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Convenience, Accessibility, and the Demand for Fast Food

Mark D. Jekanowski, James K. Binkley, and James Eales

This study explores the growth in demand for fast food. A distinguishing characteristic of fast food is its convenience; in today's pervasive marketplace, consumers need not travel far to find a fast food outlet. This greater availability translates into a decrease in the full price of obtaining a meal, which contributes to greater consumption. Market-level data are used to estimate demand equations in two time periods, incorporating changes in availability as well as prices, income, and various demographic characteristics. Our findings show that greater availability has led to increased consumption. Failure to account for these types of marketplace changes could lead to incorrect inferences regarding the factors responsible for the industry growth.

Key words: convenience, fast food, supplier-induced demand, travel costs

Introduction

U.S. food consumption patterns have altered dramatically over the past several decades, with the greatest change being the rise in consumer expenditures on meals prepared outside the home (food away from home, or FAFH hereafter). In 1997, FAFH accounted for about 45% of total food expenditures, up from approximately 26% in 1960 (Manchester and Clauson). Several consumer demand studies have examined FAFH expenditures (e.g., Kinsey; Redman; Lee and Brown; Sexauer; Prochaska and Schrimper; Yen; Byrne, Capps, and Saha 1996, 1998). Nearly all earlier studies have emphasized the importance of household time and the rising value of convenience as factors driving FAFH consumption. Hence, variables measuring time costs, such as hours worked and female labor force participation, are typically included in estimated models, along with income and demographic characteristics. Convenience measures are often found to be important determinants of food consumption patterns.

Symptomatic of the importance of convenience is a dramatic change *within* the FAFH market: the share of away-from-home food expenditures spent on fast food has been increasing steadily for several decades. In 1967, fast food accounted for 14.3% of total away-from-home food expenditures, and by 1999 it reached 35.5% (U.S. Department of Agriculture/Economic Research Service). Despite its growing importance, fast food has received little detailed attention in the academic literature, being considered in but a few of the FAFH studies (e.g., McCracken and Brandt; Brown; Ekelund and Watson; Hiemstra and Kim; Byrne, Capps, and Saha 1998).

Mark D. Jekanowski is a senior consultant with Sparks Companies, Inc., McLean, Virginia. James K. Binkley is professor, and James Eales is associate professor, both in the Department of Agricultural Economics, Purdue University. The authors wish to thank the *JARE* editor and two anonymous reviewers for helpful comments.

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In past research examining demand for FAFH, "convenience" has mainly been defined as arising from the time saved by avoiding meal preparation. Consequently, emphasis has been placed on factors such as spouse employment and imputed time values. While this view is generally sufficient for FAFH as a whole, it is somewhat limited in the specific case of fast food. What distinguishes fast food from other types of FAFH is that it is indeed fast—near immediate service, providing a consistent and popular product. Because of the standardized menu and consistent quality, only minimal time need be spent obtaining product information. But these inherent advantages of fast food are of little consequence unless the food is easily available. Consumers will not travel far for "reasonably good" food, nor will they drive 15 minutes to save 10 minutes in service time.[1] Thus a third characteristic of fast food is critical: outlets are generally in easily reached, nearby locations.

Accessibility is the *leitmotif* of industry strategy, as is apparent in the emphasis on market penetration. The National Restaurant Association, in its trade publication *Restaurants USA*, notes:

> Operators recognize consumers' need for convenience. Unit expansion continues to be a key component of rapid growth in the limited-service segment, and higher unit counts translate into greater consumer convenience, which in turn drives sales (*Restaurants USA*, December 1996, p. 13).

McDonald's, the fast food industry leader, avows a proactive stance that might be described as an "in-your-face" strategy. As articulated in the corporation's 1994 annual report:

> McDonald's wants to have a site wherever people live, work, play, or gather. Our Convenience Strategy is to monitor the changing lifestyles of consumers and intercept them at every turn. As we expand customer convenience, we gain market share (McDonald's Corporation USA, *1994 Annual Report*, p. 8).

The current industry emphasis on "satellite" restaurants reflects this strategy. These smaller, limited-menu, lower-volume units have considerably lower construction and operating costs, and tend to be placed on leased property, further reducing the cost of expansion. They are often joined with convenience stores and gasoline stations, and in some cases are placed inside large retail stores.

In this study, we focus exclusively on fast food, and thus we emphasize the role of market penetration as an explanatory factor, while considering prices, income, and other variables traditionally included in demand studies. In order to develop an accessibility measure and measures of price, we examine consumption across markets. With few exceptions, previous research in FAFH demand has been based on household survey data.

In the next section, we illustrate how availability can be modeled as a component of the full price faced by consumers. The empirical analysis that follows reveals this aspect of convenience to be a key factor in explaining the long-term increase in meals prepared outside the home, especially fast food.

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[1] Hiemstra and Kim found the average travel time to fast food outlets was 11 minutes, compared to 14 minutes for restaurants.

Relationship Between Accessibility and Quantity Demanded

Much of household production theory, on which convenience arguments are founded, is simply a monetization of nonmarket costs incurred by the consumer. A basic premise is that along with goods and services, time is incorporated into the utility-maximization problem (Becker). Consumers are concerned not only with the retail price of a product, but also with the time costs incurred when purchasing and consuming the product. The "full price" (P) is the sum of these two components, i.e., $P = p + vt$, where p is the retail price paid at the counter, t is the time necessary to complete the transaction, and v is the consumer value of time. Fast food suppliers emphasize minimization of time costs, that is, the maximization of convenience.

An important component of time costs is the time spent traveling to the retail outlet, which is a direct function of distance. Construction of new outlets can decrease the distance a consumer must travel, thereby lowering the full price of the product and increasing the frequency of purchase. Crafton employed a model based on time costs to describe price differences between convenience stores and supermarkets, but he focused on time spent inside the establishment, holding travel distance constant. We focus instead on travel time, which for fast food is perhaps the largest component of time costs. The following illustration shows the effect of travel time on quantity demanded.

In figure 1 we consider two consumers with identical preferences and equal income levels, but located at different distances from a retail outlet. To purchase a fast food meal, consumer 1 must travel distance r_1 to the outlet at a cost per unit of distance c, making the full price of the product $P = p + cr_1$. Consumer 2 resides further from the outlet, so must travel distance r_2, where $r_2 > r_1$. Assuming the same retail price p and cost per unit of distance c, consumer 2 will always face a higher full price than consumer 1, i.e., $P = p + cr_2 > P = p + cr_1$. Because the *full price* determines quantity demanded, consumer 1 will demand Q_1, and consumer 2 will demand Q_2, where $Q_2 < Q_1$. If travel costs were absent, each consumer would demand quantity Q_0. In an empirical setting, ignoring travel costs could lead to the appearance of unequal preferences, as consumer 1 will always demand more than consumer 2 at any given retail price. Similarly, changes in travel costs over time could be improperly attributed to a shift in demand, rather than a movement along the demand curve.

If a new outlet is constructed closer to either consumer, r for that consumer will fall, resulting in greater quantity demanded. Thus, $\bar{r}$, the average distance any consumer must travel, falls as new outlets are constructed within a market. Quantity demanded in the market increases even if the retail price p remains unchanged. The industry emphasis on market penetration is simply a recognition that $\bar{r}$ is a function of the number of outlets in the market, n, as reflected in a recent *Forbes Magazine* article:

> The more stores McDonald's puts in a city, the greater the overall number of transactions *per capita* in that market. Put another way, Greenberg's Law [after Jack Greenberg, McDonald's USA chairman] holds that the number of per capita transactions varies proportionately with penetration in a market (Samuels, p. 47).

Because the price consumers incur is $P = p + c\bar{r}$, reducing $\bar{r}$ by increasing n is (to the consumer) tantamount to a reduction in the menu price p. This effect can hardly be ignored, because $\bar{r}$ has surely fallen significantly: the number of retail fast food outlets

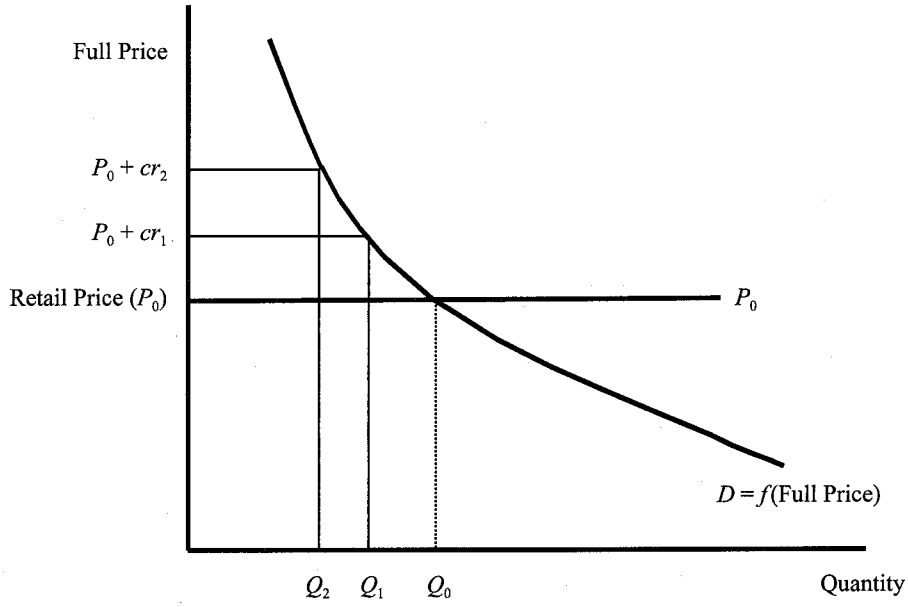

Figure 1. Quantity consumed as a function of retail price plus transportation costs

in the United States increased nearly 78% between 1977 and 1992 [U.S. Department of Commerce (USDC), *Census of Retail Trade*]. Penetration into previously untapped (e.g., rural) markets can be viewed as an extreme reduction in travel costs (distance)—even consumers in the hinterlands *could* travel to an established market area if absolutely necessary. The distance consumers are *willing* to travel is what defines a retail boundary.

Travel distance for the average consumer ($\bar{r}$) is not directly measurable, but given $\bar{r} = f(n)$, in an empirical analysis a measure can be based on n.[2] We use the number of outlets per square mile (outlet density) and its square, which not only represents the first two terms in a Taylor series approximation of $\bar{r}$, but also allows for diminishing returns to outlet density. Capturing possible diminishing returns is important given long-held industry concerns over saturation of markets (e.g., Emerson).

Travel cost per unit of distance (c in the above analysis) corresponds to the opportunity cost of time in a traditional household production model. In our model, opportunity costs of time are equally important; it is the value of the time spent traveling that is a primary determinant of the consumer's willingness to travel a given distance. Of course, there are also directly observable costs of travel for an individual, such as depreciation of an automobile, fuel expenses, and repairs, but these are unlikely to play a significant role in the overall decision to travel to a fast food outlet. The cost of travel, from an opportunity-cost-of-time perspective, depends on such factors as traffic congestion, road quality, availability of sidewalks, and other determinants that can affect the speed and ease with which a given distance can be covered.

[2] The problem of determining the distance for a consumer to the nearest outlet is formally equivalent to the problem of determining the price paid for a good by a price searcher observing n prices. This problem was introduced by Stigler in his seminal work on the economics of information.

The relation between time costs and consumer demand has been studied in other contexts. DeVany found retail outlet density and outlet size affect demand through changes in consumers' expectations of time waiting in line. By increasing firm capacity, or outlet density, demand will increase because of the decreased likelihood the consumer will experience the cost of waiting in a long queue. Decreasing this uncertainty increases the willingness of consumers to travel to a retail outlet, because the expected value of their total time costs (travel time plus time spent waiting in line) is reduced.

As demonstrated by Baumol and Ide, the breadth of product offerings by a firm can have a similar effect on willingness to travel. They note increased variety will, up to a point, increase the willingness of consumers to travel further distances by increasing the probability that all their needs are met by a single location. Firms will add products or menu items until the marginal benefit from increased sales equals the marginal cost of providing these additional items. Of course, in a fast food setting, the additional items must not compromise the simplicity of the menu, and the speed and convenience with which purchases can be made—so "value meals" and "order-by-number" options remain at the center of even the most extensive fast food menus.

The increase in individual demand owing to lower transport costs (or possibly lower search costs) and the consequent "shift" in *aggregate* demand has been labeled "supplier-induced demand." The premise is that firm location strategy can directly affect consumer transportation costs, and therefore quantity demanded. Supplier-induced demand has been investigated by several researchers, often in the context of healthcare services (e.g., Newhouse; Evans, Parish, and Sully; Anderson, House, and Ormiston). For a general treatment of this topic, interested readers are referred to Benson.

Model Specification

To explore the relationship between outlet penetration and per capita fast food sales, we construct a demand model to control for various measures of travel costs, and estimate it using cross-section data from two distinct time periods between which accessibility to fast food has clearly increased. We examine U.S. Department of Commerce/Bureau of the Census data from 1982 and 1992, the most recent years for which a complete set of data is available from both the *Census of Retail Trade* (conducted in five-year intervals) and the decennial Census (years 1980 and 1990). Fortuitously, the 1980s and early 1990s were also periods of rapid growth for the domestic fast food industry, making these especially interesting periods to examine.

The demand equation was formulated as follows:

$$\text{(1)} \qquad \textit{Per Capita Fast Food Consumption} = f(\textit{market characteristics, prices and income, demographics, regional indicators}).$$

Equation (1) was estimated for both 1982 and 1992 using the same cross-section of 85 metropolitan areas. Measures of time costs, or availability, are included under the "market characteristics" variables. Each of the variables are described more fully below.

Data Description

All data are at the Metropolitan Statistical Area (MSA) level, and are readily available from public sources. Most of the variables were compiled from the *USA Counties, 1996*

Table 1. Means and Standard Deviations of Variables, 1982 and 1992 ($N = 85$ U.S. Metropolitan Statistical Areas)

Variable	Units	1982		1992	
		Mean	Std. Dev.	Mean	Std. Dev.
Dependent Variable:					
Fast Food Consumption per Capita	(sales/price)/population	87.19	25.05	117.20	26.69
Market Characteristic Variables:					
▸ Fast Food Outlet Density	outlets/100 sq. mi.	12.61	7.50	20.23	11.89
▸ Inexpensive Restaurant Density	outlets/100 sq. mi.	7.53	4.58	11.01	6.12
▸ Expensive Restaurant Density	outlets/100 sq. mi.	4.22	2.90	6.94	7.17
▸ Food Store Density	outlets/100 sq. mi.	18.50	12.22	17.99	12.37
▸ Population Density	100 people/sq. mi.	2.57	1.58	2.85	1.77
▸ Gasoline Consumption per Capita	100 gallons	3.82	0.83	5.60	1.10
Price and Income Variables:					
▸ Fast Food Price	index (price/mean)	78.25	4.16	86.02	3.69
▸ Grocery Price Index	index	98.61	4.81	69.76	3.98
▸ Inexpensive Restaurant Price	$	3.41	0.11	3.35	0.26
▸ Expensive Restaurant Price	$	9.15	0.76	8.84	1.32
▸ Income per Capita	$000s	11.40	1.63	14.08	1.75
Demographic Variables:					
▸ Female Labor Force Participation	%	51.99	4.69	58.50	4.79
▸ African-American	%	10.42	9.94	10.96	10.25
▸ Hispanic	%	6.08	13.00	7.38	14.31
▸ Median Age	years	28.90	2.02	32.05	2.09
▸ Population Aged 5–9 Years	%	7.54	0.87	7.49	0.85
▸ Population Aged 18–21 Years	%	6.41	1.82	5.12	1.63
▸ Population Over 65 Years	%	9.93	1.95	11.41	2.04
▸ College Graduate	%	9.83	2.65	13.05	3.37
▸ Residents per Household	number	2.83	0.16	2.69	0.17

Note: 1992 prices and income are adjusted to 1982 levels.

CD-ROM, the *Statistical Abstract of the United States*, or the *Census of Retail Trade* (all of which are available through the USDC/Bureau of the Census). All price data are from the American Chamber of Commerce Research Association (ACCRA). Any MSA for which ACCRA data were not available in each year was discarded, leaving 85 MSAs for the sample, or 170 observations covering the two years considered. Table 1 reports the 1982 and 1992 means and standard deviations for each variable described below.

The dependent variable is a measure of annual per capita fast food consumption (quantity) by MSA in each time period. This measure was constructed by dividing fast food expenditures [labeled "refreshment places," a subcategory of Standard Industrial Classification (SIC) 5812 in the *Census of Retail Trade*] by a price estimate (described below) and population in each MSA.

Market Characteristic Variables

Market characteristic variables are those that control for consumer accessibility to fast food (and its substitutes) across markets. As noted above, we use fast food outlet density and its square as a proxy for average distance traveled ($\bar{r}$ in the above analysis). Substitutes for fast food include food prepared at home and meals from table service

restaurants, so we also include outlet density of retail food stores (SIC 54) and table service restaurants (subcategory of SIC 5812). Table service restaurants are segmented into two price levels: (*a*) inexpensive restaurants, which are those with an average check size of under $5 in 1982 and under $7 (nominal) in 1992, and (*b*) expensive restaurants, which include all those with higher average check sizes. For ease of interpretation, the outlet density variables are scaled to equal the number of outlets per 100 square miles.

Table service restaurants might compete with fast food on the basis of convenience. Consequently, we expect negative signs for the restaurant density coefficients with the inexpensive segment showing the stronger effect. It is much less likely that food stores compete directly with fast food on the basis of availability, because the cost associated with consuming meals at home is largely due to meal preparation, not the purchase of meal ingredients. Most consumers necessarily make regular trips to the grocery store to replenish their home inventory of raw materials used for meal preparation. Although ease of access to grocery stores is therefore unlikely to affect fast food consumption, we still expect the ceteris paribus effect to be negative.

Moreover, the trend in the grocery industry has been toward larger stores with greater product offerings, thereby increasing the likelihood that all of a consumer's grocery needs can be filled at a single location (Messinger and Chakravarthi). Larger stores explain the slight decrease in the food store density variable between 1982 and 1992 (table 1). These large store formats increasingly offer expanded deli selections and prepared meals for take-out, which is one way supermarkets have chosen to compete with fast food outlets. That there has been a long-standing concern in the grocery industry over this competition is evident. In 1992, according to *Progressive Grocer's 59th Annual Report of the Grocery Industry*, 20% of supermarket managers rated the threat from fast food competition as "great," up from 14% in 1982.

Two variables are included as proxies for the consumer cost per unit of travel distance (c in the above analysis): gasoline consumption per capita and population density. Gasoline consumption is a measure of automobile use. Assuming travel by car is a normal good, when costs per unit of distance are low, automobile use (and hence gasoline consumption) will be high. Automobile use is clearly important to the fast food industry, especially given the popularity of drive-thru windows and take-out food. Consequently, greater use of the automobile is expected to positively correlate with per capita consumption of fast food. Retail sales of gasoline service stations (from the *Census of Retail Trade*, SIC 554) divided by the respective average price of regular unleaded fuel in each MSA (reported by ACCRA) and population is our measure of gasoline consumption per capita.

Population density (hundreds of people per square mile) measures the relative ease of mobility within a city: the more densely populated an area, the more burdensome and time consuming is travel over any given distance, especially by automobile. We hypothesize a negative correlation between this variable and fast food consumption.

Price and Income Variables[3]

Retail fast food prices across MSAs are based on ACCRA data. In its *Cost of Living Index*, ACCRA reports city prices for three specific types of fast food meals:

[3] To facilitate comparison of the parameter estimates across the two years, the 1992 values of all price and income variables are deflated to 1982 levels (using the All Urban Consumer Price Index).

- Hamburger Sandwich. Defined as a 1/4-pound patty with cheese, pickle, onion, mustard, and ketchup; McDonald's Quarter Pounder with cheese where available.
- Pizza. Defined as a 12"–13" thin crust regular cheese pizza; Pizza Hut where available.
- Fried Chicken. Defined as a thigh and drumstick—with or without extras, whichever is lower cost; Kentucky Fried Chicken or Church's where available.

Hamburger, pizza, and chicken outlets represent the three largest sales categories of the fast food industry.[4] The 1992 *Census of Retail Trade* reports state-level sales for each of these types of establishments (along with several other categories), which we used to develop weights reflecting the percentage of fast food sales held by each type of establishment. These weights were used with the ACCRA data in calculating an average fast food price for each MSA. Fast food sales divided by this price estimate and population provides the measure of per capita fast food consumption used as the dependent variable. This fast food price (deflated in 1992) also was included as a right-hand-side variable.

The ACCRA *Grocery Price Index* serves as the price of the food-at-home substitute for fast food. This index is computed quarterly by ACCRA based on a weighted average of 27 grocery items believed to represent the typical diet of mid-management executive households. Data are collected by local Chambers of Commerce, and the cost of living indices are reported as a service for people who might be relocating to the area.

Relative prices at expensive and inexpensive restaurants were calculated using the "average cost per meal" data in the *Census of Retail Trade*, Miscellaneous Subjects Series. The percentage of restaurants in the appropriate average cost-per-meal price categories (defined above in the "market characteristics" section), multiplied by the midpoint of each category and summed, provides a weighted average price for both inexpensive and expensive restaurants by MSA. ACCRA reports no price information for these categories. The prices at inexpensive restaurants are positively correlated with those at fast food establishments, suggesting these may be close substitutes. The extent to which inexpensive restaurants and fast food outlets compete based on price, as opposed to convenience or accessibility, can be inferred from the estimated cross-price effects. Annual income in each MSA is measured per capita, using U.S. Department of Commerce/Bureau of the Census figures.

Demographic Variables

We include the female labor force participation rate of each MSA as a measure of the opportunity cost of time. Previous studies using panel data have generally reported consumption of food away from home is greater in households where the female family member works outside the home.

Four variables are used to control for the age distribution of each MSA: median age of the population, and the percentage of the population falling within each of three separate age groups (5–9, 18–21, and over 65 years). The 5–9 age group was included because of the substantial marketing efforts aimed toward children, especially by the

[4] In 1992, national sales from fast food hamburger, pizza, and chicken outlets were roughly 43.6%, 15%, and 8.8%, respectively, of U.S. total fast food sales (USDC, *Census of Retail Trade*).

largest participants in the industry. The 18–21 age group is widely regarded to represent the "heavy users" of fast food, while the 65 and older age group is distinguished as consuming the fewest fast food meals (Emerson).

The MSA population divided by the respective number of households captures the effect of household size, which previous studies (Redman; McCracken and Brandt; Manchester) have found to have a negative effect on household (and hence per capita) consumption of FAFH. The percentage of the population with at least a four-year college degree is included to explore whether education affects preferences for fast food. The expected effects of higher education on fast food consumption are not clear. Two racial composition variables are included to control for possible preference variations based on culture: the percentage of the population classified as African-American, and the percentage classified as Hispanic—the two largest minority segments of the population.

Finally, dummy variables are included corresponding to eight geographic regions of the United States.[5] These variables are included simply to control for the possible existence of distinct food consumption patterns across regions. Such patterns could be the result of differences in fast food preferences, pricing patterns, promotion strategies, or other factors that might exhibit regional variation. The metropolitan areas included in each region are presented in appendix table A1.

Fast Food Demand Estimates, 1982 and 1992

The two cross-section demand equations (one for 1982 and the other for 1992) were estimated together as a set of seemingly unrelated regression (SUR) equations.[6] Controlling for cross-equation correlation in this manner not only improves efficiency, but also ensures valid tests of parameter estimates across equations.[7] The estimated correlation between the two equations, i.e., the contemporaneous correlation between the error terms across equations, was 0.454.[8] The parameter estimates for each year are presented in table 2, and F-tests of the joint significance of selected groups of variables are presented in table 3.

Market Characteristic Variables

Given our focus on accessibility, the most important results are the parameter estimates for the fast food outlet density variable (table 2). In both years, fast food outlet density is positive and significant, strong evidence of a direct link between the number of outlets

[5] Because New England has only a single observation in this data set (Hartford, Connecticut), it was grouped with the Middle Atlantic region, leaving eight separate regions.

[6] A Chow test of the null hypothesis of whether the two years can be pooled was calculated to test for a structural change in demand over time. With an intercept shifter in the pooled model distinguishing between years, the Chow test result was $F_{28,114} = 1.89$, which rejects the null at $\alpha = 0.05$. Removing the intercept shifter only strengthens this result.

[7] Note that this procedure is different from the usual application of SUR in demand analysis, where it is typically used to capture correlation across cross-sectional units, such as commodity demands, markets, or industries. This application could be viewed as a time-series, autocorrelation correction across the two periods, where the correlation is allowed to vary over time, but not across cross-sectional observations.

[8] If the correlation between the two equations is zero, i.e., the variance-covariance matrix of the system of equations is diagonal, SUR would provide no efficiency gains and estimation would simply revert to OLS. A Lagrange multiplier test of whether the variance-covariance matrix is diagonal produces $\chi^2_1 = 17.5$, allowing us to reject the null hypothesis of zero correlation between the two equations.

Table 2. SUR Parameter Estimates of Fast Food Consumption, 1982 and 1992

Variable	1982 Parameter Estimate	1982 *t*-Value	1992 Parameter Estimate	1992 *t*-Value
Intercept	25.214	0.14	155.261	0.63
Market Characteristic Variables:				
▸ Fast Food Outlet Density	3.201***	2.91	3.158***	3.62
▸ (Fast Food Outlet Density)^2	−0.031	−1.58	0.004	0.41
▸ Inexpensive Restaurant Density	0.827	1.17	−0.248	−0.30
▸ Expensive Restaurant Density	−1.903*	−1.87	−0.352	−0.51
▸ Food Store Density	−0.385	−0.72	−0.366	−0.63
▸ Population Density	−8.507	−1.65	−20.981***	−2.82
▸ Gasoline Consumption per Capita	2.559	1.09	−1.145	−0.72
Price and Income Variables:				
▸ Fast Food Price	−1.138***	−2.85	−2.539***	−4.23
▸ Grocery Price Index	0.307	0.91	0.573	1.00
▸ Inexpensive Restaurant Price	5.691	0.46	−5.429	−0.86
▸ Expensive Restaurant Price	2.955	1.29	−0.784	−0.65
▸ Income per Capita	5.756**	2.45	3.214	1.58
Demographic Variables:				
▸ Female Labor Force Participation	−0.613	−1.21	0.375	0.54
▸ African-American	0.211	0.91	0.580**	2.55
▸ Hispanic	0.262	1.27	0.702***	2.63
▸ Median Age	1.130	0.37	3.113	0.71
▸ Population Aged 5–9 Years	7.068	1.19	−1.605	−0.26
▸ Population Aged 18–21 Years	7.545***	2.68	3.578	0.90
▸ Population Over 65 Years	−0.351	−0.55	−0.769	−0.85
▸ College Graduate	0.425	0.35	−0.773	−0.76
▸ Residents per Household	−43.601*	−1.76	3.241	0.11
Regional Indicators:				
▸ New England/Middle Atlantic	4.200	0.41	−2.404	−0.23
▸ South Atlantic	40.235***	3.70	37.984***	3.55
▸ East North Central	16.358*	1.89	13.516	1.41
▸ East South Central	33.819***	3.29	41.853***	3.84
▸ West North Central	8.116	0.97	19.180*	1.85
▸ West South Central	26.216***	3.32	12.361	1.30
▸ Mountain	3.191	0.43	6.749	0.75
System Weighted $R^2 = 0.821$, $n = (85 \times 2) = 170$				

Note: Single, double, and triple asterisks (*) denote significance at the 10%, 5%, and 1% levels, respectively (based on a two-tailed test).

Table 3. *F*-Tests of the Joint Significance of Variable Groups, 1982 and 1992 Demand Estimates

Variable Group	1982	1992	Equal Across Periods
Market Characteristics	$F_{7,112} = 5.04$***	$F_{7,112} = 3.87$***	$F_{7,112} = 2.38$**
Prices and Income	$F_{5,112} = 3.56$***	$F_{5,112} = 4.49$***	$F_{5,112} = 2.81$**
Demographics	$F_{9,112} = 5.70$***	$F_{9,112} = 2.38$**	$F_{9,112} = 2.37$**
Regional Indicators	$F_{7,112} = 3.95$***	$F_{7,112} = 4.29$***	$F_{7,112} = 1.54$

Note: Double and triple asterisks (*) denote significance at the 5% and 1% levels, respectively (based on a two-tailed test).

serving a market and per capita fast food consumption. This result supports the hypothesis that consumer accessibility to fast food contributes directly to its convenience. Density-squared is not significant at standard levels in either equation. A test of whether the fast food density and density-squared estimates are equal across periods is rejected at the 5% level ($F_{2,112} = 3.26$), although a test that the density variable alone is equal across periods is not rejected. This finding reveals, despite a 60% average increase in outlet density in this sample between 1982 and 1992, the marginal effect of additional outlets on consumption remained strongly positive. Through 1992, market saturation was not a serious threat; firms continued to find locations within these same markets which improved consumer accessibility and directly contributed to greater sales.

Neither inexpensive restaurant density nor food store density is significant in either equation. Surprisingly, however, the density of expensive restaurants in the MSA is negative and significant at the 10% level in 1982. We know these goods are poor substitutes; the relationship may reflect differences in tastes between areas where expensive restaurants are prevalent and areas where they are not (perhaps even revealing a mild form of snobbery). The absence of an expensive-restaurant effect in 1992 likely reflects a greater acceptance of fast food among all consumers. The lack of significance of the other density variables indicates neither restaurants nor food stores compete directly with fast food on the basis of travel costs. For food stores this is not surprising, given the discussion in the previous section regarding the grocery industry and the relative importance of meal preparation time as opposed to time spent purchasing the inputs for consumption of food at home. The absence of a significant parameter estimate for the inexpensive restaurant density variable suggests that based on convenience, inexpensive restaurants are a poor substitute for fast food. This issue is readdressed in the discussion of the price parameter estimates below.

The proxy variables for travel cost (c) give mixed results. Gasoline consumption is not significant at standard levels in either equation, but population density has the expected negative effect and is significant in the 1992 equation. Population density in some ways is a superior measure of travel costs, because it does not focus on a single mode of transportation. In highly populated areas, such as inner cities, gasoline consumption per capita will naturally be relatively low, because public transportation is more common and walking may be a viable alternative. As fast food firms expand into inner city locales from the suburbs, sales at these outlets are not as directly tied to the suburban road system; hence gasoline consumption would have a negligible effect.

The much stronger negative effect of population density in 1992 suggests a structural change in the demand equation. To the extent this variable measures the cost of travel, this finding indicates fast food consumption is adversely affected by the inconvenience associated with mobility in densely populated areas. This result implies an increase over time in the value consumers place on convenience. While it is difficult to develop a truly accurate measure of consumer travel costs, these results nevertheless suggest that ease of transportation plays an important role in the demand for fast food. However, travel distance as proxied by outlet density has a stronger, more obvious and direct effect.

A joint F-test reveals the market characteristic variables as a group contribute significant explanatory power in each period. This simply provides credence to the argument that consumption decisions are driven by more than just retail price. Especially for products capitalizing on the demand for convenience, retail outlet density appears to be a useful measure for capturing the full price to the consumer. A test of the null hypothesis

that this group of variables has the same effect in each time period is rejected ($F_{7,112}$ = 2.38, p-value = 0.03), suggesting some overall change in the marginal effect of outlet density over time. Given the dynamics of the restaurant and fast food industries, especially in regard to outlet proliferation strategies, marketing-induced changes in preferences, and ever-increasing opportunity costs of time for consumers, it is not surprising that the marginal effect of outlet density was not constant over this 10-year period.

Price and Income Variables

With the expected signs, fast food price is significant in both periods, but per capita income is statistically significant only in 1982. None of the substitute prices are significant. A test of whether the fast food price parameter estimate is equal across periods suggests sensitivity to price has increased over time ($F_{1,112}$ = 4.05, p-value = 0.05). We would expect sensitivity to retail price to increase as availability increases because travel costs have been reduced, making the retail price a larger proportion of the total price. (This contention also is supported in the price elasticity estimates in table 4.) The increase in elasticity in 1992 (over 1982) could reflect the growth over time in the number of convenient meal choices, especially microwavable foods and prepared meals (home meal replacements) offered by grocery stores.

An increase in the number of substitute products in a market is typically associated with an increase in own-price elasticity. According to the *Statistical Abstract of the United States* (USDC), U.S. households owning a microwave oven increased from 20.7% in 1982, to 81% in 1993. Clearly, household adoption of this technology has led to a decline over time in the burden of preparing meals at home, to the likely dismay of the fast food industry. The ACCRA *Grocery Price Index* would not capture this effect as it does not measure the *convenience* of grocery items, which is the basis on which home meal replacements and microwavable foods most likely compete with fast food.

The fact that neither price nor availability of inexpensive restaurants is significant in either equation is not necessarily surprising: it corroborates the hypothesis that convenience drives the demand for fast food. Few other FAFH options are able to compete in this arena. Inexpensive restaurants can offer meals of equal or greater quality to fast food for about the same retail price, but if a high value is placed on time, fast food is vastly cheaper. At current levels, neither differences in price between table service restaurants and fast food, nor differences in accessibility will have a noticeable effect on fast food sales because the time cost of acquiring a meal is always greater at a table service restaurant. Even when the retail price is similar to fast food, the products, when viewed from a convenience perspective, are not. The apparent lack of competition between inexpensive restaurants and fast food outlets suggests the expansion of the fast food industry is not necessarily a threat to the inexpensive restaurant segment, since different factors drive the demand for these products. Accordingly, small, family-owned, inexpensive restaurants continue to be viable business opportunities in many markets (National Restaurant Association 1995).

Regarding income, a test of whether the income parameter estimate is equal across periods is not rejected ($F_{1,122}$ = 0.83), implying the income response has not changed greatly over time, despite a noticeable difference in the parameter estimate. The smaller but insignificant parameter estimate, along with a rise in average income, resulted

Table 4. Fast Food Price and Income per Capita Elasticity Estimates, 1982 and 1992 (at data means)

Description	1982	1992	Equal Across Periods
Fast Food Price	−1.022***	−1.884***	$F_{1,112} = 4.05$**
Income per Capita	0.753**	0.386	$F_{1,112} = 0.83$

Note: Double and triple asterisks (*) denote significance at the 5% and 1% levels, respectively (based on a two-tailed test).

in a decrease in the income elasticity estimate from 0.753 in 1982, to 0.386 in 1992 (table 4). Most other studies have found FAFH consumption has an inelastic income response.

Demographic Variables

As a group, the demographic variables contribute significant explanatory power each year (table 3), but individually most are not significant or have estimated effects that were not anticipated. The only statistically significant age variable is the percentage of the population in the 18–21 age group in 1982, which displays the expected relationship (table 2). In 1982, there also was a tendency for large households to consume fewer fast food meals. This result was expected, because meal preparation at home becomes more economical as family size increases. By 1992, neither of these relationships remained significant. A test of the null hypothesis that the group of demographic variable coefficients are equal across time is rejected at the 5% level ($F_{9,112} = 2.37$, p-value = 0.02).

Both of the racial composition variables are significant and positive in 1992. Many studies find significant differences in eating patterns based on race, including studies focusing on FAFH (e.g., Prochaska and Schrimper; Redman). Typically, these findings are attributed to differences in tastes and preferences across racial classes. We find a strengthening effect of race on fast food consumption over time, which could be indicative of a growing trend for fast food firms to expand into areas with high African-American and Hispanic populations, thereby increasing the availability to these consumers and allowing any differences in preferences to become more noticeable.

The percentage of female labor force participation is not significant in either of the periods. This reveals a possible weakness of market-level data. In panel data studies, the employment status of females is typically captured with a dummy variable, explicitly comparing the consumption behavior of working and nonworking females. Our data report the percentage of the total MSA female population in the workforce, making no explicit comparison between those already in the workforce and those who are not. It is a truism that working females have a higher opportunity cost of time, and therefore they should value the convenience of fast food. This value is not detectable in our market-level data, perhaps due to an aggregation effect. Confounding factors with female workforce participation also may exist. For example, in some households females earn a second income, whereas in other households single mothers must support children by working low-paying jobs.

Regional Indicators

Finally, as a group, the regional indicators are significant in each time period (table 3), providing evidence of differing consumption patterns across regions. The omitted region is the Pacific. In both years, the southern regions (South Atlantic, East South Central, and West South Central) tend to consume the largest quantities of fast food, while consumers in the New England/Middle Atlantic and Pacific regions consume the least. A test that the regional effects are the same in both periods is not rejected at standard levels ($F_{7,112} = 1.54$, p-value = 0.16).

Are Fast Food Price and Outlet Density Exogenous?

Using arguments founded in household production theory, we have illustrated analytically why we would expect the number of fast food outlets in a market to positively influence sales. Our empirical analysis appears to confirm this hypothesis, implying that much of the observed growth in consumption is actually the result of increased convenience and availability of fast food rather than a change in the nature of demand. The final issue we address is whether outlet density and fast food price are exogenous in our model.

A fundamental question is whether firms increase their presence in markets where consumption is already high or adjust prices accordingly, rendering these variables endogenous. Alternatively, outlet penetration may itself be used as part of a sales growth strategy. Note this does not rule out the possibility that location decisions or prices could be influenced by other explanatory variables in the model, such as demographics. Exogeneity cannot be identified per se, but we can determine if the variables in question are uncorrelated with the disturbance. This would provide evidence in favor of exogeneity, and assurance our estimates are consistent.

A Durbin-Wu-Hausman procedure (Davidson and MacKinnon) was used to test for endogeneity of fast food price and fast food density. The instruments used in the test procedure included all of the predetermined variables from the original model, plus measures of wage rates, rent, and building maintenance costs, the most important cost factors for fast food.[9] Table 5 presents the t- and F-statistics from the predicted reduced-form coefficients. The first two rows report results where price and density were tested independently, and the third and fourth rows show results of a joint test.

Consistent with the industry view on outlet proliferation as a marketing strategy, test statistic values do not indicate the presence of endogeneity. Furthermore, if market-level sales were a reasonable indicator of consumer demand for additional services and new capacity, firms might be expected to increase the size of existing units, possibly capturing economies of scale, and avoiding the large fixed costs of constructing new outlets. This is clearly not the case, as outlets have on average become smaller over time: the number of seats per U.S. fast food outlet has decreased from an average of 51.2 in 1982, to 48.1

[9] Average wage rates were calculated as the total retail payroll divided by the number of retail employees, rent expense was approximated with the average residential apartment rent (under the assumption that residential and commercial rent costs are highly correlated), and maintenance costs were approximated with the average annual cost of upkeep, including mortgage payments, for residential properties (also under the assumption that residential maintenance costs and commercial maintenance costs are highly correlated). All of these variables are readily available from the U.S. Department of Commerce/Bureau of the Census.

Table 5. Exogeneity Tests of Fast Food Price and Fast Food Outlet Density, 1982 and 1992 *t*- and *F*-Values

Description		1982	1992
Independent *t*-Tests:	Fast Food Price	1.492	−0.984
	Fast Food Outlet Density	−1.140	1.218
Joint Tests:	Fast Food Price	0.659	−0.952
	Fast Food Outlet Density	−0.155	1.358
	F-Test	$F_{2,54} = 1.18$	$F_{2,54} = 1.12$

Notes: The null hypothesis is that there is no correlation between the variables in question and the error. None of the test statistics are significant at standard levels. The *t*-statistics are from independent tests; the *F*-statistics test the joint significance of fast food price and fast food outlet density within the same equation.

in 1992 (USDC, *Census of Retail Trade*). The endogeneity test provides evidence in support of our original assertion that growth in the number of outlets is more a cause of, rather than a response to, consumer demand for fast food.

Conclusions

The demand for fast food depends heavily on the demand for convenience, and an important component of convenience is the ease of consumer access to the product. An increase in the number of fast food outlets in a market directly increases quantity consumed by decreasing the costs of obtaining a fast food meal. Proliferation of fast food outlets explains much of the historic long-term growth of this industry. The fast food industry has continually found ways to make its products more accessible, and this effort continues today, with retail outlets appearing in such varied locations as office buildings, department stores, and airports. Failing to account for this changing structure of the marketplace could lead to the inference that over time there have been dramatic changes in tastes, or that the continued growth in fast food has resulted solely from a heightened consumer demand. Our results strongly suggest much of this growth in consumption is attributable to an increasing *supply* of convenience.

We did not find any empirical evidence to indicate fast food firms are in direct competition with table service restaurants in an equivalent price range. This finding supports the common observation that few table service restaurants offer the same level of time-saving convenience as fast food, and it is the convenience-supplying attributes that give fast food its primary appeal. We did find evidence of an increase in the own-price elasticity of demand for fast food over time. Increased sensitivity to menu prices occurs because, as distance traveled to fast food outlets declines, menu prices account for a larger portion of the "full" price of fast food.

Except for a growing tendency for Black and Hispanic consumers to have higher than average fast food consumption, we found little evidence to suggest consumption of fast food varies across demographic groups or income levels. However, significant differences in regional consumption of fast food have persisted over time. With the broad appeal of this product extending across most segments of the population, if firms maintain their efforts to increase the availability of fast food, industry growth is expected to continue.

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Appendix

Table A1. 85 Metropolitan Areas Examined, Distributed into Eight Census Regions

New England/ Middle Atlantic:[a]	**Pacific:**	**West North Central:**	**West South Central:**
Hartford, CT	Bakersfield, CA	Cedar Rapids, IA	New Orleans, LA
Binghamton, NY	Los Angeles, CA	Iowa City, IA	Oklahoma City, OK
Harrisburg, PA	San Diego, CA	Wichita, KS	Amarillo, TX
Lancaster, PA	Portland, OR	Minneapolis, MN	Beaumont, TX
Syracuse, NY	Richland, WA	Rochester, MN	Dallas, TX
York, PA	Seattle, WA	Columbia, MO	El Paso, TX
		Kansas City, MO	Houston, TX
South Atlantic:	**East North Central:**	St. Joseph, MO	Lubbock, TX
		St. Louis, MO	McAllen, TX
Albany, GA	Champaign, IL	Springfield, MO	San Antonio, TX
Athens, GA	Decatur, IL	Lincoln, NE	Waco, TX
Atlanta, GA	Rockford, IL	Omaha, NE	
Augusta, GA	Springfield, IL		
Columbus, GA	Fort Wayne, IN	**East South Central:**	**Mountain:**
Charlotte, NC	Indianapolis, IN		
Greensboro, NC	South Bend, IN	Birmingham, AL	Phoenix, AZ
Hickory, NC	Lansing, MI	Huntsville, AL	Colorado Springs, CO
Raleigh, NC	Cincinnati, OH	Montgomery, AL	Denver, CO
Columbia, SC	Cleveland, OH	Lexington, KY	Boise City, ID
Gainesville, FL	Columbus, OH	Louisville, KY	Albuquerque, NM
Miami, FL	Youngstown, OH	Chattanooga, TN	Las Vegas, NV
Roanoke, VA	Dayton, OH	Knoxville, TN	Reno, NV
Huntington, WV	Appleton, WI	Memphis, TN	Billings, MT
	Green Bay, WI	Nashville, TN	Salt Lake City, UT
	Janesville, WI		
	La Crosse, WI		
	Wausau, WI		

[a] Due to data limitations, New England and Middle Atlantic are combined into a single region.