

The Information Super-Highway of the Future

The following is a transcription of the presentation by Woody Kerkeslager from AT&T.

Ellwood R. "Woody" Kerkeslager<sup>1</sup>

It is an honor to be a part of this head table and the distinguished honorees who are here. You are the people who have been advocating for me and for other consumers; I never expected that I would have the opportunity to visit with you. So I am honored for that opportunity. And my feeling extends to the members of the audience too, because I know that you are working the issues today. You're looking out for my interests and I appreciate that.

If there is one thing that I can achieve today, I hope it is to help you understand the issues of technology and how they are going to affect consumers in the next decade. If I can help you address consumer issues in a positive way to make technology-based capabilities available to consumers in the United States (and outside the United States as well), I will have accomplished my goal.

I have said "next decade", and I would like to emphasize that what we are entering right now is a decade of change which some people have compared to the Renaissance and others have compared to the beginning of the Industrial Age. The popular name which has been given to it unfortunately is very misleading, and I think, confusing to most people. Some people talk about building new highways, electronic super-highways or information superhighways. That is probably an inappropriate analogy because it makes you think of ways of moving people or building something physical as though we are about to embark upon a major public works construction program over the next decade. That is one of the things I want to correct. I would like to help you to understand the potential this has for positive impact on consumers. There are tremendous capabilities for empowering not only consumers that are represented in the

broad mainstream but also people with disabilities, consumers in inner cities and rural areas, and consumers in the developing countries of this world.

Those are the themes I would like to pick up on as well as the mainstream consumer issues that many of us are concerned about.

The other side of the equation is, if we do not do the right thing the right way, there is a downside to this. It is typically referred to as the "haves" and the "have nots." It is concerned with the information rich and the information poor. I think these are unnecessary outcomes, but they are definite possibilities if we do not address these issues in the right way.

The change I am talking about is change brought about by technology -- certain specific kinds of technology which will change our way of life over the next decade and for decades beyond that. You have the capability right now to shape that future. So I'm talking about shaping perhaps the next fifty or one hundred years depending upon how we get through this next decade. A critical issue in that transition period involves consumer interests. I strongly encourage you to be involved in this transition and to make sure that consumer interests are brought to bear, brought to bear with governments at the federal level and at the state and local level, but also working with industry to make sure that your views are heard by industry, through people like Janet and me who are working to understand the impact this will have on our customers.

So what I am going to do in the next forty minutes is hopefully have a dialogue with you. I will talk but I would appreciate any questions or comments during the talk and then we will go into a breakout session where

we will discuss and debate my comments.

I am going to describe technology to you and make you technology "experts" in the next thirty minutes, such that you will understand this new technology that I am talking about to a greater level than many people who are presently involved in the debate.

I will not attempt to make "engineers" of you and I will not literally lecture to you on the technology because one of my fundamental points is that you should not have to become experts to be empowered by this technology.

But I will try to help you to understand the scope of the technology, the industries that are involved, the ways in which those industries can provide useful applications, useful services for you, for consumers. And finally, I will talk about what "it" is that has to happen. Is there anything that we have to do; is there anything that government has to do, business has to do, consumers have to do in order to make "it" effectively useful for us? The bottom line is that there are a lot of things that have to be done, and the involvement of consumers is critical.

So let's start a discussion of the electronic superhighway. First of all, I'd like to change the name. I told you I didn't like the superhighway analogy, so I'd like to talk about information and an information infrastructure. If you think of it as an information infrastructure, a nerve center which is intended to be there to move information between people, between individuals and universities, governments and businesses... for work, education, entertainment, the quality of life of each of us...that is what we are talking about. We are talking about a national information infrastructure in the United States serving consumers, businesses, governments, universities and all other institutions. It is something that we have to plan as a nation and evolve as a nation. And it has a state and local component as well. We also have to work between nations, between the governments and businesses of countries to make sure that each national information

infrastructure works with every other NII else we are not going to be able to exchange information. We will have nothing more than an electronic Tower of Babel.

Janet's comments earlier noted that I just flew back from Europe. Many of the countries in the EC are now talking about their national information infrastructure; and so is Japan; and so is Canada; and so is Russia and China and Sweden and Norway -- virtually every country in the world at their own level is talking about their national information infrastructure and what it can do. The answer is not the same for each country, but there are some common themes.

The national information infrastructure is important. It is important for business. It is important for jobs. It is important to keep the economy growing and producing good jobs. It is important for social issues -- for health care, for education. It is important for the general quality of life.

So it is important, but I still don't know what "it" is -- what is this thing. The first thing I should say is it is not something new that we have to build. It's already here. You just have to notice it and understand what's going to happen to it and then you can effectively change it. So what is it?

It is three industries that are merging. In each one of those industries there are thousands of companies involved. In the first of the three industries are the companies that produce products that help you to communicate electronically. When I say that, you hopefully think of the telephone but you also need to think of television, radio, fax machines, personal communicators, pagers, cellular telephones, and any new device that we invent that allows or helps a human being to communicate electronically.

In the second of these three industries are the companies that provide communications networks. A typical communications network is a telephone network. Another is a cable TV network -- one-way communication from some huge source of entertainment coming at us with 500 channels of programming. Also

there is a broadcast television station, a cellular telephone network, a data network which we use in business. All of these are in the industry that provides communications networks.

Somewhere on the other side of these networks is the third industry which I call information. The information may be entertainment in the form of television programming or it may be electronic bulletin boards for access by computers. It may be another person with information. It may be a centralized computer application, and for those of you that are computer users, you understand that it may be the Library of Congress some day; it may your local library, the university library. It could be any kind of information.

These three pieces, these three industries exist now. I think you all recognize them but they don't all work together. For the most part, they operate independently, and they do their own thing. They operate that way because in the past the technology that existed limited them to doing one thing and hopefully doing it reasonably well. They were kept apart because technology did not allow them to operate together...to offer television over a telephone network or to let a computer speak over a cable TV system. Technology is improving to such an extent that all of these networks and products will be able to work together in the future. That can be good or it can be bad depending upon how it happens.

Now let me describe why it is happening. About 47 years ago there was an invention called the transistor. Some of us are old enough to have been living at that time. That invention made follow-on improvements possible in products ranging from radios and televisions to computers, so that instead of having this big radio for example, you could get these portable little things from Japan called "transistors". Some of us are old enough to remember that people actually called radios "transistors". As an engineer, it was interesting to hear that. But the invention that made these improved products practical was the transistor. Now the genius of that one invention was

that it allowed relatively large devices (vacuum tubes) which took a lot of power, weighed a lot and were relatively unreliable to be reduced to something that was a little larger than a pin head, took very little power and was much more reliable.

They were originally produced one transistor on one chip in a metal enclosure, and mounted on boards with the rest of the electrical components. Well what happened along the way was that we found out how to put more than one transistor on a chip. That capability -- integrated circuit production -- has improved to the extent that today we can produce about three million transistors or like devices on a postage stamp sized chip. Every twelve to eighteen months we double the number of devices that we can get on a chip -- and the chip costs pretty much the same. Now when you keep doing that every twelve to eighteen months, you have six million, then twelve million, and within a decade you are up to a billion and more on one little chip. And it still costs about the same.

Prior to today's meeting I had done some calculations on how many transistors would be on a chip ten years from now if the present trends continued. Unfortunately, Intel today announced that they have already done what I estimated would happen two years from now, so my numbers are already too low.

That is all the technology that I'm going to get into at this time. I'm going to tell you how that technology has affected a number of products. We all used to think that a calculator was a mechanical device -- excuse me, some of us used to think that a calculator was something on which you punched the buttons and pulled the lever and it added. And that is the way you operated a cash register and all similar devices. Well when you get enough transistors on a chip, you can create a device which can replace the mechanical calculator and you can carry this device around in your hand instead of a cart. Much easier. Much lighter. Much less expensive and much more reliable.

What happened next to the wrist watch? With enough transistors on a chip and a crystal (quartz) timing

control, we could change the wrist watch into a device that could be manufactured not for many dollars but for cents. The entire Swiss watch industry was almost destroyed. But the Swiss are very smart people. They found out that a watch is not a watch to many people -- it is a fashion statement. All of a sudden the market moved back to Switzerland with Swatch, which discovered that Swatch watches could make many fashion conscious children and adults happy. Swatch can get a lot of money for a piece of decorated plastic wrist band with an inexpensive watch attached.

These examples of a calculator and the wristwatch can be extended to the typewriter. Not many of us have typewrites any longer. Most of us have personal computers. These products are examples of the kind of changes that are being wrought by the invention of the transistor and the fact that every twelve to eighteen months we can double the number of devices on a small chip of silicon. Perhaps a more startling example is that you now have the capacity in your personal computers which used to be affordable only to government and the largest companies in America. You can now buy for \$1,000, what used to cost over \$1,000,000. Five to ten years from now at the same price you will have the computing power on your desk that is being used in research labs today. You'll have that as a consumer. If you don't need that much power, you will be able to get a less powerful version for much less money. So what I would like you to understand as a consumer advocate, as a consumer educator, is what we can do over the next decade to make sure that the power which is made available by this technology not only produces intelligent, useful devices but also, allows you to communicate easily with the capacity to select the media you want, or to select multimedia, to reach information anywhere around the world, so that location doesn't really matter any longer. Businesses are certainly working hard to understand how they can use these capabilities to help them compete, to create jobs and to serve their customers. We need an equal amount of consumer energy focused on how these technological

capabilities can be used to help consumers.

I talked about some very powerful technology that is driving change in thousands of companies here in the United States. The companies are in three industries -- remember -- communications (or information) products, communications networks and information. Who are the communications companies in this country? They include television networks, cable TV companies, the local telephone companies, the long distance telephone companies, and the cellular companies. If you add all of those up, I've named over a thousand very large companies. Next we're talking about all companies that manufacture and sell all the communications or information products -- televisions, telephones, fax machines, "copying" machines for example. That whole industry is affected. Over on the other side of the network is Hollywood, the TV producers, the universities, the producers of content, as well as the libraries and all the other repositories of information. All of these industries are going to be swept up in this change. The question is how can we make this change so these industries work to the benefit of consumers, businesses and the country as a whole?

Next month I will be going to be talking to an Executive Education class at MIT. These are business people who are trying to understand what this is going to do to their businesses. These are business people from around the world trying to understand the impact of these technology changes. As I mentioned earlier, governments around the world are pondering the same issues. It is not an easy question. Let's say you are a local telephone company, a cable company, a long distance company, or a broadcast TV company and you are trying to figure out how this change is going to effect you because your business is about to fundamentally change. The same thing is true of all the television manufacturers and the book producers. They could all be affected in the same way. It is a corporate life or death issue.

I take this a side to help you further understand why there is so

much interest and coverage in the media over these issues.

It is not unusual when there are fundamental changes in Technology occurring, that there will also be a lot of overstatement, a lot of over-promising about what will happen and when it is going to happen. The same is true here. I want to make sure I'm not guilty of the same thing. I truly expect that this restructuring of the three industries I've described will happen over the next ten years, that the fundamental change will take place by the year 2005. That is why I feel the next ten years are so critical.

Now let me say a little more about what has to happen and how you can get involved. Keep in mind that there are three industries involved and that the value of those three industries is in providing useful applications -- useful products and services for consumers and for businesses. They will be operating differently in the future, but the real issues are how can the NII be easy and useful for me, how can it be inexpensive for me, how can it be made available for everyone on an evenhanded basis. Secondly, many of the companies we're talking about exist now; they are the ones who are going to be living through all of this change. The same players are reshuffling and repositioning and changing. Who uses the national information infrastructure today? Everybody. You. You use it at home, you use it in your office, you use it at the university, the government uses it, businesses use it themselves. Everything we use and touch is benefited by this infrastructure, and the more effectively businesses use it, the more competitive they are. The NII is important if we are to have a competitive automobile industry in the United States. If we are to have the strongest university system. That is why governments have raised this issue to the top tier of their priorities. Because we are talking about moving, managing and using information in the broadest possible context, this very same infrastructure can be used to support health care. It can be used to make sure that rural areas and inner cities have the same access to

information as the suburbs. There is essentially no difference in being a thousand miles away or five feet away from information because the information is in electronic form. You can access it as easily in Hope, Arkansas as in Minneapolis.

It doesn't matter if you are in the middle of Alaska or in the middle of Africa, assuming that we have compatible, interoperable national information infrastructures, you should be able to get this information equally -- if we set up the right guidelines, if we do the right thing over the next ten years. The same thing is true in the inner cities where we have as difficult a time getting the best educators, the best health care professionals to work. We can leverage the power of this infrastructure to have access to the best there is, independent of location.

I think the key to understanding the impact of all the new technologies in the three industries I've been talking about is to know they are all based upon digital technology. With digital technologies, all information, whether it is a number, a letter, a picture or other information is represented by coded zeros and ones, can be stored in memory, and can be accessed as appropriate. The information that we want and which we access through this wonderful infrastructure should come to us in a way that is easily usable by us. You shouldn't have to understand the "QWERTY" keyboard. You simply have to know what kind of information you want and be able to either see it, or hear it, or touch it, or some other means of communication which is appropriate to you. You should be able to specify what you want and how you get that information.

If we do the right things, products like a personal computer will no longer be a daunting challenge for people. You will be able to talk to that computer, or write to that computer, or signal some other way to the computer to make sure that it understands what you want. The information will come to you, the way that you want it, from wherever it is. There will be intelligent software in the device which will find that information

wherever it is and personalize the information for you.

You will no longer have to go into the Internet and search through the billion possible locations to try to find what you want, and not have any idea whether it has any value or not. You will be able to get it certified regarding quality and know that it comes from a professional source that you can trust. I've mentioned along the way what the information infrastructure is, what it can do and how it can happen. The last point I would like to make is that this will not happen automatically. It will not happen in the most efficient way in the United States or in any other country unless government, industry and consumers work together to agree on what is it we want to achieve, set the proper goals and talk about how we are going to evolve from what exists today. Government has a role to play in this evolution, but government definitely should not do it alone. Government should work with industry, with consumers, with academia to make sure that it comes out to the right bottom line. At the Federal level the Clinton administration, Congress and the FCC are doing that. In virtually every state of the Union, the state government has some activity under way to do that also. But once you get past that high level "vision" saying this is what we want to happen, there is a lot of policy details to work out. You do not have to be a policy wonk or a technical expert to make sure your voice is heard. But, you should not assume that it will be done for you.

I was talking to some of you in the audience today before lunch, and we discussed one of the critical impediments to moving forward. I call it professional reluctance. This is a term I use to observe that a lot of professionals, for example teachers and health care professionals, will be threatened by this technology. It's up to you. It's up to me, it's up to the professionals to learn and to be comfortable with what they want and to be sure they get it. The training. The NII capabilities. The capabilities exist, to make these information products smart enough so that you don't have to have a

reluctance to use them. I would suggest that you push hard on making that happen.

There are a number of other issues which can go positive or negative -- privacy, security, consumer fraud. A lot of these issues can actually take a step forward if we do the right things, if we plan for it as we go. If we don't take the right steps, there is a potential downside. So I encourage you to be involved and address those issues. Last but not least, I suggested that there are literally thousands of companies which are going to be affected by these changes. As we go through this transition from where we are now to the future, there is going to be a lot of change. Industries will be very concerned that they are properly positioned. There is one transition in particular that is going to be very difficult. That is the transition from a monopoly to a competitive market in the exchange communications business.

I personally have lived through two of those transitions. I have lived through the transition from monopoly provision of your telephone instrument -- you rented or bought it from the telephone company -- to full competition in the provision of telephones and lots of compatible devices such as fax machines, modems, etc. Better products, more choices, lower prices. The next transition was in long distance. From monopoly to competition with similar growth in the number of choices of services, higher quality, better prices. Each of these transitions -- telephones and long distance -- was made possible by advances in technology. Each transition took a decade or more. Each produced major consumer and business benefits.

The last transition from monopoly to competition is in the local telephone and local cable markets. The way that these market transitions occur are just as important as were the other two transitions -- and consumer involvement is at least as critical here as anywhere else. I encourage you to be involved in these market changes, to make sure that it's done the best way possible for you.

Hopefully my comments have been

useful in helping you to understand what the NII is, where it's leading, and how it can be of benefit to you. Thank you very much.

At this time, if anyone has any questions, we'd like to take a few minutes for them.

Question #1

When will we be able to beam somebody up?

My name is Kerkeslager and some people use the nickname Kirk. So you can understand some of the jokes I get about "beaming me up." The actual transport of bodies is something else. However, that's a very good question. The actual transport of people may not occur. But let me talk about the impact. While the present day capabilities are pretty much limited to the research labs, I can assure you that even though you may be 10,000 miles away from a business associate, you feel literally like you're right in the same room next to each other, talking to each other.

Some people call it virtual reality -- it is not even necessary to call it that. It is just the next stages of multimedia communication. Before 10 years are out, this will be a day to day reality. You will be able to do it and afford it. So I can't beam you there but I can make it almost the same as beaming you there.

Question #2

I heard on a news report that there are about 29 million telephone lines in China. That struck me as incredibly few telephone lines. I presume we must have 600 million in the U.S., something more than the population. What do you think that this revolution in the way we communicate and group this information going to do in bridging the development in the pre-developed world. Is it going to speed or slow that process?

It's an excellent question because it exemplifies the potential upside as well as the possible downside depending on how we handle that. The measure we use in the industry -- teledensity -- measure how many telephone lines we have per

hundred households. China is at three. Three telephone lines per 100 households. In the USA it is over 97. Telephone service is available even more broadly than that number suggests in the USA, but not everyone in the United States wants it. Then there are the subsidy programs. Are they correct? We're at the point of fine tuning. China is at the point of "how do we get started?" The discussion with China is at the stage of "We understand the importance of a national information infrastructure and communication is a key part of that." They are starting to put in a telephone infrastructure. Every country has to approach it from its own perspective; "where am I, what's my culture, what kind of country are we and where do we want to go." Instead of placing priority on wires and creating the telephone system the way we did in the United States, China is choosing for some locations to put in a wireless system -- think of it as a cellular system -- that gets the capability in very quickly to a reasonably large area and can be installed less expensively than otherwise.

Endnotes

1. Vice President, Technology and Infrastructure.

**A Brief History of The American Council on Consumer Interests<sup>1</sup>  
and Celebration of Our 40th Anniversary**

This year the American Council on Consumer Interests celebrated its 40th anniversary. The following provides a brief history of ACCI and a summary of the luncheon presentation recognizing our 40th anniversary.

**Les Dlabay, Lake Forest College<sup>2</sup>  
Anita Metzen, University of Missouri-Columbia<sup>3</sup>**

On November 5, 1952, Colston Warne (President of Consumers Union) inquired by letter whether Ray Price and Henry Harap would be "interested in launching a consumer education association." Warne stated that Consumers Union would contribute financial support to bring several persons together for that purpose. Price and Harap met with Warne in Chicago and heartily approved the proposal. Twenty persons accepted an invitation to attend a planning session at the University of Minnesota. These "Charter Members" were primarily college and university professors. They approved the selection of an Executive Committee which was given the following charge: prepare a plan for a permanent organization, prepare a budget and obtain financial assistance, choose its own executive secretary, and define its functions. The following persons served on this Executive Committee: Marguerite Burk, Eugene Beem, G.E. Damon, Henry Harap and Ray Price. Eugene Beem was chosen to act as Executive Secretary.

**ACCI Charter Members**

Gladys Bahr  
Eugene R. Beem  
Howard F. Bigelow  
Marguerite C. Burk  
Persia Campbell  
Helen G. Canoyer  
Willard Cochrane  
Jessie D. Coles  
G.E. Damon  
Leland J. Gordon  
Henry Harap  
Hazel Kyrk  
Gordon McCloskey  
Ruby Turner Morris  
Warren Nelson

Ray G. Price  
Edward Reich  
Margaret Reid  
Arch W. Troelstrup  
Colston E. Warne  
Fred T. Wilhelms

The Executive Committee met in Washington on June 1, 1953, after which Consumers Union made a grant of \$7000. This grant enabled the planning group to proceed with the recruitment of members, publication of newsletters and pamphlets, and the organization of an annual conference.

Thus, the American Council on Consumer Interests was formally established in 1953. Initially, the organization was called the Council on Consumer Information; it was changed in 1969 to the American Council on Consumer Interests. ACCI was established for the purpose of stimulating the exchange of ideas among persons interested in the welfare of the consumer; to be non-political and take no stand on issues of public policy; its sole purpose to contribute to more effective fact-finding and dissemination of consumer information. The first annual ACCI conference was held in 1955 in Dayton, Ohio.

**40th Anniversary ACCI  
Celebration Luncheon**

On Friday, March 25, 1994, at the ACCI Conference, a group of founding members, past presidents, executive directors, and distinguished fellows gathered to tell the story of the organization using a theme of THIS IS YOUR LIFE, ACCI! The following is a summary of the comments of those involved:

Marquerite C. Burk (ACCI charter member; first newsletter editor; ACCI President, 1961-62; Distinguished Fellow, 1978) reflected on the hard work and productive arguments that occurred among the founding members.

Willard Cochrane (ACCI charter member) commented that he spent a lifetime trying to keep consumer interests at the forefront of farm policy. He also talked about his involvement in a pilot food stamp program in Detroit during Kennedy Administration.

Kay Price (wife of ACCI charter member Ray Price, and was present at the initial) commented that "someone once referred to me as the midwife who was present at the birth of ACCI. What I did was to see that they relaxed between labor pains." Kay also reflected on Ray's strong commitment to the education of consumers.

Ramon Heimerl (ACCI Executive Secretary, 1955-1965; ACCI Treasurer, 1972-74; Distinguished Fellow, 1978) told about attending the first ACCI conference at the YMCA in Dayton in 1955, and then attending the next 25 conferences.

Stewart Lee (ACCI Newsletter Editor, 1959-1989; ACCI President, 1962-63; ACCI Treasurer, 1960-61; Distinguished Fellow, 1977) reported writing and editing 239 issues of the ACCI Newsletter. He also said that he has always made ACCI the primary conference he attends, and encouraged all ACCI members to do the same.

Richard Morse (ACCI President, 1960-61; ACCI Treasurer, 1958-59; Distinguished Fellow, 1980) expressed appreciation for the support received from ACCI during his efforts for passage of the Truth-in-Lending and Truth-in-Saving laws. He informed the group about Senator Philip Hart asking to talk at the ACCI Conference just previous to Congressional hearings on packaging. He also told about the four-page telegram received from President Kennedy a year previous to the appointment of the first consumer advisor to the president.

Ed Metzen (ACCI Executive Director, 1965-75; ACCI President, 1975-76; Distinguished Fellow, 1982) recalled the circumstances under which he became Executive Director,

and talked about his mentors--Ray Price and Arch Troelstrup. In 1967, after paying for first issues of the *Journal of Consumer Affairs*, the ACCI treasury was down to 48 cents!

Robert McEwen (ACCI President, 1965-67; ACCI Treasurer, 1963-64; Distinguished Fellow, 1980) recalled serving as chairperson of the 1967 steering committee that resulted in the creation of the Consumer Federation of America, and told about the creation of the *Journal of Consumer Affairs* during his ACCI presidency.

Gordon Bivens (ACCI President, 1967-68; ACCI Treasurer, 1964-65; editor, *Journal of Consumer Affairs*, 1966-73, Distinguished Fellow, 1982) stated that "possibly I'm a bit biased, but the decision to establish the *Journal of Consumer Affairs* was among ACCI's significant events."

Robert Herrmann (ACCI President, 1968-69; ACCI Treasurer, 1967-68; editor, *Journal of Consumer Affairs*, 1977-80, Distinguished Fellow, 1986) commented that when encouraged to take more of an advocacy position, the organization recommitted itself to education, research and public policy.

Louise Young (ACCI President 1969-70; Distinguished Fellow, 1977) recalled that the organization changed its name from the Council on Consumer Information to the American Council on Consumer Interests during her presidency. She also noted that she was invited to the original meetings of the organization, and would have been a charter member except that another project kept her on campus.

E. Thomas Garman (ACCI President, 1974-75; ACCI Treasurer, 1972-73) told about his 10 years of service on the ACCI board and effort to encourage a change of election at annual meeting to a mail ballot.

Carole Makela (ACCI President, 1981-82; ACCI Treasurer, 1978-80; editor, *Journal of Consumer Affairs*, 1990-present; Distinguished Fellow, 1994) commented on the contribution ACCI makes to the professional development of consumer affairs specialists and to society.

Karen Goebel (ACCI President, 1993-94; Distinguished Fellow, 1992) reflected about the 1984 discussion about whether to accept corporate

funds for projects. The issue was resolved with a ballot sent to the membership; funds are accepted only when control for the project remains with ACCI.

E. Scott Maynes (Distinguished Fellow, 1992) noted that since 1979 research has had an increased role in the organization. He recalled chairing the committee that organized and obtained funding for first International Conference on Research in the Consumer Interest.

Monroe Friedman (ACCI President, 1989-90; editor, *Journal of Consumer Affairs*, 1980-1984; Distinguished Fellow, 1991) told about working as a Congressional Fellow in 1966 with Senator Philip Hart and Esther Peterson when she headed the President's Council on Consumer Interests. During his ACCI presidency, the Peterson Consumer Forum was created.

John Burton (editor, *Advancing the Consumer Interest*, 1989-94) noted that as a graduate student in the late 1960s, he sent a letter to Colston Warne with an idea for a consumer interest journal similar to what is now *Advancing the Consumer Interest*.

Barbara Slusher (ACCI Executive Director, 1983-88; ACCI President, 1993-94) remarked that she was on board 12 years as executive director, board member, and president. During that time, 45 different people served on board. This experience reinforced the wisdom that the 21 founding members had when they established the policies by which the organization works, with volunteers not paid staff members.

Anita Metzen (ACCI Executive Director 1988-present) commented on the challenges and opportunities technology has brought to the delivery of member services and ACCI publications.

Les Dlabay (luncheon moderator; editor, *ACCI Newsletter*, 1989-present) concluded with: "You have heard about ACCI's past. Those in this room represent the present of ACCI. What about the future?"

Carissa Dlabay said that "many students are ready to serve consumers and teachers and researchers. Be sure to invite a student to join ACCI."

Kyle Dlabay noted that "consumers throughout the world will continue to need the educational and research efforts provided by ACCI."

#### Endnotes

1. Taken from Henry Harap, "A Brief History of the American Council on Consumer Interests," a photocopied paper distributed by Consumers Union of the U.S., March 1981.
2. Associate Professor, Department of Economics and Business.
3. Executive Director, American Council on Consumer Interests.

## ACCI's Heritage

I shall refrain from attempting a 40-year history of ACCI. Instead, I will focus on what I believe new members of ACCI will inherit from ACCI's past.

Richard L. D. Morse, Kansas State University<sup>1</sup>

The roots of ACCI are intertwined with the consumer movement and both have been influenced by the changing social environment since the mid-1950s. Fortunately there is now available a rich resource for this. It is the recently published book, The Consumer Movement, The Colston E. Warne Lectures which I edited and appended with a section on "Perspectives of the Consumer Movement" (Warne & Morse, 1993).

More specifically, the seeds for ACCI were planted by Colston E. Warne, the visionary leader of the consumer movement. As President of Consumers Union he queried Dr. Ray Price, a leading professor of business education at the University of Minnesota and Dr. Henry Harap, professor of education at the George Peabody College for Teachers, to ask whether they would be "interested in launching a consumer education association." Both had authored significant books on consumer education, but as Dr. Warne observed in his 1977 lectures, "There was no consumer education association in the country" (p.157).

They agreed and Consumers Union funded a meeting of 21 persons who accepted their invitation to come to Minneapolis for a planning session. The result was the establishment in 1953 of the Council on Consumer Information (CCI) (Consumer Movement Archives, ACCI Papers, B-4, F-76). According to Harap's history, its purposes were: (a) To stimulate the exchange of ideas among persons interested in the welfare of consumers, and (b) To contribute to more effective fact finding and dissemination of consumer information (ACCI, 1989, p.3).

As ACCI evolved, it developed specific characteristics which give it its unique persona. The first of

six identified characteristics was set at the outset when the founders agreed that "The Council was to be non-political and take no stand on issues of public policy" (p.3).

It should be observed that many of the early leaders had written text books. Professional journals offered no outlet for these pioneers motivated to encourage consumer education. The formative leadership of ACCI was from practical-minded intellectuals who seriously believed that students were being improperly prepared not only to be wise buyers, but to teach marketing from a consumer-buyer perspective. Professors of marketing, agricultural and general economics either ignored the area or viewed it as unworthy of academic recognition. In those years, no one was fully employed as a consumer specialist; the major position supported their somewhat "avocational" consumer concern. Hence, the second characteristic is the pioneering drive for consumer education in CCI, as represented by its well respected Newsletter.

A third identifying characteristic of ACCI was its non-commercialization policy. Dr. Warne and ACCI board members followed Consumer Union's policy of complete independence from commercial ties. Some ACCI board members, as members of the American Home Economics Association, had witnessed the warping effect of business influence. And in his 1977 lectures, Dr. Warne expressed some concern over where ACCI was headed, having observed commercial exhibits at ACCI conferences. "The corridors of ACCI consumer conferences are now well filled...with exhibits of commercial representatives, each eager to get on the bandwagon and demonstrate new-found love of the consumer movement. I don't know where this will end.

Business groups are really a competitive branch of education seeking to condition people to accept the mandate of a company with something to sell" (p.160).

ACCI was dependent on subsidies from Consumers Union for almost two decades but without any trace of influence on the policies of either organization. My own recollection was of unhappiness expressed on the part of some CCI board members over the refusal of the editor of Consumer Reports to recognize ACCI and its publications. It seemed strange that CU would support CCI financially, but not in marketing its publications; that principal of independence and avoidance of even the appearance of influence by the donor was not breached. Thus, there is a *fourth* characteristic, the precedent for ACCI to receive from a non-profit educational organization financial support with no obligation for public recognition and to be policy-influence "blind." An exception was made by mail-ballot approval to accept outside funding for the Wingspread research conference.

There are two other ACCI characteristics implanted at the outset of which newcomers may not be aware. That ACCI has never been dominated by either sex is a *fifth* characteristic. Of the 21 founders, 8 were women. This is a significant ratio, for those were times when women were ignored by many professions; most professional organizations tended to be either all-male or all-female. As a home economist, I welcomed the diversity that CCI offered and am pleased that it has persisted over its 40 years.

The *sixth* characteristic is the inter-professional character of the leadership and membership. Of the founders, 9 were from education, especially business education, 6 were economists, 3 were home economists, and 3 identified with public policy. Totally absent from discussion was disdain for one's professional affiliation. This is as it should be, because consumer information and welfare do not fit well into traditional academic professional lines.

These six characteristics of ACCI are not legally binding, but are so embedded that deviation is cause

for much debate. And debate, I suppose, might be a seventh characteristic, but it is not listed as unique to ACCI and expected of academics.

#### Some Observations

I would like to take this occasion to offer some generalities that may stimulate a better understanding of the past and help in consideration of the future.

McCarthyism was still fresh in the minds of consumer leaders when CCI was founded. Consumers Union was not given a certificate of purity until February 6, 1954, after five years of incrimination by the House Committee on Un-American Activities (Warne & Morse, 1993, p.147). In 1953 the president of Florida State University directed the university book store to destroy all copies of Consumer Reports and cancel all orders (p.140,fn.130). It was risky for faculty to be identified with consumer issues.

As late as 1962 the idea of consumerism was so suspect that many papers canceled Sylvia Porter's column after she wrote a series of articles about the consumer movement and she then felt compelled to resign from the President's Consumer Advisory Council (p.176, fn.159).

The advent of Nader in the late '60s, the awakened public press beginning with ridicule of Nixon's appointment of Willie Mae Rogers (p. 182), the founding of CFA in 1968, and the new availability of contracts and grants for consumer education and research all contributed to making consumer studies attractive. Yet, professional respectability was most difficult to obtain in academia for consumer research. It was not until 1966 when ACCI launched the Journal of Consumer Affairs that there was an outlet for peer reviewed publications, an essential for professional advancement and attainment of tenure. And not until 1973 did Advances in Consumer Research and the Journal of Consumer Research emerge. Also, opportunities for doctoral studies were very limited and narrow. Doctoral programs relied primarily on economic theory and number-crunching dissertations for academic respectability.

As the consumer movement grew, traditional ways of doing business in commerce and public policy were threatened. Arguments based on ethical and moral rights of consumers and consumer sovereignty were challenged by those demanding "hard" evidence of need for change and justification based on proof of alleged benefits exceeding costs. This gave rise to a new breed of consumer activists who could apply their training in such established disciplines as psychology, statistics, law, market analysis, economic theory, and macro-economics. This gave rise to a different type of ACCI membership. Also funds became available from interested parties to produce research papers acceptable to professional journals.

In the 1980's there was mounting skepticism of consumerism and questioning of the value of consumer protection. Although legislation and regulation diminished, there was a rise in consumer-professional research into the impact of product liability, environmental laws, truth in lending, etc. In earlier ACCI years consumerism was pursued as a moral/ethical matter or as a logical component of economics and marketing by part-time consumer advocates. In later years economic inducements enabled full time professional consumer advocates and researchers to emerge in leadership roles.

#### References

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- ACCI Papers. Consumer Movement Archives, Kansas State University Libraries. Manhattan, Kansas.
- Warne, Colston E. & Morse, Richard L. D. (1993). The Consumer Movement, Lectures by Colston E. Warne, Introduction and Perspectives on the Consumer Movement by Richard L. D. Morse. Manhattan, Kansas: Family Economics Press.

#### Endnote

1. Richard L. D. Morse is Professor Emeritus of Family Economics, founder of the

Consumer Movement Archives of Kansas State University Libraries, ACCI President 1960-61, and 1980 ACCI Distinguished Fellow.

Results of the 1994 ACCI Membership Survey

The following is a summary of the results of the 1994 ACCI Membership Survey. This summary was a part of the general session "ACCI: Past, Present, and Future."

Jane Kolodinsky, University of Vermont<sup>1</sup>  
 Marlene Stum, University of Minnesota<sup>2</sup>  
 Cathleen Zick, University of Utah<sup>3</sup>

The 1993-94 ACCI membership survey was mailed to 735 ACCI members. Three hundred nineteen were returned, for a response rate of 43.4%. This is about 10% higher than the response rate of the 1989 survey and 5% higher than that of the 1985 survey. By membership category, the response rates were: 52.2% voting, 48.8% associate, and 33.6% student.

This survey focused on three major areas: membership issues, the annual conference, and publications, plus future directions, where it was found that members would like to see more electronic bulletin boards containing information about funding sources and available data sets.

Membership

We are a diverse, yet concentrated group of professionals. While we belong to over 100 different professional organizations, showing our diversity, we belong to ACCI to obtain information about consumer education, research, and policy, to network, and to build our credentials. Other membership information includes:

- ◆ 67% are employed by colleges and universities.
- ◆ 65% report Consumer/Family Economics as a major focus.
- ◆ The majority know their rights and privileges as members (80.4%).
- ◆ 86.5% would feel awkward nominating themselves for an award or the board.
- ◆ 34.7% feel the ACCI board of directors should be expanded to

3 years (45.5% neutral; 19.7% opposed).

- ◆ 21.1% feel the board of directors should expand from 12 to 14 members (43.5% neutral; 35.5% opposed).

Significant differences were found related to type of membership (individual, associate, student), primary organization (ACCI versus other) and conference attendance (>50% or <=50%).

- ◆ Fewer associate members agree that ACCI is a progressive organization.
- ◆ Fewer associate members and more regular conference attenders are aware of the mentoring program.
- ◆ Fewer associate members and more regular conference attenders agree that board terms should be expanded.
- ◆ More primary members and regular conference attenders use the electronic research bulletin board.
- ◆ More primary members agree that board terms should be expanded.
- ◆ More regular conference attenders know their membership privileges.
- ◆ More regular conference attenders think all members should have voting rights.
- ◆ More regular conference attenders believe ACCI offers sufficient opportunities for

members to become involved.

Although 44% agreed that "ACCI should offer different membership categories based on the number of publications a member wants to receive," the majority of respondents indicated they wanted to continue to receive all three publications. Individual members would tolerate an average maximum increase of \$14.00 to receive all three publications, while associate members would tolerate only \$7.00. Membership price elasticities, however, are elastic (-1.4).

### Conferences

Over 63% of respondents have attended at least 50% of conferences during their membership tenure. Findings related to conference place, timing and features include:

- ◆ 67.3% want the conference to continue to take place in a variety of cities.
- ◆ 54.7% want the timing of the conference to remain as late March/early April.
- ◆ The most popular ACCI conference link is with AFCPE (47.7%).
- ◆ CFA (38.1%) and SOCAP (34.3%) were also popular linkage choices.
- ◆ 66.8% would support linkages if they occurred every other year.
- ◆ Individual and associate members would tolerate an average maximum increase of \$22.00 in conference fees.
- ◆ The majority of respondents think conference features should remain as they are.
- ◆ Associate members are significantly different from others in that they want more consumer education sessions and fewer refereed paper sessions.
- ◆ Student members are significantly different from others in that they want

more student sessions and fewer roundtables.

- ◆ 52.5% want the Proceedings to continued to be published in the current form.
- ◆ 59.1% think ACCI should sponsor another International conference. However, only 28% would be likely to attend such a conference.

### Publications

Although different publications have different usage rates for different purposes, the most used publications are the *Journal of Consumer Affairs* and *The Proceedings* for academic work (proposal and manuscript writing). The *Journal of Consumer Affairs*, the *Newsletter*, and *Advancing the Consumer Interest* for applied work (education and program development).

- ◆ The Newsletter receives the highest overall ratings.
- ◆ Respondents employed by universities, and with Consumer/Family Economics foci rate the Newsletter higher on several characteristics than do others.
- ◆ The Journal of Consumer Affairs receives relatively high marks for quality.
- ◆ Respondents employed by universities and with Consumer/Family Economics foci rate the JCA higher on several characteristics than do others.
- ◆ Advancing the Consumer Interest receives relatively high quality marks.
- ◆ Respondents employed by universities and with Consumer/Family Economics foci rate ACI higher on several characteristics than do others.

### Conclusions

What can be concluded from the above analyses? Based on those that responded:

- ◆ ACCI appears to be moving towards having a larger "core" of members who are "academics" involved in Consumer/Family Economics, with a sizeable periphery of persons who are "secondary" members. We appear to be meeting the needs of this core group quite well. However, we know this is a shrinking group.
- ◆ There may be some simple steps ACCI can take to meet the needs of our associate members--in terms of knowledge and attitude differences, information is key. This group is less likely to know of and use some of the newer services of ACCI, for reasons which need to be better understood. Since individual members seem to agree that associate members should have the same privileges, then opportunities for involvement should increase.
- ◆ We may not want to tackle the unbundling issue at this time, since the majority of members want to continue to receive all three publications. We may want to consider a slight dues increase.
- ◆ Exploring an occasional link up with other organizations in terms of annual conferences appears fruitful. Any decision should be carefully considered given the membership's diversity.
- ◆ We may want to explore ways to make the annual conference more inviting to those who do not hold doctorate degrees or have a major focus of Consumer / Family Economics. Do we appear to be an "elitist" organization to others?
- ◆ There is room to please all types of members with regard to conference features, even though there are some differences in what different member types would like to see on a program.
- ◆ The JCA appears to be serving

its academic, Consumer/Family Economics members. ACI appears to also be serving them. If this is not the intent of this journal, then perhaps it needs to be looked at more closely.

- ◆ Although there is support for another international conference, the percentage saying they would attend is small. The efficiency and effectiveness of such a conference should be closely examined.
- ◆ ACCI may want to consider expanding the electronic bulletin board to include listings of funding sources and data sets.

#### Endnotes

1. Associate Professor
2. Assistant Professor
3. Associate Professor

## Demand for Food Variety in the United States

Demand for food variety is analyzed using data from the 1987-88 Nationwide Food Consumption Survey. The demand model is nonlinear in both parameter and variable. Results show that food variety is not a monotonically increasing function of food expenditure. The education, race, and status of household head are important factors influencing variety in American diet. Food stamp improves food variety for households under poverty.

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Information on food variety characteristics present in a consumer's food basket is useful for studying consumer demand behavior and evaluating their diet quality. Commodities consumers purchase can be viewed as collections of heterogeneous goods. Within a commodity, such as beef, consumers can purchase cheap or expensive items (Deaton, 1990), i.e., low grade hamburger vs Kobi beef steaks. The commodity composition may vary across breadbaskets according to the consumer's economic and demographic characteristics. As Pollak (1989) explained, products come in many varieties, varieties appear and disappear from markets, and over time or across places their prices fluctuate.

Consumer demand for variety have been investigated in earlier studies (Theil & Finke, 1983; Jackson, 1984; Shonkwiler et al., 1987; Lee, 1987; and Lee & Brown, 1989). Although different approaches and different kinds of data sets were employed, the findings were fairly consistent. All reported that the demand for variety in commodities increases as incomes (expenditures) rise. This study investigates the validity of this finding for the American diet, using a more flexible functional specification. The relationship between the demand for food variety defined as the number of food items in a bundle and household characteristics are also investigated. The USDA 1987-88 Nationwide Food Consumption Survey (NFCS) is used as the database.

## Theoretical Considerations

Consumer demand behavior is traditionally investigated by maximizing a consumer's utility given a set of underlying economic constraints. The problem can be defined as:

$$\begin{aligned} \text{Max } u(q) &= u(q_1, \dots, q_n), \\ \text{s. t. } \sum p_i q_i &= y, q_i \geq 0, \end{aligned} \quad (1)$$

where  $q_i$  and  $p_i$  are commodity  $i$ 's respective quantity and price, and  $y$  is the consumer's income.

The Kuhn-Tucker complementary conditions to the above maximization problem are:

$$\begin{aligned} \frac{\partial u}{\partial q_i} - \lambda p_i &\leq 0 : q_i \geq 0 \\ \sum p_i q_i - y &\leq 0 : \lambda \geq 0 \end{aligned} \quad (2)$$

where  $\lambda$  is the Lagrange multiplier and it is interpreted as the marginal utility of income.

The Marshallian demand function, from solving the first order conditions (FOC) for  $q_i > 0$  and  $\lambda > 0$ , can be represented as:

$$q_i = f_i(p_1, \dots, p_n, y). \quad (3)$$

The  $q_i$ 's in the solution comprise a consumer's commodity bundle. The number of commodities within this bundle (i.e.,  $q_i > 0$ ) is defined as the variety of the bundle. The variety, for given prices, is a function of consumer income (total expenditures)

(Jackson, 1984), i.e.:

$$V = f(y|p_1, \dots, p_n), \quad (4)$$

where  $V$  denotes the number of individual items chosen by the consumer. Jackson also reported that  $V$  is a monotonically increasing function of  $y$ . This is true under the very strong assumption that a strict hierarchic sequence to purchases is present.

As incomes grew, consumers shift the commodities. At different income levels, the commodities chosen in the bundle may differ. When a new commodity enters a consumer's basket it might replace another commodity. This is referred to as variety replacement or quality variation in literature.

A typical example of this occurs when the bundle includes an inferior good. This can be explained using the Kuhn-Tucker complementary conditions. When  $q_i=0$ , the good has never entered or it has been excluded from the bundle. In this scenario, the following must be true:

$$\frac{\partial u}{\partial q_i} < \lambda p_i. \quad (5)$$

For an inferior good, the marginal utility is negative. This strict inequality holds because  $\lambda$  and  $p_i$  are both positive. In this case,  $q_i$  will leave the consumer's consumption bundle as incomes increase.

A good may be excluded from a consumer's basket owing to shifts in consumers' tastes or the entry of new commodities. The marginal utilities of commodity  $q_i$  and consumer's income  $y$ , are decreasing functions of  $q_i$  and  $y$ , respectively. Because the decreasing rates of marginal utilities of  $q_i$  and  $y$  are different, the strict inequality is possible at a given price. The relationship between the demand for variety and income can not be determined a priori. Therefore, the theory has little to say about the rate at which commodities enter or exit the food bundle (Lee and Brown, 1989).

### Specification of Empirical Analysis

In addition to food expenditure, household demand patterns are affected by socio-economic and demographic variables (Lund & Derry, 1985; and Deaton et al., 1989). In this study the demand for variety in foods is assumed to be a function of food expenditure and a set of other socio-economic and demographic variables.

Most previous studies such as Jackson (1984) and Lee (1987) assumed that as food expenditures increase an increasing variety in food baskets will be present. This assumption may be too restrictive. In this study, the variety choice model is specified as nonlinear in both total food expenditure and its parameters. The other socio-economic and demographic variables are specified as linearly additive dummy variables. The variety choice model is specified as:

$$V = \frac{\alpha y}{(\beta + y)^2} + \sum_{i=1}^n d_i Z_i + e, \quad (6)$$

where  $V$  is variety in foods;  $y$  is food expenditure;  $Z_i$  is dummy variable  $i$ ;  $\alpha$ ,  $\beta$ , and  $d$  are the parameters to be estimated, and  $e$  is the error term.

Since the values for all food items for at-home consumption are included in food expenditures, no intercept is needed in the model. The  $\alpha$  is expected to be positive since the demand for food variety should be positive at any food expenditure level. The  $\beta$  determines the level of expenditure at which  $V$  is maximized. It can be considered as the expenditure at which the demand for variety is saturated in terms of number of food items.

Both first and second derivatives of  $V$  with respect to  $y$  are the functions of  $y$ . They both may take a positive or negative value depending upon the magnitude of  $y$ . Therefore, the relationship of the demand for variety and expenditure is

Table 1  
Definition of Variables Used in the Model

Variable	Definition
Y(\$)	Per capita at-home food cost during the survey week
PFCAH(\$)	Per capita away-from home food cost during the survey week
Dummy Variables:	
AH1	1 if per capita away-from-home food cost is zero
AH2	1 if per capita away-from-home food cost is larger than \$20
AH3	1 if per capita away-from-home food cost is larger than 0 but less than \$20
ED1	1 if household head completed less than or equal to 9 years of school <sup>a</sup>
ED2	1 if household head completed at least one year of college
ED3	1 if household head completed more than 9 years of school but less than one year of college
FS1	1 if standard household size (21-meal-at-home/week equivalent person) is less or equal to one
FS2	1 if standard household size is larger than three
FS3	1 if standard household size is larger than one but less than or equal to three
RFS	1 if food stamp recipients
NFS	1 if food stamp non-recipients
BMF	1 if both male and female heads
NMF	1 if not both male and female heads
AGE1	1 if household head is 65 years old or older
AGE2	1 if household head is younger than 65 years
RACE1	1 if household head is white
RACE2	1 if household head is not white

<sup>a</sup> The household heads for educational level and other categories refer to the female household head for female headed as well as both female and male headed households. Otherwise, it refers to male household head.

flexible under this nonlinear specification. The expenditure elasticity of variety demand can be computed by

$$E = \frac{\partial V}{\partial y} \frac{y}{V} = \frac{\alpha(\beta - y)}{(y + \beta)^3} \frac{y}{V} \quad (7)$$

The dummy variables included in the model are AH1, AH2, ED2, FS1, FS2, RACE1, BMF, AGE1, and RFS. They are defined in Table 1. The inclusion of dummy variables is then tested following the procedure proposed by Gallant (1987).

#### Data Source and Description

The 1987-88 Nationwide Food Consumption Survey (NFCS) provides an ideal database for analyzing the demand for food variety utilizing procedures described above. It

provides food consumption information as well as many socio-economic and demographic variables for 4,273 housekeeping households. These households are defined as at least one member of a household had ten or more meals from the household's food supply during the survey week.

The NFCS contains information on disaggregated food items purchased by the households. For example, meat is a major food group. It is divided into subgroups of beef, pork, lunch meats, etc. The beef subgroup includes subcategories such as steak, roast, ground beef. Steak is further subdivided to include round steak, sirloin steak, etc. The round steak subcategory is divided into "bone-in" round steak and "bone-out" round steak. Each of these is defined as an individual food item. Food variety of a consumer's food basket is measured by the number of

individual food items in the basket. The NFCS included 3,970 possible food items.

The sample means of the numbers of food items in a household's food basket by different household types and by different food cost levels are presented in Tables 2 and 3, respectively. The differences in food variety among the household groups indicate that differences of food consumption behavior occur across household types (Table 2). The total number of food items is substantially lower for low food expenditure households (Table 3). As food expenditures increase, the food variety sharply increases at first, and reaches its peak at \$50-65 weekly per capita food cost. This pattern holds for most of the nine major food groups. This phenomenon demonstrates that food variety may not increase monotonically with food expenditures.

Table 2  
Average Number of Commodities  
by Household Groups

Item	Sample size	Mean
Total Sample	4273	42.2
ED1	592	35.0
ED2	1609	45.0
RFS	309	39.0
NFS	3964	42.5
RACE1	3632	43.1
RACE2	641	37.5
BMF	2856	46.8
NMF	1417	32.9
AGE1	823	36.0
AGE2	3450	43.7

The data is divided into three sub-samples to capture the structural differences on the demand for variety by income groups. Sample I includes households falling below the poverty level. Households above the poverty level but below an annual per capita income of \$20,000 are included in sample II. Sample III includes the households whose annual per capita income is greater than \$20,000. Households under poverty are classified using the official poverty thresholds in 1987 (Ruggles, 1990). Table 4 reports the sample statistics for the three sub-data sets.

Table 3  
Average Number of Commodities  
by Food Group and Food Cost Level

Food Group	Total Food Cost (\$)			
	10-20 <sup>a</sup> (673) <sup>b</sup>	30-40 (860)	50-65 (475)	80-100 (156)
Total	34.86	45.82	46.11	41.50
Milk	3.08	4.23	4.32	4.13
Fats	2.17	2.81	2.73	2.63
Flour	3.39	3.99	3.55	2.72
Bakery	3.49	4.89	5.09	4.69
Meat	3.65	4.48	4.34	3.64
Poultry	1.57	1.97	1.99	1.78
Eggs	0.90 <sup>c</sup>	0.89	0.87	0.84
Vegetable	3.30	4.73	5.03	4.58
Fruit	1.79	2.60	2.75	2.53

<sup>a</sup> 10-20 denotes interval of \$10.01-\$20, and the same for others.

<sup>b</sup> Sample sizes are in parentheses.

<sup>c</sup> The number of commodities is less than one because there are households with no egg consumption.

Among the three sub-samples, food variety is lower for households falling below the poverty level than for others. The food variety for households with an annual per capita income greater than \$20,000 is lower than that for sub-group II. The per capita food cost away-from-home for high income household is much greater than that of the low income group. A dramatic difference between food cost at-home is not present across these income groups. The proportion of households having zero food costs at-home is much greater in sample I than it is for samples II and III. About 35 percent of the households under poverty level receive food stamps, representing more than 76 percent of food stamp recipients in the survey.

Table 4  
Sample Means of the Four Samples

Variable	Pooled (4175)	I (682)	II (2634)	III (859)
Variety	42.2	36.1	44.6	39.8
Y(\$)	27.4	22.7	25.8	36.0
PFAH(\$)	14.8	5.4	10.8	34.6
AH1	0.19	0.41	0.17	0.06
AH2	0.22	0.07	0.15	0.57
ED1	0.14	0.33	0.13	0.02
ED2	0.38	0.18	0.34	0.67
FS1	0.17	0.24	0.11	0.29
FS2	0.28	0.30	0.34	0.07
RFS	0.07	0.35	0.02	0.00
RACE1	0.85	0.66	0.88	0.94
BMF	0.67	0.40	0.74	0.67
AGE1	0.19	0.29	0.20	0.11

**Estimation Results and Discussion**

Both full (including all dummy variables) and reduced (excluding dummy variables) variety demand models are estimated for the pooled and three sub-samples. The likelihood ratio statistics strongly support the use of the full model (the last row of Table 5). The estimation result of the reduced model is not reported but the relationships between food expenditure and variety are shown in Figure 1 for the sake of comparison.

The estimated parameters and asymptotic standard errors for the full model are reported in Table 5. Most of the parameters are statistically significant with the expected signs. Figure 2 depicts the relationship between food expenditure and demand for variety in food. A comparison between figures 1 and 2 shows that the demand for variety in food attains its peak and decreases much slower when the dummy variables are incorporated.

Similar patterns exist for all four data sets (pooled and three subsets). The demand for variety in food peaks at approximately \$80 of food expenditure at-home. Beyond this expenditure level the demand for variety slowly declines. This finding is different from previously reported studies such as Jackson and Lee. Lee using the 1977-78 NFCS

demonstrated that the number of food items consumed at-home increases as food expenditure increases. The declining tendency for food variety implies that after certain level of food expenditure, the number of food items entering into the consumer's food basket is lower than those leaving the basket. This is a strong indicator of variety replacements and quality changes in consumer diet.

Figure 1  
Demand for Food Variety  
(Reduced Model)

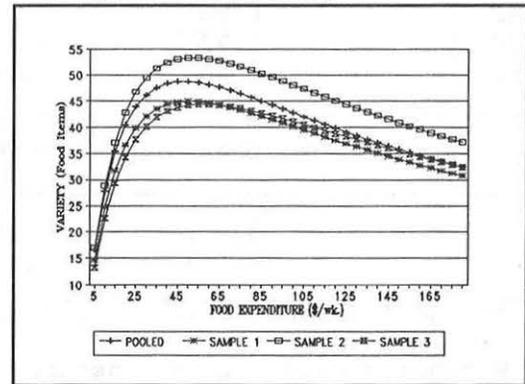


Figure 2  
Demand for Food Variety  
(Full Model)

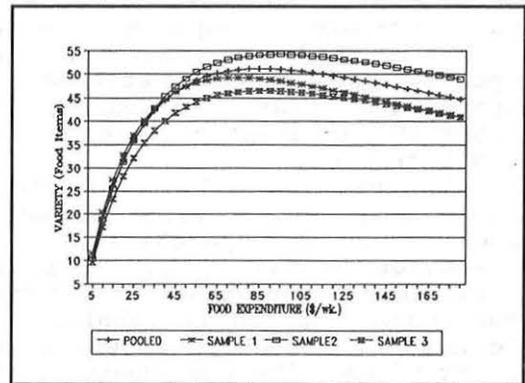


Table 5  
 Estimation Results of Variety Choice Models<sup>a</sup>

Parameter	Pooled	I	II	III
$\alpha$	17354.6**	15185.8**	20238.9**	16283.4**
$\beta$	84.86**	78.18**	93.45**	87.44**
AH1	-0.87	0.47	-1.15*	-0.53
AH2	-6.00**	-5.24**	-4.71**	-5.17**
ED2	3.26**	2.28**	4.22**	2.67**
FS1	-13.34**	-10.05**	-13.40**	-12.37**
FS2	14.08**	11.48**	13.83**	19.06**
RACE1	2.59**	1.43*	2.95*	3.07*
BMF	4.00**	3.57**	3.94**	5.45**
AGE1	2.75**	-0.48	2.91**	3.95**
RFS	0.48	1.70*	1.14	—
<hr/>				
E	0.458	0.517	0.467	0.403
<hr/>				
L	334.2 (2.41)	52.8 (2.41)	189.6 (2.41)	73.7 (2.51)

<sup>a</sup> \*\* and \* denote statistical significance at the 0.05 and 0.01 levels, respectively.

<sup>b</sup> E denotes expenditure elasticity. L denotes the likelihood ratio statistic, and the numbers in parentheses are the critical values at the 0.01 level.

The estimated coefficients of most dummy variables are consistent with those reported in other studies. Owing to a similarity in data, some comparisons will be discussed with Lee's study. Food expenditures for away-from-home is negatively related to the demand for variety. Lee reported that when the at-home food expenditure share increases, the number of food items consumed at-home also increases.

If the head of a household is highly educated, a large number of food items are purchased. The households headed by both male and female demand for higher food variety than single headed households. If the head of household is white, the number of food items purchased in the basket tends to be large. Household size is another major factor determining a household's food variety. The larger the household size, the more food items it consumes. This is expected due to possible taste differences among household members. Finally, the age of household head is also positively

related to food variety. These results are all consistent with Lee's findings.

Some differences between the results of using pooled and sub-data sets are worthy of mentioning. Food stamp participation is significant for Sample I while it is not significant for the whole sample and Sample II. This finding suggests that the food variety of households in Sample I is severely limited by the income. Food stamps improve the diet variety. For households above the poverty level food stamps may not significantly affect their diet in terms of variety. Lee found that the effect of food stamp program participation on food variety was not significant. This might be explained by the fact that he used the whole sample. Since the food stamp program may be appropriate only for households below the poverty line, its effect can be captured more effectively by estimating the model for a sub-sample. The age effect is not significant for the Sample I. Demand for food variety for

households with an elderly head is higher than for other households in Samples II and III.

The expenditure elasticities for food variety at the sample means are reported in Table 5's penultimate row. They are positive and less than unity. These estimates show that at the mean level the demand for food variety is more expenditure elastic for households under poverty than it is for those above the poverty line. Differences among the expenditure elasticities also indicate the need for sample partitions in variety demand analysis.

#### Conclusion

This study proposes an alternative specification for the demand for food variety. The estimated results demonstrate the appropriateness for the nonlinear specification of food expenditure. Including demographic variables improves model's performance. Furthermore, the sample partitions provide useful insights into the effects of socio-demographic variables on food variety. For example, the food stamp program is a relevant variable when studying the demand for variety for households below the poverty line.

The empirical results show that food variety is not a monotonically increasing function of food expenditure. High food expenditure households are more likely to consume high variety foods, but only up to a certain expenditure level. When food expenditures rise above the certain level, the number of individual food items purchased may actually decrease. This results in a higher price or unit value for each food item. Thus consumers are shifting away from purchasing lower quality toward higher quality food items as income rises. The educational levels, race, and household head status are major factors determining the food variety in American diet.

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#### Endnotes

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**Do Consumers Respond to Health Information in Food Choices?  
Models and Evaluation of Egg Consumption**

Previous studies suggest that the diffusion of cholesterol information is a major reason for the continuing decline in U.S. per capita egg consumption. This study examines the effects of health concerns about cholesterol and demographic variables on egg consumption by applying the Tobit and double-hurdle models to the 1989 CSFII data. Results show that health concerns have significant impacts on the decisions about whether to consume eggs and how much to consume. Demographic variables with statistically significant effects on egg consumption include region, employment status, age, sex, race, education and household size.

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**Introduction**

Per capita egg consumption in the United States has declined steadily from 320.7 eggs in 1960 to 235.0 eggs in 1992 (USDA, various issues). Identification and assessment of causes for the continuing downward trend in egg consumption are of great importance for egg producers and processors concerned with preventing further shrinkage of their industry or creating market niches for their products. Educators and others concerned with understanding factors explaining dietary patterns and changes also need evidence on specific determinants of food choice and behavior.

Previous studies have suggested that the diffusion of information on the links between cholesterol and arterial disease is a major factor leading to the decline in egg consumption in recent decades (Putler, 1987; Brown and Schrader, 1990; Stillman, 1987). By including a nonlinear function of time in the demand equation to correspond with the diffusion process of cholesterol information, Putler concluded that cholesterol information first had an effect on egg consumption in the second quarter of 1969 and the full impact was achieved by the fourth quarter of 1980. Brown and Schrader constructed a cholesterol information index to estimate the effect of cholesterol information on egg consumption. Their index is defined as the sum of medical articles supporting a link between cholesterol and heart

disease minus the sum of articles questioning such a link. Using quarterly data from 1955 to the second quarter of 1987, Brown and Schrader concluded that information on the links between cholesterol and heart disease had significantly reduced per capita shell egg consumption over the study period. This index has also been used by two other studies to examine the impact of cholesterol information on consumer demand for pork, beef, poultry, fish, fat and oil (Capps and Schmitz, 1991; Yen and Chern, 1992).

Most of the earlier studies on the effects of health factors on food consumption have relied on aggregate time-series data and heroically simplified measures of health information, such as time trends and number of medical or health-related articles (Putler, 1987; Brown and Schrader, 1990). The simplified aggregate measures may be poor proxies for consumers' specific health concerns because individuals differ in exposure to media sources and in cognitive skills to process health and diet information (Lin and Milon, 1993). Although many studies have used household and individual survey data to model consumer demand for food products such as eggs, shellfish, milk, bread and butter (Frazao, 1992; Lin and Milon, 1993; Haines, Guilkey and Popkin, 1988; Blisard and Blaylock, 1993), the findings about the effects of cholesterol information on egg consumption, based on aggregate time-series data, have not been tested and corroborated by indi-

vidual or household survey data. Frazao used the 1988 Bureau of Labor Statistics' Continuing Consumer Expenditure Survey (CCES) data in a two-step decision model to examine the egg expenditure decisions of female-headed households, but no health or nutrition factors were included in the analysis. In contrast to these earlier studies, this study attempts to assess the effects of health concerns about cholesterol and several demographic variables on egg consumption using the microdata from the 1989 USDA Continuing Survey of Food Intakes by Individuals (CSFII).

The use of survey data allows examination of the effects of detailed demographic variables and health concerns that are generally not available in aggregate time-series data, most often used by economists. With cross-section survey data, however, zero-observations present new estimation problems. The Tobit model has been widely used in estimating single demand equations from survey data because a significant proportion of participants tend to report zero expenditure or consumption for specific commodities in the survey (Tobin, 1958; McCracken and Brandt, 1987). However, the Tobit model is extremely restrictive because it assumes that all zero observations represent standard corner solutions in the sense that positive expenditures or consumption would occur if some variables like prices and income changed. This assumption may not be true, however, for the cases when some of the zeros are a result of "nonparticipation" decisions (i.e., decisions not to consume the product at all) rather than corner solutions (Cragg, 1971; Jones, 1989). Furthermore, the Tobit model restricts the decisions about whether to consume and how much to consume to be determined by the same variables and in the same way. Several studies on food demand have reported rejection of the Tobit model (Frazao, 1992; Haines, Guilkey and Popkin, 1988; Lin and Milton, 1993; Blisard and Blaylock, 1993). This paper uses Cragg's double-hurdle model, which nests the Tobit model, to assess the effects of health concerns about cholesterol and several demographic variables on egg consumption.

The following sections specify the double-hurdle model, describe the data source and variable definitions, present the estimation results and empirical findings, and summarize major conclusions.

#### The Double-Hurdle Model

Some commonly used models to deal with the problem of zero consumption or expenditures include the Tobit, infrequency of purchase, double-hurdle and Heckman models. One major difference among these models is in their assumptions about the sources of the zero observations. For example, the infrequency of purchase model assumes that the zero expenditures result from either standard corner solutions or infrequency of purchases (Blisard and Blaylock, 1993), whereas the Heckman model assumes that everyone who is a potential user of the product is observed with a positive consumption and therefore no individual is at a standard corner solution (Heckman, 1979; Maddala, 1993).

The double-hurdle model assumes that each consumer makes two choices with respect to a product, such as eggs, to maximize his or her utility: whether to consume (participation decision) and how much to consume (consumption decision). These two decisions can be determined by the same set or two different sets of independent variables (Cragg, 1971; Jones, 1989). The model assumes that both participation and consumption equations are linear in their parameters ( $\alpha$  and  $\beta$ ) with normally distributed error terms. Let matrix  $X$  be defined to include variables hypothesized to determine the participation decision and matrix  $Z$  be defined to contain variables which determine the consumption decision. Based on these assumptions, the specification of the double-hurdle model begins with three equations for observed consumption, participation and consumption (see Jones, 1989):

Observed consumption:

$$(1) \quad Y = D Y^{**};$$

Participation equation:

$$(2) \quad W = \alpha X + u, \quad D = 1 \text{ if } W > 0 \text{ and} \\ D = 0 \text{ otherwise; } u \sim N(0, 1);$$

Consumption equation:

$$(3) Y^{**} = \max (0, Y^*),$$

$$Y^* = \beta Z + v; \quad v \sim N(0, \sigma^2)$$

where  $Y$  is observed consumption and  $D(1,0)$  is an indicator of whether the consumer is a user or not.

These equations imply that to observe a positive consumption the consumer must pass two hurdles: be a potential user of the product ( $D = 1$ ) and actually use the product ( $Y^{**} > 0$ ). If the sample is divided into those with zero consumption (denoted by 0) and those with positive consumption (denoted by +), the likelihood function for the double-hurdle model is (see Cragg, 1971):

$$(4) \prod_0 [1 - \Phi(\alpha X) \Phi(\beta Z / \sigma)] \prod_+ (\sigma^{-1}) \Phi(\alpha X) g[(Y^* - \beta Z) / \sigma],$$

where  $\Phi(\cdot)$  and  $g(\cdot)$  denote normal distribution and density functions,  $\sigma$  is the standard error,  $X$ ,  $Z$ ,  $\alpha$  and  $\beta$  are as defined in the above equations.

Under this specification, zero consumption presents either a standard corner solution or a nonparticipation decision. If all the individuals are actual or potential users of the product [i.e.,  $\Phi(\alpha X) = 1$ ], equation (4) reduces to the likelihood function of the Tobit model:

$$(5) \prod_0 [1 - \Phi(\beta Z / \sigma)] \prod_+ (\sigma^{-1}) g[(Y^* - \beta Z) / \sigma].$$

Thus, we can use a likelihood ratio test to test the hypothesis that the Tobit model performs as well as the double-hurdle model. If the test fails to reject the null hypothesis, all the zero consumptions may come from corner solutions and therefore the Tobit model is sufficient to model the consumption behavior. Otherwise, a significant number of the observed zero consumptions do not result from corner solutions and therefore the double-hurdle model should be used to model the participation and consumption decisions.

Because the variables and their coefficients in the participation equation ( $X$  and  $\alpha$ ) are allowed to differ from those in the consumption

equation ( $Z$  and  $\beta$ ), we are able to assess and test the effect of each independent variable on the decisions of whether to consume and how much to consume. For example, we can test if health concerns about cholesterol have different impacts on the participation and consumption decisions. The results provide useful insights into the effects of cholesterol information on egg consumption and can be used to corroborate the findings from time-series studies.

#### Data and Variable Definitions

Data used in this study are compiled directly from the 1989 CSFII data. Since 1989 the CSFII has included both data on food intakes and demographics as well as a follow-up telephone Diet and Health Knowledge Survey (DHKS) to collect information on individuals' diet and health knowledge from a selected sample of the CSFII. The DHKS allows studying the relationship between individuals' actual dietary intakes and their attitudes and knowledge about diet and health. The 1989 CSFII included over 5000 individuals; 1906 of them, ones designated as the main meal planner or preparer, participated in the DHKS. Most of the DHKS participants were women and household meal planners. Each participant was asked many questions about her or his knowledge and perceptions regarding to healthful diet, relationships between nutrient intakes and health problems, nutrient content of selected food items, grocery shopping activities, food labels, food safety, food storage and cooking, etc.

The dependent variable of this analysis is the three-day average daily egg consumption which is directly available in the data file. The explanatory variables include age, sex, race, education, per capita income, household size, education, work status, region, urbanization, body mass index, health problems related to cholesterol, and three cholesterol variables to measure individual's health concerns about cholesterol. The first cholesterol variable represents an individual's opinion about his or her cholesterol level, the second one indicates whether a participant knows of links between cholesterol and health problems, and the third one measures an

individual's personal opinion about the importance of avoiding too much cholesterol.

The participants were also asked questions regarding their knowledge about the cholesterol content of selected food items. However, the questions are which of two food items has more cholesterol for 12 pairs of food items such as egg white and egg yolk. Because eggs are not compared to any other food item such as beef or pork, the responses to these 12 questions may not be useful in explaining individuals' egg consumption behavior. In addition to cholesterol, the survey includes similar questions about fat, saturated fat, sugar, and several other nutrients. Although individuals' health concerns about fat are likely to affect their egg consumption, these variables are not included in our analysis because the responses to the fat and cholesterol questions are highly correlated. In this study only 1492 adult individuals (age  $\geq 18$ ) with complete records in the DHKS and CSFII are included. The definitions of dependent and independent variables are reported in Table 1. And the summary statistics for the full sample and individuals with positive egg consumption in the survey are shown in Table 2.

The determinants of participation and consumption decisions (X and Z) are assumed to be the same in this analysis because it is generally difficult to rationalize why one variable should affect participation but not consumption or vice-versa (Lin and Milton, 1993; Blisard and Blaylock, 1993).

#### Empirical Findings

The double-hurdle and Tobit models, represented in equation (4) and (5), are estimated using the maximum likelihood procedure in TSP. In Table 3 the second and third columns present the double-hurdle estimates and the fourth column presents the Tobit estimates. Based on a likelihood ratio test, the hypothesis that the Tobit model performs as well as the double-hurdle model in modeling egg consumption is strongly rejected at the 0.01 significance level. This result is consistent with several previous studies of consumer demand for food products such as

shellfish, beef, pork, poultry, milk and butter (Lin and Milton, 1993; Frazao, 1992; Haines, Guilkey and Popkin, 1988; Blisard and Blaylock, 1993).

The double-hurdle estimates indicate that the independent variables have significantly different impacts on the participation and consumption decisions in sign and / or magnitude. Although only two consumption coefficients in the double-hurdle model have different signs compared to those in the Tobit model, the two models have significantly different estimates and interpretations (Table 3). The coefficients of region variables suggest that, compared to residents in other regions, residents in the midwest are less likely to consume eggs and the average consumption level in the northeast is significantly lower. Urbanization, full time employment, per capita income and age have positive impacts on participation but negative effects on consumption. The effects of urbanization and per capita income are not statistically significant. Household size shows a significant negative effect on participation and an insignificant positive impact on consumption. According to the coefficients of sex, male individuals are less likely to consume eggs but tend to consume much more when they consume eggs. The positive coefficients of race and body mass index (bmi) suggest that blacks and individuals who are relatively over weight are more likely to consume eggs and tend to consume more when they consume. On the other hand, individuals with higher education or health problems related to cholesterol may be observed with both low participation rate and low level of egg consumption.

Among the six coefficients of cholesterol variables, five of them are significantly different from zero at the 0.10 significance level. The first pair of coefficients indicate that individuals who think their cholesterol level should be lower consume much less eggs although their participation rate is relatively higher. One possible explanation is that individuals willing to reduce their cholesterol level are likely to reduce their egg intakes rather than completely remove eggs from their

Table 1  
Variable Definitions

Variable	Definition
Northeast	Equals 1 if individual resides in the northeast, zero otherwise.
South	Equals 1 if individual resides in the south, zero otherwise.
West	Equals 1 if individual resides in the west, zero otherwise.
City	Equals 1 if individual resides in a central city, zero otherwise.
Work	Equals 1 if individual is employed full time, zero otherwise.
Education	Years of formal education completed (equals 17 if it is more than 17).
Pincome	Per capita annual income in 1,000 dollars.
Hsize	Number of persons in household.
Age	Age in years.
Sex	Equals 1 if individual is a male, zero otherwise.
Race	Equals 1 if individual is black, zero otherwise.
Bmi	Body mass index (ratio of weight in kilograms to the square of height in meters).
Hproblem	Equals 1 if individual has been told he or she has heart disease, high blood pressure or high cholesterol by a doctor, zero otherwise.
Cholest1	Equals 1 if individual thinks his or her cholesterol should be lower, zero otherwise.
Cholest2	Equals 1 if individual has heard any health problems that might be related to how much cholesterol a person eats, zero otherwise.
Cholest3	Importance of avoiding too much cholesterol (equals 1 for not important at all, equals 6 for very important).
Eggs	Egg consumption (grams per day).

diet. The coefficient of the second cholesterol variable suggest that individuals who have heard about the links between cholesterol intake and some health problems are less likely to consume eggs and tend to consume less when they consume eggs. The third cholesterol variable, measuring individuals' opinion on the importance of avoiding too much cholesterol, shows a negative impact on participation but a positive impact on consumption. There are two possible explanations for the positive effect

on consumption. First, because "too much cholesterol" is an ambiguous concept, individuals who think avoiding too much cholesterol is very important may consume more eggs because their standards for "too much cholesterol" are higher than other individuals. Second, if we assume that individuals have a common standard for "too much cholesterol", the individuals with more egg consumption may think avoiding too much cholesterol is more important because their cholesterol level is closer to the

Table 2  
Sample Statistics

	Full Sample		Users	
	Mean	Standard Deviation	Mean	Standard Deviation
Northeast	0.181	0.386	0.154	0.362
South	0.404	0.491	0.429	0.495
West	0.185	0.388	0.206	0.405
City	0.296	0.456	0.306	0.461
Work	0.294	0.456	0.295	0.456
Education	11.701	3.140	11.423	3.209
Pincome	9.931	10.100	9.348	9.643
Hsize	2.612	1.576	2.660	1.556
Age	48.636	18.464	48.114	17.939
Sex	0.204	0.403	0.218	0.424
Race	0.137	0.344	0.172	0.377
Bmi	25.837	5.524	26.258	5.673
Hproblem	0.318	0.466	0.296	0.457
Cholest1	0.404	0.491	0.395	0.489
Cholest2	0.823	0.382	0.791	0.407
Cholest3	4.954	1.430	4.895	1.434
Eggs	16.830	27.606	39.174	29.980
U.S. Observations		1492		641

"too much" level. Fortunately, the questionnaire design of the DHKS was changed to include a question on "how important it is to you to choose a diet low in cholesterol" in the 1991 DHKS. The response to this question seems to be a good indicator of individuals' concerns about cholesterol. One way to test these explanations is to estimate the same model using the 1991 CSFII data.

#### Concluding Remarks

Consumer concerns about food-borne health risks have rapidly emerged as a major issue in food demand analysis. This study estimated the effects of health concerns about cholesterol and demographic variables on egg consumption decisions by using the Tobit and double-hurdle models. The results show that the Tobit model is strongly rejected in examining egg consumption decisions. This finding is consistent with the results of several previous studies on household or individual food demand. Our double-hurdle estimates indicate that health concerns about cholesterol and demographic variables have significantly differ-

ent impacts on the decisions about whether to consume eggs and how much to consume. Ignoring the two-step decision process may lead to erroneous conclusions.

Health concerns about cholesterol are identified as important determinants of consumers' participation and consumption decisions. Individuals who think their cholesterol level should be lower and individuals with the information of links between cholesterol and health problems are likely to have relatively low participation rate and / or low volume of egg consumption.

The results of this study are in fairly close agreement with the findings about cholesterol and egg consumption based on time-series data. The increasing consumer concerns about the health effects of egg cholesterol are likely the major reason for the continuing decline in U.S. per capita egg consumption. Efforts to reduce cholesterol content of eggs are strongly recommended to prevent further shrinkage of the egg industry. Furthermore, because egg cholesterol is mainly contained in the yolk, new egg products with less

Table 3  
Double-Hurdle and Tobit Models of Egg Consumption

Variable	Double-Hurdle		
	Participation	Consumption	Tobit
Intercept	1.756*	30.396*	14.882
Northeast	0.385*	-13.803*	-7.469*
South	0.365*	-1.737	3.766
West	0.330*	5.965	10.754*
City	0.057	-2.861	-2.213
Work	0.364*	-7.424*	-0.049
Education	-0.091*	-0.668	-1.619*
Pincome	0.004	-0.166	-0.084
Hsize	-0.083*	1.612	0.249
Age	0.031*	-0.690*	-0.248*
Sex	-0.573*	23.463*	13.044*
Race	0.444*	4.037	10.052*
Bmi	0.002	0.556*	0.626*
Hproblem	-0.218	-5.303	-8.441*
Cholest1	0.267*	-9.289*	-4.596*
Cholest2	-0.283	-6.242*	-8.987*
Cholest3	-0.228*	2.333*	-0.449
$\sigma$	43.657*		50.679*
-Log L		3922.060	3945.070

\* Significant at the 0.10 level.

or no yolk may have a potential market.

This study also shows that well designed questionnaires are very important in collecting data on individuals' diet and health knowledge. Any ambiguity of concepts such as "too much cholesterol" should be avoided. An extension of this study would estimate the same model of egg consumption using the survey data in later years.

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**An Analysis of the Specialty Product Market for Maple Syrup:  
The "Sweeter" Choice for Consumers?**

To begin to analyze consumer demand for specialty foods, we examine the case of pure versus imitation maple syrup. Using a pooled cross-section time series of data collected in the northeastern U.S. and Generalized Least Squares we estimate price, income, promotion, and other selected consumer characteristic elasticities. Results show that consumers base decisions more on price than on promotional efforts of retailers, income and unemployment rates shift the demand for both pure and imitation maple syrup, and promotional efforts of either syrup type increase sales of both syrup types.

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### Introduction and Background

Specialty foods have been making inroads onto the tables of consumers during the past several years. However, even when the definition of specialty foods includes all specialty crops, information available about these markets is virtually nonexistent. Reasons for the dearth of information include the fact that production is often highly specialized, taking place on small acreages, and that marketing is highly diversified (Powell et al. 1968). Yet, recent studies suggest that agricultural specialty foods will fill a market niche and should be profitable (Kline 1986; Skenazy 1988; Homestead Design 1989). Vermont alone reports between \$400 and \$500 million dollars in sales from specialty foods, up from a fledgling industry ten years ago (Barna 1993). Despite their growth in the marketplace, we know very little about the demand characteristics for these products, in particular, how consumers react to price changes and marketing strategies.

To begin to analyze consumer responses to factors related to the sale of specialty foods, we examine the case of pure versus imitation maple syrup. This study uses a pooled cross-section time series of data collected in the northeastern United States and Generalized Least Squares to estimate price, income, promotion, and other consumer

characteristic elasticities.

There are several reasons why maple syrup was chosen as the specialty food for this study. First, while pure maple syrup was originally a staple product dating back to the days of the pioneers, it became one of America's first specialty products with the advent of maple imitations, developed in the early 20th century. Second, maple syrup has a place in a firmly established market, with U.S. production of pure maple syrup having an average value of over 33 million dollars in the last three years alone (Sendak 1992). Knowledge gained about this established specialty food may be transferred to other products in the introductory stages of their product lifecycles. Third, there is a clear substitute for pure maple syrup in the marketplace, allowing the comparison of consumer reactions to factors affecting demand between a specialty product and its mass market counterpart.

### Literature Review

The limited work in the area of agricultural specialty crops has some bearing in the specialty food area. Specialty food crops can demand a premium in the marketplace based on their differentiation from mass market counterparts. Centner et al. (1989) examined the premium charged for Vidalia onions. Of particular interest was how labeling laws that prohibit mislabeling of non-Vidalia

onions affected the premium. Using OLS Regression and time series (1982-88) data, they found that the premium decreased every year after the labeling law went into effect (1985), thus showing that producers of a specialty crop with a recognizable and strong name are subject to fraudulent infringement in the absence of legal protection. Pure maple syrup is a specialty food product that benefits from this protection. Only 100% pure maple syrup may be labeled as such.

With respect to the maple syrup industry, there have been no studies of consumer responsiveness to syrup prices and promotional activities. Maple syrup research has focused primarily on the production and processing of maple syrup (Taylor and Pasto 1970; Sendak and Jenkins 1982; Sendak and Bennink 1985; Allbee 1991; Hinrichs 1992). The small body of literature which does focus on the demand side of the marketplace is descriptive in nature, quite dated, and essentially void of any economic analysis (Sendak 1974; Agriculture Quebec 1975; Sendak 1978; Sendak 1982; Sendak and Jenkins 1982; Sawyer, Worthington and Sendak 1979). Much of this literature involves surveying consumers to discern their preferences for pure versus non-pure syrup as well as various grades of pure maple syrup and to define their purchasing patterns.

Sendak (1974) surveyed maple syrup consumers by telephone in 15 cities in the United States and Canada. Because most of the U.S. maple syrup is produced in the Northeast, this area was more heavily sampled. Findings indicated that over 50% of the consumers surveyed ranked unique flavor, being a natural food item, being available year round, and convenience of purchase very important characteristics of maple syrup. Over 81% of consumers indicated that pure maple syrup tasted better than any other syrup or topping. However, only 25% of those living in maple producing regions and 20% of those living in other regions used pure maple syrup exclusively. Imitation maple syrups were used by about 60% of respondents. Using many of the same criteria as Sendak (1974), Consumer Reports (1991) found pure maple syrup to be of

consistently higher quality than imitation maple syrup in every respect.

Sendak (1978) studied consumers in non-maple producing regions with respect to preferences for graded syrup. Results indicated that an individual's perception is not sharp enough to detect the difference between pure and non-pure maple products, nor could they detect quality differences. However, the consumers in maple producing regions were able, with ease, to tell the difference between the pure and non-pure product. A more recent study (Sendak 1982), found consumer in non-maple producing regions perceived a brand of nonpure syrup to be pure in 56% of the cases.

Taylor and Pasto (1970) found that in 1964, 50% of maple syrup produced was sold by 77% of sugarbush operators from their own home, while only 5% of production was sold in consumer packages to other retail stores by 11% of producers. Thus, in 1964, producer sales of packaged syrup to retailers was found to be the least important in terms of volume (Taylor and Pasto 1970). By 1972, however, these statistics had changed. Sendak (1974) found the most promising outlet for maple syrup sales was the supermarket, although roadside stands and mail-order catalogs should not be overlooked. About one quarter of maple syrup consumers in maple producing regions purchased maple syrup at a supermarket, while 60% purchased syrup from roadside stands. In contrast, consumers in non-maple producing regions purchased syrup in supermarkets 68% of the time, while purchases at road side stands stood at about 9%.

With respect to promotion decisions, Taylor and Pasto (1970) found that 26% of maple procurer said they advertised, varying from 18% in the smallest-sized group with production of less than 200 gallons, to 54% in the largest-sized group, with production of 800 or more gallons. Roadside advertising was the most used medium because most sales occurred at the site of production. Since this early study, Sendak (1982) found that providing product information increased the purchase rate of pure maple syrup by

over 90%. With the exception of these two studies, there have been no formal analyses of the effects of promotion on maple syrup sales, although Vermont's Maple Promotion Board has developed advertising programs intending to enhance the image of maple syrup.

In summary, there has been limited research focusing on demand analysis of specialty products, despite significant growth in consumption of these products in recent years. For maple syrup in particular, no quantitative studies have been conducted which examine the effects of own- and cross- price, promotion, and consumer income on consumer demand for pure maple syrup.

### Model Specification and Estimation

#### Theoretical Framework

The model is based on classical microeconomic theory, where the quantity of brand  $i$  maple syrup demanded in time period  $t$  ( $Q_{dit}$ ) is a function of the price of maple syrup ( $P_{it}$ ), the price of related goods ( $Pr_{it}$ ), per capita income ( $I_{it}$ ), a dummy variable for syrup brand ( $D_{it}$ ), and other exogenous variables affecting demand ( $V_{it}$ ). That is:

$$Q_{dit} = f(P_{it}, Pr_{it}, I_{it}, D_{it}, V_{it}) \quad (1)$$

We can state the above function in matrix notation as:

$$Q_{dit} = BX_{it} + e_{it} \quad (2)$$

where  $X_{it}$  is a vector of the variables influencing the demand for maple syrup as indicated above,  $B$  is a vector of coefficients conformable to the dimension of  $X_{it}$ , and  $e_{it}$  is a random error term which is assumed to be time-wise autoregressive.

Elasticities generated from the results can be used to examine the effects of specific changes in variables such as prices, income, and promotion efforts, on maple syrup demand. Additionally, syrup brands for which these effects are greatest can be identified.

#### Data

Infoscan<sup>R</sup> grocery data was purchased for use in estimation from

Information Resources in Waltham, MA. The data is a quadweekly time-series over a four year period (1988-91) for four SMSAs in the northeastern U.S., the largest maple producing region in the U.S. It includes prices, quantities, and promotional activities for both pure and imitation maple syrup at the brand level. Our analysis focuses on the top five selling brands of both pure and imitation syrup. Thus, in each of four SMSAs, we have observations for five brands (for both pure and imitation syrup) over 52 quadweekly time periods. The Infoscan<sup>R</sup> data are supplemented with data about per capita income, unemployment rates, and prices of complements (flour), within each SMSA, for each year.

The definitions of variables used in estimation and descriptive statistics for all of data are provided in table 1. All prices and income figures are in 1991 dollars. Over time, the quantity of pure maple syrup demanded has risen, despite a ten year U.S. trend of a decrease in consumption of sugars and sweets (Lutz et al. 1993). At the same time, its price has fallen in real terms. For imitation maple syrup, quantity demanded has risen, as has the price. Over the four year time period, the percent of stores having merchandised pure and imitation maple syrup has been sporadic, ranging from zero to over 80% in a given quadweek. Per capita income has declined over the period, while the deflated price of maple syrup complements has risen.

#### Empirical Estimation

Given that the price and quantity data span only a four year period and that the income observations vary within a narrow range, a constant elasticity form is appropriate. A double-log specification was chosen and the estimated coefficients are interpretable directly as elasticities. The double-log form was also chosen to control for dimensional misspecification. In a linear form, a unit of change in an independent variable produces the same change in the dependent variable regardless of the value of the dependent variable. In the case of food demand, this clearly is not expected.

Table 1  
Descriptive Statistics

VARIABLE	LABEL	SMSAA	PURE MAPLE		SMSAD	SMSAA	IMITATION MAPLE		SMSAD
			SMSAB	SMSAC			SMSAB	SMSAC	
QUANT	oz <sup>a</sup>	347.59	171.36	774.4	473.42	4508.50	28,809.99	14,933.25	3521.34
QBRAND1	Brand1	167.55	723.94	226.65	219.82	1813.29	9227.64	4937.42	4402.30
QBRAND2	Brand2	88.00	609.04	220.35	112.39	783.94	7298.43	3339.24	613.36
QBRAND3	Brand3	52.08	244.74	193.18	61.66	736.93	2824.00	3027.65	581.99
QBRAND4	Brand4	21.56	115.72	115.52	59.00	633.47	2407.30	1830.28	363.93
QBRAND5	Brand5	18.40	21.92	18.70	20.52	540.87	2052.62	1798.66	331.23
PRICE	Price/oz.	.27	.26	.28	.27	.08	.07	.08	.08
PRICE1	Brand 1	.28	.26	.28	.26	.05	.05	.05	.05
PRICE2	Brand 2	.29	.28	.31	.26	.09	.08	.09	.08
PRICE3	Brand 3	.30	.25	.27	.30	.09	.08	.08	.08
PRICE4	Brand 4	.24	.25	.28	.26	.09	.08	.08	.08
PRICE5	Brand 5	.25	.23	.25	.28	.10	.08	.09	.09
MERCH	% stores	13.40	9.70	9.80	13.80	37.99	33.05	32.15	28.01
MERCHB1	Brand 1	23.5	19.42	14.8	25.7	47.93	37.90	29.76	38.39
MERCHB2	Brand 2	18.62	13.09	6.54	12.86	41.39	40.69	48.30	32.44
MERCHB3	Brand 3	10.89	11.55	14.64	5.77	44.49	36.33	33.40	
MERCHB4	Brand 4	7.57	1.72	11.25	14.31	22.85	23.18	29.0	27.67
MERCHB5	Brand 5	2.09	0.40	1.89	10.51	33.31	27.15	20.31	10.84
PRICES	Ave Price	.08	.07	.08	.08	.28	.24	.28	.27
PRICEC	Price flour	.19	.19	.19	.19	.19	.19	.19	.19
INCOME	Per Capita	16,236	16,776	18,944	12,685	16,236	16,776	18,944	12,686
UNEMP	Unemp Rate	4.27	4.76	4.01	3.31	4.27	4.76	4.01	3.31

<sup>a</sup> in thousands N=260

One maple and one non-maple equation of the following form were estimated for each of four SMSAs in the Northeast (eight equations in total):

$$\text{QUANTM} = \alpha_0 + \alpha_1 \text{TIME} + \alpha_2 \text{PRICEM} + \alpha_3 \text{PB1M} + \alpha_4 \text{PB2M} + \alpha_5 \text{PB3M} + \alpha_6 \text{B4M} + \alpha_7 \text{APRICENM} + \alpha_8 \text{MERCHM} + \alpha_9 \text{AMERCHNM} + \alpha_{10} \text{PRICECOM} + \alpha_{11} \text{INC} + \alpha_{12} \text{UNEMP} + \text{ERROR} \quad (3)$$

$$\text{QUANTNM} = \beta_0 + \beta_1 \text{TIME} + \beta_2 \text{PRICENM} + \beta_3 \text{PB1NM} + \beta_4 \text{PB2NM} + \beta_5 \text{PB3NM} + \beta_6 \text{B4N} + \beta_7 \text{APRICEM} + \beta_8 \text{AMERCHM} + \beta_9 \text{MERCHNM} + \beta_{10} \text{PRICECOM} + \beta_{11} \text{INC} + \beta_{12} \text{UNEMP} + \text{ERROR} \quad (4)$$

where: =

QUANTM=Oz of brand i pure maple purchased in time period t  
 QUANTNM=Oz of brand k nonmaple purchased in time period t  
 PRICEM=Price/oz of brand i pure maple sold in time period t  
 PRICENM=Price/oz of brand k nonmaple purchased in time period t  
 APRICEM=Average price/oz of top five selling pure maple brands in time period t

APRICENM=Average price per ounce of top five selling imitation maple brands in time period t

PB1M=Brand 1 dummy\*price of brand 1

PB2M=Brand 2 dummy\*price of brand 2

PB3M=Brand 3 dummy\*price of brand 3

PB4M=Brand 4 dummy\*price of brand 4

MECHM=Percent of stores having brand i pure maple displayed or featured in time period t

MERCHNM=Percent of stores having brand k imitation maple displayed or featured in time period t

AMERCHM=Average percent of stores having the top five selling pure maple brands displayed or featured in time period t

AMERCHNM=Average percent of stores having the top five imitation maple brands displayed or featured in time period t

PRICECOM =Price of complements (flour) in time period t

INC=Per capita income in period t

UNEMP=Percentage of the labor force unemployed in time period t  
 i = 1,...,5 pure syrup brands  
 k = 1,...,5 imitation maple syrup brands  
 t = 1,...,52 quadweeks between 1988 and 1991

Since the disturbance term in a demand equation for syrup in one SMSA is likely to be correlated with the disturbance terms in demand equations for syrup in other SMSAs, and since the disturbances within each equation are not considered to be independent over time, these eight equations were estimated as a system of seemingly unrelated regression equations with autoregressive disturbances, where each equation is a pooling of five cross-sections (brands) and 52 time periods (quadweeks). The system can be written as:

$$Q_m = X_m \beta_m + \epsilon_m \quad (m = 1, 2, \dots, 8) \quad (5)$$

where each equation has 260 observations, and  $\epsilon_m$  is a vector of disturbances.

The assumptions are that the regression disturbances in *different* equations are mutually correlated, and the disturbances *within* the same equation are correlated and follow a first-order autoregressive scheme. Thus, a Generalized Least Squares estimation of the system of equations can improve efficiency of the estimates over use of OLS.

Prior to using a two-stage Aitken estimation procedure, we transformed the original observations using an estimate of  $\rho$  ( $\hat{\rho}$ ) computed from least-squares residuals. The system of equations actually estimated is:

$$(Y_{mt} - \rho_m Y_{m,t-1}) = \beta_{m1} (X_{it,1} - \rho_m X_{1,t-1,1}) + \beta_{m2} (X_{1t,2} - \rho_m X_{1,t-1,2}) + \dots + \beta_{mk} (X_{mt,k} - \rho_m X_{m,t-1,k}) + U_{mt} \quad (m=1, 2, \dots, M) \quad (6)$$

### Results

In general, signs of the estimates conform to expectations, and most parameters are significant at the .01 level. Table 2 presents results.

Own price effects are negative

and significant in all cases. In SMSAs A and B, pure maple syrup is less elastic than imitation maple syrup, while in SMSAs C and D, pure maple syrup is more elastic. In SMSAs A and B, pure maple syrup is relatively inelastic, while in SMSAs C and D it is quite elastic. It is important to note that the parameter PRICEM or PRICENM in the pure maple or imitation syrup equations respectively, represent the elasticity for the least popular (lowest selling in terms of sales volume) of the five brands analyzed in each SMSA. Table 3 presents elasticity estimates. These results indicate that for the most part, the demand for the top selling brand in each SMSA is more elastic, regardless of whether the syrup is pure or imitation. Thus, consumers of the best selling (top) brand in each SMSA are quite responsive to changes in the price of that brand. It is also true that for five of the eight SMSAs, the largest selling brand is not as elastic as the second largest selling brand, but the elasticities do tend to decrease from brand two to brand five even in these cases.

Results regarding the effects of the price of substitutes are inconsistent, but the signs are positive where significant. Indications are that imitation syrup consumers are far more responsive to changes in the price of the pure substitute than pure maple syrup consumers are to changes in the price of the imitation substitute. Thus, pure maple syrup consumers appear to perceive fewer maple syrup substitutes than imitation maple syrup consumers do.

Increases in the percent of stores merchandising syrup increases consumption for both syrup types. Elasticities for both are inelastic, but larger for imitation maple syrup. Cross merchandising appears to help the syrup category as a whole. Increases in pure maple syrup merchandising increases the demand for imitation maple syrup and visa versa.

The effects on demand with respect to changes in the price of complements were weak and unexpected. Only in SMSA A, for pure maple syrup, did we obtain a significant and negative effect. We attribute these

Table 2  
Parameter Estimates

VARIABLE	LABEL	PURE MAPLE				IMITATION MAPLE			
		SMSAA	SMSAB	SMSAC	SMSAD	SMSAA	SMSAB	SMSAC	SMSAD
INTERCEPT		1.38*** (-3.41) <sup>a</sup>	-1.95*** (-6.18)	-.79*** (-3.43)	-.53* (-1.84)	.23 (1.21)	-.13 (-.64)	.32 (1.34)	-.42*** (-3.18)
TIME	Time period	-.47* (1.81)	.99*** (3.69)	-.16 (-1.30)	-.16 (-1.24)	.13*** (3.11)	.09 (1.55)	.02 (.45)	.30*** (3.43)
PRICE	Price of 16oz	-.64*** (-3.51)	-.11 (-1.01)	-3.87*** (-8.75)	-2.19*** (-5.17)	-1.91*** (-8.19)	-1.73*** (-7.83)	-1.32*** (-6.73)	-1.43*** (-13.92)
PB1	Price*Brand 1	-.37*** (-5.74)	-.70*** (-14.17)	-.40*** (-11.82)	-.42*** (-10.12)	.02 (.55)	-.07*** (-3.41)	-.004 (-.159)	-.05*** (-4.67)
PB2	Price*Brand 2	-.25*** (-3.75)	-.64*** (-13.06)	-.48*** (-12.20)	-.25*** (-6.00)	-.03*** (-2.13)	-.20*** (-15.13)	-.08*** (-5.55)	-.05*** (-4.86)
PB3	Price*Brand 3	-.13** (-2.11)	-.49*** (-10.40)	-.32*** (-10.08)	-.14*** (-3.61)	-.007 (-.51)	-.05*** (-3.79)	-.05*** (-3.65)	-.03*** (-2.87)
PB4	Price*Brand 4	.03 (.67)	-.37*** (-8.42)	-.27*** (-8.89)	-.04 (-.98)	.01 (.85)	-.05*** (-3.72)	.03*** (2.48)	.2* (1.76)
PRICES	Price substitute	.75 (1.01)	-1.01*** (-2.33)	2.02*** (4.66)	.41 (.81)	.29 (1.22)	-.23 (-1.48)	-.46 (-1.04)	.74*** (2.59)
MERCH	% of stores merchandising	.03*** (2.52)	.06** (1.83)	.04*** (3.15)	.009 (.74)	.03*** (3.04)	.07*** (5.39)	.07*** (5.65)	.01*** (2.66)
MERCC	% of stores cross-merch.	.002 (-.12)	-.04 (.71)	.006 (.45)	-.02** (-2.48)	.008 (.914)	.009 (.76)	.00 (.02)	.01* (1.86)
PRICEC	Price of Complements	-2.14*** (-2.51)	.41 (.70)	.29 (.76)	.65 (1.23)	.05 (.16)	.332 (1.28)	.84** (2.26)	.77*** (3.31)
INC	Per Capita Income	.48*** (.08)	.63*** (9.81)	.80*** (16.93)	.55*** (11.45)	.15*** (2.34)	.33*** (5.06)	.43*** (7.17)	.55*** (20.30)
UNEMP	Unemployment Rate	-.18*** (-.62)	-.37* (-1.58)	-.38** (-2.19)	-.30** (-2.27)	-.08 (-.94)	.01 (.16)	.007 (.06)	.008 (.125)

D.W. 1.785 1.871 2.084 1.962 1.785 1.871 2.084 1.962

System R<sup>2</sup> = .83 \* Significant at <.10 level, \*\* Significant at <.05 level, \*\*\* Significant at <.01 level, \*T-statistics in parentheses, N=260

Table 3  
Pure and Imitation Maple Syrup Price Elasticities

	SMSAA		SMSAB		SMSAC		SMSAD	
	Pure	Imitation	Pure	Imitation	Pure	Imitation	Pure	Imitation
BRAND1	-1.01	-1.89	-.81	-1.79	-4.27	-1.32	-1.78	-1.48
BRAND2	-.88	-1.93	-.75	-1.92	-4.35	-1.40	-2.61	-1.48
BRAND3	.77	-1.90	-.60	-1.77	-4.19	-1.37	-2.44	-1.46
BRAND4	-.68	-1.89	-.48	-1.76	-4.13	-1.35	-2.32	-1.42
BRAND5	-.64	-1.90	-.11	-1.72	-3.87	-1.32	-2.19	-1.43

poor results to our use of the price of flour as a proxy for the price of complements. This measure included prices of substitutes as well as complements. For example, in addition to the price of flour and pancake mixes (complements), it also included the price of cereal mixes (substitutes).

Both pure and imitation maple syrup are normal goods. Estimated elasticities are less than one, but the values for pure maple syrup are larger than for imitation. Given that price of pure maple syrup per ounce is over three times that of

imitation maple syrup, this result is not surprising to find for a specialty product compared to its mass marketed counterpart. As the unemployment rate rises, consumption of both syrup types falls. For pure maple syrup this effect is larger. This result is in line with the finding that the income elasticities are greater for pure than for imitation syrup.

#### Implications

The results obtained from this study have several implications.

Foremost is the finding that loyalty to the top selling brands in each of the four SMSAs was not found. In fact, the largest selling brands are associated with the largest price elasticities. When this result is combined with the finding that promotion does not do a great deal to increase demand, we conclude that consumers' purchase decisions are influenced significantly more by price than by promotional activities.

Promoting either syrup category was found to increase syrup sales overall. Thus, promoting a specialty product or its mass market counterpart will stimulate consumption in either market. However, even though the estimated promotion elasticities were positive, promotion's (feature and/or display) effects on syrup consumption appear to be quite small. Results indicate that consumers may respond more strongly to other types of promotional activities. First, given the finding that pure maple syrup is a substitute for imitation maple syrup, and the opposite is not true, then pure maple promotions may be most effective if they focus on differentiating pure maple from its imitation counterpart. Second, given that consumers are price sensitive with respect to maple syrup, lowering the price of pure maple syrup even slightly through use of coupons should bring about an a larger change in quantity demanded than feature/display advertising.

Results relating to income and unemployment were expected, but given recent decreases in per capita incomes and increases in the unemployment rate, consumption of pure syrup may actually fall in the future, *ceteris paribus*.

In summary, consumers are price sensitive and appear to base decisions on price instead of promotion. In fact, consumers are quite unresponsive to promotional efforts related to displays and features. Income increases and unemployment rate decreases cause a shift in demand that increases the consumption of pure maple syrup more than it causes an increase in consumption of imitation maple syrup. Thus consumers appear to be acting in a rational manner with regard to specialty products that are priced

higher in the marketplace. When the means are available, they will choose the specialty product. When the means are not, they tend to choose the mass market counterpart.

### Limitations

Despite the robustness of the study's results, several limitations should be noted. Data availability is one. First, our measure of the price of complements is poor. As mentioned earlier, the price of flour included prices of complements as well as prices of substitutes. A second limitation is that we used information spanning only a four year time period. To gain an understanding of a market and evaluate changes in elasticities over time, clearly a longer time series is preferable. Unfortunately, this information is not readily available. Related to data limitations is the fact that although a substantial portion (50% in maple producing regions) of maple syrup purchases are made at supermarkets/grocery stores, in the Northeast there are other important market outlets. Purchases at farmstands, specialty product outlets, or at the site of production are not uncommon. It would be interesting to compare demand elasticities for the various marketing outlets. This research is currently in progress.

Another concern is the fact that our data assumes a constant quality within the pure maple syrup category. While we can differentiate quality across categories of syrup (pure versus imitation) we have not accounted for quality differences among the top five brands of *within* each category. This is not as large a problem for pure maple syrup, which is almost always available in the supermarket as Grade A medium or dark amber, as it is for imitation maple syrup, for which Consumer Reports (1991) found a wide variation in quality across brands.

Finally, our analysis is limited to the Northeast, a maple producing region. In one sense, this choice of sample has enhanced the results, as Sendak (1974) found that these consumers are better able to differentiate between quality levels of pure versus imitation maple syrup.

On the other hand, these results can only be generalized to the maple producing region and do not provide insight into the consumer behavior of a wide majority of Americans. Future research plans, however, include the analysis of syrup demand in Canada, the worlds largest producer of pure maple syrup, and nonmaple producing regions of the United States.

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#### Endnotes

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### Food Safety Concerns And Food Intakes

Data from 2,715 individuals who were main meal planners and/or preparers in U.S. households participating in USDA's Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey 1990 and 1991 were utilized to estimate profiles of individuals who are concerned about food safety and to examine the effects of those concerns on their food intakes. The theoretical framework was the Health Belief Model. Two different but statistically equivalent models were used for this purpose. These were a Heckman two-stage model, and a two stage least squares instrumental variables model. They consisted of a common probit regression model in the first stage where profiles were estimated and of separate selectivity-bias corrected linear regressions for 65 food groupings in the second stage relating the amount of each food eaten in three days to food safety concern and other characteristics. It was found that higher education, white race, not living alone, and living in the midwest were associated with a higher likelihood of food safety concerns. Food safety concern was associated with decreased consumption of vegetables and fruits, and cakes, cookies, pastries, and pies. It was also associated with increased consumption of sugars, grain mixtures, and total beverages, including alcoholic beverages, beer, and regular carbonated soft drinks.

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#### Introduction

Food safety has become an important health concern in the United States. It has increased in the last few years, perhaps because of well-publicized incidents of both pesticide and microbial contamination of foods (Schafer et al, Dunlap and Beus). Press coverage of related scientific studies such as the recent National Academy of Science report on the risks facing children, especially because of pesticide exposure, has also contributed to public awareness and understanding of the food safety issue (National Research Council). This concern has in turn prompted an increasing interest by policy makers and professionals in issues related to food safety. In particular, a recent conference on valuing food safety resulted in a publication of a considerable number of economic studies on the topic (Caswell).

Most economic studies focus on estimating the value of food safety to consumers, and society at large, and their willingness to pay. The resulting estimated benefits can be compared to the expected costs of

providing the required level of food safety. By their nature these studies tend to utilize specialized data sets or experimental data (e.g., NE-165).

Few studies, however, address issues such as food safety concern and its effect on dietary intake. The importance of diet in maintaining good health and preventing costly diet-related diseases has been long recognized. It has received considerable attention in recent times, as the population is aging and health care commands, and will probably continue to command, a growing share of the Gross National Product. Concern about food safety may have diet-related health implications. For example, people who avoid eating some foods because of a false perception that they are not safe could be making a costly mistake, in both personal and social terms. If, on the other hand, people are consuming food that rightly poses a health risk because of inadequate risk assessment, there again is a costly mistake.

Economic studies dealing with food safety rely on several research

methodologies to generate useful results. Among them are contingent valuation, experimental economics, conjoint analysis, hedonics, and cost-of-illness. The economics of food safety and nutrition is a relatively new field. Two factors seem to hamper rapid growth in this area. One is the relative lack of data that permit linking both food safety concerns and actual food intake. Another is a relative lack of a well developed theoretical framework in economics that is well suited to explaining the food-safety-diet set of behaviors.

Data sets that contain information on both food safety concerns and dietary intake are uncommon. The only such data sets at the national level that we are aware of are those provided by the USDA's Continuing Survey of Food Intakes by Individuals (CSFII). The CSFII measures food and nutrient intakes, and its concomitant Diet and Health Knowledge Survey (DHKS) measures knowledge, attitudes, and practices related to diet and health, including food safety concerns.

When addressing food safety questions, non-economists often utilize models such as the health belief model. In particular, the health belief model attempts to explain why, in the absence of any overt symptoms of disease, people engage in behavior to protect their health.

In this study, we use the theoretical framework of the health belief model and data from the CSFII/DHKS 1990 and 1991 to statistically #1) identify main meal planners/preparers who report being concerned about food safety and #2) assess the effects of food safety concerns on their food intakes.

## Methods

### Data

Data used in this study were collected in USDA's CSFII/DHKS 1990 and 1991. The CSFII/DHKS was first conducted in 1989 and continued in 1990 and 1991. The survey design was such that each year's data would be nationally representative and could be used independently. The three years combined would provide a larger sample size.

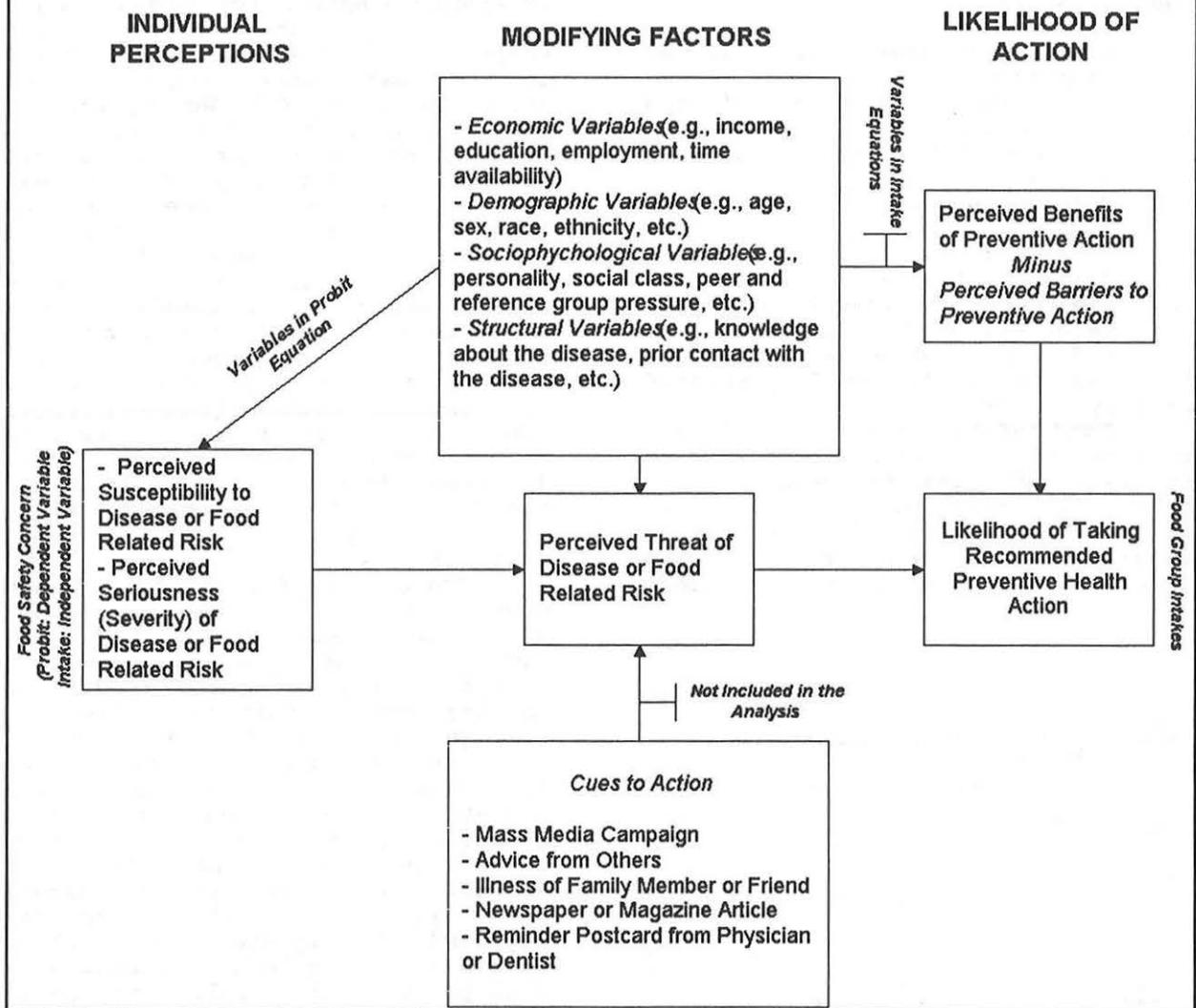
The CSFII provides ongoing data on food and nutrient consumption with a yearly sample of about 2,000 households containing about 5,000 individuals. In CSFII 1989-91, three days of food and nutrient intake data were obtained along with relevant demographic, economic, and self-reported health-related data.

The DHKS is a follow-up to the CSFII. The person identified as the main meal planner/preparer in each household participating in the CSFII was contacted by telephone about six weeks after the food intake data were collected. For each of the survey years, about 1,900 main meal planners/preparers participated in the DHKS. They answered a 30-minute questionnaire related to their nutrition knowledge, attitudes, diet-related behaviors, and food safety concerns. About 80 percent of the DHKS sample is female, and about 20 percent male. In DHKS 1989-91 there were several questions relating to food safety, but the DHKS questionnaire was changed for each year of the survey. Questions were added, dropped, or modified. The 1990 and 1991 surveys were utilized for this study because the 1989 DHKS did not provide the needed information. This analysis included only individuals who provided complete information on three days of dietary intake. After eliminating schedules with missing values for one or more of the analysis variables, 2,715 individuals (one per household) with three days of intake data were included in the analysis sample.

### Theoretical framework

We used the health belief model (Becker and Maiman, Schafer et al) to motivate our statistical model. The health belief model attempts to explain why, in the absence of overt symptoms of illness, people engage in behavior to protect their health. Figure 1 is a conceptual map of the health belief model. The model postulates that there are two sets of beliefs or factors that provide the motivation to engage in health-promoting behavior. The first set of factors pertains to a person's readiness to take action (labeled "Individual Perceptions" in figure 1); the second set of factors pertains to such factors that enhance

**Figure 1**  
**The Health Belief Model: Food Safety Concern and Food Intake (Adapted from Becker and Maiman).**



or impede such action (divided into two sets and labeled "Modifying Factors" in figure 1). The readiness dimension has to do with the individual's perceived vulnerability to a disease and the anticipated seriousness of the consequences of incurring the disease. These perceptions are the primary determinants of the probability that

the person will take preventive action (labeled "Likelihood of Action" in figure 1). In addition, the probability of the individual taking action is influenced by a set of modifying factors. These include sociodemographic characteristics, economic variables such as income and the cost of the action (in money, time and other terms such as

discomfort), and by cues to action such as media exposure, physician advice, acquaintance with someone who suffered from the disease, etc.

In this study, the readiness set of variables is thought to be reflected in the answer to the following question:

*Which of the following concerns you the most?*

1. Drug residues in animal products
2. Pesticide residues on fruit and vegetables
3. Bacteria and parasites in foods
4. Food additives
5. Not concerned about any of the above

Answers 1 to 4 were construed to indicate concern or readiness to take food-safety-related dietary action. Answer 5 indicated no concern or no readiness to take food-safety-related dietary action.

Food safety concern or readiness to take dietary action was related to modifying factors to readiness to take food-safety-related dietary action via a probit statistical model. The dependent variable of the probit model was food safety concern

(concerned=1, not concerned=0). The independent variables included in the probit model were respondent's sex, age (under 30 years, between 30 and 43, and 44 or over), education (less than high school completed, high school completed, college completed), employment status (full-time, part-time, not employed), race (White/nonwhite), ethnic origin (Hispanic/nonhispanic), pregnancy and lactation status, whether the respondent lives alone, participation in food assistance programs (Food Stamp Program or FSP, Women, Infants and Children or WIC), household headship status (both male and female heads, male head only, female head only), household income for the previous year as a percentage of the poverty threshold (under 131 percent, between 131 and 300 percent, and over 300 percent), household food sufficiency status (enough/not enough to eat), geographic region (northeast, west, midwest, south), urbanization status (central city, suburban, nonmetropolitan), tenancy status (owns, rents, or occupies dwelling without payment of cash), and whether there is a child under 18 years of age present in the household.

The effect of readiness to take dietary action (i.e., being concerned with food safety) and of modifying factors on the likelihood to take action (i.e., to modify dietary intake), were estimated for three-day average intakes of 65 food groupings. For each equation in the model, the dependent variable was the average amount of the respective food grouping eaten over three non-consecutive days. The independent variables were food safety concern (yes/no), sex, education (less than high school completed, high school completed, college completed), employment status (full-time, part-time, not employed), race (White/nonwhite), participation in food assistance programs (FSP or WIC), household headship status (both male and female heads, male head only, female head only), household income for the previous year as a percentage of the poverty threshold (as a continuous variable), household food sufficiency status (enough/not enough to eat), geographic region (northeast, west, midwest, south),

Table 1  
Concern about Food Safety: Probit Coefficients and Sample Means.  
CSFII/DHKS 1990-91 (N=2,715).

Variable	Coefficient	T-ratio	Probvalue	Mean
Concerned (Dep. Var., "1"=YES, "0"=NO)				0.91
CONSTANT	1.160	5.38	0.00	
Sex (Female)	0.096	0.70	0.49	0.81
Age Under 30	-0.124	-1.07	0.29	0.18
Age Over 44	-0.157	-1.44	0.15	0.49
Completed High School	0.206	2.44	0.01	0.55
Completed College	0.408	2.81	0.00	0.15
Employed Part Time	0.243	1.96	0.05	0.14
Employed Full Time	0.122	1.26	0.21	0.30
Nonwhite	-0.239	-2.46	0.01	0.17
Hispanic	-0.034	-0.25	0.80	0.07
Pregnant	0.039	0.16	0.87	0.03
Lives Alone	-0.379	-2.85	0.00	0.27
On Food Stamps	-0.187	-1.63	0.10	0.14
On WIC	-0.049	-0.13	0.89	0.01
Male Head Only	0.148	0.76	0.44	0.11
Female Head Only	0.206	1.74	0.08	0.33
Income Under 131%	0.000	0.00	1.00	0.41
Income Over 300%	0.121	1.13	0.26	0.29
"Not Enough to Eat"	0.031	0.17	0.86	0.04
Midwest	0.266	2.31	0.02	0.25
South	0.009	0.09	0.93	0.36
West	0.111	0.97	0.33	0.21
Suburban Household	-0.071	-0.76	0.45	0.42
Nonmetro Household	-0.059	-0.60	0.55	0.27
Rents	0.084	0.92	0.36	0.36
No Cash for Rent	0.106	0.55	0.59	0.03
Child Less than 18 Present	0.049	0.45	0.65	0.40

and estimated distance from the household to the grocery store.

#### Statistical model

Probit analysis was used to identify readiness-for-dietary-action factors that independently influence the respondent's perception of food safety risk. It is possible (indeed likely) that those who are concerned about food safety may be different in some important, unobservable ways that influence their dietary intake, regardless of their food safety concerns. If that is the case, then, any association found between food safety concern and food intake will be wrongly attributed to food safety concern when in fact it was partly due to those other unobservable factors. Statistically, this bias occurs because an independent variable (food safety concern) is correlated with the omitted variables from the model, i.e., the error term. Because of this potential estimation bias, called the selectivity bias, it is important to use a statistical technique that adjusts for these effects. Two different but statistically equivalent techniques that accomplish this goal are the "treatment effects" variant of the Heckman two-stage procedure (Greene, p.p. 609-10; Maddala, p. 264), and the Two Stage Least Squares (2SLS) method (Fomby, et al, p.p. 480-82). In the Heckman two-stage approach the results from the probit analysis (step one) are used to construct a variable called the inverse Mills ratio. Then this ratio is included in Ordinary Least Squares (OLS) regressions relating food intakes to food safety concerns and other factors which influence dietary intakes and this eliminates the selectivity bias from the estimates. Similarly, in the two stage least squares method the probit results are used to construct the predicted probability that a respondent is concerned with food safety which is then used as an *instrument* for food safety concern in the intake equations. This instrumental variable is correlated with food intakes, but not correlated with the error term, thus producing unbiased estimates. All analyses were performed using the statistical

software package LIMDEP, version 6.0 (Greene).

#### Results

Sample means, expressed as proportions, for the dependent and independent variables in the probit model are shown in the last column of table 1. Ninety-one percent of the sample main meal planners/preparers expressed food safety concerns. These sample means reflect the sample distribution of characteristics used in the regression models and are not weighted to compensate for the over-sampling of low-income households in the survey. Since income and most other variables used to construct survey weights were included in the analyses, use of survey weights in the multivariate analyses would be inappropriate (DuMouchel and Duncan). The estimated coefficients from the probit model are also presented in table 1. At the .05 level of statistical significance, factors associated with increased likelihood of expressing food safety concern, and readiness to take dietary action, were higher education level, being White, not living alone, and living in the midwest. These findings are in general agreement with those found by Basiotis and Guthrie, who performed a multinomial logit analysis using all the individual responses in CSFII/DHKS 1990 (Basiotis and Guthrie).

The dependent variables in the food intake analyses are shown in the first column of table 2. The second column of table 2 indicates the proportion of the sample not consuming any of the food grouping in the three days of data collection. Substantial numbers of food groupings have high proportions with zero intakes. This can present statistical estimation problems. An excellent discussion of those problems and of methods available to address them can be found elsewhere (Blaylock and Blisard, Frazao, Haines et al). For the purposes of this exploratory study, it was assumed that the high proportions of zero intakes would not appreciably alter the conclusions. This assumption was supported by a parallel analysis, not presented here, which used a model similar to the 2SLS model described

Table 2  
 Estimated Effects of Food Safety Concern on Food Intakes Using Three Statistical Methods,  
 CSFII/DHKS 1990-91 (N=2,715).

Food Grouping	Proportion Not Consuming	Effect of Food Safety Concern (+/-):P<=0.05; (++)/(-):P<=0.01)		
		OLS	HECKMAN	2SLS
1 Total meat, poultry, fish	0.02	(-)		
2 Beef	0.53		(+)	
3 Pork	0.62	(--)		
4 Lamb, veal, game	0.97			
5 Organ meats	0.98			
6 Frankfurters, sausages, ...	0.51			
7 Total poultry	0.51			
8 Chicken	0.58			
9 Fish and shellfish	0.75			
10 Mixtures mainly meat, ...	0.37			
11 Total milk products, calcium equivalents	0.10			
12 Total milk products, amount	0.10			
13 Total milk and milk drinks	0.25			
14 Total fluid milk	0.27		(-)	
15 Whole milk	0.70			
16 Lowfat and skim milk	0.55			(-)
17 Yogurt	0.94			
18 Milk desserts	0.74			(-)
19 Cheese	0.50			
20 Eggs	0.59			(++)
21 Legumes	0.74		(--)	
22 Nuts and seeds	0.82			
23 Total vegetables and fruits	0.01		(--)	(--)
24 Total vegetables	0.02		(-)	(--)
25 White potatoes	0.27	(--)		
26 Tomatoes	0.45			
27 Dark-green vegetables	0.77			
28 Deep-yellow vegetables	0.77		(-)	(--)
29 Other vegetables	0.12		(--)	(--)
30 Total fruits	0.30		(--)	(--)
31 Total citrus fruits and juices	0.62		(-)	
32 Citrus juices	0.69		(-)	
33 Dried fruit	0.95			
34 Total other fruits, mixtures,	0.42		(--)	(--)
35 Apples	0.77		(--)	(--)
36 Bananas	0.76		(--)	(--)
37 Other fruits and mixtures main	0.67			(-)
38 Noncitrus juices and nectars	0.89			
39 Total grain products	0.01	(--)		
40 Total yeast breads and rolls	0.08			
41 Quick breads, pancakes, french toast	0.59			
42 Cakes, cookies, pastries, pies	0.47	(--)	(--)	(--)
43 Crackers, popcorn, pretzels	0.61			
44 Total cereals and pastas	0.35		(--)	
45 Ready-to-eat cereals	0.60			
46 Mixtures mainly grain	0.48		(+)	(++)
47 Total fats and oils	0.15			
48 Table fats	0.36			
49 Salad dressings	0.45			
50 Total sugars and sweets	0.31			
51 Sugars	0.52		(+)	(++)
52 Candy	0.85			
53 Total beverages	0.04		(+)	(+)
54 Total alcoholic beverages	0.84	(-)	(++)	(+)
55 Beer and ale	0.91	(-)	(++)	(+)
56 Wine	0.95			
57 Total nonalcoholic beverages	0.04			
58 Coffee	0.37			
59 Tea	0.62		(-)	(-)
60 Total fruit drinks and ades	0.79			(+)
61 Regular fruit drinks and ades	0.81			(++)
62 Low-calorie fruit drinks and ades	0.98			
63 Total carbonated soft drinks	0.39		(++)	(++)
64 Regular carbonated soft drinks	0.53	(-)	(++)	(++)
65 Low-calorie carbonated soft drinks	0.78			

earlier, but with the intake equations specified as Tobit. The Tobit specification is appropriate for many situations where the dependent variable is zero for a large proportion of the observations (Blaylock and Blisard, Haines et al). Even though a few Tobit intake equations presented estimation problems, the major conclusions from that set of analyses were substantially the same as those from the simpler model presented here.

Independent variables were selected for the selectivity-adjusted regression models on the basis of previous studies (Morgan, Smallwood and Blaylock). They were described in the previous section. The inverse Mills ratio was also included as an independent variable in the Heckman two-stage procedure.

The estimated effects of food safety concern on food grouping intakes are shown in table 2 for those estimates significant at the 0.05 level. Because the Heckman procedure (Nelson) and the 2SLS method (Fomby et al) both result in estimates with high standard errors, hypotheses testing at the 0.05 level of statistical significance was thought to be conservative enough to adequately compensate for any survey design effects. For purposes of illustration, the results from OLS regressions identical to the other two methods, but not corrected for selectivity bias, are also shown in table 2. Perusal of table 2 suggests that, at least in this case, conclusions can differ dramatically based on statistical methodology chosen to analyze a given data set.

Both the Heckman and 2SLS methods strongly suggest that those who expressed food safety concerns consume less vegetables and less fruits than those who did not. They also consume less cakes, cookies, pastries, and pies. They consume more sugars, grain mixtures, and total beverages including alcoholic beverages, beer, and regular carbonated soft drinks. Those who expressed food safety concerns may also consume less of some of the milk groupings, and cereals and pastas. There was practically no evidence that the two groups differ in their consumption of the meat groupings.

## Summary and Conclusions

In order to explore the possible effects of food safety concerns on individuals' diets, two-stage Heckman and two-stage least squares selectivity-adjusting statistical models were used with data from 2,715 individuals from USDA's CSFII/DHKS 1990-1991. The theoretical framework used was a departure from those used in most economic studies in that it was the health belief model, a theoretical framework borrowed from other social sciences. In the first step of the analysis, a probit regression model relating food safety concern and various characteristics of the respondents was estimated, and a profile of those most likely to be concerned with food safety, and thus ready to take dietary action, was constructed. In the second step, linear regressions were estimated relating intakes of 65 food groupings to food safety concern and other characteristics found to be important determinants of food consumption by previous studies. To avoid confounding the effects of a general interest in good nutrition and good health, which likely correlates well with food safety concern, on the estimated effect of food safety concern on consumption of the food groupings, the Heckman two-stage selectivity-adjusting approach in its "treatment effects" form was used. In this form, the Heckman approach is statistically, but not numerically, equivalent to the instrumental variables version of the two stage least squares method, which was also used for validation purposes. The two methods produced similar results. This was in contrast to results obtained by use of OLS regressions without adjusting for selectivity bias.

The results, although preliminary and subject to a number of important limitations, are nevertheless encouraging. This is because they seem to "make sense," based on the health belief model. Future studies to further explore the potentially very important effects of food safety concerns on dietary intakes should be conducted, perhaps focusing on specific aspects of food safety concern. The major finding is that those with food safety concerns

may be consuming less fruits and less vegetables for fear of pesticide residues or bacterial and parasitic contamination. If so, nutrition education efforts may need to be expanded to include discussions of the relative risks from possible ingestion of minute amounts of pesticide residues in fruits and vegetables compared to the adverse health effects of not consuming adequate amounts of fruits and vegetables.

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#### Endnotes

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**Household Budget Allocation Patterns of Asian-Americans:  
Are They Different from Other Ethnic Groups?**

This study applied an LA/AIDS demand system with a set of demographic variables to study the differences in household budget allocation patterns between Asian-American households and households in other three ethnic groups: Black, Hispanic and White. Findings were that even after controlling for other economic and demographic factors, compared to each of the three other ethnic groups, Asian-American households had significantly different budget allocation patterns in six out of thirteen expenditure categories.

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**Review of Literature**

The population of Asian-Pacific Americans has grown substantially since 1980. While the whole U.S. population increase was 9.8% during the eleven years from 1980 to 1990, the population of Asian-Americans has increased by 107.8% (U.S. Bureau of the Census, 1992).

Asian-Americans consist of people originally from Asia and the Pacific Islands, including China, Philippines, Japan, India, Korea, Vietnam, Hawaii, Samoa, Guam. In 1990, among them, about 22.6% were Chinese, 19.3% Filipinos, 11.6% Japanese, 11.2% Asian Indians, 11.0% Koreans, and 8.5% Vietnamese. The total population of Asian-Americans was about 7.27 million in 1990, representing 2.9% of the U.S. population (U.S. Bureau of the Census, 1992).

While the effects of income and other demographic characteristics on household expenditure for a wide range of goods and services have been studied extensively by many consumer economists, there have been few studies of the effects of ethnicity on household preference structure and budget allocation patterns (Wagner & Soberon-Ferrer, 1991). Wagner and Soberon-Ferrer (1991) offered two reasons for this. First, the effect of ethnicity on household behavior did not emerge as an important research issue until the Civil Rights movement of the 1960s and the explosive growth of the Hispanic-American population during the 1970s and the Asian-American population during the 1980s. Second, expenditure

data classified by ethnicity only recently have become available, and in the early years, the sample size for some ethnic groups, especially Asian-Americans, was too small to provide a base for sophisticated statistical analysis.

It has been widely recognized that Asian-Americans were likely to have different religions, values, ethnic standards, and lifestyles from other ethnic groups. Compared to other ethnic groups, their economic status and demographic characteristics also were different. Consequently, their preference structure and household budget allocation patterns were likely to be different from other ethnic groups. Given that there has been virtually no sophisticated research on expenditure differences between Asian-Americans and other ethnic groups in the existing literature, it is important for us to explore these issues, and to understand the fastest growing minority population in the United States. In addition, information on the effects of ethnicity on expenditures also is important to marketers when planning strategies to better meet the needs of ethnic consumers, and to economists when developing the economic theory of consumer behavior (Wagner & Soberon-Ferrer, 1991).

**Theory and Method**

In the neoclassical consumer theory, consumer behavior is frequently presented in terms of preferences, on the one hand, and possibilities on the other. On the

preference side, we usually consider a consumer faced with possible consumption bundles in some set  $X$ , his/her consumption set, which is often assumed to be a closed and convex set, typically the nonnegative orthant in  $R^n$  (Deaton & Muellbauer, 1980). The consumer is also assumed to have preferences on the consumption bundles in  $X$ . On the other side, choices the consumer is facing are limited within his/her available resources. The simplest and single most important type of opportunity set is that which arises when the household has an exogenous budget, or total expenditure,  $M$ , which is going to be spent within a given period on some or all of  $n$  commodities and services. These can be brought in nonnegative quantities  $x$  at given fixed price  $P$ , where  $X$  and  $P$  are two  $n$ -dimensional vectors and  $X$  and  $P$ . This constraint can be written as

$$PX \leq M. \quad (1)$$

Given a budget constraint and a utility function representing consumer's preferences, the bundle of commodities which maximizes consumer's utility subject to the budget constraint:

$$\text{Maximize } u = u(X) \text{ s.t. } PX = M. \quad (2)$$

By means of the first-order and second-order conditions from a Lagrangian function we can obtain the Marshallian or uncompensated demand functions:

$$x_i = g_i(M, P) \quad i = 1, \dots, n. \quad (3)$$

Furthermore, an indirect utility function,  $v(P, M)$  corresponding to the maximum attainable utility, given income and prices, can be derived by substituting Marshallian demand functions into a direct utility function. By using Roy's identity, a Marshallian demand function can also be obtained from the indirect utility function.

Alternatively, the consumer's choice problem can also be solved by

minimizing the expenditure of attaining a given level of utility. By solving the dual problem

$$\text{Minimize } e = PX \text{ s.t. } u(X) = u, \quad (4)$$

we can obtain the Hicksian or compensated demand functions:

$$x_i = h_i(u, P) \quad i = 1, \dots, n. \quad (5)$$

Another property of the expenditure functions is that their partial derivatives with respect to prices are the Hicksian demand functions. This property is sometimes referred to as Shephard's lemma:

$$\frac{\partial e(u, P)}{\partial p_i} = h_i(u, P) = x_i, \quad i = 1, \dots, n. \quad (6)$$

Since utility maximization and expenditure minimization must imply the same optimal choice, given the same preference structure and budget constraint, the two solutions must coincide. That is:

$$x_i = g_i(M, P) = h_i(u, P), \quad i = 1, \dots, n. \quad (7)$$

Utility functions (direct and indirect), expenditure functions, and demand functions (Marshallian and Hicksian) are linked together to form the well known theory of duality in demand analysis (Deaton & Muellbauer, 1980). The Marshallian and Hicksian demand functions derived from the neoclassical consumer behavior theory should possess four properties: adding-up, homogeneity, symmetry and negativity. (Deaton & Muellbauer, 1980).

This study employed the linear approximation of the Almost Ideal Demand System (LA/AIDS) first introduced by Deaton and Muellbauer (1980) to analyze the budget allocation patterns of the households in the sample. The AIDS demand system was derived from a specified, well-behaved expenditure function. Incorporating more than 20 demographic variables into the demand system facilitated capturing the many faceted effects of ethnicity on

household budget allocation behavior.

Following Deaton and Meullbauer (1980), the LA/AIDS demand function was specified:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log (M/P^*), \quad (8)$$

where  $P^*$  was a price index defined by using the Stone index:

$$\log P^* = \sum_k w_k^* \log p_k. \quad (9)$$

Twenty-four demographic variables were incorporated into the LA/AIDS demand system using a form close to Blundell, Pashardes and Weber's (1993) specification. This specification was realized by allowing the parameters  $\alpha$  and  $\beta$  in the LA/AIDS budget share system, and only these parameters, to vary with the demographic variables. More specifically, the budget share system with demographic variables was specified as

$$w_i = \alpha_{i0} + \sum_{h=1}^m \alpha_{ih} D_h + \sum_j \gamma_{ij} \log p_j + (\beta_{i0} + \sum_{h=1}^m \beta_{ih} D_h) \quad (10)$$

where  $i$  and  $j$  referred to expenditure categories, and the  $D$ 's were demographic variables. A two-stage tobit procedure was employed, correcting for limited dependent variables for expenditure categories alcoholic beverages and tobacco products.

To maintain the theoretical properties of the budget share equation system, the following cross-equation parameter restrictions applied:

$$\begin{aligned} \sum_k \alpha_{k0} &= 1, & \sum_k \alpha_{kh} &= 0, & h &= 1, 2, \dots, m \\ \sum_k \beta_{k0} &= 0, & \sum_k \beta_{kh} &= 0, & h &= 1, 2, \dots, m \\ \sum_k \gamma_{jk} &= 0, & \sum_j \gamma_{jk} &= 0, & j &= 1, 2, \dots, k \end{aligned} \quad (11)$$

The estimation results obtained from the LA/AIDS analysis were then used to estimate several reduced models of the LA/AIDS equations by eliminating one certain ethnic variable at a time. Joined F-tests were then performed to test the significance of ethnic effects on household budget allocation patterns

after adjusting for other economic and demographic differences. Specifically, the F-statistics were formulated as follows:

$$F = \frac{(SSE_R - SSE_F) / (df_R - df_F)}{SSE_F / df_F} \quad (12)$$

where  $SSE_F$  was the sum square errors of the full model, in which all the independent variables were included. The  $SSE_R$  was the sum square errors of the reduced model, in which the ethnic variable tested was dropped out of the model. The degree of freedom was denoted  $df$ .

### Data and Descriptive Statistics

Three major data sources were used in this study. They were: 1980-1990 Consumer Expenditure Survey (CES), 1980-1990 Consumer Price Index (CPI), both collected by the Bureau of Labor Statistics (BLS), and 1990 ACCRA Cost of Living Index (CLI), published by the American Chamber of Commerce Researchers Association. In any demand studies, expenditures, prices and demographic variables (representing preferences) are the three major components. The CES data set, collected yearly since 1980 by BLS, provided very detailed information on household expenditures and household demographic characteristics (U.S. Bureau of Labor Statistics & Department of Labor, 1991). The price data coming from the CPI, published by BLS as early as 1913 and every year thereafter, were compatible and consistent with the CES, since the CPI data used expenditure weights obtained from the CES data (U.S. Bureau of Labor Statistics, 1988). While the CPI provided price data over time, the CLI published price differences among cities and standard metropolitan statistical areas (SMSA's) for major expenditure categories, and was therefore used as a supplement to the CPI price data in this study (American Chamber of Commerce Researchers Association, 1990). The sample periods in this study were each year from 1980 to 1990.

For this study, only households that completed the CES interview for an entire calendar year were selected. Furthermore, since the CPI

did not provide price index for households in rural areas, rural households were excluded. For detailed information about data construction, refer to Fan (1993).

Thirteen mutually exclusive summary expenditure categories were selected for this study: (1) food at home; (2) food away from home; (3) shelter; (4) fuel and utilities; (5) household equipment and operation; (6) apparel and upkeep; (7) entertainment; (8) transportation; (9) education; (10) health care; (11) alcoholic beverages; (12) tobacco; and (13) personal care.

To construct a consistent data set, all the expenditure categories of interest were created or modified following the category definitions defined in the 1990 CES documentation.

Price indices were initially constructed for 14 region/city-size classifications. There were three city-size classifications for Northeast and West and four city-size classifications for Midwest and South. However, since the CES city size information was suppressed for households living in the West region due to confidentiality, price indices were finally constructed for 11 region/city-size combination plus Western region for each year.

Independent variables used in this study were categorized into three groups: income, price and demographic variables. Although the budget allocation patterns of Asian-American households were of interest in this study, three other ethnic groups were also included as comparison groups. These three ethnic groups were: Non-Hispanic Black, Non-Hispanic White and Hispanic households. A household was classified into a certain particular group if the reference person was reported as having that particular ethnic background. Households not belonging to any of the above four ethnic groups (such as native American Indians) were excluded from this study since their sample size was too small to form an independent group.

The income variable used in this study was yearly total expenditure defined by subtracting social security payments, cash contributions, life insurance

payments, and net vehicle outlays from the BLS defined total expenditure, and was a sum of the 13 expenditure categories discussed above. The definitions of the price and expenditure variables are provided in Table 1.

Table 1  
List of variables

Variables	Description
(W,P) <sup>a</sup> FDHOME:	Food at home
(W,P)FDAWAY:	Food away
(W,P)SHELTER:	Shelter
(W,P)UTILITY:	Utility
(W,P)HOUSEO:	Equip. & oper.
(W,P)APPAREL:	Apparel
(W,P)ENTERT:	Entertainment
(W,P)TRANSP:	Transportation
(W,P)HEALTH:	Health care
(W,P)EDUCAT:	Education
(W,P)ALCHOL:	Alcohol
(W,P)TOBACC:	Tobacco
(W,P)PERSCA:	Personal care

a Variables beginning with "W" stand for the budget shares of the corresponding expenditure categories; Variables beginning with "P" stand for the prices of the corresponding expenditure categories.

The following set of demographic variables were entered into the model: (1) ethnic dummy variables; (2) other demographic characteristics of the reference person - age and its squared term, gender, education, occupation, and labor market participation; (3) demographic characteristics of the household - number of earners, family composition; (4) tenure choice; (5) geographical location - region; (6) time - a continuous year variable; (7) interaction term of age and the time variable.

In addition to the above 23 demographic variables and one interaction term, interaction terms of ethnic groups with other demographic variables were also tried and the results were very unsatisfactory due to multicollinearity. In particular, all interaction terms of ethnicity with

the time variable were not significant, indicating a clear time trend of the effects of ethnicity on budget allocation patterns over the sample period did not exist. Therefore, ethnic variables were only entered as dummy variables. However, the model specification allowed for all the demographic variables to interact with total expenditure and prices through the Stone index. so the final estimated model still had reasonable flexibility to capture nonlinear effects of ethnicity, if any existed.

After deleting ineligible samples according to the previously discussed criteria, the total sample size was 8651 households that were interviewed for a whole calendar year during 1980 to 1990. Among them, 176 were non-Hispanic Asian-American households, 944 non-Hispanic Black households, 474 Hispanic households, and 7507 non-Hispanic White households.

The mean age of the reference person of Asian-American households was 46.5, younger than the average age of the reference person of White households (49.7) and Black households (46.8), and older than that of Hispanic households (43.6). The reference persons of Asian-American households had the highest proportion of college or more education (27.9%) in all ethnic groups. On average, Asian American households had a larger family size than both White and Black households, but a slightly smaller family size than that of Hispanic households.

Noticeable family structure differences were observed among the four ethnic groups. Asian-American households, similar to Hispanic households, were more likely to be traditional families. Slightly more than a half of the Asian-American and Hispanic households in the sample consisted of a husband, a wife, and children or grand parents. On the other hand, about half of the White households enjoyed a relatively "modern" life style where they either remained single or married without children. About 17% of the Black households in the sample were single parent households, approximately three times higher than the mean proportion of all other three ethnic groups combined.

The reference persons of Asian-American households had the highest portion of being white collar workers (41.5%) and the lowest proportion of being not working (13.6%) among all ethnic groups.

The geographical distribution of residences also revealed certain patterns and habits for different ethnic groups. While the residence sites of White households were relatively evenly distributed in the Northeast, Midwest, South and West, the majority (81%) of Asian-American households in the sample resided in the West.

On average, Asian-American households had the highest mean after-tax income at \$29,829 a year, while Black households had the lowest mean annual after-tax income at \$15,193. However, when family size was taken into consideration, White households' mean per capita after-tax income was the highest among all four ethnic groups, at \$10,328 a year, followed by Asian-American households (\$10,065). A summary of descriptive statistics of income, total expenditure and budget shares is presented in Table 2.

Table 2  
Mean budget shares: by ethnicity

Var.	Asian	Black	Hisp.	White
FDHOME	0.175	0.212	0.237	0.162
FDAWAY	0.056	0.034	0.038	0.056
SHELTER	0.261	0.223	0.241	0.215
UTILITY	0.076	0.152	0.104	0.109
HOUSEO	0.047	0.040	0.042	0.057
APPAREL	0.053	0.064	0.060	0.057
ENTERT	0.056	0.038	0.041	0.063
TRANSP	0.146	0.126	0.139	0.142
EDUCAT	0.037	0.020	0.021	0.025
HEALTH	0.060	0.046	0.047	0.071
ALCHOL	0.012	0.012	0.011	0.015
TOBACC	0.010	0.018	0.009	0.015
PERSCA	0.012	0.014	0.011	0.012

To test whether Asian-American households had significantly different household budget allocation patterns from the other three ethnic groups, unadjusted two-sample t-tests on budget shares between Asian American households and households in

other three ethnic groups were performed.

The results of the unadjusted t-tests suggested the existence of significant differences in household budget allocation patterns for Asian-American households compared to households in other ethnic groups. The test results indicated that Asian-American households allocated a significantly smaller proportion of their budget to food at home, fuel and utilities, and apparel than both Black and Hispanic households, but a significant larger proportion to education than all other ethnic groups. Asian-American households also spent significantly more of their budget on shelter than both Black and White households. Although these t-tests were not adjusted for households' economic and demographic characteristics, it is still valid to conclude that the observed budget allocation patterns were significantly different for Asian American households from other three ethnic groups.

#### Results and Discussion

The LA/AIDS demand system was estimated by the iterative seemingly unrelated regression (ITSUR) method. While the variances of budget shares for food at home, shelter, utility, transportation and health care were well explained by the set of independent variables, lower R<sup>2</sup>s were observed for other budget share categories, especially education. However, further investigation of the results showed that the majority of the independent variables had their expected sign and were significant. Therefore, the analysis and discussion of the estimated marginal effects of the demographic variables should have provided reasonably plausible information.

To accurately assess the impact of ethnicity on household budget allocation patterns, several adjusted F-tests were performed to test the joint significance of specific ethnic variables. The results of the joint F-tests are summarized in Table 3, along with the budget share differences predicted at sample mean levels.

Table 3  
Adjusted Budget Share Differences for Asian-American Households from other Ethnic Households Predicted at Sample Mean Level (F-Statistics in Parentheses)

Budget Shares	Asian vs. Black	Asian vs. Hisp.	Asian vs. White
FDHOME	0.0109 <sup>b</sup> (3.4028)	-0.0192 <sup>a</sup> (5.7974)	0.0018 (1.1343)
FDAWAY	0.0148 <sup>a</sup> (8.3055)	0.0067 <sup>c</sup> (2.3000)	0.0047 (0.8592)
SHELTER	0.0346 <sup>a</sup> (6.4072)	0.0110 (0.9927)	0.0352 <sup>a</sup> (8.2572)
UTILITY	-0.0374 <sup>a</sup> (48.3623)	-0.0129 <sup>a</sup> (5.0247)	-0.0161 <sup>a</sup> (10.6774)
HOUSEO	-0.0054 (0.9596)	0.0047 (0.9596)	-0.0085 <sup>c</sup> (2.6868)
APPAREL	-0.0176 <sup>a</sup> (14.2924)	-0.0080 (2.1988)	-0.0031 (1.0994)
ENTERT	0.0028 <sup>c</sup> (2.8868)	0.0033 <sup>b</sup> (3.6085)	-0.0131 <sup>a</sup> (8.1792)
TRANSP	-0.0090 (2.0709)	-0.0040 (1.7439)	-0.0003 (0.8720)
EDUCAT	0.0066 (1.6101)	0.0094 <sup>b</sup> (3.6803)	0.0124 <sup>a</sup> (6.6705)
HEALTH	0.0093 (1.7832)	0.0043 (0.3021)	-0.0036 (1.0127)
ALCHOL	-0.0037 (0.9093)	-0.0017 (0.0110)	-0.0043 (0.0109)
TOBACC	-0.0010 (1.1313)	0.0054 <sup>b</sup> (4.5250)	-0.0066 <sup>a</sup> (9.0500)
PERSCA	-0.0049	0.0005	0.0015

a = 99% significance level

b = 95% significance level

c = 90% significance level

Holding other things at sample mean levels, Asian-American households allocated about 1.1% (\$196) more of their budget to food at home than Black households, but about 1.9% (\$339) less of their budget than Hispanic households. There were no significant differences in the budget share for food at home between Asian-American households and White households. In terms of the budget share for food away from home, Asian-American households allocated about 1.5% (\$268) and 0.7% (\$125) more of their budget to food away from home than Black households and Hispanic households, respectively.

Again, there was no significant difference between Asian-American and White households in the budget share for food away from home.

Asian-American households were similar to Hispanic households with respect to the budget share for shelter. Compared to Black and White households, Asian-American households allocated about 3.5% (\$625) more of their budget to shelter than both of them. However, Asian-American households allocated significantly less of their budget to fuel and utilities than households in all other three ethnic groups.

For entertainment expenditures, Asian-Americans allocated more of their budget to entertainment than both Black and Hispanic households, but less of their budget than White households, holding other things at sample mean level. Asian-American households also allocated about 0.9% (\$161) and 1.4% (\$250) more of their budget to education than Hispanic and White households. When other factors were controlled, there was no significant difference between Asian-American and Black households in terms of the budget share for education.

There were also significant differences in the budget share for tobacco products between Asian-American households, Hispanic households and White households. Asian-American households spent less of their budget on tobacco products than White households, but more than Hispanic households.

In total, among 13 expenditure categories, Asian-American households had significantly different budget allocation patterns for six expenditure categories, compared to Black, Hispanic and White households, after other factors such as total expenditure, prices, education, age and household composition were controlled. Compared to White households, Asian-American households were more family-oriented (higher budget share for shelter) and education-oriented. Compared to Black households, Asian-American households allocated more of their budget to food (including food at home and away from home) and shelter, but less to apparel. Compared to Hispanic households, Asian-American households allocated less of their budget to

food at home, but more to food away from home. Compared to all three ethnic groups, Asian-Americans allocated less of their budget to fuel and utilities, indicating they were more energy-saving oriented than households in other three ethnic groups, on average.

### Implications and Conclusions

The purpose of this study was to analyze the differences in household budget allocation patterns for Asian-American households and other ethnic groups: non-Hispanic Black, non-Hispanic White and Hispanic households. Findings were that Asian-Americans, as a growing minority group in the United States, were indeed different in their household budget allocation patterns, compared to Black, Hispanic and White households. They allocated more of their budget to education and shelter, but less to fuel and utilities than at least two of the other three ethnic groups, after other factors were controlled. One possible explanation was the Asian tradition of respecting education and educated people. It was also possible that as a minority group, they felt their career opportunities were limited. Only through getting more education could they establish their economic and social status in the United States. It was possible that Asian-Americans also were likely to accumulate their assets by purchasing products with potential value appreciation, such as housing.

The results of this study may be useful for marketing. By understanding and recognizing differences in budget allocation patterns between Asian-American households and households of other ethnicity, the production sector can better identify market segments for their line of products, so that more information can be provided to the specific market segment to increase market efficiency, especially in those areas where the proportion of Asian-American population is high. On the other hand, special consumer needs could be better identified and product design could be more customized. An example of this would be the housing market in the Western region, where about 80% of the Asian-

American households in the sample resided. Given the information that Asian-American households allocated more of their budget to shelter than other ethnic groups, housing developers could target this Asian-American market segment by analyzing their special housing needs and by building houses matching their taste.

The results of this study may also be used by consumer educators and financial planners to help those Asian-American households who are at a relative economic disadvantage and in financial trouble. To better help these troubled households, consumer educators and financial planners need first to understand the households they are helping. The information provided in this study is especially useful to them in understanding the specific needs and preferences of Asian-American households.

Although the importance of ethnicity in expenditure and consumption studies has been widely recognized in recent years, the classification of ethnic groups has been very diverse in empirical literature, especially when sample size was small and combined ethnic groups had to be formed. The results of this study can provide some guideline for combining Asian-American households into other ethnic groups in expenditure studies so that households within the combined group could be as homogeneous as possible. The results suggested that for different expenditure categories, the choice of combined ethnic groups should be different. For example, for expenditure studies on food at home or food away from home, Asian-American households and White households can form one combined group, since their budget allocation patterns for these two expenditure categories were not significantly different. However, when expenditure on shelter is of interest, Asian-Pacific households and Hispanic households should be in one combined group, while Black and White households can form another group.

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#### Endnotes

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