.028)*
FY	0.034 *	0.033 *	Log (FY)	0.103 *	0.089 *
	(0.011)	*(0.011)*		*(0.036)*	*(0.036)*
II. Semi-Log			**IV. Share**		
Constant	25.225	25.432	Constant	1.557	1.540
	(5.642)	*(5.714)*		*(0.057)*	*(0.060)*
Check	-2.171 *	-1.910 *	Check	-0.024 *	-0.021 *
	(0.884)	*(0.893)*		*(0.009)*	*(0.009)*
Log (FY)	2.628 *	2.493 *	Log (FY)	-0.256 *	-0.254 *
	(1.118)	*(1.131)*		*(0.011)*	*(0.012)*

(Estimated standard errors in parentheses)

Source: the San Diego food stamp cashout demonstration.

*Significant at 95% confidence level.

Besides the variable for full income (FY) and the dummy variable check (1 for check recipients, 0 otherwise), each regression included variables (not shown) for farmily size in AME, other income in the household race, education, age, presence of children, presence of elderly, and female head. The Tobit estimate used 1.1 times coupon benefits (1.1 Yco) as the point of censoring.

in food than what the check amounts to anyway," the man seems to grasp the main point of the Southworth Hypothesis, and he seems to agree with it.

In closing, even though it appears that the non-experimental models we use fail to capture something important that can be observed in experimental studies, it should be noted that experimental studies also have their shorcomings. Regression techniques are still essential in many circumstances: when experimental studies are too expensive, or blocked by ethical concerns; when conclusions from a few study sites must be generalized to assess national policies; or when analysts want a deeper understanding of the causal relationships between the variables under study, rather than just a simple comparison of cohort means. For all of these reasons, it seems likely that researchers in this field will have to use both experimental and non-experimental methods.

One irony of these results is that if simple OLS estimates had been obtained using non-experimental data from the San Diego and Alabama sites, they could have produced a pretty good picture of the difference between the marginal effects of coupons and ordinary income. Correcting for the kinked budget constraint would have gained almost nothing. The main hazard in terms of policy analysis would have come from assuming that check benefits would be treated the same as ordinary income, which is an issue that apparently can only be addressed with experimental data.

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