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THE EFFECT OF HEALTH CONCERNS ON FOOD DEMAND

by

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ABSTRACT

THE EFFECT OF HEALTH CONCERNS ON FOOD DEMAND

By

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How much health risk are consumers willing to accept in their food purchases? Their preferences are not clearly articulated in the market due to difficulty in finding out how safe a food product is and a lack of choice between foods with different degrees of safety or healthfulness.

This thesis applies the economic theory of goods characteristics (Lancaster, 1966) to generate a hypothesis that a change in health risk or safety information will affect food demand. Case studies, consumer survey data, and food demand studies are reviewed with certain empirical consequences expected to support the hypothesis.

Results indicate that consumers are aware of and concerned about health risks in food, acute health risk information has an effect on consumption, and changes in health risk information may be partly responsible for shifts in demand for certain foods.

Future research is suggested to empirically test the importance of health risk information on food demand.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Do consumers consider healthfulness along with price and other factors when purchasing food? Producers of foods such as beef and eggs allege that per capita consumption of their products is declining because of increasing concern among consumers about health risks in food consumption. Marketers and nutritionists claim that food consumption is trending toward healthier, safer food. Advertisers and product labels are stressing "natural" foods and selling products in tamper proof packages. Are these changes in food consumption patterns due to health concerns, or are they better explained by other factors?

Who wants to know?

Although safe, healthy food is a goal of the U.S. food system, we know very little about the operational definitions of safety or healthfulness in the minds of consumers. Government regulators and food producers have made decisions on what level of safety is appropriate based on assumptions of what consumers want. The actual demand for food safety is difficult to ascertain because it is not something that can be bought directly. Instead, safety is one of many considerations when purchasing a good.

For the purpose of this paper, food "safety" and/or "healthfulness" will be considered synonymous in that they both are characteristics of food that help prolong life. This definition allows consideration of both short and long term health risks in food.

Food regulators would like to know whether the current level of food safety is acceptable for consumers. Food healthfulness, like most consumer safety information, has a high information cost (Schmid, 1986), making it difficult for consumers to determine whether a food is safe or not. The government role has historically been to provide health and nutrition information or require such information on food labels, enforce pre-set safety standards, or restrict potentially risky methods of food production (eg. pesticide use). Is this enough? Too much?

Producers would like to know if consumers would pay more for or purchase greater quantities of food that is increasingly healthful. For example, red meat producers would like to know if health concerns have caused sales of their product to drop dramatically since the mid 1970's. Could modifications such as leaner, chemical-free meat, or a new health-oriented advertising program help strengthen their markets? With possibly as much as two thirds of the population still "eating the same old way" (Brody, 1985), perhaps the purported "health-motivated" shifts in diet and nutrition are not as revolutionary as they would appear. Advice that producers should "sell healthier food" may not in actuality bring about the increased prices needed to economically justify production of alternative products.

Economists would like to be able to have accurate economic models to assist in answering questions posed by regulators or producers on what a change in food safety or healthfulness means to the price or quantity of food purchased. Traditional economic models include price, income, and sometimes socioeconomic factors as key determinants of market-level food demand. Incorporation of information about changes

in food safety may enhance the explanatory or predictive ability of such models.

1.2 Research Objective and Approach

Empirical study of the effect of food safety and healthfulness considerations on food demand would be complex and costly. Traditional economic theories may not be easily adaptable to the problem and relevant data would be expensive to obtain. Thus, the appropriate first step is to see what can be learned from readily available studies and data.

The primary objective of this thesis is to discover what existing studies or data can tell us about the effect of food safety and healthfulness considerations on food purchases. If these considerations appear to be affecting purchase behavior, future research needs will be assessed and potentially fruitful research strategies recommended.

To guide and focus the review, and to develop research strategies, a theoretical framework is developed to explain how food safety and healthfulness affects food purchases. While one possible model is that changes in food purchases reflect changes in consumer preferences for safety, the view taken here is that they reflect changes in food products, or information about products. For example, over the past two decades, major reports on diet and health have been issued by Congress, the National Academy of Sciences, the U.S. Department of Agriculture, the American Heart Association, and the National Cancer Institute. In addition, numerous incidents of chemical contamination of food have been reported in the media. Likewise, food processors

have introduced new food products emphasizing healthfulness. These changes in health information about food are used in a theoretical explanation of the effect of food safety considerations on food purchases.

This theoretical framework is based on the theory of consumer goods characteristics (Lancaster, 1966) and household production theory (Becker, 1965). The basic feature of this theory is the assumption that a consumer's utility is a function of the consumption of characteristics such as color, taste, safety, and size, rather than products per se. It provides a framework for examining whether a change in information about a particular product characteristic, such as healthfulness, changes demand for the product.

After development of a theoretical model, a series of hypotheses are stated which selectively focus the review of existing studies and data. The hypotheses are in the form of empirical results we would expect to find in three types of empirical studies and data sets if the theory were correct. The three types of studies and data examined are: 1) case studies of the impact of changes in safety or perceived safety on product demand, 2) surveys of consumer attitudes about food safety and healthfulness and related food purchase behavior, and 3) studies analyzing the demand for major food commodities where changing consumption trends may be expected to have resulted from known changes in information about the food safety or healthfulness.

Based on the review, conclusions are drawn about the hypotheses and the implications, if any, of these conclusions for government regulators and food producers. The need for more definitive research is then discussed and alternative research strategies developed and

critically assessed.

1.3 Organization of Thesis

The next chapter outlines a theory of how consumers make purchasing decisions, especially in the area of risk and food consumption. Chapter Three outlines research hypotheses and methods. Chapter Four reviews studies that have explicitly looked at how a change in product safety, such as contamination, affects demand. Chapter Five reviews consumer surveys. Chapter Six analyzes demand models to assess their explanation of changing consumption trends. Chapter Seven summarizes the conclusions from Chapters Four, Five, and Six and presents a number of research procedures for directly testing the effect of health concerns on food consumption. A small scale empirical demonstration is also presented in Chapter Seven to illustrate one of the possible research strategies.

CHAPTER TWO

THEORY

2.1 Introduction

The purpose of this chapter is to develop a model which might explain why food safety affects food purchases. The model generates a hypothesis that information and therefore, perceptions of the safety of foods and food constituents has changed over the last twenty years, and that this change has consequently changed food purchases. The model is used to derive further hypotheses which will guide the subsequent literature review and assessment of research strategies.

2.2 A Theory of Consumer Behavior

The first step in understanding how consumers articulate their demand for products is to examine how they behave as economic actors. Individuals are assumed to maximize their "utility", which is their perception of well being or satisfaction. Individuals are also assumed to be rational and make only those choices that maximize their utility, which is similar to some psychological theory where it is assumed an individual will always seek to maintain, enhance, or actualize the self (Rogers, 1951).

Individuals are assumed to have preferences, such as a desire for safe food, and to not be paralyzed by indecision when looking at a choice of alternative purchases. These preferences are assumed to be relatively stable over time. Individuals are then represented in the economic system by their preferences for goods, which drives their purchasing behavior.

An individual's utility (U) is a function of the kind and quantity of goods purchased. This may be expressed as:

$$U = f[Q_1, .. Q_n]$$

There are n goods, and Q_i represents the quantity of the ith good consumed. More of a good is generally preferred to less because it increases total utility, but personal budget constraints limit the options available to the purchaser. As income rises, it is expected that there will be increases in the quantity or number of goods purchased, and hence the level of utility obtained.

An indifference curve, as in Figure 2.1, represents those combinations of goods among which the individual is indifferent, that is, the same level of utility is provided. The higher indifference curves represent higher levels of utility. The diagonal line represents a consumer's budget constraint given income and prices for goods. The optimum choices of products are where the highest indifference curves are tangent to the budget constraint (e.g. at X).

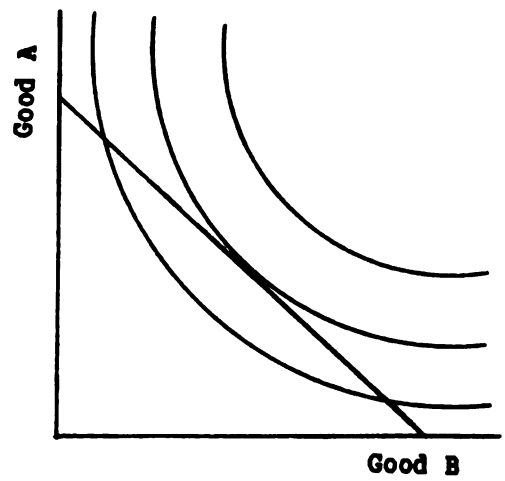

Figure 2.1 Indifference Curves with Budget Constraint

Although the above model helps to explain how choices among goods may be affected by changes in income and prices, it does not explain how changes in the properties of goods (such as the degree of safety) affects the purchase decision. As shown by van Ravenswaay (1987), the goods characteristics theory developed by Lancaster (1966) may be a useful approach for understanding the relationship between food safety and food purchases. Lancaster's theory is based on the assumption that individuals derive utility from certain properties that goods provide, rather than the goods themselves. An individual consumer's utility function using this theory would be represented by:

$$U = f[X_1, \ldots X_m]$$

There are m different properties, and X_j represents the quantity of the jth property consumed from the purchase of products.

This theory is a specific example within the framework of household production theory (Becker, 1965; Deaton & Muellbauer, 1980; Zellner, 1986;) that integrates the theory of the consumer with that of the firm. The analysis of quality and of choices between goods differing in observable characteristics has probably been the area of economics where this approach is most applied. Household production theory states that households purchase goods, such as beef, as inputs into the production of utility-yielding, non-market goods such as a meal or diet. The household will attempt to maximize utility subject to the technology and inputs available, and strive to obtain the characteristics needed to produce the end utility non-market goods.

Rather than assuming consumer preferences for goods are stable, it

is instead assumed that their preferences for the properties of goods are stable. A "property" will be defined as the overall consumer consideration in maximizing utility (such as increasing food safety or enhancing personal appearance) and a "characteristic" as an explicit component of food (cholesterol, pesticide residues, or calories). The amount of the jth property that can be obtained from the purchase of goods is a function of those goods' characteristics:

$$X_j = f(q_1 \vec{c_1}, \ldots, q_n \vec{c_n})$$

There are m common properties and r common characteristics for n goods. The notation j refers to any property, k to any characteristic, and i to any good. For each unit of good i purchased, a vector of characteristics $\vec{c_i} = (c_{i1}, \ldots, c_{ir})$ is obtained. C_{ik} is the amount of the kth characteristic (i.e. calories, sugar, or fat) obtained from consuming one unit of the ith good, and represents the technical composition of a good.

The concept of goods as vehicles supplying characteristics can provide a more orderly view of the relationship between consumer choice and product variation. Instead of suggesting that preferences change when products vary, there is a change in the characteristic set from which consumers make their purchase decision. Therefore, as consumers seek to maintain or increase their level of utility through the purchase of characteristics, a change in product composition could mean a change in the quantity of product consumed.

How does this theory apply to food safety?

An example using beverage consumption may provide some insight on how the characteristics approach relates to food safety or

healthfulness. For the following discussion, it is assumed that price and other product characteristics remain the same.

If consumers are sensitive to both their personal safety and personal appearance, it is assumed they will also be sensitive to changes in food that would affect these properties. These properties are a function of the quantity of food characteristics consumed, such as potentially risky ingredients (eg. carcinogens) in food, and calorie reduction (eg. low calorie foods). Tradeoffs would be made to obtain combinations of characteristics that offer the most utility.

Figure 2.2 illustrates the tradeoffs an individual would make between personal safety and personal appearance. Point A represents how much of the representative characteristics are delivered by a unit of a fruit drink artificially sweetened by sodium saccharin (which has been shown to cause cancer in laboratory animals) and point B by a unit of fruit drink sweetened with sugar (which will be assumed harmless to health). Since point A and B are both on the same curve, the consumer is assumed to be indifferent between them.

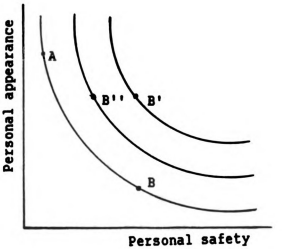

Figure 2.2 Consumer Tradeoffs in Response to Changes in Product Safety

Suppose a new, low calorie sweetener is introduced that is "as harmless" as natural sugar, such as aspartame, and product B immediately incorporates it into a new product. Point B' on Figure 2.2 shows how the new product offers less harmful ingredients (more personal safety) and less calories (more personal appearance) so it lies on indifference curve #2 and will provide a consumer more utility.

The same principle applies when there is no physical change in the characteristics of goods, but knowledge about those physical characteristics changes. For example, there are two types of food safety information (van Ravenswaay, 1987). One type is information that a certain known characteristic of food is hazardous, such as the discovery that aspartame may cause blindness in some people. With incorporation of this knowledge, the consumer would no longer view aspartame as harmless and perceive a decrease in the personal safety property of the new fruit drink as represented by point B'' on indifference curve #3. The second type of information relates to exposure. For example, if a consumer already knew that aspartame was not harmless, but was unaware of its presence in the new drink, s/he would receive no disutility from aspartame being in the product. Providing information that a characteristic known to be dangerous is in food would also elicit the response of viewing the aspartame fruit drink product at the point B''.

An historical example of this process occurred when the link between smoking and lung cancer became widely known (Lancaster, 1966). Consumers who formerly smoked unfiltered cigarettes switched to filtered ones within a relatively short time. It may have appeared that the preferences of these individuals for cigarettes, or the

properties provided by cigarette smoking had changed. However, the provision of both risk and exposure information instead gave smokers a new collection of characteristics to consider. Hitherto unknown characteristics of cigarettes (the presence of tar and nicotine) became known and were given a negative safety value, which led to a change in a smoker's decision set. Thus, it is possible that exogenous changes in food hazard and exposure information has changed demand.

2.3 A Theory of Consumer Demand

Individuals make decisions on what or how much to buy in order to maximize personal welfare, based on their preferences, personal income, and the prices of the goods involved in their tradeoffs for utility maximization. In other words, a person maximizes utility subject to prices and his/her income (m), which limits total expenditures (p q) as follows:

$$\text{Max } U = f(Q_1, \ldots Q_n) \quad \text{s.t. } m = p_1 q_1 + p_2 q_2 \ldots p_n q_n$$

$$\text{therefore } Q_i = f(p, m)$$

What happens when consumer income changes? As total expenditures rise, generally, the quantity of each good is expected to increase. These would be considered normal or superior goods (ordinary goods) and the individual would move to a higher level of satisfaction. There are goods, however, for which quantity decreases as income increases, and are termed inferior goods. As income increases, less of it is chosen because of the way it relates to other goods that are available. Examples are low quality whiskey, potatoes in Ireland, and secondhand clothing. In general, the proportion of total expenditures devoted to

food declines as incomes rise (Engel's law). Food is a necessity whose consumption goes up by a lesser proportion than does income. Therefore, it would be expected that food purchases, in the aggregate, are relatively income inelastic.

What happens when the price of a good changes? For ordinary goods, a decrease in price means an increase in quantity demanded. If one product generally provides similar utility as another, it becomes the preferred choice if its price decreases or the other's price increases. That is, it will be a close substitute. Two things happen with a price decrease. First, even if the individual were to stay on the same indifference curve, consumption patterns between goods may be reallocated to reflect the increase or decrease in price. This is known as the substitution effect. Also, if price decreases, the individual has more income available for purchases and their budget constraint will be expected to move outward, allowing increased purchases. This latter effect is known as the income effect.

How would a change in product characteristics affect demand? A negative change in a product's characteristics would reduce utility and therefore be expected to cause less of the product to be purchased. The reverse would also be expected to occur with positive changes in product characteristics. For example, a food demand model could arise from maximizing utility through acquiring characteristics such as "natural", "low cholesterol", or "low fat". Income and price would continue to constrain total expenditure. Thus, the consumer's problem is:

$$\text{Max } U = f(q_1 \vec{c_1}, \ldots q_n \vec{c_n})$$

$$\text{st. } m = p_1 q_1 + p_2 q_2 + \ldots p_n q_n$$

$$\text{Therefore } Q_1 = f(p, m, \vec{c_1}, \ldots, \vec{c_n})$$

The demand for good i would be a function of price (of the good, substitutes, and complements) income, and changes in the characteristics that represent product safety.

As stated earlier, exogenous changes in information about the quantity or quality of product characteristics will have the same effect as actual physical changes in the product. Exogenous changes in information about the kth characteristic of the ith good would be incorporated directly in the model of demand for a good since acquisition of the information is costless by definition. Therefore, the demand for good i becomes:

$$Q_i = f(\, p,\, m,\, \vec{s_1} ,\, \ldots ,\, \vec{s_n} \,)$$

where s is a vector of information on the quantity or quality of the kth characteristics of the ith good.

2.4 A Theory of Market Demand

Individual demand curves are constructed for a good by examining changes in the utility maximizing choices for a good in response to changing income, prices, or safety information. Market demand is the horizontal summation of individual demand schedules, that is, each individual's reaction to income, prices, or safety information added together comprises a market demand curve. This is why, in certain types of demand analysis, socioeconomic factors are included (age, race, education) since each group may have similar characteristics in their utility maximizing choices.

In market demand, changes in income or price are not examined on the individual level, but at the aggregate level. The aggregation of

individual tradeoffs are represented by the income or price elasticities of demand for a product, which are unitless representations of how a percent change in income or price affects a percentage change in quantity demanded.

$$\text{Elasticity} = \frac{\dfrac{\text{Change in Quantity}}{\text{Average Quantity}}}{\dfrac{\text{Change in Income (or Price)}}{\text{Average Income (or Price)}}}$$

Income elasticity of demand is positive and greater than 1 for luxury goods and less than 1 for necessities. Price elasticity of demand is generally negative for ordinary goods, with the degree of elasticity increasing (in absolute value) for goods with larger numbers of close substitutes. Cross price elasticity between two goods is positive if the goods are substitutes (that is, an increase in the price of good A causes an increase in purchases of good B), and negative if they are complements (an increase in the price of good A causes a decrease in purchases of good B). When a good's income, price, and cross price elasticities are summed together, they equal zero (homogeneity condition).

The income response of certain goods is greater than others as aggregate income increases and the characteristics approach can provide insight on that phenomenon. Higher quality versions of the same good can be thought of as a luxury good, while lower quality versions of the good can be thought of as an inferior good (Tomek & Robinson, 1981). This hypothesis could also apply to safety in that safer versions of goods may be considered higher quality. Thus, if the perceived safety of a good increases, the demand for that good would be expected to

become more income elastic, ceteris paribus. By the same reasoning, we would expect higher income consumers to spend proportionately more of their income on safety than lower income consumers, ceteris paribus.

Traditional theory acknowledges that certain goods are substitutes for others, but does not explain why. The use of the characteristics approach suggests that the reason wood is not a close substitute for bread, for example, is because their product characteristics set, and hence the properties they offer, is dissimilar. With the above explanation of the substitution process in mind, it might be expected that as information about increased safety of a product is disseminated, there would be fewer products perceived as having the same positive characteristic and therefore fewer close substitutes. A decrease in close substitutes would be expected to cause the demand for that good to become more price inelastic (Brown, 1969). Likewise, cross-price elasticities would be expected to decrease since changes in the price of other goods would have a smaller effect on purchases of the main good.

However, logic does not provide a clear guide as to whether the demand for higher grades is, on the average, more or less price elastic than for lower grades (Tomek & Robinson, 1981) The homogeneity condition would suggest that instead of safer goods becoming less price elastic due to less substitutes, they would become more price elastic to offset their becoming more income elastic. To make a conclusion in this area may require estimation of cross elasticities for all grades.

2.6 Summary

It was stated in this chapter that consumers seek to maximize utility or satisfaction and purchase product characteristics to obtain those goals. Changes in product characteristics, or more specifically, information about the quantity or quality of product characteristics would be expected to change consumer purchasing behavior. A hypothesis was stated that a change in information about health or safety characteristics would be expected to change quantity demanded, ceteris paribus.

The overall goal in using the characteristics approach will be to have a clearer understanding of what role food safety plays in the purchase decision. This knowledge will be useful in estimating consumer demand for products with changed health characteristics. It may also be able to help increase understanding of the driving forces behind changes in the American diet over the last two decades.

CHAPTER THREE

RESEARCH METHODS

3.1 Introduction

This thesis will review existing studies which we would expect to yield information about the hypothesis formulated in Chapter Two and to explore a potentially useful future research agenda. Studies will be examined, keeping in mind whether information about a characteristic representing healthfulness has changed in certain foods, to see if certain empirical consequences have been observed. This chapter discusses the types of studies to be reviewed and the types of information expected to support the hypothesis.

3.2 Expected Empirical Consequences

As a means to test whether the hypothesis developed in Chapter Two is reasonable, three areas will be investigated to see if specific empirical results have occurred.

3.2.1 Case Studies

There have been a number of studies specifically examining the impact of a change in health information on consumer purchase behavior. Of particular interest are food contamination incidences, which can provide some indication of consumer reaction to acute increases in food health risk. A partial listing of these incidences is cited on the following page.

1959	Pesticide residues in cranberries
1973	PBB in beef, pork, lamb, and eggs in Michigan
1977	Saccharin determined to be a carcinogen
1979	PCB in Montana poultry plant
1980	East coast clams determined to cause gastroenteritis
1981	PCB in Great Lakes fish
1982	Heptachlor in Hawaiian milk
"	First Tylenol poisonings
1984	Pins & needles in Girl Scout cookies
"	EDB in grain products (especially cake mixes)
"	Temik (aldicarb) in California watermelons
"	Meat antibiotics determined to affect humans
"	Glass fragments in Gerber juice products
1985	Salmonella in Jewel milk in Chicago area
"	Anti-freeze in imported wine adulterated
"	Urea contamination of Gatorade
1986	Warnings about possible salmonella in raw milk
"	Second Tylenol poisonings
"	Glass fragments reported in Gerber baby food products
"	Heptachlor in mother's milk
1987	Salmonella in poultry
"	PCB in Wisconsin fish

Although these incidences had varying degrees of publicity, they may help illustrate how consumers make immediate changes in product choices if they perceive there is a real danger to their health. It would also be anticipated that related but uncontaminated products may also experience a decrease in sales as consumers looked for more secure sources of sustenance. To test whether information about safety affects demand relationships, a review of available case studies of contamination incidences and product warnings will be undertaken in Chapter Four, looking for the following:

Expected Empirical Consequence #1: In incidences where information has been provided to consumers on changes in the safety of a product, the information will have been found to have had a significant effect on product purchases.

3.2.2 Consumer Surveys

Contamination incidences represent short term responses to health concerns. There may also be longer term health concerns affecting

consumer food purchases. The leading societal causes of morbidity and mortality, including chronic heart disease and cancer, have been increasingly linked to diet. A National Cancer Institute study (Doll, 1981) estimated that diet was the cause of 35% of cancer deaths, compared to tobacco at 30%. With the increasing focus on the connection between food and health, it would be expected that consumers would have additional characteristics they are considering in their food purchase decisions.

The following is a partial list of the changes in information about long term health effects of dietary choices over the past few decades.

1961	U.S. Heart Association Fat & Cholesterol Guidelines
1965	" "
1967	American Medical Association Convention: reduce egg, other high cholesterol foods, and saturated fat intake to avert heart disease
1976	U.S. Senate Select Committee on Nutrition and Human Needs begin hearings on U.S. Dietary Goals
1977	U.S. Select Committee on Nutrition and Human Needs Dietary Goals for U.S. released 1st edition
	" " 2nd edition
1980	U.S.D.A. Dietary Guidelines released: reduce red meat, whole dairy product, egg and increase poultry, fish, vegetable, whole grain intake
1982	National Academy of Sciences Diet/Nutrition/Cancer report: reduce fat/processed food and increase vegetable/fruit/whole grain intake
1984	National Cancer Institute report: increase fiber intake to avert colon cancer

To investigate whether consumers are receiving and responding to these changes in health information, consumer surveys will be reviewed in Chapter Five. A number of organizations and government agencies have done surveys over the years, asking what concerns consumers have regarding the foods they purchase. It would be expected that survey answers would reflect the information incidences cited above.

Expected Empirical Consequence #2: Consumer surveys will show that most people are aware of and concerned about the impact of food consumption on health in that:

a) consumers will report knowledge of health risks in food,

b) consumers will report they are changing or have changed their food consumption because of information on health risks in food, and/or

c) specific consumer concerns will change over time in response to changes in information about food health risks.

Changes in the consumption of a number of foods may be attributed to dissemination of health information, but the presence of information alone does not mean consumers have received or acted upon it. Empirical evidence suggests that consumers may ignore information which they feel has little benefit (Bettman, 1986). Therefore, if they perceive little risk (cost) associated with using a product, they may not seek out and process information about potential risks of using the product. What survey data can do is help provide a link between the dissemination of health risk information and the risk that a consumer perceives is in the food supply. If the attitudes elicited in surveys correlate with actual behavior, these perceived risks may be incorporated into the decision process and affect market demand. However, there are limits to straightforward interpretation of what survey respondents say about risks and, before going further, a few points about individual response to information under uncertainty should be made.

People have been characterized as operating like information processing systems with the transfer of information influencing the perception of risk and ultimately individual behavior. As stated earlier, it is not easy for the consumer to gauge the degree of safety

a product offers and the presence of food contaminants and pesticide residues are especially difficult for the consumer to identify. Obtaining additional information may be one way to reduce uncertainty about food safety. An increase in certainty or reduction of possible adverse consequences have been hypothesized as two key ways to reduce perceived risk (Cox, 1967).

Generally, it appears that individual perceptions of the probability of risky events happening to them is skewed in contrast to actuarial probabilities. Lichtenstein (1978) and Smith, Desvousges, and Freeman (1985) observed that individuals over-assessed the chances of low probability events and underestimated the chances of higher probability ones. This could be due to more media coverage of low probability events, and it has been hypothesized that the amount of media coverage and consumer risk perceptions are often correlated (Combs & Slovic 1979). This may also be due to findings that most people appear to be overconfident in their ability to avoid misfortune or accidents (Svenson 1979; Rethans 1979).

The degree of acceptance of the risk may affect how often it is reported as a concern. Public acceptance of risks is hypothesized as depending on the type of risk and how difficult it is to avoid it. According to Fischhoff (1978) the public is generally more willing to accept risks from voluntary activities than involuntary ones. Consumers may feel involuntarily exposed to chemical substances that pose serious consequences to their health. It has been suggested (Fischhoff, 1985) that people may be generally willing to tolerate some risk as long as they receive compensatory benefit. Larger benefits could mean greater acceptability of risk (Viscusi & Magat, 1987).

Consumers may have a limited capacity to process information, however, and as a task becomes more complex (such as coping with increased risk) consumers tend to develop more heuristics, or standard operating procedures, to help in the decision process (Payne 1976) . Their overall response to information may also be affected by how the information is packaged, or what the respondent feels can be done with it upon receipt (Viscusi & Magat, 1987).

Also to be considered is the amount of time required for the public to become fully aware of risks. As per epidemic theory (Bailey, 1975; Bartholemow, 1982; and Lekvall & Wahlbin, 1973 as cited by Putler, 1987), it may be expected that not all individuals in a population will receive new information in the initial time period in which it is broadcast. However, over time, individuals initially possessing the information may pass it on to others, thus creating a diffusion process. Thus, it may take some time before the impact of new information is noticeable.

3.2.3 Studies of Food Demand

Many of the aforementioned changes in information specifically urged consumers to moderate their intake of foods high in saturated fats, cholesterol, sodium, sugar, and alcohol. Red meats, eggs, and certain dairy products were targeted as containing some of these unhealthful components, whereas fish, poultry, fruit, vegetables, and foods high in fiber were cited as "good for you". Consumption data suggests that Americans are taking this advice as noted in Table 3.1 on the following page.

Table 3.1 Shifts in (5 yr) Average Annual Per Capita Consumption

	Per capita consumption (lbs)			Percent difference between		
	1970-74	1975-79	1980-84	1970-79	1975-84	1970-84
Red meat						
Beef	83.8	87.9	77.6	+5%	-12%	-7%
Pork	62.5	56.0	63.3	-11%	-13%	+1%
Fish						
Fresh/frozen	7.0	7.9	8.0	+14%	+1%	+14%
Poultry						
Chicken	40.7	44.8	52.9	+10%	+18%	+32%
Turkey	8.5	9.2	11.0	+8%	+20%	+29%
Eggs	40.0	34.7	33.6	-13%	-3%	-16%
Dairy						
Whole milk	198.3	163.2	133.9	-18%	-18%	-32%
Other milk beverages	68.6	91.5	104.5	+33%	+14%	+52%
Fruit						
Fresh fruits	76.2	81.0	86.0	+6%	+6%	+13%
Canned fruit	21.4	18.5	17.0	-14%	-8%	-21%
Vegetables						
Fresh	90.0	93.5	102.3	+4%	+9%	+14%
Frozen	10.0	10.3	11.2	+3%	+9%	+12%
Canned	48.0	48.0	43.6	-	-9%	-9%

Source: U.S.D.A 1985 Food Consumption, Prices, and Expenditures

However, many other factors may also explain the changes in per capita consumption. In particular, traditional economic theory suggests that changes in prices or incomes should be of primary interest. Clearly, if traditional models can adequately explain these changes in per capita consumption, our hypothesis that changes in information about food healthfulness are responsible is not supported.

If the theory outlined in Chapter Two is correct, a demand model that does not include changes in information about safety characteristics is incompletely specified. This would result in inconsistent or poor predictions in the time periods we know information changes occurred. In order to make this judgement, we need some criteria for deciding when a model does or does not adequately explain the changes in food consumption....or does or does not provide evidence that changes in health and safety information might help explain consumption trends. These criteria should then be applied to estimates of the demand for poultry, fish, eggs, beef, fresh fruits, and fresh vegetables which include the time period in which we know changes in health and safety information occurred. The criteria used are summarized below and will be examined further in Chapter Six:

Expected Empirical Consequence #3: If consumers are concerned about food healthfulness and safety, we would expect to see market demand estimates for food that do not acknowledge changes in these characteristics to show one or all of the following:

a) a lower R^2 for models that do not implicitly or explicitly account for information changes, ceteris paribus,

b) residual errors indicating over or underprediction of purchases of "unhealthful" and "healthful" foods respectively,

c) unexplained shifts in demand that correspond with changes in information regarding food healthfulness.

A "good" regression equation for a demand model is one which corresponds to theoretical expectations and helps to explain or account for a large proportion of the variation in the dependent variable. Assuming that coefficients are of the expected sign, a crude, but useful measure of goodness of fit is R^2 or adjusted R^2. The R^2 is the proportion of the total variation in the dependent variable "explained" by the regression of the independent variables on that variable.

Although a high R^2 is associated with a good fit of the regression line, it can be artificially enhanced. In time series studies, high values of R^2 can occur because any variable growing over time may help explain the variation of other variables growing over time. Serially correlated error terms can also increase R^2 significantly, and will occur in time-series studies if errors associated with observations or omitted variables in a given time period carry over into future time periods. In addition, if an omitted variable is correlated with the error term, serial correlation would be present and the estimators less efficient. The addition of more independent variables to the regression equation is likely to increase R^2. An "adjusted" R^2 should be used because it will not necessarily increase as new explanatory variables are added and removes the incentive to include numerous variables in a model without a theoretical basis.

Of particular interest will be studies that indicate changes in R^2 over time or have included a trend or dummy variable that is significant and improves the fit of the equation. These studies may be focusing on structural change, that is, changes in the parameter coefficients over time. If the parameters are changing, but the models do not acknowledge this, it would be expected that R^2 would also

change. We would expect to see decreases in the R^2 occurring whenever new information (positive or negative) is provided about health characteristics of certain food products.

The second expected empirical consequence is a non-random pattern in error terms corresponding to the period in which safety information is known to have changed. If the model is correctly specified, the errors should have close to the same properties, be nearly uncorrelated with each other, and have no discernable patterns. Model misspecification could cause errors to exhibit non-randomness, as evidenced when plotted on graphs over time. For example, if it is assumed that price is the sole determinant of the purchases of a product, several omitted variables related to demand, such as individual tastes, population, income, and weather, may be represented by the error terms. If these omitted effects are small, and independent of each other, it is reasonable to assume that the distribution of error terms will be random. However, if a significant variable is omitted, and that variable has an impact on demand, patterns such as over or underpredicting may occur when comparing model estimates with actual purchases.

Because of this, as people become more aware of food healthfulness over certain time periods, we would expect that there would be a progressive decline in the fit of traditional demand models that do not reflect these factors. We would expect the demand for "unhealthful" foods to have shifted downward because a negative characteristic has been included, and traditional models would tend to overpredict compared to actual purchases. The demand for "healthful" foods would trend upward, with traditional models underpredicting compared to

actual purchases.

The third empirical consequence is expected because model misspecification by omitting a relevant variable will cause inconsistent parameter estimates unless the omitted variable is uncorrelated with all the included independent variables. If the true model should include a variable representing a change in safety information, but the estimated model does not, the dissemination of safety information would create problems in the model's explanatory ability. It is generally assumed that parameter coefficients are stable, but if the model is misspecified, they may instead change over time. This is termed a "structural shift", and may be due to factors other than price or income.

Elasticities can be used to assess these changes as they are unitless representatives of the parameter coefficients and measure the effect of a percentage change in an independent variable, such as price or income, on the percent change of the dependent variable. The timing of the changes should be noted to see if there was new information about food healthfulness provided at that time. As discussed in Chapter Two, it would be expected that products with increased safety or healthfulness over the past decade (such as poultry, fish, vegetables, and fruit) would have become less income inelastic whereas less healthful goods (such as beef, pork, and eggs) would be more income inelastic. No such predictions can be made for price elasticities on a theoretical basis, so no consistent trend would be expected.

However, the use of changes in elasticity estimates to gauge the impact of information will be limited by inherent changes in

elasticities over time. If linear demand curves are used, they are not elastic at all points on the curve. Elasticities are usually measured and reported at average income levels. Therefore, if income has tended to increase (or decrease) over the years, the average would increase (or decrease) and the good would tend to become more (or less) income elastic.

Empirical analysis (U.S.D.A 1985) shows that deflated per capita disposable income has slowly trended upward for the past 41 years, with some drops observed in the 1970's (Cornell, 1983). Therefore, the demand for most foods may also be slowly and consistently trending toward becoming less income inelastic. If demand for beef, pork and eggs shows a trend toward becoming more income inelastic (as suggested by theory in Chapter Two), this will be opposite the natural trend over time and could mean that an exogenous factor, such as health information, may be involved. However, if demand for poultry, vegetables, and fish appears to becoming more income elastic as would be expected from dissemination of health information, this may also include the effect of increasing income over time.[1]

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[1]Statistical bias may also effect the elasticity estimates if observations on the omitted variable (health information) are correlated in the sample with observations on other independent variables, such as price or income. If the (deflated) prices of goods do not systematically increase (or decline) over the period that health information has been increasing (or decreasing), it could be assumed that the health information and price variables are not correlated. If personal income did not systematically increase (or decline) over the time period that health information was increasing (or declining), it could be assumed that the health information and income variables are not correlated.

3.3 Summary

Three empirical consequences were suggested if consumer concern for food healthfulness is currently affecting food demand. The presence of these consequences will be used to indicate if the hypothesis in Chapter Two is supported as reasonable.

First, it would be expected that acute information about product contamination or other health risks would have a significant impact on demand and/or shift consumption patterns over and above that predicted by price, income, and product availability considerations. The inclusion of a health information variable would be expected to increase the predictive ability of these demand models.

Second, it would be expected that consumer surveys would show that information on health risks in food is being received and used by consumers in their purchase decision.

Third, it would be expected that market demand models that do not implicitly or explicitly include consideration of changes in information about food healthfulness characteristics would have a significant degree of unexplained variation, residual patterns indicating over or underprediction, and unexplained structural shifts in demand.

Each of the following three chapters will examine one of these expected empirical consequences.

CHAPTER 4

CASE STUDIES

4.1 Introduction

This chapter investigates the impact of acute changes in information about specific health and safety characteristics on consumer demand for the affected products. Since the number of studies involving food are limited, related case studies involving tobacco are included as well. Information will be sought from these studies to examine whether a change in health risk information is a significant variable in demand.

When consumers' image of a product is altered by news reports or government information on new health risks, a re-evaluation of the risks associated with its consumption can be expected to occur. Some consumers may not purchase the suspect product, and this would be reflected by a drop in the demand curve for the food. The drop in demand would be expected to bring about a decline in quantity sold in the market. Price may drop as well if supply does not shift. The change in demand may be either permanent or temporary, although, as mentioned in Chapter Three, it would be expected to last as long as the health risk was in the product.

4.2 Case Studies

The following case studies will be examined for evidence of a change in demand corresponding with a change in health information.

4.2.1 Food Contamination

Brown (1969) hypothesized that a contaminated food would become less price inelastic (more price elastic) and tested this by assessing the impact of information provided before Thanksgiving in 1959 that cranberries may contain herbicide residues (amino triazole). A linear demand model was estimated where per capita purchases of cranberries (both fresh and processed) was dependent on average price, age of homemaker, and per capita income. Weekly household consumption data was used from a 300 family panel from 1957 to 1962. Elasticity estimates were then derived on an annual basis for six years. The annual demand estimations were compared to a single estimation over the entire period and an F test was used to test the hypothesis that demand was different during and following the contamination incident.

Per capita purchases of processed cranberries dropped 26% in 1959 compared to the previous year, but regained their previous level during 1960-62. Survey data at that time indicated that the decrease was in response to consumers discontinuing purchases rather than decreasing the amounts purchased (33% of respondents purchased cranberries in 1959 compared to 46% in other years). Average retail prices remained fairly constant.

The six annual price elasticity estimates were as follows:

1957 = -.87	1960 = -1.16
1958 = -.93	1961 = -.88
1959 = -.93	1962 = -.77

Although it would appear that, as expected, cranberries became more price elastic the year following the incident, the change was determined by Brown to not be statistically significant using an F test. He concluded that there was no evidence to support the

hypothesis of an increase in price elasticity following a change in public knowledge about possible pesticide contamination. However, given that there are few close substitutes for cranberries as an accessory to turkey, these findings may not be too conclusive.

Shulstad and Stoevener (1978) tested the impact of the provision of information in 1970 about mercury contamination in Oregon pheasants on the average hunting days per hunter and the number of hunters the following year. A linear demand model was estimated that included a variable representing the index of the level of information concerning mercury in pheasants. Content analysis was used to estimate the volume of information and calculate the value of the index.

The information variable was tested for its impact on the dependent variable "average hunting days per hunter" and shown to not be statistically significant. This means that if hunters had made the decision to hunt pheasants, knowledge of mercury contamination did not diminish the intensity of their hunting experience. However, with the dependent variable "number of pheasant hunters" the information variable was significant at the .01 level. The information was cited as responsible for a decrease of 17,602 hunters in 1971, which was estimated to represent 92% of the actual decrease in hunters that year. These results would be expected as per our hypothesis. As for timing, information provided 2 years before 1971 was shown to have the most impact.

Swartz and Strand (1981) investigated the effect of news reports that the James River was closed to oyster harvest due to kepone contamination. Five news variables, representing information in progressively lagged stages, were tested in a linear oyster demand

model using two stage least squares. News was measured by coding articles in major newspapers in terms of the probability that they would negatively affect sales. The codes were weighted by a measure of the probability that the article would be read using market share and prices of an advertisement in a similar location in the paper.

As expected, it was found that the majority of the variables (all except the last one) were statistically significant. Also as expected, the model including the information variables fit the observed quantity of oysters purchased from 1973 to 1976 and the incident had a negative impact on quantity demanded. The authors found that the total change resulting from a one unit change in news about oyster contamination was a decrease in per capita oyster consumption of one half gallon per thousand Maryland residents. The contaminated area was closed for harvest and marketing, therefore the estimates were based on the impact of the health information on the uncontaminated oyster market only. Consumer reaction wore off after eight weeks and consumption returned to previous levels.

Brown and Folsom (1983) examined the impact of gastroenteritis outbreaks from hard clam consumption on New York state demand. The authors, in analyzing the clam market, noted that the supply curve was nearly vertical so that as demand drops, the quantity produced is almost unchanged and only a price decrease is observed. Therefore they focused on price dependent demand models, with a dummy variable representing information about gastroenteritis. The information variable was incorporated into a littleneck clam linear demand model, which was then included in the cherrystone and chowder demand models.

Two stage least squares found the information variable to be

significant at the .019 level, and the model fit was good with an R^2 of .89. The health information variable had a negative impact on price, as would be expected. It was estimated that as a result of gastroenteritis outbreaks from clam consumption, the price of littlenecks dropped $7.33 per bushel at the wholesale level, or approximately 9 percent. The price of cherrystone clams dropped $1.97 per bushel and chowder clams $1.32 per bushel. The total market loss from the price decreases was estimated at $1.84 million over the five month period, distinct from the normal seasonal decrease in prices that would be expected during that time of year and is income lost to the industry at the wholesale level.

The authors estimated the economic loss to the industry as greater than to the consumers affected. The estimated cost of medical care, lost time, and government actions totalled $630,000. These figures suggest that changes in food safety information can have a large effect on both producer and consumer welfare. In addition, a new license fee system was proposed as a result of the contamination incident, which is will be an additional cost to producers.

In the case of Heptachlor contamination of Oahu, Hawaii milk, Smith, van Ravenswaay, and Thompson (1984) incorporated variables representing negative and positive media coverage of the contamination incident into a linear milk demand model. Also incorporated was a dummy variable representing the contamination incident and an interaction variable reflecting changed consumer habits (and thus the slope of the demand equation). The model explained approximately 93% of the variation in the independent variable, quantity of milk demanded.

Although negative media was statistically significant and associated with reduced consumption as would be expected, the positive media and interaction variables were found to be insignificant and also have a negative effect on consumption. Because the positive media variable was correlated with the negative media variable, the former was excluded from the estimated model and a one month lag on the negative media variable included. Re-estimation of the model found that the dummy variable representing the contamination incident was not statistically significant, but a 1% increase in negative media coverage was found to reduce consumption by .02% and was significant. The authors suggested that their results might mean all media coverage of the product, positive or negative, reduced consumption.

The study period ended before sales had returned to pre-contamination levels. A survey taken by Foremost, a milk company, three weeks after the incident indicated that more than 99.5% of random sample was aware of contamination, 56% reported they were buying less milk, and 24% of would buy less even after the milk problems were solved. Sixteen months after the initial milk recall, Oahu dairymen were threatened with a complete loss of market by competition from mainland milk imported to supply the market during the contamination incident.

A model of imperfect information was used by Johnson (unpublished) to examine consumer response to news reports of grain product contamination by the pesticide ethylene dibromide (EDB). Changes in information were expected to shift the demand curve for the quantity of dessert, bread, and roll mixes purchased per household in the appropriate direction. News media were determined to be the primary

sources of information on environmental hazards. A double log model was specified that included variables for cumulative column inches of news coverage (CUMCI), and a change in the column inches of news coverage relative to the preceding period (DCOL-IN). CUMCI was measured through a coding procedure and represented the amount and intensity of information provided on EDB contamination. DCOL-IN was interpreted as influencing the perceived uncertainty of available information. If there is a large increase in coverage, the author suggested that consumers would question the accuracy of earlier information whereas a decline in coverage would reassure consumers about the reliability of earlier information. A total of six model specifications were tested, all double log and including the above information variables.

In all models, the coefficients (or elasticities, due to double log model formulation) for CUMCI were negative and statistically significant, meaning that an increase in column inches of news coverage brought about a decrease in quantity demanded of the specified grain products. Considering that the news media was providing primarily negative information, the sign is as expected because this variable would decrease perceived mean quality. For DCOL-IN, the coefficients were negative and insignificant for two models, negative and significant for one model, and positive and significant for three models. The reason suggested for the positive coefficients was that those models included a negative interaction variable (the product of DCOL-IN x the log of the ratio of price of mixes to price of ready to eat baked goods).

4.2.2 Nutrition Information

In Levy et. al (1985) a quasi-experimental test was done to evaluate the impact of a nutrition information program called the "Special Diet Alert" (SDA). Brand-specific shelf markers were used to identify products considered low or reduced in sodium, calories, cholesterol, and fat in twenty Giant Food stores in the Baltimore, MD in the Washington, D.C. metropolitan areas. The stores were matched for socioeconomic and demographic characteristics, with Washington D.C. as the participating area. A model was used to identify possible program effects by analyzing covariance between stores compared to variance within stores across time. Market shares of the products were tracked over the two year evaluation period to see if the SDA program had an overall effect on long term purchases. This study differs from any of the other studies reviewed in that information was provided to promote consumption of products with greater healthfulness, rather than avoidance of unhealthful products.

Statistical analysis indicated that the average increase in market share for SDA products was 4 to 8 percent more on the average over the two years. This equated to a 1 percent increase in absolute market share for these products over the two year period. The effect of the SDA program compared respectably in size with the effects of both price and overall trends. In addition, a survey done at the beginning and end of the program, testing 100 shoppers in each of the 20 stores, verified a 19% increase in shoppers who had received SDA information.

4.2.3 Warning Labels

In Schucker et. al. (1983), the impact of information provided in 1977 regarding saccharin's carcinogenicity on diet soft drink demand

was studied. Consumer response opposing a proposed ban prompted a temporary moratorium on its implementation, and an alternative warning label program was initiated. Two dummy variables were included in a linear demand model, with generalized least squares as the estimation procedure. One variable represented news coverage, and was a 1 when the amount of coverage was over and above a certain expected average. The other variable was a 1 when a warning label was present.

As expected, both information variables had a negative impact on store sales of diet soft drinks. Advertising, as measured in total expenditures, and regular soft drink prices had a positive impact on sales. However, only the warning label and price variables were significant at the .01 level, whereas news media and advertising variables were not. Inclusion of a variable representing the initiation of the saccharin warning label in 1978 modelled the reduction in the rate of growth of diet drink sales in stores (Figure 4.1) and had an R^2 of .95. As will be noted, the growth rate essentially leveled off after 1977.

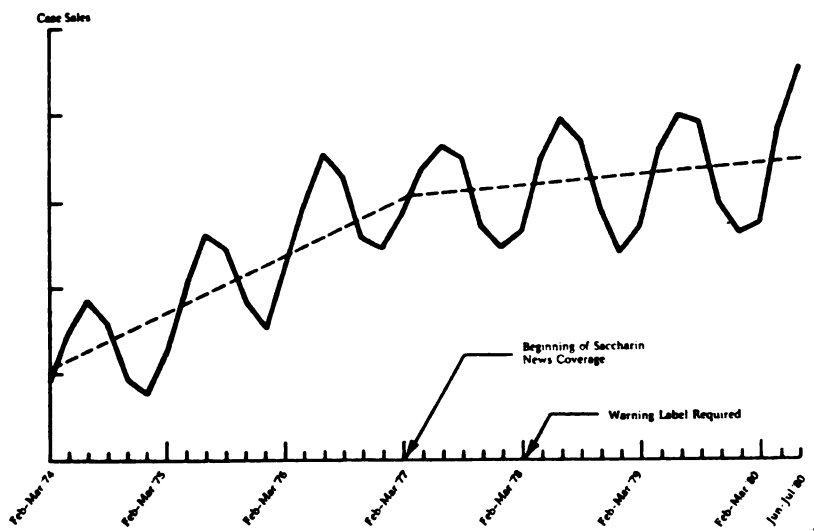

Figure 4.1 Grocery Store Sales of Diet Soft Drinks before and after the Saccharin Warning Label (Schucker et al., 1983)

In a demographic breakdown of consumer reaction, it was found that college educated consumers were the first to reduce diet soft drink consumption, which would be expected as they may be more efficient information processors. Those with young children followed, which may be a reflection of their interest in safety information. The elderly and non high school graduates did not appear to alter consumption. The authors suggested this is consistent other findings in the literature where public policies to communicate information tend to discriminate against the disadvantaged who have more incidence of reading problems.

The isolated effect of the warning label was estimated to have caused a 6% reduction in average monthly sales, as would be expected due to the addition of a negative characteristic. In a follow-up study by Orwin, Schucker, and Stokes (1984), it was found that although the diet soft drink sales growth rate eventually did resume, it remained at a level lower than would have been expected if saccharin information had not affected demand (Figure 4.2). A permanent shift was suggested, which we would expect since the saccharin was still present in the product and warning labels were also still in effect.

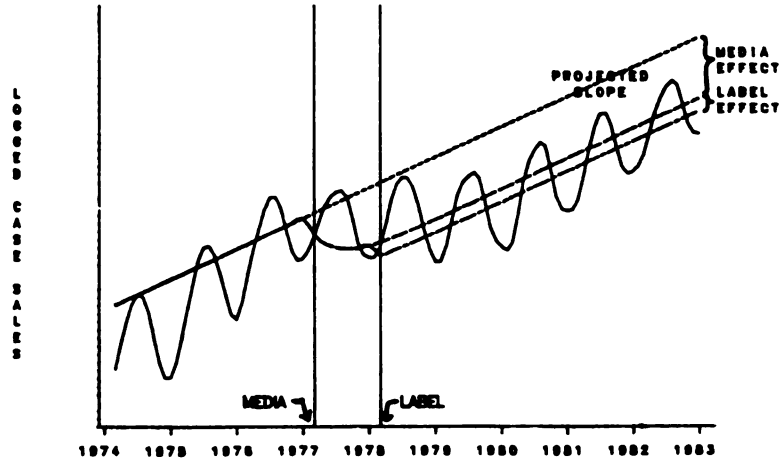

Figure 4.2 Grocery Store Sales of Diet Soft Drinks before and after the Saccharin Warning Label (Orwin, Schucker, Stokes, 1984)

4.2.4 Health Risk & Advertising

In an investigation of the impact of the ban on cigarette advertising, Hamilton (1972) included a variable representing advertising expenditures, and three different dummy variables to reflect different "health scare" incidents in a log linear demand mode. The dummy variables represented information changes that occurred in 1953-1970, 1964-1970, and 1968-1970 and the three health scare coefficients together were interpreted to measure the total effect that changes in information on safety had on cigarette consumption from 1953 to 1970.

As expected, the variables representing the information changes were all statistically significant in contributing to decreased per capita cigarette consumption. Separately, the three variables were shown to reduce per capita consumption by 47, 253, and 532 cigarettes per year respectively. The large value for the last incident may be reflective of either the type of information (anti-smoking advertisements required by law to offset positive advertisements) or increased consumer awareness due to the cumulative effect of the other two information incidences.

Hamilton calculated the elasticities of the different variables and found that the anti-smoking advertisements that were required by law (the last of the three dummy variables) had a much larger effect on annual per capita consumption than did positive advertising. Therefore, he suggested that the net effect of the ban on cigarette advertising was to stimulate consumption because both positive and negative advertisements were removed. However, since the advertising variable was not statistically significant in explaining changes in per

capita consumption, it may instead be more responsible for changes in market share.

Witt and Pass (1981) investigated the initial decrease in the number of cigarettes sold after health risk information about smoking was provided in Great Britain. Like Hamilton, they tested three "health scare" variables representative of specific information incidences (1962-1963, 1964-65, and 1971-72). The dummy variables were included in a log linear cigarette demand model.

As expected, ordinary least squares estimation found that all three of the information variables were statistically significant at the .05 level. The model provided good fit with an R^2 of .957. Based on the estimated elasticities for the different variables, a cut off point between the effect of health information and advertising was calculated. It was found that it would have been necessary to double advertising after the first scare, triple it after the second, and double it after the third if the manufacturers wished to offset its impact. The authors suggested that cigarette advertising is mainly concerned with increasing the market share of particular brands, however, in testing whether the overall market size may be affected by advertising and found that it was statistically significant.

4.3 Summary

As would be predicted by theory in Chapter Two, inclusion of variable(s) representing health information incidences appear to be significant and help provide an accurate reflection of consumption trends following contamination incidences. Although no overall conclusions on changes in elasticities can be made, it appears that

health risk information incidences do cause a change in product purchases.

An interesting feature was the impact of negative publicity on the product in comparison to positive advertising. In many cases it was greater than positive media. This finding may be consistent with empirical research that has shown negative information has more impact on consumer decision processes than the same amount and type of positive information (Sherrell, et al., 1985).

CHAPTER 5

CONSUMER SURVEYS

5.1 Introduction

This chapter examines what surveys reveal about how information affects consumer perceptions of food health risks. These perceived risks would in turn be theoretically affecting the consumer purchase decision. Most of the surveys use national random samples and exceptions to this rule will be noted. Survey questions that were open ended to obtain maximum information will also be noted. Since there is little uniformity among survey methods, only broad comparisons will be made. Twenty eight consumer surveys are reviewed and all tables referred to in the text appear at the end of each subsection.

5.2 Consumer Surveys

5.2.1 Do consumers report knowledge of health risks in food?

Information reaches consumers through a number of channels. As mentioned in Chapter Three, considerable information has been disseminated at various times regarding the linkage between food and health. It would be expected that consumer survey response would reflect information that: pesticide contamination may be a problem in food, with some pesticides carcinogenic; excessive use of preservatives may be related to cancer; high cholesterol intake, and certain foods are factors in heart disease; salt/sodium intake is related to high blood pressure; and a high fat diet may have a relationship to all of the above diseases. It would also be expected that highly processed foods (containing salt and preservatives), eggs, and higher fat foods

(including red meats or dairy products) would be mentioned as having a negative impact on health. Tables referred to are on pages 49 - 56.

As would be anticipated, environmental contaminants (Table 5.1), pesticide residues (Table 5.2), or harmful chemicals, additives, or preservatives (Table 5.3) were of major concern to many respondents. Although food scientists rank pesticide residues as the least important health risk (Kramer, 1986), this degree of consumer concern is consistent with studies showing that people may have a tendency to overestimate low probability events as mentioned in Chapter Three.

Many factors could affect the degree to which people's risk perceptions are heightened. The reported main sources of information on chemicals or additives was the media (Table 5.4), whose coverage tends to highlight low probability incidences. Concern about chemicals in food could also be due to the reported perceptions that cancer may result (Table 5.5), which is the most feared disease (Table 5.6). Respondents do not appear to have much faith in federal pesticide laws (Table 5.7), which could also be a source of increased concern. However, this could be tempered by the majority of the respondents' reported confidence in their own actions to reduce pesticide exposure (Table 5.8). This is consistent with discussion in Chapter Three that people have considerable confidence in their ability to avoid risk.

Respondents appear to consider tradeoffs involved in pesticide use. They reported that the benefits of chemicals do not outweigh the risk (Table 5.9). This may be partially due to an incorrect information base....the majority reported that pesticide and animal drug use resulted in increased food prices and production costs (Table 5.10), which is not generally true. The most reported benefit of

pesticides was an increase in food availability and some increase in food quality. Interestingly, food and meat safety was almost equally reported as being increased and decreased by chemical use. Although this could indicate the possible merits of a positive information program on chemical use, mention of potentially negative attributes may want to be avoided since it could further heighten concern (Zellner, 1986).

Theory would suggest that respondents would be willing to pay more for food with reduced risk in that more of a positive attribute is present (e.g. safety). The survey data indicates that there may indeed be acceptance of an increased price for safety: respondents were evenly split on whether they would pay higher prices for natural food (Table 5.11), whereas 70 percent supported paying more per pound of beef to obtain safety information (Table 5.12), and a slight majority agreed that consumers should be allowed a choice between grades of safety on a product (Table 5.13).

Tables 5.14 through 5.16 look at the ability of consumers to recall specific information items. As expected, a large number of the respondents had received information about the link between diet and cancer, and botulism or EDB in certain foods. The EDB incident had a great deal of press coverage, and by far the largest response, with specific (and generally correct) recall of contaminated products.

There was considerably more survey information available on consumer perceptions of the relationship between diet/nutrition and health than there is on their specific concerns about food safety. A large majority of respondents (88%) acknowledged some relationship between diet and health (Table 5.17), but when specifically queried, a

much smaller percentage provided information on what the health problems could be.

Heart problems were cited by over half the respondents as related to cholesterol and one fourth as related to sodium (Table 5.18), and over a third of the respondents cited fats/oils as factors (Table 5.20). Most people knew of some ingredients that were related to heart problems. Ninety percent could name a food product related to heart problems, and red meat was the most mentioned, with eggs following (Table 5.20). There was no specific correlation done to see if the respondents cited red meat (most cited food) because it contained fats/oils (most cited ingredient), or eggs because they contained cholesterol. An interesting anomaly is that cholesterol as an ingredient was cited half as often as fat as a cause of high cholesterol related health problems.

Two thirds of the respondents cited the ingredient sodium as a key factor in high blood pressure in one study, and over half cited it in another (Tables 5.20, 5.19). The actual product "salt" was cited by over a third of the respondents (Table 5.20). This suggests that respondents are able to discriminate between the food product and the ingredient and may be aware that the latter is in a number of products. Fats were cited by a few respondents as having a secondary role in high blood pressure, and after "salt" , some of the respondents cited red meat (Table 20).

When specifically asked about fat in their diet, over half of the respondents indicated that they were concerned, but there was confusion as to what type of fat to be concerned about (Table 5.21). This could be consistent with the individual developing a heuristic "avoidance of

"fat" to deal with complex information, or may simply be due to ignorance.

With the exception of cancer, respondents appear to have more confidence in their knowledge about foods related to disease than the specific ingredients involved (Table 5.20). There was the least knowledge expressed about the cause of cancer, either from food or ingredient perspective.

In addition to having received information on diet/health relationships, most consumers report that the amount of these substances in food is important to them as noted in Table 5.22. Nutrient value, salt, and vitamins are the highest concerns, and sugar, cholesterol and calories are also important. How people report they purchase food in relation to these characteristics will be the subject of the next section.

TABLE 5.1 Rank of items in order of food safety concerns

	Most serious				Least serious
	1	2	3	4	5
Environmental contaminants	55%	20%	14%	10%	2%
Disease causing organisms	54	14	17	10	6
Pesticides	38	22	20	14	6
Animal Drugs, etc	30	18	22	20	10
Food additives	17	14	14	15	41

Source: 1983 Kansas Cooperative Extension mail survey, n = 400, random sample of Kansas residents

TABLE 5.2 Degree of concern about items being in food

	Serious Hazard	Something of a Hazard	Not at all a Hazard	Not Sure
Residues, such as pesticides	77%	18%	2%	3%
Cholesterol	45	48	5	2
Salt in food	37	53	9	1
Additives/preservatives	32	55	8	4
Sugar in food	31	53	15	1
Artificial coloring	26	53	17	5

Source: Food Marketing Institute (FMI), 1984 telephone survey by Louis Harris, n = 1000, sample controlled 60% female 40% male, random digit dialing

TABLE 5.3 Women's main food concerns

Avoiding harmful additives/preservatives/chemicals	41%
High food prices	35
Freshness/availability of fresh foods	19
Avoiding salt	13
Finding nutritional foods	11
Quality of the meat/foods	7
Avoiding sugar	5
Avoiding high calorie foods	4
Spoilage	3
Tampering	3
Checking expiration dates	3
Avoiding fat	3
Tainted food/botulism/food poisoning	3
Buying natural food	2
Avoiding cholesterol	1
Insecticides on foods in growing	1

Source: Good Housekeeping Institute (GHI), 2/85 in home personal interviews, n = 100, Philadelphia sample of married women with 1 child at home, 75% Good Housekeeping readers, open ended question

TABLE 5.4 Source of information on food chemicals and additives

Magazines	42%	Television	33%
Newspapers	40	Labels	22

Source: GHI, 4/85 in home personal interviews, n = 200, 20 metropolitan area sample of main food purchasers in minimum two person households, Good Housekeeping readers

TABLE 5.5 Cause of fear of chemicals

Cancer	38%	Effects over time	15%
Publicity about cancer	22	Fear of unknown	13

Source: GHI, 4/85 in home personal interviews, n = 200, Good Housekeeping readers in 20 metropolitan areas, main food purchasers in minimum two personal households, open ended question, partial listing of top responses

TABLE 5.6 Most feared disease or illness

Cancer	59%	Heart disease	5%
Aids	13	Arthritis	1
None	10	Alzheimers	1

Source: Public Opinion 2/86. Survey by Gallup Organization 8/85, national random adult sample

TABLE 5.7 Attitude toward federal laws on pesticides

Adequate	34%	Not aware	9%
Not strong enough	47	Not sure	5
Too strict	5		

Source: Los Angeles Times 4/83 telephone survey, n = 1,223, national adult sample

TABLE 5.8 Ways to personally lessen the danger of pesticides

	very effective	somewhat effective	total
wash food	52.4%	39.7%	92.1%
remove the skin	45.0	37.5	82.5
cook food	41.5	32.9	74.4
keep self healthy	41.8	29.9	71.7
rub food	15.4	34.9	50.3

Source: Blair and Sachs 1984 telephone survey, n = 605, random sample of Pennsylvania grocery buyers

TABLE 5.9 Attitude toward pesticide benefits vs. risk

Risks outweigh the benefits	45%
Benefits outweigh the risks	35
Don't know	20

Source: Roper Organization 3/84 personal survey, n = 2,000, national random adult sample

TABLE 5.10 Perceived impact of pesticides on food

	Large Decr.	Decr.	No Impact	Incr.	Large Incr.	DK
Food prices	3%	16%	9%	51%	7%	15%
Cost of production	3	9	6	60	10	12
Food availability	1	3	15	41	25	16
Food quality (taste/appearance)	4	17	22	26	9	22
Food safety	10	33	6	21	10	21

Perceived impact of animal drugs on meat

	Large Decr.	Decr.	No Impact	Incr.	Large Incr.	DK
Meat prices	2%	22%	7%	47%	9%	13%
Cost of Production	3	22	5	49	11	11
Meat availability	1	3	13	57	12	15
Meat quality	4	23	24	21	3	26
Meat safety	11	31	10	17	5	26

Source: 1983 Kansas Cooperative Extension mail survey, n = 400, random sample of Kansas residents

TABLE 5.11 Willingness to pay higher price for natural food

No	45%
Up to 10% more	44
Not sure	11

Source: GHI 3/83 in home personal interviews, n = 200, Good Housekeeping readers in 20 metropolitan areas,female, 18-59, main food shoppers, read labels, and concerned about labeling

TABLE 5.12 Amount willing to pay for food safety information (per pound of beef)

Nothing, am satisfied	19%
Nothing, government should pay	11
1-2 cents per pound	42
3-5 cents per pound	22
6-10 cents per pound	5
over 10 cents per pound	1

Source: 1983 Kansas Cooperative Extension mail survey, n = 400, random sample of Kansas residents

TABLE 5.13 Consumer choice between safe & less safe products

	% Agree
Consumers should be allowed a choice between a "very safe" product at a higher price and the same one without the safety factor...that is a choice between safety and cost.	54

Source: Public Opinion, 2/86 12/79 & 1/80 Louis Harris survey, n = 1,488, national random sample

TABLE 5.14 Have heard or seen anything in the past month or so about a NAS report that shows connection between diet and cancer?

Yes	53%	No	45%

Source: Roper Organization, 7/82 personal interviews, n = 2000, national random adult sample

TABLE 5.15 In the past few months, what products have you heard that have been found to be contaminated and can cause botulism?

Canned salmon	45%	Canned ham	2%
Canned mushrooms	24	None	38
Canned soup	6	Don't know	5

Source: Roper Organization, 6/82 personal interviews, n = 2,000, national random adult sample

TABLE 5.16 Which have you read/heard about in past month or two?

Presence of EDB in certain food products	82%
Leakage of chemical waste into soil	78
Asbestos in school ceilings	73
Sugar substitute Aspartame	71
Acid Rain	70

Which products have you heard about in connection with EDB in food? (Of those noting EDB in food products)

Cake mixes	65%	Fresh fruit	22%
Flour	40	Baby food	18
Cereal	37	Canned vegetables	10
Bread	23	Chicken	6

Which have you heard about the effects of EDB in food products It could cause:

Cancer	60%	Nothing	4%
Respiratory problems	10	Don't know	13
Heart problems	10		
Skin rash	10		

Source: Roper Organization, 3/84 personal interviews, n = 2,000, national random adult sample (% add to greater than 100 due to multiple answers)

TABLE 5.17 Do foods have short term or long term health effects?

Both short and long term	50%
Long term on future health	38
Short term effect only	2
Don't know	11

What is the long term effect of foods on health?

Can cause heart problems	20%
Gain too much weight	20
Cholesterol buildup	16
Lead to high blood pressure	14
Lead to diabetes	12
Cancer	10
Hardening of arteries	10
Bone deterioration if low calcium	8
General health problems	6

Source: GHI 5/84 in home personal interviews, n = 200 Good Housekeeping readers in 20 metropolitan areas, with minimum 1 child at home, open ended question, partial listing of top responses

TABLE 5.18 Health problems related to consumption of:

Sodium	
Hypertension	51%
Heart problems	29
Excess fluid retention	9
Uremia or kidney disease	6
Diabetes	2
Stroke	1
Have heard bad, don't know why	4
Have not heard of problems	27
Cholesterol and saturated fat	
Heart problems	57%
Atherosclerosis, arteriosclerosis	26
Hypertension	10
Obesity	2
Stroke	2
Cancer	1
Diabetes	1
Have heard bad, don't know why	5
Have not heard of problems	37

Source: 1982 Food and Drug Administration (FDA) telephone interview survey by Market Facts, Inc, n = 1,000 in national probability sample with random digit dialing, respondents over 18 years, open ended question, substance anchored group

TABLE 5.19 Perceived dietary factors related to high blood pressure

Salt, sodium, salty foods	54%
Alcohol	26
Cholesterol	17
Fats	17
Caffeine, coffee, tea, colas	9
Sugar, sweet foods	6
Calories, excessive food	6
Pork	5
Tobacco, smoking	4
Saturated fats	4
Starch, starchy foods	3
Additives, preservatives, colors	2
Fried foods	2
Have not heard about diet relationship or don't know specific substances	22

Source: 1982 Food and Drug Administration (FDA) telephone interview survey by Market Facts, Inc, n = 1,000 in national probability sample with random digit dialing, respondents over 18 years, open ended question, disease anchored group

TABLE 5.20 What foods are associated with certain health problems?

High blood pressure			
Foods		**Ingredients**	
Salt	37.5%	Salt/sodium	66.5%
Red meats	13.0	Fats	13.0
Bacon	8.0	Cholesterol	7.5
Eggs	7.5	Caffeine	6.5
Don't know/NA	16.0	Don't know/NA	21.5

Heart trouble			
Foods		**Ingredients**	
Red meat	32.5%	Fats/oils	39.5%
Eggs	23.5	Cholesterol	28.5
Fats	18.5	Salt	12.0
Meats	11.5	Don't know/NA	32.5
Salt	9.0		
Butter	7.0		
Don't know/NA	10.0		

Cancer			
Foods		**Ingredients**	
Red meat	11.5%	Saccharin	14.0%
Bacon	9.0	Nitrite/nitrates	10.5
Diet soft drinks	7.0	Fats	10.5
Meat	7.0	Chemicals	8.5
Don't know/NA	37.0	Don't know/NA	37.0

High Cholesterol			
Foods		**Ingredients**	
Eggs	59.0%	Fats/oils	39.5%
Red meats	15.5	Cholesterol	16.5
Fats	15.0	Egg yolks	8.0
Butter	13.0	Don't know/NA	37.5
Don't know/NA	10.0		

Source: GHI, 4/85 in home personal interviews, n = 200, Good Housekeeping readers in 20 metropolitan areas, main food purchasers in minimum two person households, open ended questions, partial listing of top responses

TABLE 5.21 Concern about saturated versus polyunsaturated fats

Concerned about both	23%
Concerned about saturated fats only	7
Concerned about polyunsaturated fats only	3
Concerned about fats, but not aware of diff types	23
Not concerned at all	35
Not sure	8

Source: 1982 Food and Drug Administration (FDA) telephone interview survey by Market Facts, Inc, n = 1,000 in national probability sample with random digit dialing, respondents over 18 years

TABLE 5.22 How important is the amount of ( ) in the food you eat?

	Very	Fairly	Not very	Not at all
Nutrient value	52%	37%	9%	2%
Salt	49	27	18	6
Vitamins	49	36	13	2
Sugar	44	30	20	6
Cholesterol	36	30	25	8
Calories	35	31	25	8
Fiber	33	35	23	8
Preservatives	28	31	30	10
Coloring	23	27	35	14

Source: Roper Organization, 10/83 personal interviews, n = 2,000, national random adult sample

5.2.2 Have consumers reported changes in food consumption because of information on health risks?

Do shoppers incorporate this information into their purchase decision? It would be expected that they would report decreased consumption of; foods that have a greater likelihood of chemicals (highly processed or preserved), foods cited as contributing to high blood pressure or heart disease (eggs or red meat), and possibly those with fat in general (for weight control). Also, it would be expected that there would be reported increases in consumption of vegetables, fish, fruit, and poultry. However, reported food consumption changes may be due to factors other than health and safety concerns. Therefore it is important to also look at consumer's reported consumption of food characteristics that may be associated with health and safety concerns, where available. The tables referred to in this section are on pages 61 - 77.

The main concern reported in the previous section was chemicals, either from pesticide residues, environmental contamination, or preservatives. In contrast to the acute health risk incidences in Chapter Four, the impact of chemical averse purchase decisions would be expected to be more difficult to observe in everyday consumption choices. Generally, certain products are not "known" for containing chemicals, so respondents must instead try to avoid certain ingredients. Conflicting responses were reported in regards to chemical concerns. Contrary to what would be expected with the earlier surveys, only one fourth of survey respondents (Table 5.23) reported that they would avoid enjoyable foods if they contain additives or preservatives. In another survey, nearly two thirds report trying to

avoid preservatives, artificial flavors, and colors (Table 5.24). The difference may be due to how the question was asked. The first question would cause them to think of a specific food and then make a decision, whereas the other one thought only of the possibility of chemicals in all foods. Avoidance would be primarily through reading label information, since the one of key purposes that consumers report for reading labels is to check whether the product contains certain ingredients that the shopper wishes to avoid (Table 5.25, 5.26). Chemical additives were cited by the majority of respondents when asked what the most frequent use of label information was (Table 5.26).

Are people making dietary changes in response to general health concerns? In 1982, only 16% of survey respondents indicated they had both seen the National Academy of Sciences (NAS) report on diet and cancer and planned to make diet changes (Table 5.27). Thirty six percent (53% x 68%) were not planning any changes even though they had seen the report and 47% had not seen the report. These responses are markedly different from Table 5.28, where 64% of the survey respondents in 1980 had made changes in their diet for health or nutrition factors. And, in 1984, 47% of the respondents (Table 29) stated they had changed their meal patterns and 63% changed their shopping habits (Table 30) in the past 2 - 3 years.

The lower response in Table 5.27 could be an example of the specific effect of one piece of information on consumer behavior over a specific time period. The information diffusion process over time could have caused a number of people to already change their diet by 1982. The largest indication of those changing their diet was in Table 5.28 where no time limit or information source was placed on the

question (have you ever changed your diet for health reasons?). The second highest response had a time limit of changing the diet within the past two years, but no stated information source. Another factor contributing to the low response may also be that the provision of new knowledge is often more important to individual decisions than the repetition of what is already known (Viscusi & Magat, 1987) and the additional information of the NAS report was not new to many consumers.

As expected, the specific foods that consumers reported to decrease consumption of (Table 5.27) are those with high preservative, salt, cholesterol, and fat contents. Respondents to an earlier, 1979 survey also cited reductions of similar foods, explicitly for fat or cholesterol purposes (Table 5.28). Of the products whose consumption was being reduced, red meat was a common target in a number of surveys (Tables 5.29 through 5.33) and vegetables, fish and chicken the target for increased consumption. Although the directions of change for certain foods are as expected if health concerns were a factor in the purchase decision, no reasons were provided for these consumption changes. The purchase influences in Table 5.34 provide an indication of some food characteristics under consideration in consumer purchase decisions. The positive vs. negative influences may be representative of consumer decision tradeoffs. For example, if a consumer is interested primarily in taste (or has no knowledge of or interest in other product characteristics), beef or chicken would be equal choices. However, if price is the main interest, chicken would be chosen as it ranks highest as a value for its money and cost. If the consumer is sensitive to health risks from food, beef loses some of its luster since it rates higher in the fat content, cholesterol, salt, and

fattening categories. In the processed meat area, it is clear that salt, fat, and cholesterol concerns are much greater considerations in the overall purchase decision than in fresh meats.

Another example of possible tradeoffs is on Table 5.35. Even though roughly one third of the respondents questioned whether convenience food is as safe as other food, this is a rapidly growing segment of food consumption (Capps, 1986). It may be that this is an area where an active tradeoff between "safety" and "convenience" is taking place.

TABLE 5.23 Attitude toward chemicals

	% agree
There are foods I enjoy but rarely buy because they contain additives/preservatives	26

Source: Yankelovich, Skelly, & White (YSW), 1985 telephone survey, n = 1,211, primary food shoppers

TABLE 5.24 Women's attitudes toward three types of additives

Try to avoid preservatives	66%
Try to avoid artificial flavors	65
Try to avoid artificial colors	60

Source: GHI 5/84 in home personal interviews, n = 200 Good Housekeeping readers in 20 metropolitan areas, with minimum 1 child at home

TABLE 5.25 How do respondents shop?

What factor most relied on when buying new food product?	
-Ingredient listing	47%
-Label statement	31
-Friends opinion	11
-Advertising	8
-Picture on label	5
How often use ingredient list when shopping?	
Frequently	67%
Occasionally	32
Seldom	2
What check ingredients for?	
Something to avoid	46%
Amount of each ingredient	13
Both amount & something to avoid	41
Rely on labels or past experience in purchase decision?	
Rely on both	58%
Past experience	27
Label information	15

Source: GHI 3/83 in home personal interviews, n = 200, Good Housekeeping readers in 20 metropolitan areas, female, 18-59, main food shoppers, read labels, and concerned about labeling

TABLE 5.26 Label information used in making purchasing decisions

	Always/frequently Used	Importance of Information
Price	92%	81%
Food name	90	76
Main ingredients	89	79
Sugar content	78	85
Complete ingredients	72	88
Chemical additives	71	81
Brand name	68	68
Calories	65	68
Salt content	63	79
Protein	51	54
Cholesterol	48	59
Fat content	42	55
Vitamins/minerals	42	61
Fiber content	41	51

Source: GHI 3/83 in home personal interviews, n = 200, Good Housekeeping readers in 20 metropolitan areas, female, 18-59, main food shoppers, read labels, and concerned about labeling

TABLE 5.27 Response to National Academy of Sciences (NAS) Report

Of 53% of sample who have seen report, Do you think you will change your diet?

Major changes	4%	No changes	68%
Moderate changes	26		

Of those who have heard about or seen this report and will make major or moderate changes in their diet (16% of total) their response will be to:

	Eat more of	Eat less of
Smoked sausage	*%	69%
Bacon	6	69
Frankfurters	6	63
Bologna	6	63
Ham	6	50
Smoked Fish	6	44
Whole milk	25	25
Ice cream	19	13
Kale	13	13
Broccoli	56	6
Cabbage	50	6
Whole grain bread	50	6
High fiber foods	56	6
Cauliflower	44	6
Brussels sprouts	31	6
Spinach	50	6
Carrots	63	*
Fruit	69	0
Fresh fish	56	*

Source: Roper Organization, 7/82 personal interviews, n = 2000, national random adult sample *less than 1% change

TABLE 5.28 Have you made diet changes for health/nutrition reasons?

No 46% **Yes 64%**

Sugar reduction	52%
Weight control	43
Salt reduction	29
Fat content reduction	8
Cholesterol reduction	23
Nitrite concerns	12
Saccharin concerns	5
Preservatives, etc	10

(continued on next page)

Of those responding yes, what have those changes been?

Fat and cholesterol concerns

Bacon, sausage, prep. meats. . . . .25% have reduced consumption
Eggs, beef, fresh pork. . . . . 20% have reduced consumption
Poultry, fish, shellfish. . . . . 20% have increased consumption
Whole milk. . . . . 15% have reduced consumption, with
11% changed from whole to lowfat
Butter, other fats/oils. . . . . .10% have reduced consumption

Source: U.S. Department of Agriculture (USDA), 1979 personal interviews, n = 1,353, nationwide random sample, respondents main food shopper/preparer, open ended question, partial listing of concern/food relationships

TABLE 5.29 Have meal patterns changed in past 2 years?

No 54% Yes 47%

less red meat	11%
different schedules	5
more vegetables	5
more fish	4
less calories	4
more chicken/white meat	3
more nutrition conscious	2
lowered salt intake	2
lowered fat/cholesterol	2
less vegetables	2

Source: GHI 5/84 in home personal interviews, n = 200 Good Housekeeping readers in 20 metropolitan areas, with minimum 1 child at home, open ended question, partial listing of top responses

TABLE 5.30 Have food shopping habits changed compared to 2-3 yrs. ago?

No 38% Yes 63%

buy more fresh fruits/veg.	14%
read labels more	9
compare prices more	7
shop more carefully	7
buy more low cal products	5
buy less processed foods	4
avoid additives now	4
buy less red meat	3

Source: GHI 5/84 in home personal interviews, n = 200 Good Housekeeping readers in 20 metropolitan areas, with minimum 1 child at home, open ended question, partial listing of top responses

TABLE 5.31 Reported changes in use of certain foods in past 2-3 years

Decreased use of		Increased use of	
Red meat	17%	Fish	24%
Eggs	17	Chicken	16
Beef	15	Poultry	13
Meats	13	Milk/dairy products	4
Milk/dairy products	6	Veal	3
Pork/ham	5	Seafood	2
Cheese	3	Cheese	2
Cholesterol/saturated fat	3	Meat (decreased price)	2
Fried foods	2	Eggs	.5
Fish	2	Pork	.5
Cold cuts	2		
Hot dogs	1		
Fat on meat	1		
Bacon	.5		
No change in these products	35%		

Source: GHI 5/84 in home personal interviews, n = 200 Good Housekeeping readers in 20 metropolitan areas, with minimum 1 child at home, open ended question, partial listing of top responses

TABLE 5.32 Reported changes in purchase of certain foods over prior years

	Buying More	Buying Same	Buying Less	Not Buying
Vegetables	65.5%	33.5	1.0	0
Fish/seafood	55.5	32.5	5.5	6.5
Natural foods	50.0	36.5	1.5	12.0
Red meat	4.5	31.0	62.5	2.0
Low cal foods	46.5	25.5	.5	27.5
Health food	23.5	34.0	1.0	41.5
Dietetic foods	22.5	19.5	1.0	57.0

Source: GHI, 4/85 in home personal interviews, n = 200, 20 metropolitan area sample of Good Housekeeping readers, main food purchasers in minimum two person households

TABLE 5.33 Percent of respondents who have increased or decreased consumption of selected food areas in past 2 years

	Decrease	Increase	No change
Salt	74%	0%	25%
Sodium	69	0	32
White sugar	63	.5	36
Cholesterol	57	3	40
Saturated fats	57	2	33
Food preservatives	56	0	41
Artificial flavorings	53	0	43
Calories	53	9	38
Red meat	50	6	45
Caffeine	48	3	45
All other sugars	49	1	46
Food coloring	46	0	49
Processed foods	40	2	54
Polyunsaturates	30	13	54
Saccharin	24	6	19
Eggs	24	13	63
Aspartame	7	42	16
Diet foods	5	17	36
Fish	4	49	46
Vitamins	3	29	62
Vegetables	2	58	41
Fresh fruit	2	57	42
Chicken	1	52	48
Fiber	1	53	44
Natural foods	0	43	48

Source: GHI 5/84 in home personal interviews, n = 200 Good Housekeeping readers in 20 metropolitan areas, with minimum 1 child at home

TABLE 5.34 Purchase Influences for fresh and processed meats

	Mean for fresh meat	Ground Beef	Fresh Beef	Pork	Chicken
Positive purchase influences					
Variety of serving	59	78	67	32	76
Taste appeal	55	47	66	52	66
Ease of preparation	52	73	55	30	59
Appeal to children	38	68	30	15	56
Value for money	33	45	30	25	76
Wholesomeness	33	36	39	25	73
Nutritional value	33	29	47	24	65
Cost	32	41	32	22	65
Exciting to eat	28	23	39	23	47
Negative purchase influences					
Fat content	24	25	21	26	13
Cholesterol	21	21	21	22	11
Salt content	21	18	19	27	15
Fattening	20	19	19	21	14

	Mean for proc. meat	Ham	Lunch Meats	Hot Dogs	Bacon
Positive purchase influences					
Ease of preparation	60	60	69	63	49
Appeal to children	43	33	48	57	33
Taste appeal	38	52	27	16	58
Variety in serving	22	36	20	10	22
Value for money	21	27	21	21	13
Exciting to eat	18	31	7	6	26
Wholesomeness	17	28	13	10	16
Nutritional value	8	15	8	3	5
Negative purchase influences					
Salt content	43	44	44	34	50
Fat content	36	27	31	34	52
Cholesterol	34	20	33	27	44
Fattening	28	25	27	24	34

Source: Yankelovich, Skelly, & White (YSW), 1985 telephone survey, n = 1,211, primary food shoppers

TABLE 5.35 Is convenience food ( ) as other food?

As safe	65%	Less safe	31%
Safer	3%		

Source: U.S.D.A. 1974 personal interviews, n = 2,503, nationwide random sample, respondents main food shopper/preparer

5.2.3 Have specific consumer concerns changed over time in response to changes in information on food safety characteristics?

The number of incidences of food contamination with pesticides would be expected to cause an increase in concern about chemicals by survey respondents. It would also be expected that consumers would have a greater knowledge of diet and health relationships over time due to continued release of health information. The tables referred to in this section are on pages 71 - 73.

As expected, respondent levels of concern over pesticides increased substantially in the only survey available over different time periods (Table 5.36). Respondents appear to be increasingly concerned about pesticides, especially as it relates to farmer exposure. Reported television exposure increased 35% reflecting either increased coverage of pesticide incidents and/or increased viewing time. The majority of respondents report receiving information on pesticide use from books, newspapers, and television (Table 5.37).

As would be anticipated if concerns about pesticides was increasing, 38% fewer Pennsylvania survey respondents reported in 1984 that they were using pesticides in the garden than in 1965 (Table 5.38). However, this could also be due to overall changes in the number of respondents gardening in 1984 compared to 1965. Seventy percent of 1984 respondents reported believing that pesticides effect cows milk and chicken meat, compared to thirty percent in 1965. Likewise, the 1984 respondents reported less confidence that farmers, government regulations and store inspections protect them from exposure.

There is no indication of how much chemical exposure the respondents perceived they were actually receiving, however. Although

they may be able to reduce their own exposure through reduced chemical spray use at home (or home preparation steps as in Table 5.8), what percentage of milk and chicken meat do they feel contains pesticides? And, are they avoiding these products? It is also not clear if the increased concern is due to information having been provided on new hazards from chemicals or information about increased exposure to chemicals already known to be hazardous.

The only other indication of chemical concerns over time is in Table 5.39 where respondents show an increasing awareness of specific chemical compounds such as nitrates and saccharin. And in another survey (Table 40) respondents appear to be expressing somewhat decreased concern about chemical additives, preservatives, and cancer causing ingredients over time.

As would be expected, there is increasing reported concern about dietary factors such as fat, cholesterol, calories, and salt (Table 5.40). There was an increase in interest to restrict fat for reasons other than weight control, as well as increased effort to avoid foods high in cholesterol (although on this latter point the majority of respondents still do not appear to avoid these foods) (Table 5.41). Also, there appeared to be an increase over time in those respondents who claim to be cutting down on meat for health reasons and a slight decrease in respondents that felt meat is healthier for them than other foods.

A change in respondent lifestyles was noted in Table 5.42, that may have an effect on food consumption. The largest shift in population attitude has been a decrease in the "meat lovers" group, with a similar increase in the "active lifestyle" area. This latter

group is not as closely related to health concerns as it is to convenience and weight control (Yankelovich, Skelly, and White, 1985), but is closely followed by an increase in "health oriented" lifestyle that has definite food consumption patterns. In addition, people appear to be transforming their weight control diets into health diets (Table 5.43) and those respondents fitting the "pro meat" attitude category have declined 17% from 1983 to 1985 (Table 5.44).

TABLE 5.36 Percentage of consumers with a Great Deal or Some Concern over pesticide use, 1965 and 1984.

	1965	1984	% change
How much have you personally been concerned or worried about the possible dangers of farmers using pesticides?	31.6%	76.0%	44.4%+
How much danger from pesticides do you feel there is for the farmer who handles and applies them?	15.0	78.7	63.7%+
How much danger do you feel chemical sprays and dusts have for wildlife that may come into direct or indirect contact with them?	51.8	80.8	29%+
How much danger do you feel there is to the person who eats fruits and vegetables that have been sprayed or dusted with pesticides?	41.5	71.1	30.1%+

Source: Blair and Sachs 1984 telephone survey, n = 605, random sample of Pennsylvania grocery buyers. 1965 telephone survey n = 728 reduced to fit 1984 sample

TABLE 5.37 Sources of information about dangers of pesticide use

	(percent responding positively)		
	1965	1984	%change
Read in Newspapers	50.5%	71.7%	21.2%+
Read in Books	41.1	71.9	30.8%+
Seen on TV	29.4	64.5	35.1%+
Discussed with Family	26.8	54.5	27.7%+
Discussed with Friends	23.8	44.2	20.4%+
Heard on Radio	23.2	41.5	18.3%+
Attended Meeting on Topic	2.2	4.3	2.1%+

Source: Blair and Sachs 1984 telephone survey, n = 605, random sample of Pennsylvania grocery buyers. 1965 telephone survey n = 728 reduced to fit 1984 sample

TABLE 5.38 Respondent attitudes toward pesticide use

	(percent responding positively) 1965	1984	%change
Govt. adequately regulates chemical use in or on food	97.7%	45.8%	51.9%-
Foods purchased from retail stores are adequately inspected	94.0	48.9	45.1%-
Farmers are careful w/pesticides	81.5	61.6	19.9%-
Use chemical sprays in garden	72.9	35.0	37.9%-
Pesticides effects cows milk	30.8	69.9	39.1%+
Pesticides effect chicken meat	24.7	67.1	42.4%+

Source: Blair and Sachs 1984 telephone survey, n = 605, random sample of Pennsylvania grocery buyers. 1965 telephone survey n = 728 reduced to fit 1984 sample, closed ended question

TABLE 5.39 Awareness of certain chemicals

	1974	1979	% change
Nitrate is safe/very safe	35%	19%	16%-
Saccharin is safe/very safe	59	30	29%-

Source: U.S.D.A. 1979 personal interviews, n = 1,353, random nationwide sample, respondents main food shopper/preparer **1974

TABLE 5.40 What is it about the nutritional content of what you eat that concerns you and your family the most?

	1983	1984	%change	1986	%change
Chemical additives (MSG/steroids)	27%	25%	2%-	16%	11%-
Sugar content, less sugar	21	22	1%+	18	3%-
Vitamin/mineral content	24	19	5%-	22	2%-
Food/nutritional value	10	10	9%+	11	1%+
No preservatives	22	17	5%-	15	7%-
Salt content, less salt	18	17	1%-	20	2%+
Freshness, purity, no spoilage	14	12	2%-	8	6%-
Balanced diet	10	9	1%-	14	4%+
Calories, low calories	6	9	3%+	11	5%+
Fat content, low in fat	9	8	1%-	17	8%+
Cholesterol levels	5	8	3%+	13	8%+
Natural	12	6	6%-	3	9%-
No cancer/illness causing ingred.	10	6	4%-	5	5%-
Protein value	5	6	1%+	5	0
Quality of food	3	5	2%+	1	2%-
Food coloring	6	4	2%-	2	4%-
Junk food	4	4	0	2	2%-
Carbohydrate content	1	2	1%+	2	1%+
Fiber content	2	1	1%-	3	1%+

Source: FMI 1983, 1984, 1986 telephone surveys by Louis Harris, n = 1001 1983, n = 1000 1984, n = 1004 1986, samples controlled 60% female, 40% male

TABLE 5.41 General attitudes toward food: 1983 and 1985

Agree strongly with statement	1983	1985	%change
It's important to limit fat even if not concerned about weight control.	57%	68%	11%+
I am extremely concerned about the amount of salt in my diet	46	53	6%+
I make a real effort to avoid foods high in cholesterol	39	45	7%+
There are foods I enjoy but rarely buy because they contain additives/preservatives.	26	26	0
Concern over weight control has a big influence on the types of food I buy.	35	38	3%+
Meat is definitely healthier for me than other foods I might eat instead.	13	12	1%-
I am considering/have cut down on the amount of meat I eat for health reasons.	19	26	7%+

Source: YSW 1983 and 1985 telephone surveys, n = 1,211, primary food shoppers

TABLE 5.42 Changes in distribution of population segments

	1983	1985	% change
Meat lovers	22%	10%	12%-
Creative cooks	20	17	3%-
Price driven	25	23	2%+
Active lifestyle	16	26	10%+
Health oriented	17	24	7%+

Source: YSW 1983 and 1985 telephone surveys, n = 1,211, primary food shoppers

TABLE 5.43 Trends in type of diet

	Female			Male		
	1977/78	1983/84		1977/73	1983/84	
Weight loss	63%	44%	19%-	48%	31%	17%-
Medical & health	26	35	9%-	35	44	9%+
Watching & gaining	11	21	10%+	17	25	8%+

Source: General Mills/Market Research Corporation of America Survey

TABLE 5.44 Shift in meat attitude

	1983	1985	%change
"Pro meat"	67%	50%	17%-

Source: YSW 1983 and 1985 telephone surveys, n = 1,211, primary food shoppers

5.2.4 Demographic Differences

Not all consumers appear to receive and retain food health information equally. Therefore, it is possible that shifts in socioeconomic factors could affect consumer response to health risk information.

Higher income consumers reported less concern about pesticides (Kramer, 1986), but more concern about sugar intake, weight control, and cholesterol (USDA, 1980). As would be anticipated, respondents with higher income and education levels expressed greater interest in information about product ingredients (USDA, 1977) as they may be more efficient information processors. Those with more education appear to be less concerned about animal drugs (Kramer, 1986), have more faith in food inspection procedures to protect them from bacterial contamination (USDA, 1977), but are more concerned about fat intake and cholesterol (USDA, 1980). In another survey, higher education levels appeared related to increased concern about pesticide use (Blair & Sachs, 1986), as well as greater belief that food products had traces of pesticides (USDA, 1977).

Older and unemployed persons seemed to worry more about food additives, as did the less educated and lower income categories (Kramer, 1986). Older and black consumers were more concerned with reducing salt intake or controlling blood pressure, which may be a function of specific health situations. Older people did not appear to be as aware of government's role in providing information on food and health risks (FDA, 1980). Decreased income or education was negatively correlated with the ability to match food borne diseases with the products in which they occur (USDA, 1977). Less educated consumers

also tended to recommend banning hazardous products more compared to receiving information about product risks and being given a choice on actions to take (FDA 1980). These last three points are consistent with the observation by Schucker et al. (1983) that government information policies may discriminate against the under-advantaged who have more reading difficulties.

5.3 Summary

Do consumers report knowledge of health risks in food? As expected, consumers generally report that they have received information about chemical or dietary health risks. They also appear to have a higher degree of concern for low probability events such as chemical exposure. As for the reported impacts of dietary factors on health, specific problems were mentioned such as heart disease, high blood pressure, and cancer.

Did respondents report changing food consumption practices because of information on health risks? At present, there is little survey data from which to draw conclusions that consumers are or are not consciously changing their consumption to avoid chemicals. They may be willing to pay more for information on chemicals, or chemical free products, and read labels to assess the presence of chemical ingredients. The case studies in Chapter Four, provide a stronger basis for conclusion about shifting consumption patterns due to chemical avoidance. As for concerns regarding diet and health, it is clear that there are reported reductions in certain foods that may be correlated with health risks, but reasons for the reduction in consumption were not given.

There is also little indication of the degree of response of the general public in avoiding unhealthful characteristics. It was noted in the Special Diet Alert study mentioned in Chapter Four (Levy, et al., 1985) that those with special diets reported a much higher participation level in the program. It may be that a number of the health factors mentioned (i.e. cholesterol, sodium) are known to be detrimental, but only those with heart problems or high blood pressure are actually changing consumption to avoid them. It is also possible that there is widespread interest in food and health relationships from the weight control perspective, and these effects are difficult to separate from health effects with current data.

Has there been a change in consumer concerns over time? As for changing concerns about chemicals, only one survey, of one state, was available to provide a clear picture. There was significantly heightened awareness between 1965 and 1984 of the risks of pesticides and health. It is possible, however, that an increase in chemical concerns would result from contamination incidences (EDB in grain products in 1984 when the survey was taken) or from those not related to food. As noted in Table 5.45 (page 78), the Tylenol tampering incident had ramifications for food consumption. The majority (88%) of respondents felt it would be sensible to inspect all food and beverage packages....and the frequency of those actually doing so was approximately as high as those inspecting drug packages alone.

One survey noted that there may be a trend toward less concern about chemicals in purchase decisions. This may be in direct relation to the increase in information about diet and health that has been made available, as well as the ability of consumers to assess whether

chemicals are present in their food. It has been theorized that people will indicate less concern about a risk if they have not experienced it recently, or have not had to make direct choices about it....which may apply to food purchases and chemical residues.

There appeared to be a wide range of responses to the different surveys, but generally there was no a clear indication or mandate that people are willing to increase consumption of and/or pay more for healthier food. Although people report that they are more aware of the general risks facing them (Table 5.46), most reported in 1980 that food was as safe or safer than five years previously (Table 5.47) and in 1983 most still believe that the food in the supermarkets was safe (Table 5.48). Safety is reported as a key factor in shopping (Table 5.49) but also reported as usually taken for granted (Table 5.50), and consumers report that they are placing an increasing amount of trust in themselves to assure that the products they purchase are safe (Table 5.51).

TABLE 5.45 What is your opinion of the following actions, in light of the Tylenol poisoning incidences?
(Separate question: What of the following have you done?)

	Sensible	Goes further than necessary	Ridiculous	Don't know	Have done
Throw out all X-str. Tylenol capsules	76%	13%	9%	2%	15%
Throw out all Tylenol products	28	43	26	3	5
Put away all Tylenol products until more info	62	18	17	3	6
Throw out all capsule medicines	12	36	49	3	1
Inspect all drug packages you buy	98	3	2	1	28
Inspect all food & beverage packages you buy	88	8	4	1	27
Have done none of above					50
Don't know					3

Source: Roper Organization, 10/82 personal interviews, n = 2,000, respondents are 99% of original sample - representing those who have heard of Tylenol problems, national adult random sample

TABLE 5.46 How much risk do you believe people are subject to today compared to 20 years ago?

More risk	80%
Less risk	6
Same amount	14

Source: Public Opinion, 2/86 12/17 & 1/80 Louis Harris survey, n = 1,488, national random sample

TABLE 5.47 Is food safer than five years ago?

Much safer	9%	Slightly less safe	14%
Slightly safer	19	Much less safe	7
About the same	46	Not sure	5

Source: 1980 FDA Survey, n = 1,570, national probability sample, primary food shopper in household

TABLE 5.48 The food in the supermarkets is safe to eat

	1982	1983
Agree	89%	88%

Source: Louis Harris 1/82 telephone survey, n = 1,003, national male and female food shoppers & Louis Harris telephone survey 1/83, n = 1,001, national male and female food shoppers

TABLE 5.49 Importance of 11 characteristics when food shopping

	Scale of 1 to 10
Food is safe	9.6
Food is good tasting	9.2
Food is fresh	8.7
Food is pure	8.2
Food is priced right	8.1
Food is natural	7.0
Food contains no preservatives	6.6
Food is low in calories	6.5
Food is health food	5.9
Food is light	5.7
Food is new and different	4.8

Source: GHI, 4/85 in home personal interviews, n = 200, 20 metropolitan area sample of Good Housekeeping readers, main food purchasers in minimum two person households

TABLE 5.50 Attitude toward safety

Take for granted in foods	64.0%
Must check everything I buy	29.0

Source: GHI, 4/85 in home personal interviews, n = 200, 20 metropolitan area sample of Good Housekeeping readers, main food purchasers in minimum two person households

TABLE 5.51 Who relied on most to be sure that products you buy are safe

	1979	1983	1984	% change
Yourself	39	46	48	9%+
Consumer organizations	19	6	9	10%-
Federal government	18	24	22	4%+
Manufacturers	17	13	11	6%-
Retailers	5	5	5	0
State government	1	3	3	2%+
Other	1	*	1	0

Source: Food Marketing Institute (FMI), 1984 telephone survey by Louis Harris, n = 1000, sample controlled 60% female 40% male, random digit dialing

CHAPTER SIX

DEMAND STUDIES

6.1 Introduction

Increases in per capita consumption of poultry, fish, fresh fruits and vegetables and decreases in per capita consumption of beef and eggs over the past decade may be due to changes in information about health risks in food. This chapter examines empirical estimates of demand for these foods to see how they explain changes in per capita consumption trends. Only one study could be found that explicitly examined the effect of health information on food purchases (eggs). Nonetheless, it is useful to examine the predictive power of alternative models, for if they fully explain per capita consumption trends, our hypothesis is not supported.

As discussed in Chapter Three, three sets of criteria are used to gauge how well alternative models predict consumption trends. The first is a comparison of the explanatory power of alternative models where we will use an R^2, or adjusted R^2 when available, as a measure of goodness of fit. We would expect that models that do not account for information changes explicitly (by incorporating an information variable) or implicitly (by incorporating time trend or dummy variable in the period of information change) will not predict changes in consumption as well as models that do. Thus, it is expected that R^2 will be significantly lower in models that do not explicitly or implicitly account for a change in information.

The second criteria concerns trends in residuals in the period during which information changes occurred. We expect that the

predictive power of models that do not explicitly or implicitly account for information changes will decline during the period that we know information changes occurred. It would be expected that poultry, fish, and fresh fruits or vegetables would tend to be underpredicted due to the omission of a change in information about their positive health characteristics. Beef, pork, and eggs would tend to be overpredicted due to the omission of a change in information about their negative health characteristics.

The third type of criteria concerns evidence of changing demand parameters, and hence elasticity relationships, in the period during which information changes occurred. The structure of demand is usually assumed to remain unchanged over the period under observation (Cornell, 1983), however, shifts in price/quantity relationships may occur over time and structural coefficients in the demand equation may not in fact be stable. If these changes cannot be explained via price or income, other factors such as changes in health characteristics of food may be involved. Changes in R^2 over time could also be reflective of parameter change since that would have a direct impact on goodness of fit.

Because of information in the mid 1970's that poultry, fish, eggs, and fresh fruits and vegetables are healthier and should be increased in the American diet, it would be expected that these products would become less income inelastic, because an increase in healthfulness is an increase in quality and hence the good is superior. The reverse would be expected for the demand for beef, pork, and eggs because of information at the same time that they could have harmful health effects if consumed in excess. It would be expected that these less

healthful products would become more income inelastic and less price inelastic. There is a less obvious theoretical basis for price elasticity changes as noted in Chapter Two, and it would therefore be expected that no consistent patterns would be observed.

Fifteen consumer food demand studies will be reviewed to see if they have these expected empirical consequences. These studies are listed with the variables in their respective models and the estimates reported, on Tables 6.1 and 6.2 on the following pages. Specific data from the studies are presented in Tables 6.3, 6.4 and 6.5 at the end of the chapter. As the reader will note, there is little, if any uniformity among the studies that can facilitate straightforward comparison. Generally, they have differing objectives, use different data sets, and have different model specifications. Although most provided own-price and income elasticity information, very few reported them over time. They also generally did not report or graph residual errors and only two used adjusted R^2. Therefore, certain foods will have more information for comparison than others.

Table 6.1 Summary of Variables Used in Demand Models

	Depdt. Variable	Price	Income	Time Trend	Socio-Demographic	Other
<u>Cross Sectional</u>						
Blaylock/Burbee 1986 (eggs)	P Q		x		x	
Blaylock/Smallwood 1986 (fruits/vegetables)	P Q		x		x	
Cheng/Capps 1985 (seafood)	log P Q	x	x		x	
Smallwood/Blaylock 1984 (40 food items)	P Q		x		x	
<u>Time Series</u>						
Chavas 1983 (poultry)	Q	x	x			
Cornell (1986) (beef, pork, poultry)	log P		x			Q
Eales/Unnevehr 1987 (poultry, pork, beef)	<u>P Q</u> M	log P	log X/P			
Ferris (1985 animal) (1986 vegetable)	log Q	log x	log x	log x		
Haidacher 1982 (poultry, red meat fish, eggs)	P Q	x	x			
Huang (1985) (40 food items)	Q	x	x			
Huang/Haidacher 1986 (poultry, red meat fish, eggs)	Q	x	x			
Manderscheid 1987 (pork and beef)	market price		x	x		Q
Putler 1987 (eggs)	Q		x	x	x	health info
Thurman 1987 (poultry, pork)	log Q log P	log x	log x log x			log Q
Unnevehr 1986 (poultry, pork, beef)	Q	x	income distrib.			

Table 6.2 Summary of Estimates Reported

	R^2	Residuals	Parameter Change	Other
Cross Sectional				
Smallwood/Blaylock 1984 (40 food items)	no	no	no	can compare elasticities between these two studies
Blaylock/Smallwood 1986 (fruits, vegetables)	no	no	no	
Blaylock/Burbee 1985 (eggs)	no	no	no	no
Cheng/Capps 1986 (seafood)	unadjusted	no	no	no
Time Series				
Chavas 1983 (poultry)	no	no	yes	no
Cornell (1986) (beef, pork, poultry)	adjusted	no	yes	no
Eales/Unnevehr 1987 (poultry, pork, beef)	unadjusted	no	yes	no
Ferris				
1985 (animal)	adjusted	no	yes	no
1986 (vegetable)	unadjusted	no	yes	no
Haidacher 1982 (poultry, red meat fish, eggs)	no	no	no	equation errors
Huang 1985 (40 food items)	no	yes	no	equation errors
Huang/Haidacher 1987 (poultry, red meat fish, eggs)	no	yes	no	equation errors & magnitude test
Manderscheid 1987 (pork and beef)	unadjusted	yes	yes	no
Putler 1987 (eggs)	unadjusted	no	yes	no
Thurman 1987 (poultry, pork)	no	no	yes	no
Unnevehr 1986 (poultry, pork, beef)	unadjusted	no	yes	no

6.2 Demand Studies

6.2.1 Poultry

Poultry consumption has increased significantly over the past ten years. Specifically, the annual average per capita consumption of chicken and turkey has increased 32% and 29% respectively since 1970. Also, since the mid-1970's, consumers have been told to increase the amount of white meat in their diet for health reasons, while decreasing consumption of traditional substitutes, such as beef. And as noted in Chapter Five, many of the survey respondents reported that they were increasing poultry consumption for their health. Could this be the reason for the observed increase in per capita consumption, or is it price or some other factor?

6.2.1.1 Goodness of Fit

Huang (1985), and Huang & Haidacher (1987) estimated a complete demand system, and stated that their models (with only price and income as key variables) "explained over 95% of the variation in turkey and chicken consumption from 1953 to 1983". This actually means that the statistical fit of their model matched the variation in actual purchases 95% of the time. This would not have been expected if health information was important to consumer purchase decisions. However, these studies should considered cautiously in that they may have had some problems with serial correlation (leading to high R^2 and inaccurate parameter estimates) as noted in the error patterns (Figures 6.1 - 6.5). Over and undershooting of predictions compared to actual values can be an indicator of serial correlation in the model. This tendency will also be discussed later in light of our hypothesis. An earlier study by Haidacher (1982) has been often cited as an example of

the stability of demand, but will not be discussed since the data utilized ended in 1977, which would omit a key period of information change.

Although Cornell (1986) mentioned the possibility of health information affecting consumer purchase decisions, he obtained an adjusted R^2 of .95 for broilers in a linear estimation using price and income variables from 1950 to 1982. Durbin Watson statistics were in the inconclusive range, so there is no evidence of the presence or absence of serial correlation.

However, in a different model, Ferris (1985) found that adjusted R^2 could be improved for chicken and turkey demand when a linear time trend variable beginning in 1977 was incorporated, which is as expected. Although the components in the trend variable were not specified, the timing corresponds with what is known about changes in information on health effects of poultry consumption. In addition, grouping the data in 1960-84 and 1970-84 sections showed that the fit for chicken and turkey deteriorated in the latter period...turkey most dramatically. Eales and Unnevehr (1987) also found through the use of an intercept dummy variable that there was a one time shift in demand in the mid 1970's.

6.2.1.2 Error Analysis

As expected, chicken consumption has been underpredicted since 1975 using only price and income models (Huang 1985), but turkey consumption has been overpredicted (Figure 6.1 on following page). Thurman noted that residuals in annual consumer demand models for poultry are serially correlated and hypothesized that model specification was at fault. This could contribute to the under and

overprediction tendency.

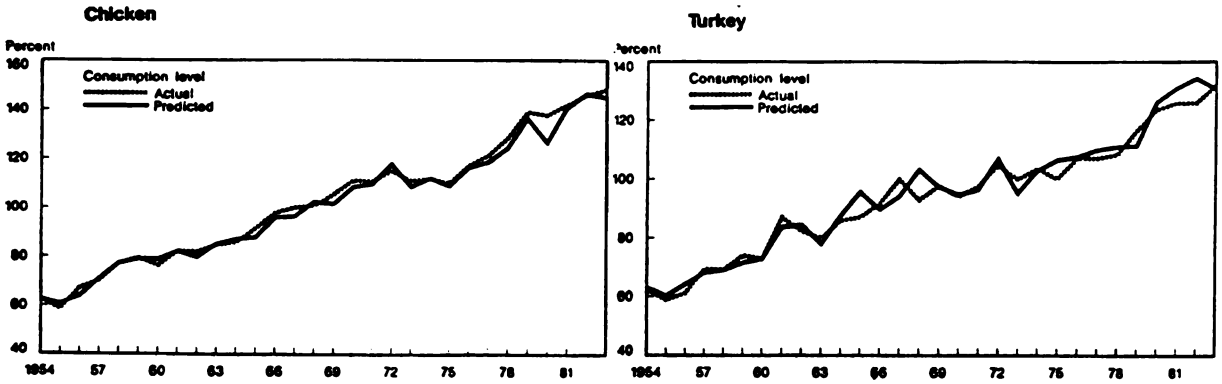

Figure 6.1 Actual vs. Predicted Per Capita Poultry Consumption (Huang, 1985)

6.2.1.3 Parameter Change

We would expect poultry demand to have become less income inelastic since the mid 1970's. Our hypothesis does not predict any consistent changes in price elasticity of demand, but it may have become smaller in absolute value due to the consistent decrease in prices over time. We would expect cross price elasticities between chicken and beef to decline (in absolute value) as they become less of a substitute for each other.

Poultry demand appears to have become less income inelastic, as expected. In Ferris (1985), the income elasticities for chicken and turkey demand were higher in the 1970 to 1984 period than the 1960 to 1984 period. When Ferris incorporated a trend variable into the model, the income elasticity for broilers was nearly identical for the two time periods. This implies that the trend variable picked up a factor that was distorting the income variable, and hence the income elasticity. Turkey demand was much more income elastic and the income coefficient more statistically significant with the trend variable in

the 1960-84 period, but this did not hold for the 1970-84 period. Chavas (1983) estimated that poultry income elasticity increased from .12 in 1975 to .28 in 1979, and concluded that poultry consumption appears to be increasingly responsive to income changes.

As expected, no consistent changes in price elasticity of demand were noted. Cornell (1986) noted that broiler direct flexibilities[1] have been increasing in absolute value over time, (-.78 from 1950-66 and -.249 from 1967-1982) indicating that chicken demand is becoming less price sensitive, which would be expected from decreasing prices over time. Own price elasticities for poultry demand were the same for Ferris between the two time periods, but decreased to the range of Haidacher/Huang (1987) with the inclusion of the trend variable. However, Thurman found that poultry demand became more own price elastic, changing from around -.59 before 1973 to -.71 after. early 1970's.

Cross price elasticities of demand declined (absolute value) in the early 1970's. Pork became less of a substitute for poultry meat and appeared to be more of an independent good. Chavas (1983) also found that the cross price elasticity with respect to pork decreased from .19 to .001 from 1975 to 1979. Cornell (1986) noted that cross price flexibilities with beef and pork were increasing over time, which again means that poultry demand is becoming less sensitive to the price of beef and pork over time.

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[1]A flexibility coefficient gives the percentage change in price associated with a one per cent change in quantity, ceteris paribus, and under some conditions is approximately equal to the reciprocal of the corresponding price elasticity (Tomek & Robinson, 1981). Therefore, if demand is elastic, the price flexibility coefficient will be less than one, and if inelastic, will be greater than one.

6.2.1.4 Summary

Although some studies statistically found that demand estimation with only price and income variables "explains" over 95% of the variation in poultry consumption between 1953 and 1983, other models showed that increased fit is possible with the inclusion of a trend variable. Error analysis tended to show that chicken consumption was underpredicted, as would be expected. However, turkey consumption was overpredicted.

Changes in parameter values were noted for poultry demand based on evidence of shifting elasticities and statistical tests. Studies generally showed that poultry demand has become less income inelastic over time. The elasticities no longer changed over time when a trend variable was included which would suggest that in some way model misspecification via an omitted factor may be affecting elasticity estimates. As would be anticipated, changes in price elasticity of demand were inconsistent and no conclusions could be made.

6.2.2 Fish

Annual average per capita fish consumption has increased 14% since 1970. Fish has been highly touted as healthful food in number of studies, and, with the exception of contamination incidences, has generally received favorable press. It would be expected that fish response would be similar to poultry. However, the limited number of studies available do not allow conclusions to be made. And, it is still to soon to see what the impact of recent information that fish oil may be a cancer preventative will be.

As would be expected, fish consumption was underpredicted (Figure 6.2). Estimates of changes in demand parameters over time were not

available.

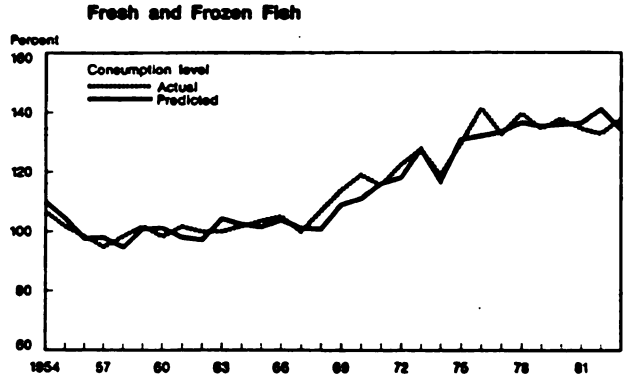

Figure 6.2 Actual vs. Predicted Per Capita Fish Consumption (Huang, 1985)

6.2.3 Fruit and Vegetables

Since 1970, average per capita fresh fruit and vegetable consumption has increased 13% and 14% respectively. Like poultry and fish, increased consumption of fresh and frozen vegetables has been recommended for health reasons.

6.2.3.1 Goodness of Fit

A complete demand system estimation was stated by Huang (1985) as statistically explaining 98% of the variation in vegetable and fruit consumption from 1953 to 1983 (Huang, 1985). However, in the Ferris (1986) model it was found that predictions of vegetable consumption were improved with incorporation of a trend variable in 1977, which would be expected. Comparisons of models with and without the trend variable were not available in the Ferris study.

6.2.3.2 Error Analysis

The expectations for over and underprediction of consumption were realized with consumption of processing vegetables (which have been perceived as "unhealthy") being consistently overpredicted, and fresh

fruit consumption underpredicted (Figure 6.3 on following page). As expected, there has been consistent overprediction of consumption of specific "unhealthful" products such as canned peas since 1979 and canned fruit cocktail since 1977, and underprediction of consumption of specific "healthful" products such as oranges (since 1979), grapes (since 1972), other fresh fruits (since 1977), lettuce (since 1977), and other fresh vegetables (since 1978).

6.2.3.3 Parameter Change

As expected, vegetable demand appears to be less income inelastic over time. For example, Smallwood and Blaylock (1984) used 1977 cross sectional data and estimated income elasticities for aggregate vegetable and fruit groups at .15 and .04, respectively. Using the same model, Blaylock & Smallwood (1986) used 1980 cross sectional data to estimate income elasticities for fruits and vegetables at .24 and .19, respectively. Frozen vegetables would appear to have the largest response in quantity demanded for income changes, but estimates of variations over time are not available.

6.2.3.4 Summary

As expected, model fit for one study was improved with the addition of a trend variable, and fresh vegetable consumption has been underpredicted whereas processed vegetable consumption has been overpredicted. Also as expected, vegetable demand may becoming slightly less income inelastic over time.

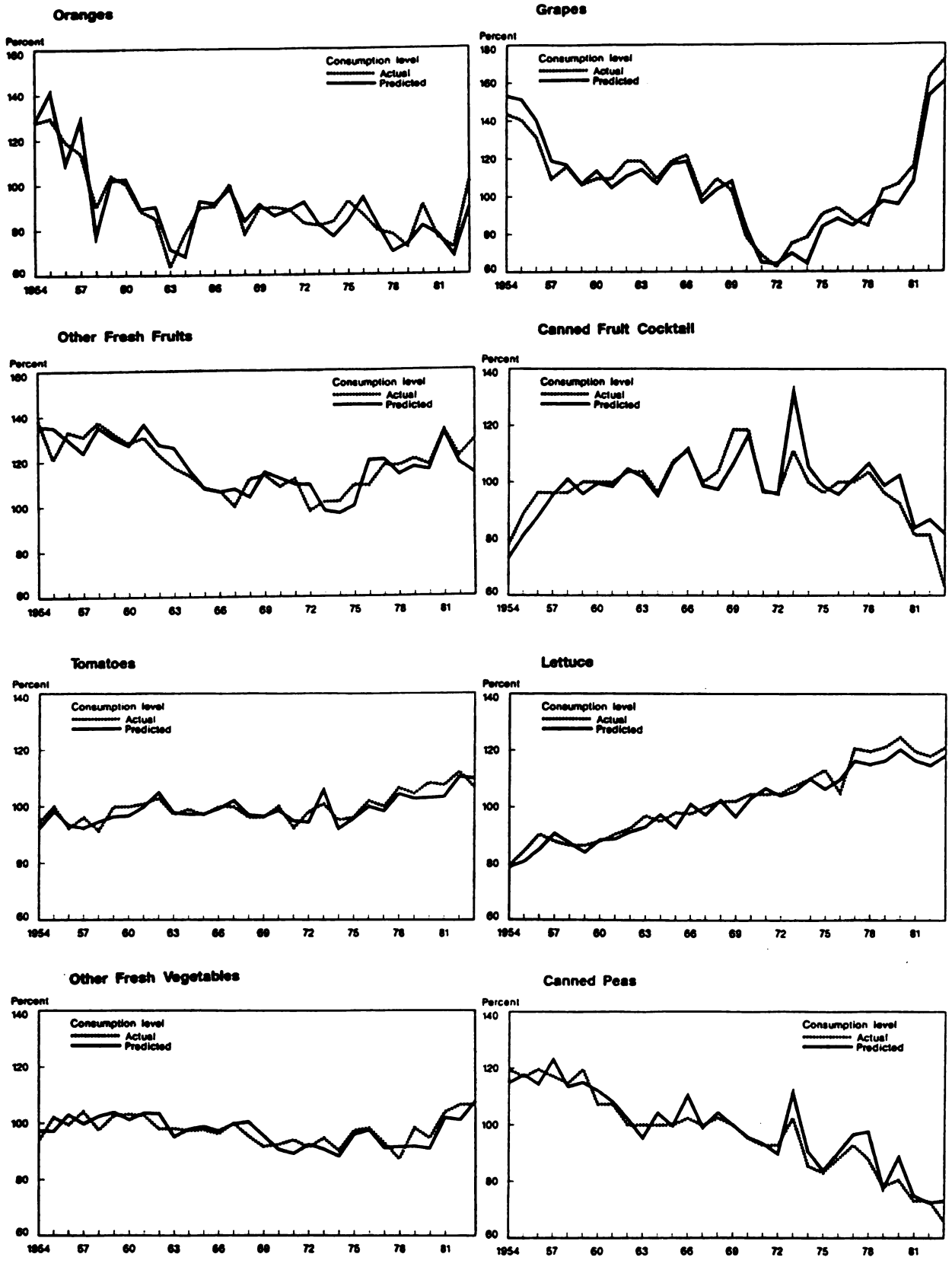

Figure 6.3 Actual vs. Predicted Per Capita Fruit & Vegetable Consumption (Huang, 1985)

6.2.4 Beef and Pork

Annual average per capita consumption of beef has declined 7% since 1970, but 12% since the 1975 period when consumption was at a peak. Pork per capita consumption saw an overall slight increase since 1970, consisting of an 11% drop between 1970 and 1975, and then a 13% increase since 1975. Information has been provided to the public suggesting that red meat consumption be reduced to restrict fat or cholesterol intake. This occurred at the same time that substitutes (poultry, fish) were being touted as "healthy" food choices. As noted in the survey data, the majority of respondents cited red meat as a factor in high blood pressure, heart problems, and high cholesterol. Most survey respondents also said that they were trying to cut down on consumption.

6.2.4.1 Goodness of Fit

Huang (1985), and Huang & Haidacher (1987) again determined that their model statistically explained over 95% of the variation in beef, veal, and pork quantity demanded through the use of a complete demand system with only income and price variables. Cornell (1986) obtained an adjusted R^2 for table beef of .69, for hamburger beef of .72. However, R^2 for table beef was increased to .73 using a linear spline function, .91 with a cubic spline and hamburger beef to .93 with linear spline and .95 with cubic spline. This would be expected since spline functions offer a means of modeling changes in demand structure. Pork R^2 was estimated at .81 and not changed through use of a spline function.

The Ferris (1985) model showed that the adjusted R^2 for beef and pork tended to increase when a trend variable beginning in 1977 was

included. Durbin Watson statistics were closer to 2 with the trend variables, indicating less serial correlation, which as mentioned is a concern in the Huang (1985) and Huang & Haidacher (1987) studies.

Also as expected, the goodness of fit was shown to have been steadily decreasing for both pork and beef, with an abrupt drop in 1977 (Manderscheid, 1987), which would have been expected in light of health information being disseminated at that time. The drop was noted from estimating R^2 from time series data on a yearly basis from 1955 to 1985.

6.2.4.2 Error Analysis

As expected, beef and veal consumption has been overpredicted since 1979, pork since 1980, and other meat since 1979 (Figure 6.4) In Manderscheid (1987) the standardized forecast errors on predicted market price from 1977 to 1985 were significantly greater than from 1960 to 1977, which also would have been expected. Specifically, there was a tendency to overpredict beef and pork prices in the latter period as errors have increased over time since 1977.

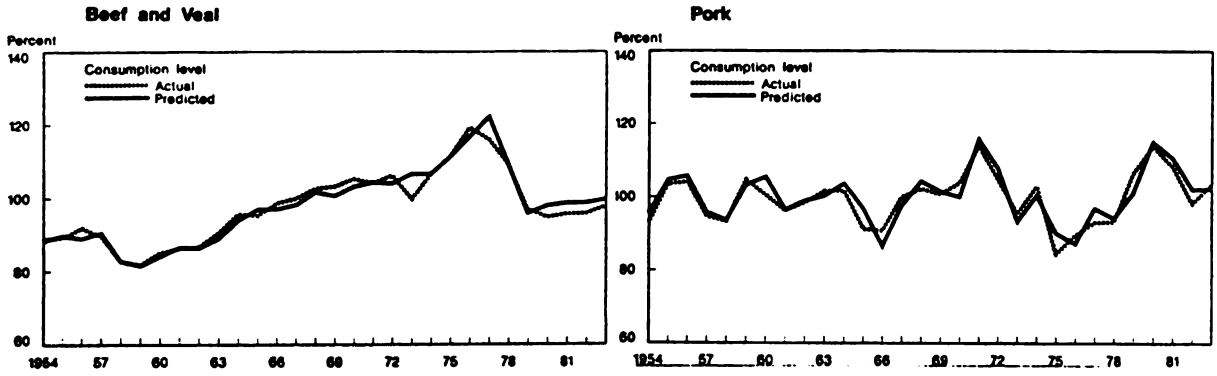

Figure 6.4 Actual vs. Predicted Per Capita Red Meat Consumption (Huang, 1985)

6.2.4.3 Parameter Change

A change in income elasticities was noted as expected. Through the use of a Kalman statistical filter (Chavas, 1983), beef demand was shown to have became more income inelastic between 1975 to 1979. Ferris (1985) noted that without using a trend variable in the beef model, the income elasticity for beef demand from 1970 to 1984 was not statistically significant, and barely positive, which is much more inelastic than during the entire 1960 to 1984 period. Income elasticity for pork was negative during the 1970 to 1984 period, indicating an inferior good. Both of these observations would be expected. As in poultry, the addition of a trend variable caused the income elasticities for beef demand to stay the same between the two time periods, which would be anticipated since the timing of the variable coincides with health information. However, this did not occur with pork.

Changes in price elasticity estimates were inconclusive, as expected. Cornell (1986) noted through the use of a time/quantity interaction variable, that the own-quantity slope for beef is becoming significantly flatter over a thirty three year period, which implies that quantity demanded would be more price sensitive. The direct flexibilities for both table and hamburger beef had declined since 1977, also indicating that the good is becoming more price sensitive. However, Ferris (1986) found that price elasticities for both beef and pork were similar between 1960 to 1984 and 1970 to 1984 estimates, and that the inclusion of a trend variable in the demand model did not alter the estimates. And, the use of the Kalman filter in Chavas' study showed that beef demand has become more price inelastic during

the 1975 to 1979 period, which is opposite Cornell's findings.

6.4.2.4 Summary

In summary, although one estimation process provided estimates of red meat expenditures with only price and income variables, other studies showed that goodness of fit was improved through the use of a trend variable, or by grouping data from 1970 to 1985 rather than 1955-1985. As would be expected, error terms showed consistent overprediction of both beef and pork consumption since the 1970's. Also as expected, beef and pork demands were trending toward becoming more income inelastic over time in some studies. There were no consistent changes in price elasticity noted.

It is interesting to note that a number of studies mentioned the possibility of health information affecting demand. Ferris (1985) concluded that the improvement in R^2 and increased stability of elasticities with inclusion of a trend variable indicated a structural change occurred around 1977 and health concerns were mentioned among the possible causes. Chavas (1983) suggested that data before 1975 may not be very useful in forecasting poultry or beef demand in the 1980's and suggested that random elements were introduced into these demand models in the mid 1970's. Hypotheses were advanced, but not tested, that fat and cholesterol concerns may have produced this shift. Manderscheid (1987) suggested that a structural change occurred in the market demand for pork and beef in 1976-1977, as evidenced by the abrupt changes in forecast errors and decreasing R^2. Although there were no explanations provided for the shift, health concerns were also cited as a possible cause. Cornell (1986) discussed the possible impact of cholesterol information on beef consumption, but did not

incorporate this into his empirical model.

6.2.5 Eggs

Since 1970, the annual average per capita egg consumption has decreased 16%. Specific health information about the dangers of excess egg consumption has been provided to the American public as early as 1961, but was not widespread until 1969. As per the survey data, many consumers perceive eggs as related to cholesterol, which is a factor contributing to heart disease.

6.2.5.1 Goodness of Fit

Huang (1985) felt that 98% of the variation in egg consumption could be explained through a complete demand system based on income and price factors alone. However, Putler (1987) felt that demand estimates for eggs should include a variable representing dissemination of health information starting in 1967. The R^2 for his equation was .99, and the health information variable was determined to be statistically significant at the .01 level, which would be expected. The procedure for Putler's research is discussed more in depth in Chapter Seven.

6.2.5.2 Error Analysis

Figure 6.5 on the following page shows a consistent overprediction for egg consumption beginning in 1969, as we would expect. This overprediction coincides with Putler's analysis of when information on eggs and cholesterol began to be disseminated on a wider basis.

6.2.5.3 Parameter Change

Estimates of changes in elasticities of demand for eggs were not available, but it was noted that eggs were generally income inelastic. (Blaylock & Smallwood, 1986; Blaylock & Burbee, 1985).

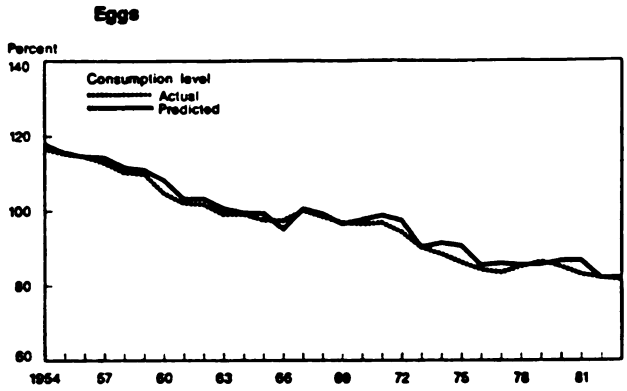

Figure 6.5 Actual vs. Predicted Per Capita Egg Consumption (Huang, 1985)

6.2.5.4 Summary

Although one model explained a significant amount of the variation in egg consumption, another showed that the use of a health information variable can enhance the predictive power of an egg demand model. A demand model using only price and income consistently overpredicted purchases, as expected. Putler (1987) found that health information on cholesterol, beginning in 1967 was statistically significant in predicting a decline in shell egg consumption of 10 to 11 eggs per quarter, or 14%. A second variable found statistically significant in predicting the decline was an increase in working women, which meant fewer wives cooking full breakfasts, and this was responsible for a decline of 7.26 eggs eaten per capita per quarter, or 10%.

6.3 Alternative Hypotheses

There have been a few studies that have examined other explanations for the changes in consumption that have been observed over the past decade.

6.3.1 Changes in Product or Product Market Characteristics

Eales & Unnevehr (1987) hypothesized that changes in product characteristics mix was responsible for consumption trends and examined the appropriateness of aggregate (i.e. all products in one group) vs. disaggregate (whole birds, parts & processed) chicken models. In estimating purchases using a disaggregated chicken or beef model, a decrease in estimated R^2 was noted.

They suggested that the growth in cut up parts and processed chicken would result in increased income elasticities of demand for aggregate chicken since they are normal goods whereas whole birds were estimated as inferior goods. They found that indeed income elasticities were negative for whole birds and hamburger, and higher for parts and processed chicken and table cuts of beef. However, the income elasticity for pork was also higher in the disaggregate study even though the commodity had not changed between the two studies.

Thurman (1987) suggested, but did not directly test, the hypothesis that the outward shift in demand for chicken was due to the introduction of specialized franchise chicken restaurants. New channels in chicken consumption resulted in an outward shift in the derived demand for poultry meat. At the same time, franchise retailers made specialized capital commitments to chicken as a retail product making their purchases less responsive to the prices of substitute meats. He predicted that chicken own price elasticities would decrease, and his study showed that they generally have done so.

As cited in Cornell (1986), Wohlgenant (1982) hypothesized that unexplained structural shifts in demand for meats can be attributed to quality changes in the composition of meats consumed. Rather than

presume that negative shifts in the demand for red meat have been due to changing tastes and attitudes toward health, he hypothesized that the shift is due to substitution of new processed poultry meats for processed red meats. In testing this hypothesis, he incorporated a variable representing an index of quality changes in the demand equation, and found that after netting out price effects between 1970 and 1980, about one half of the unexplained increase in poultry demand and one-third of the unexplained decrease in demand for red meats was due to quality changes.

6.3.2 Changes in Income Distribution

Unnevehr (1986) hypothesized that changes in income distribution were responsible for consumption trends and re-specified the demand model to account for shifts in income distribution. When the average income variable in the demand model was replaced with one that accounted for income distribution, the goodness of fit for poultry and pork demand models decreased slightly, whereas it increased for beef. Unnevehr suggested that in addition to income distribution changes, there has been a shift in preference for chicken such that consumption has increased over time more than would be predicted by shifts in income distribution.

6.4 Summary

The following expectations, based on the hypothesis that changes in health information is affecting food demand were generally met in reviewing the studies in this chapter:

-A greater fit in poultry, vegetable, beef, and pork demand equations can be obtained through the use of a variable that may implicitly represent changes in information.

-The fit of egg demand equations can be improved through the addition of a variable that explicitly represents changes in health information.

-Poultry and vegetables have become less income inelastic since health information was provided in the mid 1970's.

-Beef and pork have become more income inelastic since the mid 1970's.

-Chicken, fish, fresh vegetable and fruit consumption has been consistently underpredicted since the mid 1970's.

-Processed vegetable, egg, beef, and pork consumption has been overpredicted since the mid 1970's.

-No consistent changes in price elasticity of demand were noted for chicken, turkey, beef, or pork.

The following expectations were not met, or were inconclusive, due to conflicting results in the studies reviewed:

-Turkey has been consistently underpredicted since the mid 1970's.

The following expectations could not be examined due to a lack of data:

-The fit of fish demand models can be improved through the use of an implicit information variable.

-Fish demand is becoming less income inelastic over time.

-Egg demand is becoming more income inelastic over time.

-No consistent changes in price elasticity of demand for fish, vegetables, or eggs has occurred.

Although three studies indicated that they could predict consumption trends accurately with only price and income factors, the residuals from two of the studies provided evidence of over and underpredicting as expected. These two studies also used time series data and provided no information as to presence of serial correlation, which may have been involved.

A number of other studies showed that there may have been shifts in demand in the mid 1970's over and above price or income effects. Two of them incorporated trend variables to help explain this shift and one incorporated a specific health information variable starting in 1967. In all cases, the implicit or explicit information variables were significant and helped improve goodness of fit in the demand models.

The residuals appeared to generally follow the predictions, with turkey as an exception. Their shifts toward over or underpredicting all happened in the 1970's, at varying times, which may be indicative of different information incidences. It was noted in another study that forecast errors for beef and pork increased significantly beginning in 1977.

Changes in income elasticities for poultry demand generally appeared to increase over time, suggesting that like increasing quality, increasing safety or healthfulness may be perceived as a more superior good. Beef and pork demand income elasticities tended to decrease over time, as expected. The latter observation may be more significant in that this change is opposite to what would be expected from the slow increase of average income over time. However, no conclusions can be made for price elasticities....when data was available, the changes in these estimates were inconsistent.

Table 6.3 Goodness of Fit Measures for Demand Studies

		Beef/Veal	Pork	Chicken	Turkey	Eggs	Fresh/Frozen Fish	Canned Fish	Shellfish	Finfish	Fresh Vegetables	Frozen Vegetables	Canned Vegetables	Fresh Fruit	Fruit Juice
Equation Errors (%)															
Huang (1987)		2.43	2.88	2.93	4.24		3.31	3.95			3.46			5.38	6.82
Haidacher/Huang (1987)		2.43	2.88	2.93	4.24		3.31	3.95							
R^2															
Cheng & Capps (1986)									.17	.16					
Eales & Unnevehr (1986)	aggregate	.63	.67	.96											
	disaggregate	.53 .70	.71	.75 .82											
Ferris (1985)	60-84	.82*	.85*	.99*	.92*	.99*									
	70-84	.72*	.92*	.96*	.84*	.99*									
w/trend	60-84	.98*	.87*	.99*	.94*	.99*									
	70-84	.95*	.90*	.98*	.92*	.99*									
Ferris (1986)	cross section											.65	.74		
	time series										.82	.94	.77		
Manderscheid (1987)	55-75	.93	.91												
	55-85	.45	.70												
Putler (1987)						.99									
Unnevehr (1986)		.58	.97	.98											
w/ income variable		.78	.92	.92											

* adjusted R^2

Table 6.4 Income Elasticities of Demand

		Beef/Veal	Pork	Other Meat	Chicken	Turkey	Eggs	Fresh fish	Frozen fish	Shellfish	Finfish	Fresh Vegetables	Frozen Vegetables	Canned Vegetables	Fresh Fruit	Fruit Juice
Blaylock/Burbee (1985) cross section		.36			ns		ns ns									
Blaylock/Smallwood (86)		.23[2]	.16[2]	.19[2]	.11[2]		.001[2]	.375[2]				.24[2]	.23[2]		.19[2]	
Smallwood/Blaylock (84)												.15[2]	.48[2]	.04[2]	.17[2]	
Chavas (1983)		ns	.39[1]		.62											
Cheng & Capps (1986)									.11[1]	.14[1]						
Eales & Unnevehr	aggregate	.34[2]	.28[2]		.53[2]											
	disaggregate	-1.6[2] 1.57[2]	.04[2]		-.25[2] .82[2]											
Ferris (1985)	60-84	.60	-.29		.91	.34[1]	-.29									
	70-84	ns	ns		1.30	.59[1]	-.37									
w/trend variable	60-84	.44	.39		.93	.44	.39									
	70-84	.44	ns		.90	ns	.24[1]									
Ferris (1986)time series												ns	1.2	ns		
Haidacher (1982)		.23	.48	.44	ns	ns	.49[1]	.39[1]								
Huang (1985) Haidacher/Huang (1987)		.46	.44	ns	.36	.32[1]	ns	ns	ns			.29[1]		.33[1]	-.34[1]	1.12
Unnevehr (1986)		ns	.47[3]		.92[3]											
w/ income variable		.87[3]	ns		7.1[3]											

*all reported elasticities are at least t = 2 in significance unless otherwise noted
ns = not significant
[1]t = 1
[2]no significance levels or standard errors given
[3]1% significance level

Table 6.5 Own Price Elasticities of Demand

		Beef/Veal	Pork	Other Meat	Chicken	Turkey	Eggs	Fresh/frozen fish	Canned fish	Shellfish	Finfish	Fresh Vegetables	Frozen Vegetables	Canned Vegetables	Fresh Fruit	Fruit Juice
Chavas (1983)		-.97	-.74		-.80											
Cheng & Capps (1986)										-.85[1]	-.67[1]					
Eales & Unnevehr	aggregate	-.57[2]	-.76[2]		-.28[2]											
	disaggregate	-2.60[2]	-.57[2]		-.68[2]											
		1.60[2]			.43[2]											
Ferris (1985)	60-84	-.58	-.81		-.74	-.69	-.07[1]									
	70-84	-.56	-.84		-.70	-.61	ns									
w/trend variable	60-84	-.51	-.87		-.52	-.37	-.13									
	70-84	-.55	-.83		-.50	-.27[1]	-.15									
Ferris (1986) time series												ns	-.30	ns		
Haidacher (1982)		-.66	-.73	-.69	-.58	-.65		.11[1]	.29							
Huang (1985) Haidacher/Huang (1987)		-.61	-.73	-1.40	-.53	-.68	-.15	ns	ns			-.21		-.69	ns	-.56
Thurman	pre 1973		-.36		-.55											
	post 1973		ns		-.70											
Unnevehr (1986)			ns	-.79[4]		-.35[3]										
w/ income variable		-.60[4]	-.84[4]		-.80[4]											

*all reported elasticities are at least t = 2 in significance unless otherwise noted.
ns = not significant
[1]t = 1
[2]no significance levels or standard errors given
[3]5% significance level
[4]1% significance level

CHAPTER SEVEN

SUMMARY AND FUTURE RESEARCH

7.1 Summary of Findings

This thesis has examined how consumer health concerns may be affecting food consumption. A framework was developed to examine how a change in a food characteristic, such as safety, is related to the consumer purchase decision. A hypothesis was posed to test the reasonableness of this framework as follows:

> A change in information about the health risk posed by food will bring about a change in food demand, ceteris paribus.

If this hypothesis was reasonable, it was suggested that certain empirical consequences would be observed in case studies, consumer surveys, and demand models. The following summarizes expected compared to observed empirical consequences.

Empirical Consequence #1: Case Studies

EXPECTED: In incidences where information has been provided on changes in the safety of a product, the information will have a significant effect on demand for that product.

OBSERVED: It was found through reviewing eleven studies of changes in information about product health risk that the market was affected as expected during the period studied.

Purchases or price of the product with increased health risk declined, and in some cases an altered level of consumption was observed for an extended period after the incident. Increased consumption was noted for products advertised as having less health risk.

There was no evidence that price and/or income responses (elasticities) changed after the incident, nor how long the health information incident affected consumption.

Demand models had improved predictive power if a variable representing a change in information about product safety was incorporated.

Empirical Consequence #2: Consumer Surveys

EXPECTED: Consumer surveys will show that most people are aware of and concerned about the impact of food consumption on health in that:

a) Consumers will report knowledge of health risks in food,

b) Consumers will report changes in their food consumption because of information on health risks in food, and

c) Specific consumer concerns will shift over time in response to new information about food health risks.

OBSERVED: It was found through reviewing twenty eight sources of survey information that:

a) A large number of survey respondents were aware of food health risks from chemicals or food components (i.e. cholesterol, sodium, or fat).

b) Survey respondents reported a decrease in consumption of foods with negative publicity about health risks and an increase in consumption of positively reported products, although the reasons for the changes were not given.

c) Some responses showed that public awareness of food health risks is increasing, but there was limited data on survey responses over time from which to make conclusions.

Empirical Consequence #3: Food Demand Studies

EXPECTED: If consumers are concerned about food healthfulness and safety, we would expect food demand estimates that do not acknowledge changes in information about these characteristics to show one or more of the following:

a) A lower R^2 for models that do not implicitly or explicitly account for information changes, ceteris paribus,

b) Residual errors indicating over or underprediction of purchases of "unhealthful" and "healthful" foods respectively,

c) Unexplained shifts in demand that correspond with changes in information regarding food healthfulness. Demand for foods with positive changes in health information would become less income inelastic.

OBSERVED: In a review of fifteen food demand studies, it was observed that:

a) R^2 was increased when demand models included a trend variable coinciding with dissemination of health information in the mid 1970's.

b) Although the explanatory ability of a demand system relying strictly on price and income variables appeared to be good, residual errors from these models showed a tendency to overpredict consumption of unhealthful foods, and underpredict consumption of healthful foods.

c) Structural change was noted by declines in model predictive ability over time, and/or changes in parameter coefficients. Healthful foods generally were becoming less income inelastic over time, as would be expected from food increasing in quality or superiority.

Although some of the observed consequences may be attributed to other causes, studies of alternative hypotheses generally were not supportive. The findings did not offer conclusive proof that health concerns are affecting demand, nor provided empirical estimates of the economic impact of health risk information. However, it would appear that our hypothesis would provide a reasonable framework for policy analysis and future research.

7.2 Policy Implications

If health information has a significant impact on consumer purchase behavior, the following areas may be important considerations for food producers and government.

The continued integrity of a food product is an essential issue for food producers and processors. Contamination incidences have shown that the cost to both consumers and producers can be great. Producers and processors have a lot at stake and should be interested in assuring continued product safety and healthfulness. This would apply both to actual changes in the product, as well as changes in information about the product.

Isolating the effect that changes in health information has on consumer purchase patterns and product prices could provide estimates

for the food industry to gauge whether increasing the perceived healthfulness of their product is economically justified. This framework could be used to estimate the amount of effort required to offset negative health information. If the effect of increasing perceived healthfulness on product purchases or price is not enough to offset increased costs, it would perhaps be more fruitful for the industry to pursue another strategy such as product promotion to a market segment of the consuming public not as concerned about health.

If a change in health risk information does occur, there is evidence that negative publicity may have a much stronger effect on consumer behavior than positive (Witt & Pass, 1981; Hamilton, 1971; Smith, van Ravenswaay & Thompson, 1984; Sherrell et al,1985). In the case of cigarette health warnings, it was suggested that two to three times as much money would need to be spent on positive advertising to offset the effect of negative advertising. The beef industry is currently on an informational campaign to increase the consumer's perceptions of beef healthfulness and this type of research could give them an indication of the amount of resources it will take to turn around declining consumption trends.

Some information sources may be considered more credible than others (Smith, van Ravenswaay, & Thompson, 1984). Producers of an "unhealthful" commodity may want to look not only at how much negative health information has been disseminated, but by whom. If they decide to embark on a campaign to regain healthful status, and have adequate resources to do so, they may want to consider using an equally credible source for positive health advertising.

On this latter point, government often plays a key role in

disseminating negative health information. Although they are protecting the consumer from harm, they may also bear some responsibility in assisting the impacted industry. For example, if the industry does seek to regain a healthful image to the consuming public, government may be the credible information source needed to offset negative publicity.

Since health risk information may have a strong impact on consumer behavior, those responsible for its dissemination (such as government) may need to consider certain steps to help prevent consumer overreaction. Risk literature suggests that people overestimate low probability risks, although it is not clear if they will respond to them in that studies have shown people are reluctant to insure themselves against costly, but rare disasters (Heiner, 1983). Therefore, in disseminating information about low probability risks, some estimates of the likelihood of encountering these risks may need to be included. In addition, the literature suggests that people also seem to react more strongly to mandatory rather than voluntary risks, so instructions to the public on how to minimize risk exposure may also be needed.

Land grant institutions engaging in agricultural research projects may need to look at the safety or healthfulness of the products being developed not only from an ethical perspective but also a marketability perspective. Research focused on increasing crop yield or animal speed of maturation, may do so at the cost of increased chemical or drug use. If consumers are concerned about food safety, the demand for new products may be less than anticipated if they are less healthful, and result in decreased producer returns if they adopt new research

methods.

> Agricultural research may need to embrace a broader agenda that includes a concern for the effects of agricultural technology on the health and safety of agricultural producers and a concern for the nutrition and health of consumers... (Vernon Ruttan 1982 as quoted in Edens et. al 1984)

7.3 Future Research

With our theoretical framework in place, and evidence that we may heading in a reasonable direction, future research may be warranted to directly estimate the empirical effects of health information on food consumption. The results of these empirical studies could be used by food producers, government, and economists to answer the following three questions:

> How much of an effect does a change in health risk information have on the overall demand for certain foods?
>
> How much are consumers willing to pay to reduce food risks?
>
> What is the demand for health or safety in food?

7.3.1 How much of an effect does a change in health risk information have on the overall demand for certain foods?

To find out the specific impact on quantity consumed that can be attributed to changes in information about a health characteristic, the contamination incidences as per Chapter Four and the demand studies that incorporated a trend variable provide some possible approaches.

7.3.1.a An example of a health information model

Putler (1987) provides us with an example of a research project designed to answer the above question. The linkage between the rapid decline in shell egg consumption beginning in the late 1960's and the release of medical information in 1967 that dietary cholesterol in eggs

is correlated with increased incidence of high blood cholesterol and heart disease was tested through the use of a household production model. Like the model presented in Chapter Two, a household production model is based on the hypothesis that a change in health information about a good means that the characteristics of that good have changed. Consequently, the demand for the good is changed.

Putler's major contribution is in estimating the length of time it takes for the full effect of an information change to manifest itself in a market. Putler argues that an exogenous, one time change in information about a good's characteristics does not produce a one time shift in market demand. Rather, the shift in market demand occurs gradually over a period of time because not all consumers in the market receive the new information at the same time. Thus, to estimate the full effect of the information change on purchases, it is necessary to estimate the length of time it takes for the information to diffuse among the population of consumers.

Borrowing concepts from epidemic theory, Putler modeled the percentage of consumers possessing the information at time t as:

$$h(t) = \frac{\exp[(B + A)T] - 1}{\exp[(B + A)T] + B / A}$$

$T = \{ (t - t^*) + |t - t^*| \} / 2$, where t^* is the time that health information was released and t represents the time period variable which takes the value one for the first quarter of 1960 and increments by one from 1961 on. B is the percentage of hearers spreading the information to other consumers (also known as the "intensity of transmission between individuals) and A is the percentage of the population exposed to new information from a source (also known as the

"intensity of transmission from the source). As A approaches zero, communication between consumers dominate source effects; as B approaches zero, information from the source dominates communication between consumers.

The percentage of consumers receiving the information, h(t), was included in the following model estimating the quarterly per capita demand for shell eggs:

$$x = m + S_1q_1 + S_2q_2 + S_3q_3 + E_{aa}p_a + E_{ap}p_p + E_{ao}p_o + ny + wL + Zh(t)$$

where m, $S_{1,2,3}$, $E_{a,p,o}$, n, w, A, B, t* and Z are the parameters to be estimated, $q_{1,2,3}$ are dummy variables corresponding to the first, second, and third calendar quarters respectively, $p_{a,p,o}$ are the prices of grade "A" large eggs, pork, and other meats respectively, y is per capita disposable income, L is the percentage of women over age 20 who are employed, and h(t) is the time trend health information variable. All prices and income were deflated by the CPI.

Because t* was endogenously determined, the model no longer had continuous first derivatives with respect to all estimated parameters. An estimation was carried out by performing a grid search over values of t* ranging from -17(1955) to 57(1975), and using gradient based methods to estimate the remaining parameters. A nonlinear two-stage least squares was chosen as the estimation procedure.

Statistical results tracked the actual values of estimated per capita consumption exceptionally well and health information was shown to have a statistically significant effect on shell egg consumption. The information diffusion term was not constant, meaning that a variable indicating an instantaneous discrete shift would not have as

effectively predicted egg purchases. One hundred percent of the information's effect on shell egg demand was estimated to have occurred over an 11 year period beginning in the second quarter of 1969 and ending in the fourth quarter of 1980. The health information was estimated to have reduced per capita shell egg consumption by 14%.

7.3.1.b What do we need to know to use a health information model?

To successfully model trends in food consumption, one would need to be sure of what and when information had been disseminated. There are a number of possible health information events, as noted in Chapter Three, but these are from only a perfunctory search of publicized highlights. Survey results in Chapter Five showed that most people seemed to get their information about chemical/food health risks from newspapers or magazines. A thorough content analysis of major newspaper/magazine coverage of health information incidences would provide a more accurate measure of their timing for demand analysis. Coupled with a specification of the diffusion process within the consuming population, this measure could be used to assess the impact of information change on a good.

Content analysis had its roots in World War II as a means to obtain information on enemy nations that public opinion polls would have normally provided, and the U.S. annually spends billions on newspaper content analysis throughout the world (Naisbitt, 1982). It is generally effective in determining the public's shifting priorities because only the more important items will be covered due to competition for a limited amount of media space. In some situations it is considered to be more trustworthy an indicator of opinion than direct surveys, since no one knows the content analysis is occurring.

Several different types of approaches to content analysis are possible. One possibly fruitful approach would be to code articles from widely read newspaper and magazine publications to see when and what type of new information about food health risks appears. This was done in the contamination studies since they were high publicity, short term incidences. Once the information events are found, there are a number of ways to grade or categorize the amount and/or intensity of the publicity (Shulstad & Stoevener, 1978; Swartz & Strand, 1981; Smith, van Ravenswaay, & Thompson, 1984).

7.3.2 How much are consumers willing to pay to reduce food risks?

If the goal is to obtain information about what to charge for a new or improved food safety characteristic, how much food safety programs contribute to product price, or whether a decrease in safety will affect product price at all, the following approaches are suggested.

7.3.2.a An hedonic pricing model

A model that could be derived from characteristics theory is a hedonic price function where the price of a good is considered a function of the characteristics it provides. The model estimates how a change in a characteristic affects price, and assigns that price difference as the value of the characteristic.

Hedonic analysis can measure the price differentials that arise due to quality differences across similar goods (Hoehn, 1986). As early as 1929, Waugh concluded that "there is a distinct tendency for market prices of many commodities to vary with certain physical characteristics which the consumer identifies with quality, and the relation of these characteristics to prices may in many cases be fairly

accurately determined by statistical analysis". If safety is similar to quality in that it varies among goods and increased safety is preferred to less safety, it may also have a similar relationship to food pricing.

The hedonic pricing technique has been used to estimate consumer willingness to pay for products with explicit variation among characteristics such as houses (square footage) or automobiles (horsepower). The value of environmental amenities has been estimated by comparing housing prices in areas with differing environmental conditions. Hedonic pricing has been widely discussed in the literature (Barmish, 1983; Rosen, 1974; Bartik, 1987; Epple, 1987; Prato & Bagali, 1976; Ladd & Suvannunt, 1979; Morgan, et al., 1979; Eastwood et al., 1986) and can be expressed mathematically in a linear additive form where:

$$P_i = B_1C_1,\ldots, B_kC_k \quad (i = 1,\ldots,n;\ k = 1,\ldots,r)$$

B_k is the marginal implicit price of a characteristic represented by:

$$B_k = \partial P / \partial C._k$$

which is the change in income spent for a change in characteristic obtained. C_{ik} would be the marginal amount of characteristic k associated with a unit of good i (e.g. the amount of fat in a pound of steak) and can be represented by:

$$C_{ik} = \partial C._k / \partial Q_i$$

which is the change in characteristic k divided by the change in quantity i purchased.

Although it would be convenient to consider the implicit marginal price as the consumer's willingness to pay for a specific characteristic, there may be a theoretical problem in doing so with food. The estimated marginal implicit price of food would be a function of both supply and demand, so it represents the market price, which reflects both the consumer's marginal willingness to pay and the suppliers marginal willingness to sell. This causes problems in model specification because if supply shifts (e.g. because of a change in input costs), the parameter coefficients will change even if the characteristics did not. This limitation has not stopped researchers from using this method on food, however, with estimates focusing primarily on the value of nutrients.

Ladd & Suvannunt (1976) used a linear hedonic price equation with the price of various foods as a function of the amounts of sixteen different nutritional elements per pound. The majority of the estimated implicit nutrient prices were statistically significant, with some of the nutritional elements having a negative parameter value. It was suggested that these negative elements may have imparted an unpleasant taste, texture, or odor to the food.

Morgan, et al. (1979) also used a linear hedonic price equation to also estimate the value of nutritional and other characteristics of foods. Breakfast cereals were targeted because they are labeled, regularly purchased, and contain nutrient supplements. Nineteen dietary components, five other product characteristics, and four market factors were used. In pretesting model specification, the authors found that the use of individual dietary components as product characteristics inappropriate. As a "heuristic" or decision rule,

buyers may value cereals that "contain more vitamins and minerals" and may not know or precisely evaluate the individual nutrient factors. Three classes of cereal (high nutritive, kids stuff, traditional) were used because previous experimentation indicated that different weights were given to the characteristics depending on the type of breakfast cereal.

In addition to providing data on individual implicit prices Morgan, et al. estimated how much these prices contributed to the price of one ounce of Kelloggs Corn Flakes. The characteristics analyzed were calculated to have contributed 2.8 cents per ounce of cereal. With the actual (wholesale) cereal price of 4.6 cents per ounce, this comprised over half of the total.

As an example of using hedonic pricing to assess the impact of health information on price, I created a linear model using breakfast cereal data obtained from Consumer Reports (October 1986). I chose this data set not necessarily for its accuracy, but because it conveniently categorized 60 breakfast cereals by quantitative factors such as price, calorie, fat, fiber, sodium, and sugar per ounce, and two qualitative factors "sour" and "sweet". To see if other characteristics have an impact on price, parameters representing information found in the product title, such as "bran or high fiber", "fruit", "natural" and the brand name were added to the model. The dependent variable was in cents per ounce, which ranged from 10 to 18. The estimation process (via OLS on SPSSPC) was performed on the total sample of 62 cereals, plus three groupings similar to Morgan, et al.; nutritive, standard, and kids stuff. The different groupings were made because people may be selecting cereal types as a way of expressing

preferences for certain characteristics, or there may be different consumers for the three cereal types. The results are summarized in Table 7.1 below.

Table 7.1 Hedonic Regression of Breakfast Cereal Characteristics

	Full Sample	Nutritive	Standard	Kids Stuff
Quantitative Factors				
Calories	-.003	-.082	.216	NA[1]
Fat	.341	1.009	4.987	-.491
Fiber	-.117	-.687	.229	1.786
Protein	-.368	-.333	.358	-1.549***
Sodium	.002	.006	.011	.012
Sugar	.185**	-.358	2.075*	.548
Qualitative Factors				
"Sour"	-1.851***	-5.439*	4.407	.923
"Sweet"	-1.457*	-3.532	4.553	NA[1]
Label Information				
"Fiber or Bran"	-.472	.182	1.561	NA[2]
"Fruit"	-1.743***	-3.514**	5.213	.441
"Natural"	-1.178	.223	NA[2]	NA[2]
Brand Name				
General Mills	.190	-4.075	-10.429	NA[3]
Kellogg	.321	.785	-.897	-2.334
Post	-.361	-.538	-10.687*	-1.812
Quaker	-.814	-1.857	-17.813**	-1.896
Ralston Purina	NA[3]	NA[3]	NA[3]	NA[3]

*significantly different from zero at the .20 level
**significantly different from zero at the .10 level
***significantly different from zero at the .05 level

[1]Not computed due to no variation of characteristic in sample
[2]Not computed due to characteristic not present in sample
[3]Not included in analysis to avoid multicollinearity

At first glance, the model does not appear to be valid. The signs on a number of the characteristics are not as theoretically expected if people viewed these representing positive or negative health factors (eg. sugar appears to be a positive attribute, whereas "fruit" in the title was negative). The majority of the characteristics are not statistically significant. It is interesting that the coefficient for protein was both statistically significant and negative for the "kids stuff" category, possibly implying that children express an aversion to "good for you" cereals. Also, "fruit" in the title had a greater negative impact in the "nutritive" class compared to the total sample. Post and Quaker brand names had a strong negative connotation in the standard cereals category.

The adjusted R^2 for the total sample was .235, which means that roughly one fourth of the variation in price was explained by the characteristics. It is not clear whether or not the consumer is actually interested in any of these characteristics when making the purchase decision, however, or whether the characteristics represent the property "safety" in the mind of the consumer. This makes any interpretations of the above model unrealistic, since it would be misspecified by inclusion of irrelevant variables and omission of relevant ones.

7.3.2.b What do we need to know to use an hedonic model?

In using a hedonic pricing model, characteristics are assumed to be objectively quantifiable as well as identifiable, and used by consumers in the purchase decision. A key problem in using technical or label characteristics is that the consumer purchase decision may include a number of subjective considerations, making correct model

specification difficult. For example, how is "safety or healthfulness" represented in food? Is it the presence of a brand name and/or USDA inspection, or instead the absence of preservatives, chemicals or cholesterol?

As the reader will note, prior research using the characteristics approach on food commodities has focused on package-identifiable characteristics such as nutrient content or calories. An assumption was made that consumers read labels and incorporated this information into the decision process. Consumer researchers question whether information printed on the package is used by the consumer (Jacoby, 1977), and instead suggest that heuristics or decision rules are used to make their purchase decision (Kahnemann, 1982). Also, the provision of information associated with proteins, minerals, and vitamins has been shown to have little impact on consumer behavior (Muller, 1985; Russo et al., 1985).

However, this does not mean we cannot hope to obtain fruitful results from this method. As discussed in Chapter Three people appear to avoid risks to their person more than selecting goods that have a positive benefit. If this is the case, characteristics representing reduced risk in the mind of the consumer may be more germane for food consumption analysis than those used in prior studies that focused on positive characteristics such as nutrients.

To empirically use a hedonic pricing model and obtain meaningful results, classes of foods that vary in the amount of safety offered need to be selected (e.g. leanness levels for meat). The consumer perspective on purchase decision making is also needed regarding what food characteristics represent safety or healthfulness and how they are

used in making purchase decisions. Focus groups could be called upon to find out what the most important characteristics are in the choice of particular foods. To avoid biasing respondents only toward safety concerns, questions should first be open ended and seek information on a number of possible food characteristics. For example:

> What do you think is good about ___ (a food product)?
>
> What do you think is bad about ___ (a food product)?
>
> How do you assess these characteristics when purchasing ____ (a food product) ?
>
> Did you eat _____ (a food product) in the last 24 hours? What were the important considerations in your decision to consume this food?
>
> Are you concerned about ___ (cholesterol, sodium, fat, calories, preservatives etc.) Why? What foods have these characteristics?
>
> Compare the following products. Which one would you choose and why? (provide alternate labels expressing different degrees of nutritive safety)

Information obtained from the focus groups could be used to design multiple choice surveys on a larger scale. (Pre-testing the multiple choice questions with a small sample group should be done to determine if they provide the kind of information we are seeking.) If a nation-wide sentiment of consumer response to food safety or healthfulness is desired, these questions could be provided to the U.S. Department of Agriculture, for inclusion on their 1987 Nationwide Food Consumption Survey (NFCS). The NFCS is done every ten years, with a sample of approximately 15,000 households. The survey is composed of: 1) a 1 week recall of the kinds, quantities, values, and sources of food used from home supplies and, 2) an individual intake record listing the kinds and quantities of foods eaten both at home and away from home.

7.3.2.c Contingent valuation experiment

A process that poses valuation questions directly to participants through a contingent market environment may be able to provide some indication of how much consumers will pay for reduced health risk from food. Known as contingent valuation, it is less costly than actual market experiments (Bentkover, et al., 1986) and may avoid model specification problems (such as accounting for supply vs. demand effects or accounting for actual product vs. consumer used characteristics) that could be encountered in estimating willingness to pay from actual market data. It is used by economists more commonly in the environmental amenity area. The procedure has some disadvantages in that the way information is presented to participants could bias responses, and results may not be reflective of true market behavior.

An experimental situation would be designed where randomly selected participants are asked what they would be willing to pay for food items containing different risk (healthfulness or safety) levels. An approach similar to Viscusi & Magat (1987) where they assessed consumer willingness to pay to avoid adverse health outcomes from using household cleaners could be taken. Participants were asked how high of a price new (less risky) products would have to be before they would rather buy the old (riskier) product. The price where they would keep the riskier product is how much they are willing to pay to accept that much more risk...alternatively, since increased risk would mean less safety, this would also provide an implicit value of the safety component of the new, less risky product.

Pre-designated characteristics (preferably obtained from the focus groups mentioned earlier) could be used and information on the amount

of health risk in terms of those characteristics provided. Neither product need be "real" in that they can be created for the situation so that the characteristic being tested can vary as needed.

7.3.2.d Conjoint analysis experiment

In contrast to contingent valuation, conjoint analysis gives the consumer information about a number of relevant characteristics of the alternative products available and asks them to rank products by order of overall attractiveness (Viscusi & Magat, 1987). Consumer preferences are structurally decomposed into part worths, importance weights, or ideal points to express the utility of different characteristics and different levels of those characteristics in the consumer's overall decision set.

Conjoint analysis has been recognized as an appropriate research methodology for the study of multiple characteristic trade-offs, and is commonly used by marketers in that it can replicate consumer decision tasks. Even if consumers are unable to articulate their trade-offs directly, this analysis can provide estimates from their overall preference rankings (Crown & Brown, 1984). The estimates obtained could be used to give an indication of risk/dollar trade-offs in food safety.

Crown & Brown (1984) used conjoint analysis in their investigation of the trade-offs between flame retardance versus other blanket attributes. A focus group was used to assess what product characteristics were relevant in consumer purchase decisions. Different levels of each characteristic to be used in the experiment were established. A group of characteristics and three price levels were presented to participants at the same time. Actual pieces of

blankets were provided, and controlled for characteristics not under consideration (i.e. same type and color were used). The blanket pieces were treated or labelled to differentiate between varying degrees of: roughness, flame retardance, care, and price. Participants were instructed to group the nine specimens into three piles; likely to buy, unsure, and not likely to buy and arrange them in each pile from most preferred to least preferred. Lastly, they were asked to give the reasons for selecting the most preferred and rejecting the least preferred.

The authors used a "MONANOVA algorithm" to calculate utility functions for each factor for each respondent. Certain products were found to be the most preferred, and the importance of the four characteristics were calculated by taking the difference between the high and low utility values for each one. The results were reported graphically and showed the type of tradeoffs participants made between the four attributes. The tradeoff between money and flame retardance could be used to assess what that characteristic is worth to a consumer.

Crown and Brown noted that most consumers thought all blankets were flame retardant. Although it was not a commonly discussed attribute in the focus groups, when participants were faced with a decision to purchase a product labelled flame retardant versus one that was not, it became the most important attribute. This finding should be kept in mind when doing focus group surveys for food healthfulness or safety. Survey data in Chapter Five indicated that most people take safety for granted and trust the government inspection program to protect them. Therefore it is possible that characteristics

representing safety would not be likely to arise in discussion unless consumers were faced with a choice between products that have clear safety differences.

A second approach using conjoint analysis was taken by Viscusi and Magat (1987) in having participants rate pairs of household cleaning products on a scale. The rating observations for each of five product pairs were regressed against both the change in cost levels for each pair and the change in injury levels for each pair. The results provided a set of parameter estimates of the relative importance of money to injuries for that consumer. The absolute value of the ratio of the two parameters (for risk and cost) was estimated as each subject's willingness to pay to reduce the accident rate by one accident per million households. They found that the conjoint analysis method resulted in higher values for injury avoidance than did contingent valuation.

7.3.3 What is the demand for health or safety in food?

The previous approaches pertain to estimating demand for a food in light of changing characteristics. A difficulty in interpreting empirical results from these approaches is that people in reality may have an overall demand for characteristics and trade off the amounts they obtain from different foods in an unequal manner. For example, if consumers are concerned about saturated fat, they may not reduce consumption of all fatty foods but instead focus on cheese and ice cream and continue to eat McDonald's hamburgers. If only hamburger demand was estimated, it would appear that consumers are not concerned about fat, even though they had indeed reduced their fat consumption.

A different approach would be to estimate the demand relationships

for food characteristics representing the properties "safety" or "healthfulness". This is more in line with a household production model where the end product would be a healthful diet. The demand for a characteristic is a function of the prices of characteristics (as defined by focus groups and determined in a hedonic pricing model), the amount of characteristics supplied by all foods consumed, and income.

$$C_k = d_k\,(P_1, P_2, .., P_n;\ I;\ C_{11}, C_{12}, \ldots C_{1x}, C_{21}, C_{22}, \ldots C_{2x}, \ldots\ C_{n1}, C_{n2}, \ldots C_{nx})$$

Eastwood et al. (1986) took this approach in estimating household nutrient demand. The authors first estimated a set of hedonic price equations for groupings of food nutrients and the prices of the characteristics determined were included in a second equation that estimated nutrient demand across households. Household characteristics were also incorporated into the characteristics demand equation from cross sectional data to assess what a change in socioeconomic variables would do to demand for nutrients.

Statistical results showed that the own price elasticities of demand for the nutrients were all negative, meaning that as the implicit prices of the characteristics increased, the quantities demanded decreased. Income elasticities of demand were all positive and less than one, so nutrients are similar to normal goods.

Knudsen and Scandizzo (1982) also took this approach in estimating the demand for calories in developing countries. They wanted to explore the effect of calorie price differences, income, and other socioeconomic factors on the intra-country and inter-country distribution of calorie uptakes; with the goal of understanding the impact of income growth and distribution on alleviating malnutrition.

They first calculated calorie consumption by expenditure groups, through household consumption data and converting it into calories. Then, a weighted regression was estimated relating the average expenditure per calorie to per capita total expenditure. The sum of the constant term and the residuals was used as an estimate of the basic price of calories. A series of functions were estimated relating calorie intake to total expenditure levels and the basic price estimate.

It was found that the quantity of calories consumed in response to increases in income at the poverty line varied between countries.... those with the most malnutrition showed considerably higher income elasticities. Countries with a calorie intake above Food and Agriculture Organization requirements had lower price elasticities of calorie demand.

7.4 Limitations of Empirical Research

In practice, some of the assumptions of utility theory, such as fully informed, rationally maximizing economic actors may not be valid. It is possible consumers do not maximize utility due to lack of information, training in how to use the information provided, or instead purchase goods for other reasons unbeknownst to economists.[1]

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[1]These assumptions could be considered violated in the case of the breakfast cereal consumers who complained to General Mills that Cheerios were not aerodynamically sound when thrown (they veered to the left and right), or requested that Kix be made square so that they would not roll around on the floor (Wall Street Journal, 9/14/87).

This is one of the oldest critique of economics .... the ability of agents to maximize successfully (Heiner, 1983). According to Heiner, an individual will instead set up decision rules to deal with uncertainty in the choice set, and as discussed in Chapter Three, the more complex the problem the more decision rules are relied upon. Careful calculation of prices and values may be perceived as an appropriate decision technique in a purchase situation or it may not (Shaffer, unpublished). The food consumer may in effect be a "satisficer", operating with "bounded rationality"....terms coined by Simon (1957, 1979). A satisficing consumer would not follow our traditional utility assumption of seeking the highest indifference curve and instead operate in what could be considered a "comfort zone". Bounded rationality would reflect the fact that humans are limited in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information. These two mechanisms operating together could lead to unpredictable consumer behavior.

In addition, product price may not clearly reflect quality differences. Akerlof (1970) theorized that imperfect information about product quality causes it to not be clearly expressed in the market. Like food safety or healthfulness, buyers may be aware of the average quality within a market, but not of specific purchases. According to Akerlof, prices will generally reflect the average product quality when specific product quality is not known. A consumer may feel overall that all products provide enough healthfulness and not pay more for a product that claims to have more of this characteristic.

How does this relate to changes in safety information? Consumers may only seek the available information that they perceive is essential

to the purchase decision, and may limit their information search if a product appears adequate for their purposes. For example, in USA Today (7/25/86), it was reported that there has been little interest in a nutritional booklet offered by five major fast food chains outlining what is in the food they offer. When queried as to whether she would use the booklet, one consumer said "No, I've never been sick because I wasn't eating properly".

Similar to human beings who will simplify their shopping decision process with search and choice rules, economic analysis tools also make simplifying assumptions. Both processes may provide second best solutions. However, if our goal is to explain or predict consumer behavior as realistically as possible, rigid economic models need to allow for inputs from factors that may be important in the decision making process. This paper has been written toward that goal...given the constraints under which both consumers and economists operate.

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