AN ABSTRACT OF THE THESIS OF

Soung-kook Shin for the degree of Doctor of Philosophy in Agricultural and Resource Economics presented on April 13, 1998.

Title: A Nested Logit Model of the Determinants of Away-From-Home Food Consumption

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The increasing demand for meals eaten away from home has increased the interest in developing a more complete understanding of the food-away-from-home (FAFH) consumption patterns in the United States. Previous studies have examined factors that explain variations in FAFH expenditures in the aggregate. However, no previous examinations have dealt with the relationship between FAFH consumption and meal price.

The National Panel Diary (NPD) data for the year 1989 were used for the analysis. A sub-sample of single person households was chosen to permit estimation of meal prices. The data set contains demographic information and purchase information.

The three step nested logit model was used to examine the FAFH decision behavior process as a whole. These steps are: first, the consumer decides whether to eat out; second, if he/she decides to dine out then he/she chooses the type of food facility – fast-food, mid-scale, or up-scale facility - to patronize; and third, given the food facility, the consumer chooses from among five food categories: beef, pork, poultry, seafood and other foods. It is at the third stage that price is hypothesized to play its most important role.

With respect to the role of price in selecting particular food categories, the estimated price elasticities of demand were negative in all cases except for beef in the fast-food facilities and beef and seafood in up-scale restaurants. Two possible explanations are offered to explain the positive price elasticities: the relative price effect and Giffen behavior.

Other findings for particular food categories emerged. Midwest households (single-person) have a higher probability of choosing beef and pork, when compared to households from the other regions. South, West, and Northeast households show a higher likelihood of choosing seafood products when dining at up-scale restaurants.

A Nested Logit Model of the Determinants of Away-From-Home Food Consumption

by

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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A NESTED LOGIT MODEL OF THE DETERMINANTS OF AWAY-FROM-HOME FOOD CONSUMPTION

CHAPTER I

INTRODUCTION

1.1 Background

Fundamental eating patterns have been changing dramatically. For many Americans, a typical breakfast is a bowl of cereal, which they may eat while standing and reading the paper. Lunch is a cheeseburger and fries picked up in the drive-in lane at the fast-food outlet and eaten while driving. Dinner may be a home-delivered pizza or prepared foods picked up at the deli counter in the supermarket on the way home from work. Fewer and fewer consumers are sitting down to eat the traditional "three regular meals" a day.

In addition, consumers in the United States have been spending more and more money for food-away-from-home (FAFH). As shown in Figure 1, total food spending in 1970 was $117.1 billion, out of which $39.6 billion were spent on FAFH and $77.5 billion were spent on food-at-home (FAH) in nominal dollars. The values in 1980 were $305.9 billion for total food expenditures, $120.3 billion for FAFH and $185.6 billion for FAH. In 1992, spending was $601.0 billion for total food, $272.6 billion for FAFH, and $328.4 billion for FAH (Food Institute). In real per capita terms, expenditures for FAFH have grown more than FAH expenditures. In 1970, real per capita FAH expenditures were about $962 (in 1982-84 dollars), while in 1989, they were $922, a decline at a 0.2 percent annual rate over

the 20 year period. However, annual real per capita FAFH expenditures in 1970 were $522, while in 1989, they were $734, an increase at an annual rate of 1.9 percent over the 1970-89 period.

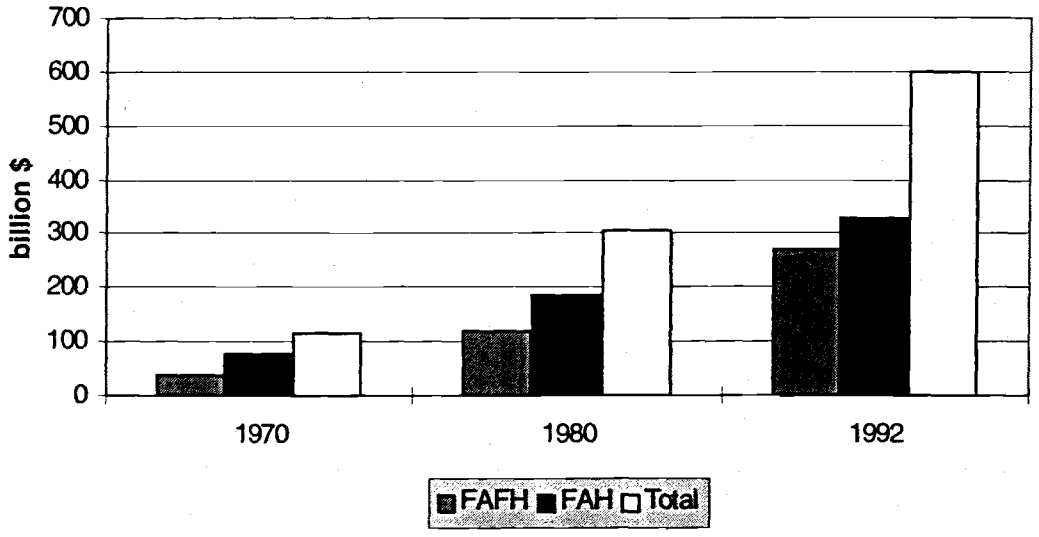
The share of total food spending represented by FAFH expenditures rose from 33.8% in 1970 to 39.3% in 1980 and to 45.3% in 1992 (Manchester, 1993). The FAFH expenditures included commercial food service establishments (restaurants, fast food businesses, cafeterias and caterers) as well as non-commercial food outlets (e.g. schools, military dining halls and child care centers). Commercial foodservice establishments accounted for 78 percent of industry sales in 1994.

Over the period of 1980 to 1990, sales of FAFH increased an average of 5.6 percent annually, or about 2.5 percent per year when adjusted for inflation. That compares with a 0.4 percent inflation-adjusted annual rise in retail food sales for food at home.

Why has the FAFH sector experienced such growth? The explanation seems to lie, at least in part, in demographic and socio-economic changes in the population and the resulting impact on the opportunity cost of time.

U.S. households are demographically more diverse. According to the 1990 census, the percentage of U.S. households headed by married couples declined from 73 percent in 1960 to 55 percent in 1990. In the 1950s, the white middle class defined the American mass market (Koten, 1987). Consumer products were marketed to the predominant homogeneous middle class. The stereotypical U.S. family consisted of a working father, a mother who was a full-time homemaker, and at least two children. That stereotypical family represented only 7 percent of all households by 1987 (Rich, 1987). In 1995, 29 percent of the households were married couples without children; 25 percent were married

Figure 1. Total Food Spending in U.S.



couples with children; five percent were female heads of households without children and no spouse; eight percent were female heads of households with no spouse but with children; three percent were male heads of households with no spouse; 10 percent were single men; and 15 percent were single women (Statistical Abstract of the U.S. 1996). Among these households, one person households are the fastest growing and are likely to exhibit non-conventional food consumption patterns (i.e. FAFH consumption). More than one quarter of households represent only one person. Smaller households now spend more money per person on food, eat out more often, buy more convenience foods and cook less than do larger households. For instance, employed persons living alone spend much more on FAFH than any other group (Manchester, 1993). Not surprisingly, there is an increasing demand for food products in smaller packaging units. Singles and small families also typically consume more of their food away from home.

The age distribution is another important demographic force affecting food consumption. Due to the aging of the baby-boom population, the median age has increased from 30 in 1980 to 33 in 1990. By 2020, almost half of the U.S. population will be age 50 or more (Noah, 1991). Because of information about the linkages between longevity and health and diet, older people are changing their diets and giving more consideration to the foods they eat (e.g., less fat and sodium, more grains, fruits, and vegetables). Another consequence of an aging population is the shrinking of a labor pool in the fast food sector. Young adults are a declining share of an aging work force in the fast food sector. The demand for labor is not expected to ease in the near future. In fact, employment for food preparation and service positions is expected to grow 37 percent between 1986 and 2000 (Food Marketing Review, 1989).

Changes in consumer lifestyles have also been occurring and have been noticed since at least the mid 1980s. The primary social, economic, and demographic factors appear to be: (1) a growing number of women, both married and single, in the work force; (2) increased emphasis on convenience in eating out; (3) more families living on two incomes; (4) the impact of advertising and promotion by large food service chains; (5) and more people in the age group of 25 to 44 who are inclined to eat out more often (Putman and Van Dress, 1984). These changes are promoting the move towards eating out.

The growth of the fast food sector has contributed to the rapid increases in the FAFH consumption during the last two decades (Emerson, 1990). The number of fast food eating establishments has more than tripled in the last twenty years. The fast food industry has placed outlets in locations not previously served, such as schools, military bases, and international markets. Also, menus are being enlarged to include items such as salad bars,

soups, baked potatoes, burgers, and whole grain buns. In recent years fast food restaurants have begun to face growing competition from within the industry, including supermarkets and other food stores that prepare take-out food.

Many supermarkets contain on-site bakeries, salad and juice bars and even natural food corners. This trend has forced many full-service restaurants to serve lighter dishes and to emphasize freshness, quality, and regional cooking in order to attract consumers. More variety of products and service will continue to develop to meet the consumers' demand for speed, convenience, and availability. Also, customers' use of self-service restaurants has become more common in the last decade and a continued expansion of such businesses seems likely to surface throughout the food service industry as labor costs and labor shortages increase.

Increasingly, food companies need to target products at particular market segments. Consumers have become heterogeneous, with distinctly different food consumption habits. The market is breaking up along regional and demographic lines.

Many food companies now categorize consumers into groups by life-style and market their products accordingly. The Pillsbury Company has divided food consumers into five such categories: the Chase and Grabbits, 26% of consumers; the Functional Feeders, 18%; the Down Home Stokers, 21%; the Careful Cooks, 20%; and the Happy Cookers, 15% (Senauer, Asp and Kinsey, 1991). The Chase and Grabbits are yuppies and married couples without children. They are willing to try new and different foods, and they want convenient places to eat. They are a rapidly growing group. Functional Feeders are typically older; the husband works in blue-collar, union job. They are interested in preparing traditional meals in more convenient ways. Down Home Stokers eat traditional

regional and ethnic foods. Their incomes are lower, and when the wives work, it is from economic necessity. Careful Cooks are better educated, older, frequently retired, and have higher incomes. They try to eat a healthful, nutritious diet but still want to enjoy their food. Happy Cookers are households where one of the members enjoys cooking and baking. They buy basic ingredients and nutritious products such as fresh fruits and vegetables. The Chase and Grabbits and Careful Cooks are growing market segments, whereas the other three are declining.

The increased demand for FAFH consumption and the response of the industry are often attributed to increases in the opportunity cost of time (Prochaska and Schrimper 1973). There has been an increase in the number of households with more than one earner and such households generally have less time to cook and more money to spend. Thus, they eat more in restaurants where cooking time is saved, despite paying prices that are higher than those in grocery stores. One study showed that, among married couples under age 55 with two earners, almost 40 percent of food expenditures were for FAFH, while among married couples where the wife was not in the labor force, only 24 to 30 percent of food expenditures were for FAFH (Waldrop, 1989). Since total food expenditures of the two groups were quite similar, it appears that the higher incomes and scarcer time of the dual earners led them to select more food prepared outside the home.

The number one choice of leisure time activity appears to be eating out. Higher opportunity costs of time may induce consumers to substitute away-from-home dining experiences for more time-intensive recreational activities (bowling, theater attendance, etc.). The FAFH choice, by combining food consumption with a relaxing change of environment may be providing a joint product-service combination that, from the

consumer's perspective, leads to increased consumption efficiencies. This view is supported by a 1989 survey, which revealed the importance of eating out as a leisure time activity (Cox, 1989).

On the other hand, the role of leisure in the dining out activity may have another interpretation. For those less constrained by time than by income, dining out may be a relatively low cost form of leisure. In support of this view is a recent finding that those who spent the most time on FAFH were older people, college graduates, unmarried people, and those with incomes between $25,000 and $35,000 (McAdams, 1987). These are also the categories of people who have the most leisure time. The elderly with more leisure time are seeking activities with a slower pace rather than ways to be more efficient. Eating in restaurants is one such activity. In any event changing demographic, socio-economic conditions and lifestyles appear to have changed the demand for food consumed away from the home. The effects may be direct (e.g. higher income may increase demand) or indirect (through changing the opportunity cost of time and the choice of leisure activities) but the result has been growth in the FAFH sector.

The growth in the FAFH expenditures at commercial food outlets in conjunction with changes in the demographic composition and tastes of the consuming public has generated interest in empirical studies of the FAFH phenomenon. In response researchers have conducted economic analysis of the demand for food consumed away from the home. As revealed in the discussion in chapter II, where the empirical literature on this topic is reviewed, much has been learned about this important sector of the food market.

Nonetheless the role of a key economic variable has not been studied. The variable is price. There exists no systematic analysis of how changes in price affect the food choice

decision in the away-from-home market. The primary reason for this is the absence of appropriate data. Government surveys of the consumption of food away from the home have focused on household expenditures, thus depriving the analyst of the possibility of assessing price-quantity relationships.

The present study addresses this issue by the simple expedient of examining the away-from-home dining behavior of those who reside in single-person households. Total expenditure by a single person household on a meal consumed away from the home can be viewed as the "price" of that meal.

Focus on single person households has an additional advantage. As just discussed, such households have grown in numbers and represent an increasing share of all U.S. households and of the FAFH markets. Thus their demand for food away from the home is of interest in and of itself. In addition because the theory of consumer choice pertains to decision-making by the individual, focusing on single person households permits a more direct testing of the hypotheses generated by the neoclassical theory. Complications of family size and composition are avoided.

This study, then, attempts to identify the demographic and socio-economic characteristics of those single person households who eat away from home and attempts to model their FAFH consumption decision. In addition the study examine the role of these demographic and socio-economic factors and of price on the decision to eat away from home, the selections of the type of dining facilities, and the choice of foods in the FAFH establishment.

1.2 Problem Statement and Objectives

Most studies dealing with FAFH behavior have treated expenditures in the aggregate; others have disaggregated expenditures according to type of meal occasion (breakfast, lunch, dinner), type of meat product, and type of food facility. However no studies have dealt with FAFH behavior as a whole, where the decision to eat out is viewed (by the analyst) as having several components, such as whether to eat out, where to eat out, and what food to select. In addition little is known about the demographic and socio-economic characteristics of individuals in relation to this decision-making process.

In this study, a three-level nested logit model is designed to explain how an individual chooses among a discrete number of alternatives as a function of the prices and characteristics of those alternatives. A key question is: do meal prices influence the choice of items selected by the consumer from a restaurant menu? Does the answer to that question depend on the kind of restaurant facility, e.g., whether it is a fast food or an up-scale establishment?

The objectives of this research are to (1) develop theoretical and empirical models for FAFH decision behavior using a nested logit approach; (2) determine socio-economic and demographic effects on FAFH choice by type of food facility; (3) determine socio-economic and demographic effects on FAFH choice by type of food commodity; (4) make comparisons with previous work; and (5) determine price effects on FAFH choice by type of food facility.

CHAPTER II

LITERATURE REVIEW

The studies related to the analysis of away-from-home food expenditure or consumption are reviewed in this section. Most of the earlier literature on FAFH has been either descriptive or expenditures were examined as a single category without disaggregating by type of food or by type of food facility (LeBovit, 1967; Prochaska and Schrimper, 1973; Redman, 1980; Smallwood, 1981; Derrick, Dardis & Lehfeld, 1982; Kinsey, 1983; Putnam & Van Dress, 1984; Blaylock & Smallwood, 1986; Lee & Brown, 1986; Lippert & Love, 1986; McCracken & Brandt, 1987; Nayga, 1991; Nayga & Capps, 1992; Yen, 1993; Byrne, 1994). A study by McCracken and Brandt attempted to evaluate selected factors on FAFH expenditures by type of facility. Also, Byrne analyzed the factors on FAFH expenditure by type of facility and by meat commodity.

Prochaska and Schrimper included the opportunity cost of the homemaker's time in a household production-consumption model of FAFH consumption. Wage rates were used to compute the value of time for each homemaker. The study used the Spring portion of the1965-66 USDA Household Food Consumption Survey data set. The researchers found that the opportunity cost of the homemaker's time is an important factor affecting food consumption away from the home. In particular, those households in which the opportunity cost of time is high due to the presence of a homemaker employed outside of the home, tend to consume more FAFH than do households with homemakers whose opportunity cost of time is low. The analysis also found that a family with preschool age

children tend to eat fewer meals away from home. In examining the role of race the analysts found that in the South and West regions, households of black and non-whites other races tend to eat less away from home than do white households.

Redman examined the impact of women's time allocation on expenditure for meals away from home and on prepared foods. The data were from the diary portion of the Bureau of Labor Statistics (BLS) 1972-73 and the 1973-74 Consumer Expenditure Survey (CES). Variables measuring the age and schooling of the women, which the Prochaska and Schrimper study did not include, are treated explicitly in the model. The study found that household expenditures on foods requiring little preparation time are influenced by those characteristics of women that affect the allocation of their time to household production. Household income has a positive effect on FAFH consumption while family size has a negative effect. Families with preschool children spend less on FAFH than do families with older children. Families in metropolitan areas were found to spend more on FAFH than do families in rural areas due to the availability and prices of eating places. Younger women spend more on meals away from home than do older women because of differences in life styles. Employed wives buy more prepared foods but not more FAFH, while more education appears to decrease the demand for prepared foods. According to the results of this study, Redman suggested that "the restaurants and fast food industries should focus on young families without small children and the prepared-food industries should orient themselves to the older families where the wife has returned to the labor force."

Kinsey examined the effects of various sources of household income, including that earned by full and part-time working wives and children, on the marginal propensity to consume (mpc) FAFH for both white and nonwhite families. Tobit regression analysis was

applied to data from the 1978 Panel Study of Income Dynamics (PSID). Income, annual food expenditure, and demographic data were used to estimate the mpc and income elasticities. The study found that the presence of a full-time working wife in the household did not increase the mpc of FAFH. Income elasticities for FAFH were less than 1.0 and greater than 0 suggesting that FAFH is a normal good for all households. Kinsey states that, "eating FAFH is not necessarily less time-intensive than home produced meals ... and that those who eat out to reduce meal production time might frequent limited menu, family type, or fast-food restaurants where service is swift and prices relatively low." (p.18)

Lee and Brown studied food consumption at home and away from home by employing a switching regression model that emphasized both the household's choice of whether to eat out and the factors affecting consequent FAFH and FAH expenditure. For estimation, the USDA 1977-78 Nationwide Food Consumption Survey (NFCS) data set was used. The researchers found that the higher income household tends to consume more FAFH and that suburban area families are more likely to eat away from home than are those in rural areas or central cities. Moreover, living in the North Central region, being an employed female head of household, and having a high level of education increased the likelihood of eating away from home. However, households with infants and older members (those less than 4 years old and greater than 50) are less likely to eat away from the home. Another result is that, once a family decides to consume FAFH, income does not have a significant effect on food expenditure away from home unless the household income is more than $20,000 per year.

Using the BLS 1980 Diary Consumer Expenditure Survey data set, Lippert and Love tried to identify changing food expenditure relationships on FAFH and prepared food

purchases between 1972-73 and 1980 as using several socioeconomic variables. The results indicate that in 1980, family income, wife's employment and college education, having a metropolitan residence, and family size were all positively related to expenditures for FAFH. However, families which have pre-school and elementary school children tend to have lower levels of FAFH expenditure.

McCracken and Brandt studied expenditure on FAFH by type of food facility. The 1977-78 USDA NFCS data and Tobit analysis were used to identify the factors affecting FAFH consumption by type of facility. The sociodemographic variables included in the model are education and age of the household head, time of FAFH consumption (during the week versus on the weekend), location of the household, race, household size, and employment status of the head of household. The value of time for the head of the household was estimated using a stochastic censoring model. This model has a potential market earnings equation, a reservation earnings equation, and a sample selection rule which determines whether or not an individual participates in the labor market. The results were consistent with previous studies for the effect of income, race, and location of residence on total expenditure on FAFH. By disaggregating FAFH expenditures by type of facility, the analysts were able to demonstrate that expenditures at restaurants and other commercial establishments were positively affected by household income but that income was only marginally significant for fast-food facilities. McCracken and Brandt speculate that "individuals eat at restaurants other than just to save time (e.g., as a recreation diversion) and that eating away from home in fast-food places depends less on income than on the value of the food preparer's time". Household size and composition have stronger effects

on spending at fast food and other commercial facilities than at restaurants. The researchers further suggested that as more married women experience higher opportunity costs of time from participating in the labor force, then more food will be consumed at fast-food and other commercial establishments, as opposed to restaurants.

Nayga studied socio-economic and demographic characteristics affecting both FAFH and FAH consumption. He developed a complete demand systems approach using the 1987-88 NFCS data to estimate various elasticities for FAFH, FAH, and non-food consumption. This study also estimated demand for nutrients. Logit models were used to investigate both the decision to eat FAFH and the decision to eat a particular meat product (i.e., beef, pork, lamb, poultry, fish) either away from home or at home. Due to the relatively high proportion of individuals who did not purchase any meals from FAFH, the Heckman procedure was employed to correct for selection bias. Nayga also studied various factors affecting FAFH consumption by type of facility. The research shows that as the labor force participation rate of women increases, the share of total expenditure on FAFH increases but the expenditure share of FAH decreases relative to nonfood item. The study found that individuals residing in central cities, individuals from the West, Asian/Pacific Islanders, and employed individuals are more likely to eat fish and shellfish when dining at FAFH facility. Household size has a negative impact on consumption of fish and shellfish from FAFH. Age and income show positive effects and individuals who consumed FAFH during the weekend are more likely to eat fish and shellfish away from home. The results indicate that employed individuals consume significantly more meals at fast food establishments but only marginally more in restaurants than do unemployed individuals.

Income was not statistically significant in any of the FAFH facilities. These findings are consistent with those of the McCracken and Brandt study.

A study by Nayga and Capps analyzed the demographic and socio-economic profile of households that consume food away from home, updating similar research by Lee and Brown for the 1977-78 USDA National Food Consumption Survey. Data used for the Nayga-Capps study came from the 1987-88 USDA National Food Consumption Survey. Logit modeling techniques were used to measure the effects of urbanization, region, race, gender, employment, food stamp participation, special diets, household size, age, income, and day of the week on the decision of whether or not to consume FAFH. Maximum likelihood estimate results indicated that regionality, race, employment, food stamp participation, household size, age, income, day of week, and seasonality significantly impact the FAFH decision. The findings are: Blacks and Hispanics were less likely to consume FAFH than are whites; employed households were more likely to consume FAFH than unemployed households; participation in food stamp programs had a negative effect on the decision to consume FAFH; household size and age had negative effects but income had a positive effect on the decision to consume FAFH; households were more likely to consume FAFH on weekends then on weekdays; and consumption of FAFH was less likely for the periods January to March and July to September than for April to June and October to December.

Yen studied FAFH expenditures by working wives, using 1989 BLS CES data and the Box-Cox double-hurdle model. Independent variables are: income (wife's income is excluded), wife's labor hours per week, household size, age of wife, wife's education, home ownership, race, and location of household. This study also was able to distinguish the

effects of the explanatory variables on the decision of whether to consume FAFH from the decision of how much to spend on FAFH. The results showed that households with working wives and higher income tend to consume more FAFH. Yen's study demonstrated that higher education of the wife will increase the probability of consuming FAFH but will have a negative effect on FAFH expenditures for those households that go out to eat. Household size and wife's age are positively related to expenditure on FAFH. This study, like the others, did not examine one-person households separately.

Byrne used 1982-1989 data from the National Panel Diary Group (NPD) to investigate the food away expenditure by meal occasion, by food facility, and by meat commodity. The logit technique was used to find FAFH participation. From these logit regressions, the inverse Mill's ratio (IMR) was calculated for the unobservable censoring latent variable. This IMR was used as an independent variable to estimate the parameters of a logit model of the FAFH participation decision by food facility and by meat commodity. Every decision step was estimated by a logit model. For example, to estimate FAFH participation by meat commodity, 5 logit equations were used -- one for the participation decision, one for whether to select beef, one for pork, one for poultry, and one for seafood. Byrne found that larger households are more likely to purchase FAFH at quick serve facilities and are more likely to consume beef.

In summary, previous studies on FAFH expenditure or consumption demonstrated that common socio-demographic factors included income, household size, urbanization, region, race, employment, and education. Some of the results from these studies differed regarding the relative importance of these factors on FAFH consumption or expenditure, primarily due to the use of different consumption models, data bases, and estimation techniques. To

examine the role of the opportunity cost of time, researchers have used one of two measures: (a) wage rates, either actual or estimated and (b) a dummy variable that distinguishes between employed and unemployed women. The results are not uniform across types of facility. The opportunity cost of time appears to play a larger role in determining FAFH expenditures at fast food facilities than in other commercial restaurants. In determining the values of income levels, number of children in the household and several other demographic and socio-economic variables, it appears to be important to distinguish among the various types of FAFH facilities.

A critical variable missing in all of these studies is price. The primary reason is that most data sources report on household expenditures, making it difficult to calculate meal prices when households contain more than one person. Researchers have argued that this is not a serious omission when cross-sectional data are used if one can assume prices do not vary much from location to location. Among the innovations of the present study is explicit consideration of the price variable.

CHAPTER III

THEORY AND METHODS

As suggested by the research to date, changes in the demand for food away from the home can be attributed, at least in part to rising incomes, changing composition of the household and other developments in the demographic and socio-economic characteristics of the U.S. population. Increases in the opportunity cost of time have also been found to play a role. The present chapter reviews some of the theoretical considerations behind this phenomenon. It also offers a possible explanation for the role that price pays in the FAFH market. The second half of the chapter develops an empirical model to be used in examining the decision to consume food away from the home.

3.1 Household Food Consumption and the Opportunity Cost of Time

The "household economics" framework was introduced by Gary Becker three decades ago. Becker argued that time has value and that its value affects consumers' decisions. Time has an economic value because it is limited. An individual's wage rate is the best practical measure of that person's opportunity cost or value of time. An opportunity cost is what must be foregone by making one choice rather than another. People who choose to work only part time in the labor force, or not at all, are foregoing the wage or salary they

could have earned. For those not employed in the labor force, the wages they would be able to earn if employed are considered the relevant opportunity costs of their time. Potential wages are largely dependent on a person's age, education, and other factors, including conditions in the labor market. The traditional economic model of the consumer views people as receiving utility directly from the consumption of the products and services they purchase. However, the fact that people not only purchase goods in the market but, also, produce goods at home yields a modern theory of the allocation of time among three activities: production in the home, work in the market, and leisure time spent consuming goods (Gronau, 1977).

The fundamental result of the theory is that wages determine the value of both market and home production time. This framework can be applied to different situations, including the production and consumption of meals. Ekelund and Watson (1991) used household production theory to explain the household production of meals. Their explanation is as follow: suppose that a representative household receives utility from only meals and leisure - meals that may either be produced in the home or purchased at restaurants with income earned from working in the market. Under these circumstances, the individual works at home producing meals until the marginal product is equal to the real wage. As shown in Figure 2, the home meal production possibilities curve MA24, shows diminishing marginal product of time as more home time is devoted to meal production. The slope of the straight line from Y1 is given by the ratio of the market wage rate to the price of a restaurant meal. It is tangent to MA24 at point A, where the marginal product of home time equals the real wage (nominal wages divided by the price of

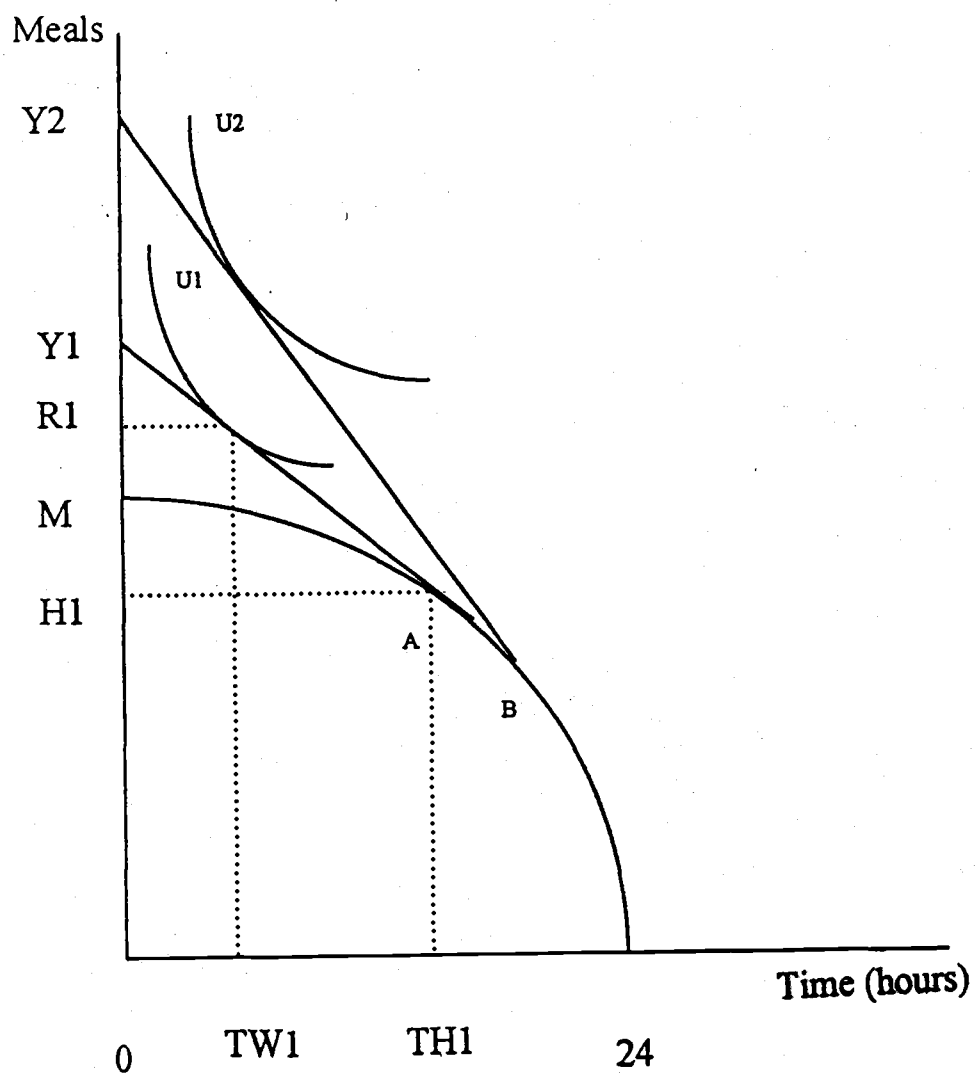


Figure 2. Household Meal Production

restaurant meals). This household will work in the home up to point A and then work in the market for real wages to purchase meals, maximizing utility along the constraint Y1A24 at the tangency with U_1. That is, the household devotes 24 minusT_{H1} hours to home production, T_{H1}-T_{W1} to market labor, and T_{W1} hours to leisure. Likewise, the consuming unit prepares and consumes H_1 home cooked meals and R_1-H_1 restaurant meals. An increase in real wages shifts the budget constraint to Y_2B24 and a new utility-maximizing tangency occurs. At the higher wage (or lower restaurant meal price) it is clear that fewer meals will be produced in the home and the number of restaurant meals will increase either absolutely or relative to home produced meals. This model, then, predicts a positive relationship between wage rates and the demand for meals away from the home.

While this framework provides a rationale for observed increases in the demand for food away from home it does not address the question of food choice after the FAFH decision has been made. Economic intuition suggests that, with respect to the choice question, relative prices must play a role. One approach to this question is proposed next.

3.2 Shipping the Good Apples Out

If consumers tend to eat in restaurants more and more, then what is the role of restaurant price on the consumer's selection of food and food facilities ? For example, does the consumer who dines in the family type restaurant choose different food items than when he or she dines in a high class restaurant ? One possible answer lies in relative prices, in an extension of the so-called "shipping the good apples out" proposition.

The "shipping the good apples out" issue is a very interesting real economic phenomenon with several varied applications. The example cited in Silberberg (1990) depicts the phenomenon through a newspaper exchange initiated by an irate consumer who wrote (Seattle Times, October 19,1975):

> "Why are Washington apples in local markets so small and old-looking ? The dried-up stems might seem they were taken out of cold storage from some gathered last year. Recently, some apple-picking friends brought some apples they had just picked, and they were at least four times the size of those available for sale here. Where do these big delicious apples go ? Are they shipped to Europe, to the East or can they be bought here in Seattle ? - M.W.P" (Silberberg 1990, pp.386).

The textbook answer was provided by an economist several days later (Seattle Times, October 28, 1975):

> "Reading M.W.P.'s complaint that all the good apples were being shipped East, you might be interested to know that 'shipping the good apples out' has been a favorite classroom and exam question in the economics department at U.W. for many years.
>
> It is a real phenomenon, easily explained:
>
> Suppose, for example, a "good" apple costs 10 cents and a "poor" apple 5 cents locally. Then since the decision to eat one good apple costs the same as eating two poor apples, we can say that a good apple in essence "cost" two poor apples. Two good apples cost four poor apples.
>
> Suppose now that it cost 5 cents per apple (any apple) to ship apples East. Then, in the East, good apples will cost 15 cents each and poor ones 10 cents each. But now eating two good apples will cost three - not four poor apples.
>
> Though both prices are higher, good apples have become relatively cheaper, and a higher percentage of good apples will be consumed in the East than here.
>
> It is no conspiracy - just the laws of supply and demand." (Silberberg 1990, pp.386)

This is a specific case of the general proposition supplied by Alchian and Allen (1964), that if a given transportation cost is added equally to the prices of two similar goods, then, because this will reduce the relative price of the more expensive good, the effect will be a relative increase in the consumption of the higher-quality good.

Can this proposition help understand food selections by consumers who dine out? In the neoclassical theory of consumer choice the quantity of a particular good or service demanded is hypothesized to be a function of that good's price, prices of other, especially related goods, and the consumer's income (or total expenditures). As the price of the good or service rises (falls), relative to the other prices, the quantity demanded falls (rises). Thus it is relative prices that matter.

What are relative prices in a restaurant? When one purchases a beef hamburger in a fast food restaurant he or she buys a "bundle" of commodities and services consisting of beef, a hamburger bun, lettuce, other ingredients, the cooking service, utensils and the other services that are part of this dining experience. When one purchases a fish sandwich, fish replaces the beef but the other items remain as part of the bundle. These items may be viewed as analogous to the transportation costs of the "shipping the good apples out" example. If fish is more expensive than beef, adding identical "fixed" charges means that the price of fish sandwich relative to the price of beef hamburger is less than the price of fish relative to the price of beef. One would, then, expect the relative consumption of fish to beef to be higher in fast food restaurants than in retail stores, where beef and fish can be purchased without the accompanying ingredients.[1]

As more expensive goods and services are bundled with the fish and beef the relative price of fish may fall even faster. This is likely to be the case as one moves to more up-scale restaurants, where salads, vegetables, white table cloths and the services of waiters, waitresses and dishwashers are added to the bundle.

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[1] See Umbeck for an opposing view.

The situation is complicated by the presence of several items on the menu (Silberberg, 1990) and by the addition of greater "recreation" components to the dining experience, as suggested by previous research. Furthermore restaurants that emphasize low prices, such as fast food restaurants may pay careful attention to how closely their menu items substitute for each other and, thus, attempt to set similar prices anyhow. In any event, even when one is using cross-sectional data, differences in relative prices can be expected. This proposition gives one explanation of consumer food choice behavior in certain types of restaurants, where the transportation cost is replaced by the various services associated with all meals in a given restaurant.

3.3 Nested-Logit Model

As discussed in Chapter 2, the food choice decision for dining away from the home has been modeled through a variety of approaches. Because the present study views the process as involving three interdependent steps - whether to dine out, where to dine out and what menu item to select - the nested logit model appears to be an appropriate choice.

Morey, Rowe and Watson (1993) used a nested-logit model for individuals contemplating salmon fishing. The nested-logit was structured by participation and site choice: whether to go out to fish; if individual fishes, in which region; and where to fish within the selected region.

McFadden(1978) considered the problem of choice in housing location. To choose a house, a consumer faces a choice of community and dwellings in certain given

communities. The consumer will choose the alternative (community dwelling) that maximizes his utility.

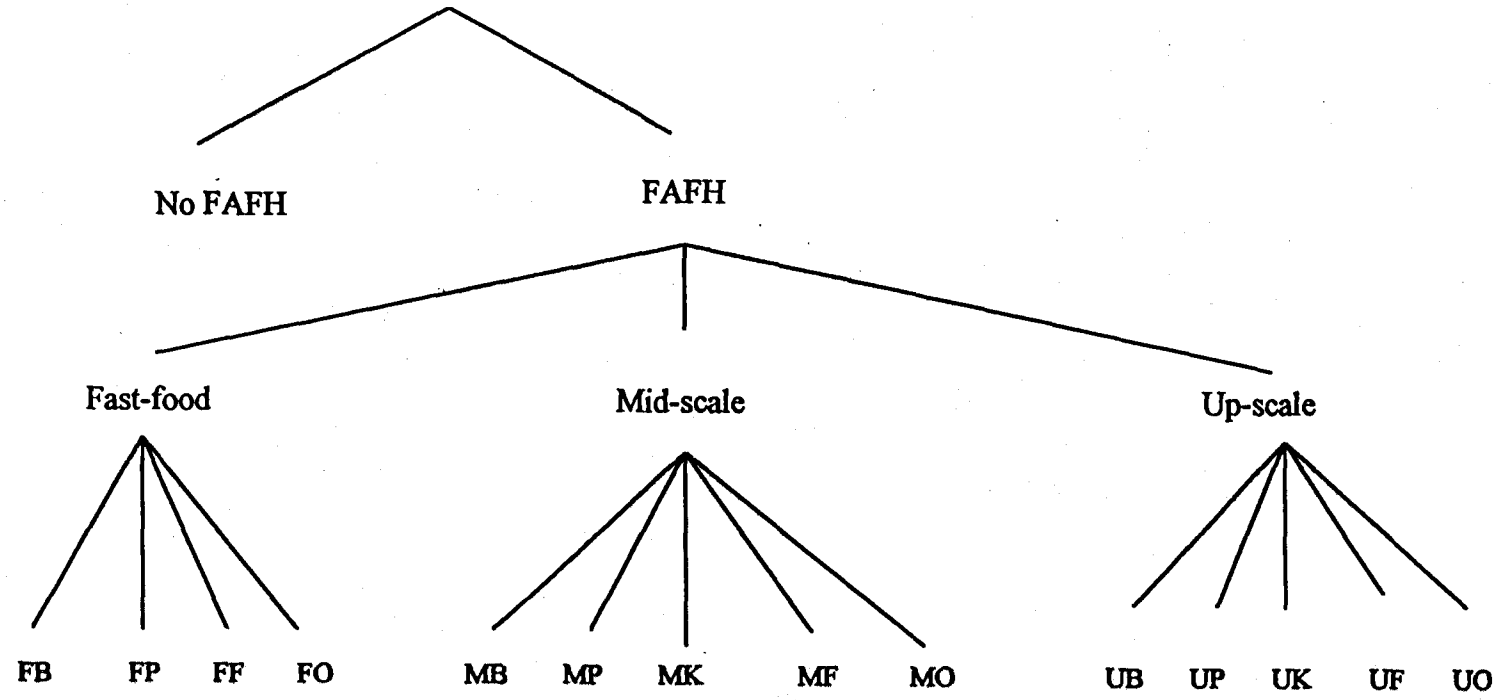
Figure 3 shows a hierarchical or nested decision structure for FAFH. The consumer's choice of whether or not to dine away from the home (i = 1,2) provides a transition to the next decision node of selecting among fast food service, midscale or upscale restaurants (j = 1,2,3), with the final node involving the choice of meals (k = 1, 2,3,4,5) which are identified by their primary protein ingredient. In this study those selected were beef, pork, fish, poultry and others, while "others" includes pizza, salads, and ethnic dishes. The choices on lower branches of the trees are conditioned on prior choices at each transition node.

Using the random utility specification, the utility derived from eating meal k within food facility j at home or out (i) is:

$$U_{ijk} = V_{ijk} + \varepsilon_{ijk} \qquad (3.1)$$

where, V_{ijk} is the conditional indirect utility function that measures the observed utility, and ε_{ijk} is the unobserved portion of utility. The unobserved determinants ε_{ijk} are assumed to have a Generalized Extreme Value (GEV) distribution and to capture the consumer's tastes and preferences known to the individual but not to the researcher.

The assumption of the GEV distribution allows for the model to be estimated as a nested-logit. With the GEV distribution, the probability P_{ijk} that the (i,j,k)th alternative will be chosen is given by



B: beef
P: poultry
K: pork
F: seafood
O: others

Figure 3. A Choice Hierarchy For Food-Away-From-Home (FAFH)

$$P_{ijk} = e^{V_{ijk}} / \sum_{l=1}^{2} \sum_{m=1}^{3} \sum_{n=1}^{5} e^{V_{lmn}} \qquad (3.2)$$

The observable portion of utility is defined by the conditional indirect utility function relating to type of food choice

$$V_{ijk} = \beta' X_{ijk} + \alpha' Y_{ij} + \gamma' Z_i \qquad (3.3)$$

where X_{ijk}, Y_{ij}, and Z_i refer to the vectors of explanatory variables specific to categories (i,j,k), (i,j), and (i), respectively. The parameters that define utility in equation (3.3) also determine the probability of choosing a particular type of food (meal):

$$P_{ijk} = P_{k|ji} P_{j|i} P_i \qquad (3.4)$$

The probability of choosing food k given type of facility j and the decision to eat out will involve only the parameter β :

$$P_{k|ij} = e^{\beta' X_{ijk}} / \sum_{n} e^{\beta' X_{ijn}} \qquad (3.5)$$

In equations 3.6 and 3.8, the terms I_{ij} and J_i are called inclusive values and δ and λ in equations 3.7 and 3.9 are parameters to be estimated. The inclusive values link the three decision stages of the simultaneous decision. Inclusive values are scalar measures of the desirability of a subset of alternatives; that is, they measure the expected highest utility from the most highly valued alternatives in the subset. Therefore, I_{ij} is the expected value

of the maximum utility from the subset of *k* choices of food alternatives to be faced if j is chosen. For the specified model to be consistent with utility-maximizing behavior, McFadden (1978) has shown that the coefficients on the inclusive values have to lie in the unit interval. However, Borsch-Supan (1990) showed that inclusive value coefficients can lie outside the unit interval and be consistent with utility maximization. The necessary condition for this argument is that the inclusive value coefficient be less than $1/(1-P_k)$. P_k denotes the probability that choice k is selected. The inclusive value can be determined by aggregating over the utilities associated with selected choices from each nest in the hierarchy. Thus, in this study,

$$I_{ij} = \log(\sum_{k=1}^{5} e^{\beta' X_{ijk}}) \qquad (3.6)$$

and is the log of the denominator of the conditional probability of selecting eating at facility type j. Using the inclusive value, the probability of choosing types of food facility *j* is given by :

$$P_{j|i} = e^{\alpha' Y_{ij} + \delta I_{ij}} / \sum_{m} e^{\alpha' Y_{im} + \delta I_{im}} \qquad (3.7)$$

To determine the choice of eating out or eating at home, define another set of inclusive values:

$$J_i = \log(\sum_{m} e^{\alpha' Y_{im} + \delta I_{im}}) \qquad (3.8)$$

Then

$$P_i = e^{\gamma' Z_i + \lambda J_i} / \sum_{l} e^{\gamma' Z_l + \lambda J_l} \qquad (3.9)$$

where the parameters δ and λ are the coefficients on the inclusive values at each transition node. Note that the utility information from lower level alternatives is reflected in higher level choices.

The estimation technique from the LIMDEP program for a nested-logit model is the full information maximum likelihood method. With simultaneous estimations, all information is utilized in the estimation of each parameter, and parameters that are common across submodels are necessarily constrained to be equal. The log-likelihood function is given by:

$$\ln L = \ln [P(klji) \times P(jli) \times P(i)]$$

$$= \ln P(klji) + \ln P(jli) + \ln P(i)$$

The marginal effects of an explanatory variable, x(r), on the probability of choosing alternative (k,j,i) will be estimated from the parameter estimates of the log-likelihood function as :

$$dP(k,j,i) / dx(r) = P(k,j,i)\, \Delta(r)\, F$$

where $\Delta(r)$ = coefficient on x(r) and F is effects on limb, branch and twig.[2]

[2] More detail is in the User's manual , LIMDEP 7.0 (p.522)

CHAPTER IV

DATA AND DESCRIPTIVE STATISTICS

4.1 Description

The data used in this study originated in a survey conducted by the National Purchase Diary (NPD) Group Inc. for the U.S. Department of Agriculture (USDA). This survey which began in 1976, is conducted for each quarter of the year and is designed to generate data on the FAFH spending of approximately 12,800 households. Each participating household keeps a dairy over a two-week period for each quarter on FAFH expenditures. In addition of data handle both demographic and purchase information. Each participating household receives a gift valued at $25 to $35 for each full year of participation.

The present study uses data for 1989 collected from one-person households. The NPD data set has 51,168 observations, and the single-person households data set has 11,200 observations. Among the 11,200 observations, there were 870 observations for which there was no reported FAFH consumption during the survey period. All of the descriptions of this chapter are from one-person households data.

4.2 Demographic Data

The demographic data include income, region, race, gender, education, season, and age of the respondent. On average, individual in one-person households ate out about 4

times in each two-week survey period. This contrasts with 3.6 times for all households surveyed.

The education variable (EDU) is defined in terms of the level of formal education achieved by the household head, measured in years of schooling. Seventy five percent of individuals in one-person households reported at least some college level education.

With respect to race, three categories are used for this study: white (the base group), blacks (BL), and other races (OTHER) such as American Indian, Hispanic and Asian. The black households were 2.6 percent and 2.2 percent were in the "other" category. For the entire sample, blacks and "others" accounted for 4.2 and 2.6 percent of the households, respectively.

The region variable divided the country into four areas: West, South, Midwest, and Northeast. Figure 4 shows the census regions. The South and Midwest regions account for the largest portion of the sample.

In the sample 51.3 percent of single households were headed by women. A binary variable (SEX) assigns a value of one if its household heads is female and zero if male.

The income variable (NINC) measures household income at the midpoint of the income class range. Thirty seven percent of the sample had incomes ranging from $15,000 to $30,000 per year.

The season during which each FAFH decision was made is represented by a set of binary variable: winter (base), spring (SP), summer (SU), and Fall (FA). The winter quarter is December, January, and February; the spring quarter is March, April, and May; the summer quarter is June, July, and August; and the fall quarter is September, October, and November.

Figure 4. Census Region

Region	State
West (WE)	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
South (SO)	AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN TX, VA, WV
Midwest (MW)	IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI
Northeast (base)	CT, MA, ME, NH, NJ, NY, PA, RI, VT

Table 1. Descriptive Statistics for Demographic Variables (One-person Households)

Variable	Mean	Std. Dev.	Minimum	Maximum
Education				
EDU	14.93	2.49	7	18
Race				
BL	0.03	0.16	0	1
OTHER	0.02	0.15	0	1
Region				
MW	0.28	0.45	0	1
SO	0.31	0.46	0	1
WE	0.18	0.39	0	1
Gender				
SEX	0.51	0.50	0	1
Income				
INC	23513.41	15685.56	5000	100000
Season				
SP	0.23	0.42	0	1
SU	0.23	0.42	0	1
FA	0.21	0.41	0	1
Age				
AGE	60.54	18.39	23	96

The age variable (AGE) ranged from 23 to 96 years old. About half of the households are under 60 years old. The descriptive statistics for demographic variables are exhibited in Table 1.

4.3 Purchase Data

The households recorded information for each dining out visit made during a two week survey period. The data includes cost of meal purchased, day of week, meal occasion (breakfast, lunch, dinner), type of foods consumed, type of food facility, distance for the restaurant, and location before dining out. There are 11,200 dining out observation on one-person households with observations in each quarter available for analysis.

The food facilities in this data set are categorized into fast-serve restaurants (e.g., fast food restaurants), mid-scale restaurants (e.g., family style restaurants), and up-scale restaurants (e.g., formal dining). The mean cost of a meal (NCASH) per visit for fast-serve restaurants is $4.60, for mid-scale is $6.88, and for up-scale is $15.57. The most often-visited facility type by households was fast-food restaurants; 40 percent of the sample visited fast-food restaurants during the survey period. The second most frequently-visited facility type was mid-scale restaurants (36 percent), while the least frequented type was up-scale restaurants (17 percent, figure 6). The proportion of weekend(WKD) dining out experiences was 29 percent.

As indicated earlier, the types of meals are classified into 5 categories: beef, pork, poultry, seafood, and others. Each diner lists up to six foods that they consumed during the visit. If any one of these foods consists primarily of one of the meat commodities, then the

foods consumed by that individual are classified as a meal for that respective category. If a diner had a hamburger in a certain meal, then the diner's consumption is defined as a beef meal. Salad, pizza and other pasta foods are classified as "other". The average price for each food category is exhibited in table 2. There is no category of pork at fast-serve restaurants.

Table 2. Means of Meal Cost by Food Type and by Food Facility

Type	Mean ($)
Fast-serve	
beef (FB)	3.42
poultry (FP)	4.67
seafood (FS)	4.56
other (FO)	5.76
Mid-scale	
beef (MB)	6.16
pork (MK)	5.96
poultry (MP)	7.09
seafood (MS)	9.11
other (MO)	6.10
Up-scale	
beef (UB)	16.16
pork (UK)	13.24
poultry (UP)	15.01
seafood (US)	21.18
other (UO)	12.27

Table 3. Descriptive Statistics for Purchase Variables

Variable	Mean	Std. Dev.	Minimum	Maximum
Cost of Meal				
NCASH	6.85	5.90	0	49.20
Day of Week (Weekdays vs. Weekend)				
WKD	0.29	0.45	0	1
Meal Occasion				
LUNCH	0.48	0.50	0	1
DINNER	0.41	0.49	0	1
Place Before Meal				
HOME	0.35	0.48	0	1
WORK	0.42	0.49	0	1
REC	0.21	0.41	0	1
Time				
NTIME	11.62	12.38	0	61

Where REC stands for recreational location and NTIME is the number of minutes it takes to travel from the before-meal location to the food facility.

Figure 5. Average Meal Cost by Type of Food Facility

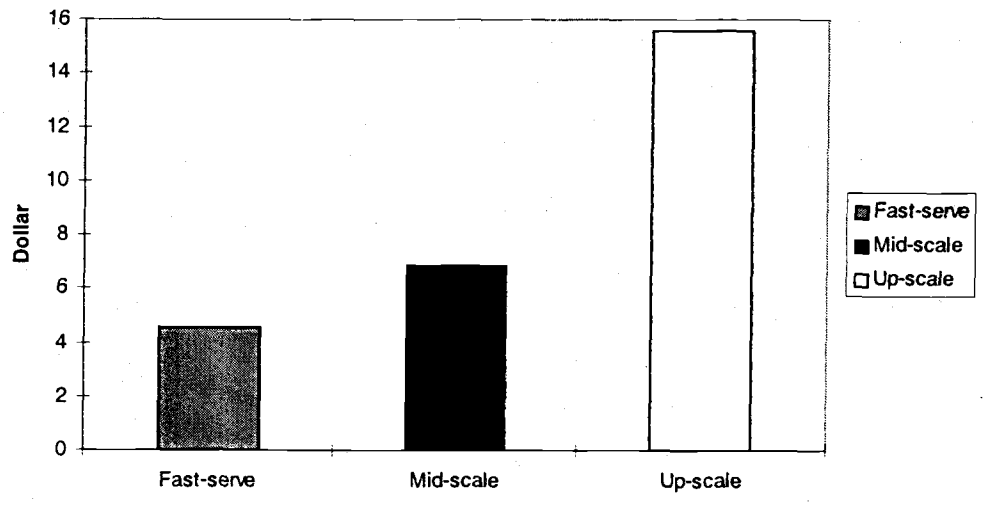


Figure 6. Proportion of FAFH Dining Experience for Sample, by Type of Food Facility

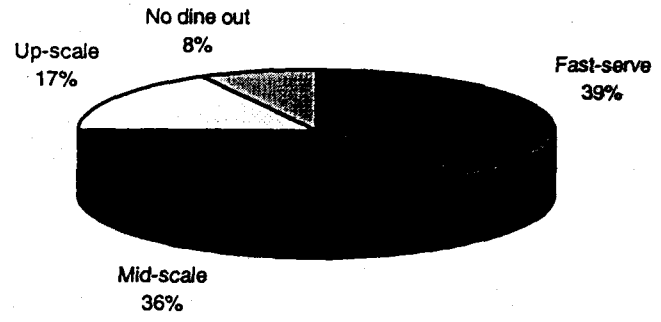
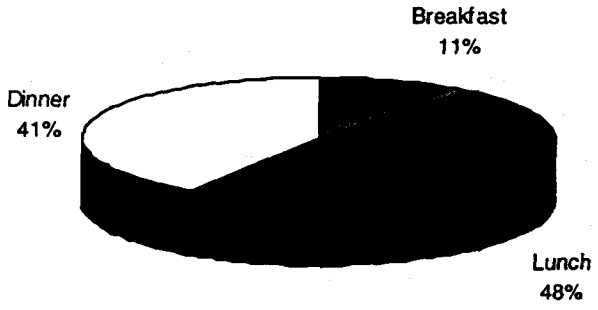


Figure 7. Proportion of FAFH Meals for Sample, by Meal Occasion



For the single person households in the sample, lunch accounted for the largest share of dining out experiences (48.4 percent), followed by dinner (40.8 percent) and breakfast (10.8 percent), during the survey period (figure 7).

The information on the diner's location before going out to eat consist of home, work, and a recreational location. If a diner was at work and chose to go out to eat then work was recorded. Places of Shopping trips and vacations are classified as recreational locations. The data set includes the time to get from these locations to the food facility in minutes. The average time to get to the fast-serve restaurant is 10 minutes, mid-scale is 13 minutes, and up-scale is 15 minutes. The descriptive statistics are exhibited in Table 3.

4.4 Predicted Variables

4.4.1 The Value of Time

As a measure of the value of time to the household, the estimated wage rate of the householder is used. The wage equation for one-person households was estimated using the NPD data. Since wage rates were not given in the NPD data, wage rates were generated from the household income and actual number of work hours per week.

When the value of time for the one-person household is predicted from the wage equation, a sample selection bias problem occurs in the estimation procedure (Heckman 1974, 1979). Among the 11,200 observations, 3428 observations were reported to be for persons who were unemployed. To include their observations in the wage equation, sample selection bias is corrected in the estimation of the wage equation. McCracken and Brandt

(1987) followed the labor supply work of Heckman by using two possibly related equations: first, a potential market earnings equation and second, a reservation earnings equation reflecting an earnings level below which the individual chooses not to work. That is, they imputed a sample selection rule which determines whether or not an individual participates in the labor market and thus has observed market earnings.

In the present study, Heckman's method for correcting sample-selection bias is utilized in the estimation of the wage equations. In the first stage, a probit equation for labor force participation is estimated. From the parameters estimated in the probit equation, the inverse of Mill's ratio(MILL) is estimated. In the second stage, the inverse of Mill's ratio, which represents the probability that an observation is selected into the sample, is included as an additional regressor in the ordinary least squares estimation of the wage equation for the truncated sample of employed households (this procedure corrects for sample selection bias). Table 4 shows the results of the probit estimation for labor force participation of one-person households. The explanatory variables are the household head's age (AGE), age squared (SQAGE), education (EDU), gender (SEX), and race (BLACK, OTHER). The age squared variable is included because it was expected that wage rates would increases with age, but not in a linear pattern.

Table 5 shows the estimation results of the wage equation for the one-person householders with jobs. The natural logarithm of the wage rate is used as the dependent variable to allow for non-linearlities. The explanatory variables are discussed above and MILL is the inverse Mill's ratio. The parameter estimate on the Education variable shows that higher

Table 4. Results of Probit Estimation for Labor-force Participation

Parameter	Estimate	t-statistics
Constant	0.3006	1.780
AGE	0.0477	9.391
SQAGE	-0.0942	-22.991
EDU	0.0729	17.868
SEX	-0.1590	-7.894
BLACK	0.0272	0.459
OTHER	0.7534	8.562

Table 5. Results of the Estimation of the Wage Equation

Parameter	Estimate	t-statistics
Constant	-0.3094	-2.360
AGE	0.0467	9.499
SQAGE	-0.0278	-4.877
EDU	0.0785	16.786
SEX	-0.0587	-7.212
BLACK	-0.1645	-7.773
OTHER	0.0136	0.631
MILL	-0.1826	-3.082

education gives higher wages. Women exhibited lower wage rates than men. The coefficients in Table 5 were used to calculate the estimated value of time (expected wage rate) for one-person households.

4.4.2 Predicted NCASH and NTIME

The NCASH variable can be interpreted as the price of a meal for one-person households. Because consumers cannot visit all 14 restaurant type - food categories, NCASH is predicted for each category to generate the meal prices for all categories and for all households. This provides a representation of price tradeoffs among different restaurant-food choices that each household faces and allows efficient estimation of the demand for eating out.

Seven explanatory variables are included to capture the influence of the decision on how much to spend on the meal. The explanatory variables are: non metropolitan are (URB2), suburban area (URB3), West (WE), South (SO), Midwest (MW) and meal occasion (LUNCH, DINNER). The NCASH is used as a dependent variable and the ordinary least squares estimation procedure is used. The results are reported in the Appendix (Tables A1-A14).

The NTIME variable is the actual time, measured in minutes, to get to the food facility. There is only one NTIME value observed for each visit; for example, if the consumer went to a fast-food restaurant, then there are no corresponding values of NTIME for mid-scale and up-scale restaurants. Therefore, the NTIME variables are predicted for fast-food, mid-scale, and up-scale facilities separately.

The ordinary least squares estimations was used with the following explanatory variables: age (AGE), income (NINC), gender (SEX), race (BLACK, OTHER), non metropolitan area (URB2), suburban area (URB3), location before dining out (HOME, WORK, REC), and period of the week (WKD). Tables A15-A17 show the results of estimation.

CHAPTER V

AN EMPIRICAL ANALYSIS

5.1 Estimation

The empirical framework of this study is as follows. Food choice is modeled as a nested-logit model based on socioeconomic variables. The first equation of interest is the utility from choosing food *k* given that food facility *j* and the decision on whether to go out, *i*, have been made.

$$V_{klji} = \beta_0 + \beta_{1k} * NCASH_k + \beta_2 * BL + \beta_3 * OTHER + \beta_4 * MW + \beta_5 * SO + \beta_6 * WE + \beta_7 * SP + \beta_8 * SU + \beta_9 * FA + \beta_{10} * INC \quad (5.1)$$

where NCASH = meal price at the chosen food facility
BL = race is black
OTHER = race is non-white and non-black
MW = region is mid-West area
SO = region is South area
WE = region is West area
SP = season is Spring
SU = season is Summer
FA = season is Fall
INC = income
β_k = coefficient for each food category

In this equation, the meal price is included to capture the price effect on the type of food chosen. The race variables are included to see if there is a difference of food choice among the white, black and other races. The region variable is included to determine if food preferences differ among the regions. The season variable is included to see if food preference differ among the seasons. The null hypothesis is that there are no differences across race, region or season but three variables are included because they have been shown to be important in other FAFH analysis. An inclusive value (I_{ij}) is estimated by equation(3.6). Each meal type is hypothesized to be a normal good (service) and thus income is hypothesized to be positively related t the decision to dine out.

The equation for the utility from choosing food facility *j* given the decision to dine out has been made (i.e., i =1, when i=0 => does not dine out, i =1 => dines out).

$$V_{ji} = \alpha_1 * NTIME_j + \alpha_2 * INC + \alpha_3 * EDU + \alpha_4 * I_{ij} \qquad (5.2)$$

where NTIME = time to get to the food facility
INC = annual income
EDU = years of education
I_{ij} = inclusive value, determined by equation (3.6)

NTIME is a time measure in minutes to get to the chosen food facility from the place where the dining decision is made. The NTIME variable is intended to capture the effect of location of food facility on the decision to dine there. It is hypothesized that the less time it takes to get to a facility the more likely the consumer is to choose it for dining purposes. INC is intended to see whether higher income consumers are more likely to dine out in more expensive food facilities than are lower income consumer.

This role for income is beyond that associated with the selection of meals once the decision to dine out has been made.

An inclusive value (J_i) is calculated by equation (3.8). The inclusive value coefficient indicates substitutability across alternatives. If the inclusive value coefficient is greater than one then substitution the among nests is greater than substitution within nests.

The utility from choosing whether or not to dine out is

$$V_i = \gamma_0 + \gamma_1 * AGE + \gamma_2 * AGESQ + \gamma_3 * WAGE + \gamma_4 * SEX + J_i \qquad (5.3)$$

where AGE = age of the participants
AGESQ = squared age
WAGE = hourly wage rate for participants
SEX = gender (0 = male, 1 = female)
J_i = inclusive value

The WAGE variable is used for the value of time hypothesis and is assumed to be positive related to the opportunity cost of time. We expect that higher wage rate households tend to dine out more than do lower wage rate households. Since a higher wage rate indicates a higher opportunity cost of time, higher wage rate households are likely to dine out instead of preparing meals at home, in order to save cooking time. The AGE variable is included to see if older people tend to dine out more than younger people. To be consistent with FAFH research, a gender variable is included, although it is hypothesized that it plays no role in the decision to dine out.

5.2 Results

The equations were estimated via the LIMDEP program.

5.2.1 The Utility of Food Choice

The estimated coefficient on the NCASH variable, which is the price of the meal in equation (5.1), had a negative sign for food choices in mid-scale facilities and positive signs for those at both fast-food and up-scale facilities. The latter results suggest that, irrespective of food item, the higher the price the more likely consumer are to select it. It was conjectured that the reason for the positive price coefficient signs was the characteristic of the NCASH variable. Since NCASH variables are predicted by region and urbanization area, the estimated coefficient results from comparing price across, not within, regions (much like using nominal, rather than "real" prices in a time series analysis). In other words the actual relative prices faced by the consumer are not reflected by this specification. To correct this phenomenon, each household's NCASH figure was deflated by the price that household was estimated to pay for the "other food" category in a mid-scale restaurant. (The author is grateful to Dr. Seong-hoon Hong for this suggestion). Tables 6, 7, and 8 show the results of the first equation of the nested logit model.

Table 6. Food Choice Utility Estimates for Fast-Food Facilities

Variable Name	Coefficient	t-ratio
Constant	0.3542	4.428*
NCASH (beef)	2.8336	3.902*
NCASH (poultry)	-0.7209	-3.082*
NCASH (fish)	-0.1871	-3.762*
BL	0.5770	3.600*
OTHER	0.4236	2.891*
MW	0.4398	3.638*
SO	0.2481	3.480*
WE	-0.2615	-3.165*
SP	0.2050	2.809*
SU	0.1823	2.848*
FA	0.3160	4.333*
INC	-0.2047	-4.717*

* indicates significance at .05 level

Table 7. Food Choice Utility Estimates for Mid-Scale Facilities

Variable Name	Coefficient	t-ratio
Constant	1.2671	2.131*
NCASH (beef)	-0.0407	-2.147*
NCASH (pork)	-0.7659	-3.044*
NCASH (poultry)	-0.8075	-3.273*
NCASH (fish)	-0.5872	-2.852*
BL	0.2539	1.747**
OTHER	1.2450	5.600*
MW	0.1327	2.057*
SO	0.0658	2.188*
WE	-0.2179	-3.003*
SP	0.2885	4.763*
SU	0.1184	2.279*
FA	0.1866	3.021*
INC	-0.7525	-3.680*

* indicates significance at .05 level
** indicates significance at .10 level

Table 8. Food Choice Utility Estimates for Up-Scale Facilities

Variable Name	Coefficient	t-ratio
Constant	-1.5082	-4.462*
NCASH (beef)	0.3819	4.927*
NCASH (pork)	-0.2009	-2.058*
NCASH (poultry)	-0.0396	-2.544*
NCASH (fish)	0.4036	6.327*
BL	-0.6119	-2.548*
OTHER	-0.5510	-2.528*
MW	-0.3355	-3.873*
SO	0.2989	3.834*
WE	0.4436	4.546*
SP	0.9142	9.352*
SU	1.0215	4.530*
FA	0.9426	3.087*
INC	0.0755	3.713*

* indicates significance at .05 level

With the results of NCASH coefficients, the own price elasticity for each food category is reported in Table 9.

Table 9. Own Price Elasticity by Food Category

	beef	pork	poultry	seafood
Fast-Food				
NCASH	1.358	N/A	-0.490	-0.118
Mid-scale				
NCASH	-0.632	-0.527	-0.437	-0.558
Up-scale				
NCASH	0.287	-0.689	-0.349	0.745

The negative coefficient associated with each food category in the mid-scale facilities indicates that when the price of a particular meal -- beef, pork, poultry, fish-- increases, then the probability of choosing that food category decreases for the consumer who decides to dine out and to choose a mid-scale facility. This is also true for poultry and seafood in fast food facilities and for pork and poultry in up-scale facilities. On the other

hand, positive coefficients are reported for up-scale beef and fish products. One possible explanation for the finding that a food item would have a positive price elasticities in an up scale facility but a negative price elasticity in a mid-scale facility is the "shipping the good apples out" argument. [3]

Suppose each menu price consists of a "fixed" and a "variable" component. The variable portion is associated primarily with prices paid by the restaurant for the variable (especially entree) food items in the meal. The fixed component indicates the other costs: dishwashing, labor, food items served with every meal, etc. These fixed components are the same across menu items but are higher in the upscale restaurants than the mid-scale restaurant. [4] Now consider two menu items: poultry (p) and fish (f) and suppose the price of fish (pf) is greater than the price of poultry (pp) in both restaurants. Suppose that between 2 periods (t_1 and t_2), the variable component of the fish price (cf) rises while the variable component of the poultry price (cp) does not change. Suppose also that *cf* is greater than the *cp* is the same for the 2 restaurants. Finally suppose that, in addition to the increased in *cf*, the "fixed cost" components (k) also rise between t_1 and t_2.

So the question is: let *cf* rise and let *k* increase but *k* rise by the same percentage in the two restaurants. This means both *pf* and *pp* rise in both restaurants. But, if *pf/pp* falls, then we would expect the quantity of fish demanded - related to the quantity of poultry - to rise; if *pf/pp* rises, then the quantity of fish demanded to fall. Under what

[3] Dr. Richard Johnston shared his thoughts on this part.

[4] Dr. Carol Tremblay suggests that the time spent in an up-scale restaurant could be also viewed as a cost whose value is invariant with respect to meal choice.

circumstances then, would *pf/pp* fall or rise between t_1 and t_2 given the above changes in the *k* and *c* values ?

Suppose that

$$\text{at period } t_1 : \quad pf^1 = k + cf^1$$

$$pp^1 = k + cp^1$$

$$\text{so} \quad \frac{pf^1}{pp^1} = \frac{k + cf^1}{k + cp^1}$$

$$\text{at period } t_2: \quad pf^2 = \alpha k + cf^2$$

$$pp^2 = \alpha k + cp^1$$

$$\text{where} \quad \alpha > 1, \text{ and} \quad cf^2 > cf^1 > cp^1$$

$$\text{so} \quad \frac{pf^2}{pb^2} = \frac{\alpha k + cf^2}{\alpha k + cb^1}$$

under what circumstances is $\dfrac{pf^1}{pp^1} > \dfrac{pf^2}{pp^2}$?

That is, under what conditions on α and pf^2 will the relative price of fish fall even when the absolute price rises ?

In other words, when will

$$\frac{k + cf^1}{k + cp^1} > \frac{\alpha k + cf^2}{\alpha k + cp^1} \quad ?$$

$$\Longrightarrow \quad \frac{k + cf^1}{\alpha k + cf^2} > \frac{k + cp^1}{\alpha k + cp^1}$$

subtract $\frac{k+cp^1}{\alpha k+cf^2}$ from both sides,

so $$\frac{k+cf^1}{\alpha k+cf^2}-\frac{(k+cp^1)}{\alpha k+cf^2}>\frac{k+cp^1}{\alpha k+cp^1}-\frac{(k+cp^1)}{\alpha k+cf^2}$$

==> $$\frac{k+cf^1-k-cp^1}{\alpha k+cf^2}>(k+cp^1)\left[\frac{1}{\alpha k+cp^1}-\frac{1}{\alpha k+cf^2}\right]$$

==> $$\frac{cf^1-cp^1}{\alpha k+cf^2}>(k+cp^1)\left[\frac{(\alpha k+cf^2)-(\alpha k+cp^1)}{(\alpha k+cp^1)(\alpha k+cf^2)}\right]$$

==> $$\frac{cf^1-cp^1}{k+cp^1}>\frac{cf^2-cp^1}{\alpha k+cp^1}$$

==> $$\frac{\alpha k+cp^1}{k+cp^1}>\frac{cf^2-cp^1}{cf^1-cp^1}$$

This says that we can expect *pf/pp* to fall if the relative increase in the difference between the two variable costs is less than the relative increase in *pp* -- in other words, the "fixed cost" component must dominate, a situation that is characteristic of the restaurant industry. If the inequality is reversed, then *pf/pp* will rise. It is possible then, that there are condition under which when the price of the more expensive good increases its relative price decreases and thus quantity demanded rises. This could lead

positive relationship between the price of the more expensive good (fish) and the quantity of fish demanded.

In the present study relative - not nominal, prices are used. However the deflator of all price is the price of "other foods" in the mid-scale facility. A test of the above hypothesis, then, cannot be made but must await further study.

It is worth noting that relative food prices in the mid-scale and up scale facilities are consistent with the "shipping the good apples out" argument, at least for the averages of the prices used in this study. The relative price ratios are reported in Table 10.[5] The ratios for Table 10 are the average of the ratios from predicted NCASH.

Table 10. Price Ratios Between Food Prices by Food Facility

Food Facility	$P_{seafood} / P_{beef}$	$P_{seafood} / P_{poultry}$	$P_{seafood} / P_{pork}$
Fast-food	1.31	0.95	N/A
Mid-scale	1.44	1.66	2.23
Up-scale	1.35	1.33	1.51

Table 10 shows that the averages of the up-scale price ratios are closer to 1 than are their mid-scale counterparts. This suggests that higher price meals suppose to be relatively cheaper in up scale than in mid-scale restaurants.

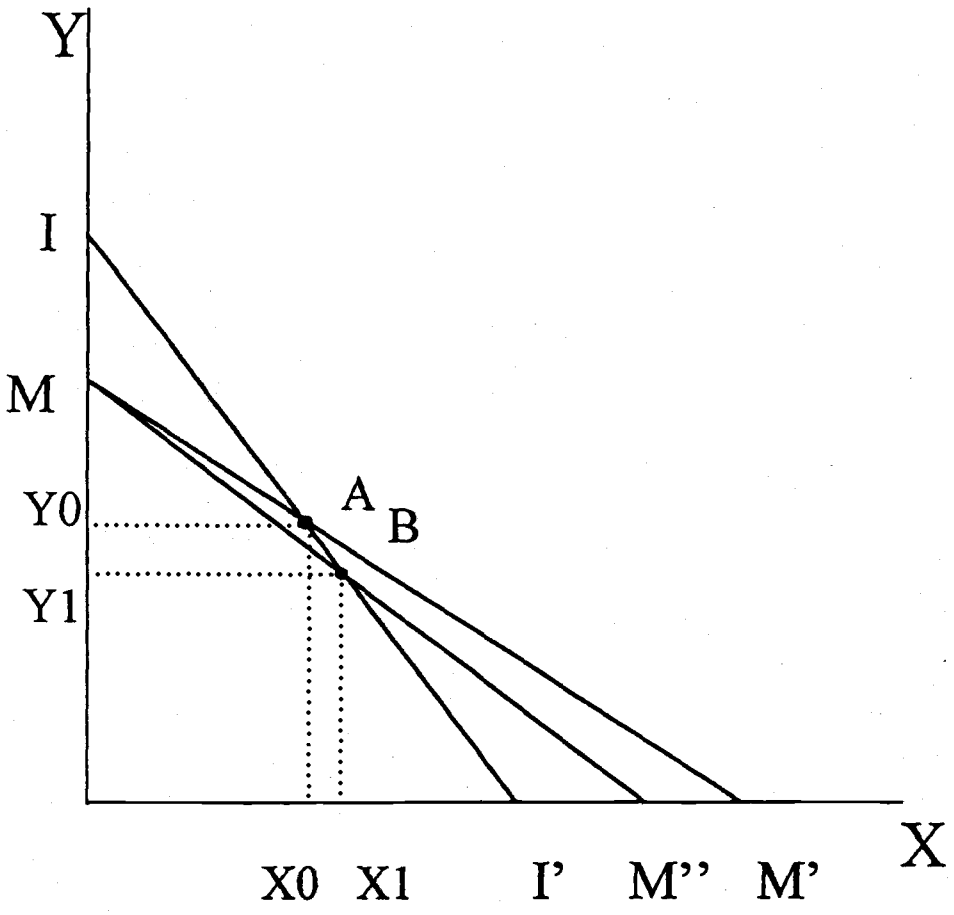
[5] Simple regression on $P_{seafood} / P_{poultry}$ and $P_{seafood}$ shows negative signs.

It is unlikely that this framework is helpful in understanding the positive own-price elasticity estimated from data for fast food dining if only because the price of a beef is the least, not the most, expensive food option. One possible explanation is a variation on the "Giffen behavior model" (Johnston and Larson, 1994). According to the Johnston and Larson study, Giffen behavior implies that there are circumstances in which increased prices of a low-priced item leads to a rise in quantity demanded.

Suppose there are two binding upper constraints for the consumer to choose a meal. One is an upper limit to the total number of meals ate. Consumer will purchase in a given period - two wkkds, in this study. The line I I' in figure 8 shows this constraints and is called the "satiation frontier". The other constraint is the budget constraint, which is line MM' in figure 8. The axes in figure 8 show number of X meals (beef at fast food) and Y meals (beef at home) per period of time. For X to be Giffen requires that price of beef at fast food has to be cheaper than the price of beef at home - considering the opportunity cost of preparation time, and so on.

The consumer consumes $0Y_0$ beef at home and $0X_0$ beef at the fast food facility. When beef price in the latter goes up, the budget line shifts to MM'' and quantity of beef demanded at the fast food restaurant increase from $0X_0$ to $0X_1$. Johnston and Larson wrote, "the intuition is especially clear if the two goods are nearly perfect substitutes in achieving satiation: the less expensive good provides the least-cost way of reaching satiation, even for own-price increases, so long as it remains the least-cost source of satiation of the two goods". The positive elasticity of demand for beef at fast food facilities can, perhaps, be explained by this Giffen-like behavior.

Figure 8. Giffen Behavior with Two Binding Upper Constraints



Again, as in the case of the positive price elasticities in the fast scale restaurant, this is a hypothesis to be tested via future research. A full-scale test would require data on beef purchase for at-home consumption.

The conditional probabilities of food choice by race and region are calculated. The dummy variables for race and region can be analyzed by comparing the probabilities that result when the variable takes its two different values (0,1) with those that occur with other variables held at their sample means. The equation 5.1 and 3.5 were used for the calculations. Tables 10, 11 and 12 show the results. The probability patterns are similar at up-scale facilities, with seafood dominating the other food categories. In mid-scale restaurants, whites are more likely to choose beef than they are the other categories; pork slightly dominates for blacks; and the "other" group is more likely to select seafood. The probability figures are remarkably similar, as is the case in fast food facilities, where the highest probability figures for blacks, others and whites are beef, poultry and seafood, respectively. The last of these was not expected and may be a consequence of focusing on single person households.

Table 11. Probabilities of Choosing Particular Food Categories At Fast-Food Facilities by Race

	beef	poultry	seafood
Black	0.3508	0.3322	0.3170
Other	0.3326	0.3375	0.3299
White	0.3113	0.3440	0.3447

Table 12. Probabilities of Choosing Particular Food Categories At Mid-Scale Facilities by Race

	beef	pork	poultry	seafood
Black	0.2533	0.2557	0.2502	0.2408
Other	0.2410	0.2432	0.2380	0.2778
White	0.2747	0.2484	0.2430	0.2339

Table 13. Probabilities of Choosing Particular Food Categories At Up-Scale Facilities by Race

	beef	pork	poultry	seafood
Black	0.2454	0.2401	0.2136	0.3396
Other	0.2555	0.2213	0.2345	0.2887
White	0.2452	0.2011	0.2144	0.3393

Table 14. Probabilities of Choosing Particular Food Categories At Fast-Food Facilities by Region

	beef	poultry	seafood
Midwest	0.3908	0.3901	0.2191
South	0.2189	0.3891	0.3920
West	0.2746	0.3623	0.3630
Northest	0.2200	0.3791	0.3998

Table 15. Probabilities of Choosing Particular Food Categories At Mid-Scale Facilities by Region

	beef	pork	poultry	seafood
Midwest	0.2543	0.2557	0.2492	0.2408
South	0.2547	0.2487	0.2313	0.2585
West	0.2044	0.2722	0.2664	0.2569
Northest	0.1598	0.2875	0.2813	0.2714

Table 16. Probabilities of Choosing Particular Food Categories At Up-Scale Facilities by Region

	beef	pork	poultry	seafood
Midwest	0.5014	0.4114	0.0534	0.0338
South	0.2454	0.2014	0.2136	0.3396
West	0.2445	0.2006	0.2128	0.3421
Northwest	0.2541	0.2016	0.2210	0.3233

Some regional differences appeared. Single-person households in the Midwest showed higher probabilities of choosing beef and poultry than the other categories irrespective of type of restaurant. Seafood appears to play a similar role for Northeast consumer. Patterns in the West and the Northeast are similar: poultry and seafood dominate beef in fast food restaurants; pork has the highest probability figures in mid-scale facilities, although they are only slightly higher than those for poultry; seafood is the clear leader at up-scale restaurants.

These differences across regions and race were not expected and explanations are not readily apparent. In the cases of beef in the Midwest and seafood in the other three regions supply may be a factor. That is there may be relatively more restaurants in the Midwest that specialize in beef and more seafood restaurants in the other regions, all of which are characterized by ocean coastlines.

Additional support for the "shipping the good apples out" hypothesis is provided by the seafood probability figure of Tables 13 and 16 with those of Tables 12 and 15. For all races and all regions except the Midwest, the "up scale" probabilities are higher than their corresponding "mid-scale" figures. Faced with relatively less expensive seafood, up-scale restaurant diners are more likely to select seafood than are their mid-scale counterparts.

5 . 2 . 2 The Utility of Food Facility Choice Results

Tables 17 - 19 reports the findings from that part of the model that focuses on the choice of the restaurant facility. The NTIME coefficient is statistically significant and

has a negative sign in each of Tables 17 and 18. This indicates that if either a fast-food or mid-scale restaurant is far from the consumer's location, the lower the probability of visiting that facility.

Table 17. Fast-Food Facility Choice Utility Estimates

variable	coefficient	t-ratio
NTIME	-0.2226	-2.536*
INC	-0.6168	-3.889*
EDU	-0.8868	-6.746*
Inclusive Value	1.3609	3.315*

* indicates significance at .05 level

Table 18. Mid-Scale Facility Choice Utility Estimates

variable	coefficient	t-ratio
NTIME	-0.2281	-3.266*
INC	0.2208	3.281*
EDU	-0.2267	-6.904*
Inclusive Value	1.7954	5.993*

* indicates significance at .05 level

The marginal effects for the INC and EDU are calculated by food facility. The results are exhibited in Table 19. Since the up-scale facility was used as the "base" in estimation, the partial derivatives of equation 3.7 show the marginal effects of the regressors on probabilities. The result of taking the partial derivative of equation 3.7 with respect to X_i is

$$\frac{\partial P_{ji}}{\partial X_i} = P_{ji}\left[\beta_j - \sum_m P_{mi}\beta_m\right] \qquad (5.3)$$

where P_{ji} is the probability of choosing a fast food or mid-scale facility and $\sum_m P_{mi}\beta_m$ stands for the summation of that probability times the corresponding coefficient for the fast food or mid-scale facility.

Table 19. Marginal Effect for Choosing Food Facility by Income and Education

	Fast Food	Mid Scale	Up Scale
INC	-0.1040	0.0968	0.0112
EDU	-0.0353	0.0134	0.0342

The result from estimated marginal effect of income indicates that higher income households are less likely to choose fast food restaurants. The higher education

households had higher probabilities of visiting mid-scale and up-scale restaurants than fast food restaurants.

The inclusive value coefficients are greater than 1 and the condition that for utility maximization, the inclusive value coefficient is less than $1/(1-P_k)$, where P_k is the probability to choose k, is satisfied. This implies that substitution among nests (i.e., from one type of food facility to another) occurs more readily than substitution within nests (i.e., from one food category to another).

5.2.3 The Utility of Dining Out Result

Finally, Table 20 reports on the results of examining the decision of whether or not to dine out. The estimated coefficients on both the age and wage variables are negative and statistically significant, indicating that the probability of not dining out is lower the older the consumer or the higher his or her opportunity cost of time. Younger households showed a lower probability of dining out and older households had a higher probability of dining out. The higher wage rate households had a higher probability of choosing to dine out. No statistically significant difference is found between the likelihood of males and females deciding to dine out.

Table 20. Utility Estimates for Choose Not to Dine Out

variable	coefficient	t-ratio
Constant	39.0012	1.068
AGE	-22.0451	-1.739*
AGESQ	3.8101	1.455
WAGE	-0.4860	-3.307*
SEX	-0.0942	-0.259
Inclusive Value	2.6969	6.296*

* indicates significance at .05 level

CHAPTER VI

SUMMARY AND CONCLUSIONS

The increasing demand for meals eaten away from home has increased the interest in a complete understanding of FAFH consumption patterns in the U.S. Most previous FAFH studies have treated expenditure in the aggregate and no previous examinations have examined the relationship between FAFH consumption and meal prices. This study developed theoretical and empirical models to determine the effects not only of demographic and socioeconomic factors but also of prices on decision-making for FAFH.

The National Panel Diary (NPD) data for the year 1989 on single person households were used for the analysis and were obtained from the USDA. Single person households were chosen because their expenditures in a meal could be used as a measure of the price of that meal. The data set also contained demographic information and purchase information. The demographic information for the household included household composition, race, income, education, labor hours worked, residence location, age, and gender. The information on purchases included the cost of the meal, types of food consumed, and the type of food facility.

The three step nested-logit model was used to examine the FAFH decision process as a whole. These steps are: first, the consumer decides whether to eat out; second, if he/she decides to dine out then he/she chooses the type of food facility - fast-food, mid-

scale, or up-scale facility; third, given the food facility, the consumer chooses from among five food categories: beef, pork, poultry, seafood or other foods.

With respect to the role of price in selecting particular food categories, the estimated elasticities were negative in all cases except for beef in the fast-food facilities and beef and seafood in up-scale restaurants. In these three cases the estimated elasticity figures were positive. In all cases the estimated price elasticities were based coefficients that were on asymptotically statistically significant (at the 5 % level).

Two possible explanations are offered for the positive price elasticities: the relative price effect and Giffen behavior. The relative price effect is associated with the "shipping the good apples out" proposition under which the relative price of a high priced good increases even though its absolute price decreases, leading to an increase in the share of the high priced good demanded. This may lie behind the positive price elasticities associated with the most expensive meal items (beef and seafood) in up-scale restaurants. Giffen behavior is also a case in which increased prices lead to a rise in quantity demanded. This behavior is generally associated with relatively low-priced items. This could help explain the finding of a positive price-quantity relationship for the low-priced beef meal in fast food restaurants.

In all cases where the estimated price elasticity was negative, its magnitude (in absolute value) was less than unity. These price-inelastic demands suggest that, at least with respect to these broadly-defined meal categories, each category has its own "market niche".

Several other findings for particular food categories emerged. At fast-food facilities, single person white households have a higher probability of choosing seafood than other

meal items while black households have a higher probability of choosing beef. Both white households and black households tend to choose more seafood products when dining at up-scale facilities, while Hispanic and Asian households have a higher likelihood of consuming seafood at mid-scale facilities. Midwest region households (single-person) have a higher probability of choosing beef and pork, when compared to households from the other regions. South, West, and Northeast region households show a higher likelihood of choosing seafood products when dining at up-scale restaurants. Recall that, in all cases, the results pertain to single person households.

In the equation pertaining to the selection of food facility, the time to get to that facility carries a negative coefficient. The longer the time it takes to get to a restaurant the less likely is the consumer to dine there. For example, a hamburger selling for $1.65 at a fast-food restaurant only three blocks from one's home, when compared to one for $1.45 at a restaurant two miles away, is differentiated by location. The consumer may choose the $1.65 hamburger because the more expensive one is the more economical purchase due to the reduced transportation and time costs.

The results of examining the role of income in choosing among types of facility show that higher income, single-person households usually have a lower demand for dining at fast-food facilities. This result suggests that, even though the higher income households have higher opportunity costs, they choose to visit the more expensive facilities because they can afford better quality food, better quality service, or a dining experience that includes a recreational component. The higher education households have a higher probability of choosing mid-scale and up-scale facilities. This finding may indicate that

upper income, upper education, single person households are not only concerned with healthy diets but also demand higher quality food and food service.

Older householders show a higher probability of dining out. The higher wage rate households also have a higher probability of dining out because the opportunity cost of time for higher wage rate households is higher.

In contrast to the results of earlier studies this work suggests that, when meal prices are included in the analysis some of the earlier findings are confirmed while others are not. Among the former are: older householders are more likely to dine out and householders with a higher opportunity cost of time have a higher probability to dine out. Among the latter are: different role for race and region than reported by others and the time to get to the food facility is an important determinant of where to dine and different preferences of meal items among races and regions.

Finally this study has generated some hypotheses about the FAFH decision that merit further investigation. Additional analysis of the role of price, especially if this can be extended to the case of larger households, should address this study's findings of some positive price-elasticities of demand. Meanwhile it is hoped that the present analysis contributes to understanding a complex decision process associated with consumption of food in the United States.

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APPENDIX

Table A1 Estimated NCASH by Fast-food Beef

Variable	Coefficient	t-ratio
Constant	2.5120	19.657
URB2	-0.0349	-3.377
URB3	0.1464	1.598
REG2	-0.3605	-3.896
REG3	-0.2166	-2.431
REG4	-0.1770	-1.612
LUNCH	1.0440	5.481
DINNER	1.7500	6.994

R-square	0.0589
Adjusted R-square	0.0575
Number of Observations	2063

Table A2 Estimated NCASH by Fast-food Poultry

Variable	Coefficient	t-ratio
Constant	4.3467	3.356
URB2	-0.0710	-3.355
URB3	-0.0644	-2.321
REG2	-0.7175	-3.337
REG3	-1.0425	-4.996
REG4	-0.0719	-0.297
LUNCH	0.4483	2.351
DINNER	1.6117	1.260

R-square	0.0527
Adjusted R-square	0.0494
Number of Observations	768

Table A3 Estimated NCASH by Fast-food Seafood

Variable	Coefficient	t-ratio
Constant	2.6148	1.489
URB2	-0.1574	-1.597
URB3	-0.0050	-2.016
REG2	-0.6386	-1.988
REG3	-0.4737	-1.551
REG4	0.0665	0.174
LUNCH	1.9687	1.135
DINNER	2.9029	1.672

R-square	0.0252
Adjusted R-square	0.0182
Number of Observations	362

Table A4 Estimated NCASH by Fast-food Other Food

Variable	Coefficient	t-ratio
Constant	2.7986	7.879
URB2	0.1621	2.682
URB3	-0.2663	-1.154
REG2	0.0716	0.325
REG3	0.4478	2.037
REG4	0.0805	0.339
LUNCH	1.6023	5.555
DINNER	4.5947	1.033

R-square	0.1385
Adjusted R-square	0.1365
Number of Observations	1232

Table A5 Estimated NCASH by Mid-scale Beef

Variable	Coefficient	t-ratio
Constant	3.3574	6.108
URB2	0.3013	1.234
URB3	1.0503	4.281
REG2	-0.6531	-2.705
REG3	-0.3542	-1.503
REG4	0.6104	2.098
LUNCH	1.4971	2.955
DINNER	4.2664	8.303

R-square	0.0852
Adjusted R-square	0.0834
Number of Observations	1191

Table A6 Estimated NCASH by Mid-scale Pork

Variable	Coefficient	t-ratio
Constant	5.9918	11.663
URB2	-0.3430	-0.875
URB3	0.5780	1.459
REG2	-1.1973	-3.093
REG3	-0.6255	-1.522
REG4	-0.7984	-1.731
LUNCH	-0.2164	-0.638
DINNER	2.7957	7.229

R-square	0.0656
Adjusted R-square	0.0613
Number of Observations	549

Table A7 Estimated NCASH by Mid-scale Poultry

Variable	Coefficient	t-ratio
Constant	6.5300	3.098
URB2	0.1052	0.246
URB3	1.1868	2.733
REG2	-1.6583	-3.841
REG3	-1.2885	-2.950
REG4	-0.5225	-0.967
LUNCH	0.7283	0.260
DINNER	2.7183	1.315

R-square	0.0672
Adjusted R-square	0.0637
Number of Observations	519

Table A8 Estimated NCASH by Mid-scale Seafood

Variable	Coefficient	t-ratio
Constant	6.5228	2.348
URB2	-0.1184	-0.168
URB3	1.3104	1.874
REG2	-0.8616	-1.484
REG3	-0.2167	-0.389
REG4	1.3053	1.949
LUNCH	-0.3390	-0.125
DINNER	4.4429	1.633

R-square 0.0731

Adjusted R-square 0.0697

Number of Observations 550

Table A9 Estimated NCASH by Mid-scale Other Food

Variable	Coefficient	t-ratio
Constant	4.4423	3.051
URB2	0.2379	2.783
URB3	0.9386	3.199
REG2	-0.9007	-3.472
REG3	-0.2524	-0.943
REG4	0.2857	1.006
LUNCH	0.8914	4.191
DINNER	4.1529	7.523

R-square	0.1009
Adjusted R-square	0.0990
Number of Observations	1186

Table A10 Estimated NCASH by Up-scale Beef

Variable	Coefficient	t-ratio
Constant	5.4326	0.914
URB2	2.8459	1.304
URB3	3.5978	1.713
REG2	-6.7327	-4.337
REG3	-3.7656	-2.420
REG4	-5.7191	-3.442
LUNCH	5.5089	0.996
DINNER	6.4348	2.982

R-square 0.0914

Adjusted R-square 0.0864

Number of Observations 428

Table A11 Estimated NCASH by Up-scale Pork

Variable	Coefficient	t-ratio
Constant	6.5746	2.298
URB2	-0.1546	-0.065
URB3	0.5798	0.260
REG2	1.9090	1.203
REG3	2.1609	1.352
REG4	1.4858	0.802
LUNCH	2.9914	1.432
DINNER	7.8645	3.768

R-square	0.0575
Adjusted R-square	0.0422
Number of Observations	138

Table A12 Estimated NCASH by Up-scale Poultry

Variable	Coefficient	t-ratio
Constant	6.5515	1.577
URB2	-0.7325	-0.351
URB3	1.6897	0.844
REG2	-5.1012	-3.631
REG3	-3.0672	-2.209
REG4	-4.9220	-3.060
LUNCH	-2.7468	-0.267
DINNER	2.9628	0.288

R-square	0.0689
Adjusted R-square	0.0603
Number of Observations	231

Table A13 Estimated NCASH by Up-scale Seafood

Variable	Coefficient	t-ratio
Constant	12.7800	1.484
URB2	3.2587	1.580
URB3	7.4475	3.796
REG2	-7.4479	-4.979
REG3	-5.0842	-3.723
REG4	-4.8809	-3.068
LUNCH	-0.9842	-0.116
DINNER	10.9379	1.295

R-square	0.0982
Adjusted R-square	0.0941
Number of Observations	476

Table A14 Estimated NCASH by Up-scale Other Food

Variable	Coefficient	t-ratio
Constant	6.9484	4.737
URB2	0.8343	0.718
URB3	2.6317	2.386
REG2	-3.1249	-3.615
REG3	-2.3387	-2.956
REG4	-1.6661	-2.021
LUNCH	2.1225	2.208
DINNER	8.5733	9.282

R-square	0.0986
Adjusted R-square	0.0949
Number of Observations	673

Table A15 Estimated NTIME by Fast Food Facility

Variable	Coefficient	t-ratio
Constant	7.2789	3.222
AGE	0.0652	4.589
NINC	-0.0001	-0.102
SEX	0.8445	2.358
BLACK	-0.1328	-1.403
OTHER	-0.8739	-0.753
URB2	-0.8442	-1.362
URB3	-0.8492	-0.728
WKD	1.5923	3.172
HOME	-0.8184	-2.450
WORK	-0.3832	-1.493
REC	1.8353	1.010

R-square	0.1080
Adjusted R-square	0.1019
Number of Observations	4425

Table A16 Estimated NTIME by Mid-scale Facility

Variable	Coefficient	t-ratio
Constant	6.5675	2.167
AGE	0.0928	1.161
NINC	-0.0034	-2.730
SEX	1.6923	2.321
BLACK	0.4872	1.231
OTHER	2.6621	1.872
URB2	-1.9300	-1.040
URB3	-1.9122	-1.193
WKD	1.9448	2.676
HOME	1.6127	1.427
WORK	0.4167	2.551
REC	4.3372	1.586

R-square 0.1416

Adjusted R-square 0.1389

Number of Observations 3995

Table A17 Estimated NTIME by Up-scale Facility

Variable	Coefficient	t-ratio
Constant	9.4123	4.935
AGE	0.1313	3.332
NINC	-0.0024	2.246
SEX	0.7262	2.806
BLACK	-0.4589	-1.696
OTHER	-1.3728	-1.655
URB2	-2.6341	-2.149
URB3	-2.5863	-2.878
WKD	1.7211	3.341
HOME	1.7629	3.363
WORK	0.1721	0.754
REC	4.3375	2.445

R-square	0.0904
Adjusted R-square	0.0872
Number of Observations	1910