

Comments on Papers by Dr. Erik de Gier and Dr. Peter Sieber

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It is apparent that the two consumer organizations, Stiftung Warentest and Consumenten bond, are doing good, and also doing well. Their representatives here have painted a clear picture of how concerned and careful they try to be. Dr. Sieber has described a much closer pattern of contacts with producers than our American Consumers Union, even giving producers the test results before publication, without any apparent undue influence, and perhaps with beneficial improvements in the tests. What I'd like to do is make some suggestions for further progress.

First, there is the selection of what to test, based on a variety of information, and guesses whether there will be reportable differences useful to consumers. Consumers have two kinds of choices to make:

1. They have to decide how much quality they want to pay for
2. They want to get that quality at the least price.

Should we test one common price level and measure quality differences, or stratify the sample by price so consumers can see what one gets for the higher price? One of Consumer Union's most useful bits of advice was that the picture quality of VCR's was almost constant, a higher price getting you only more "bells and whistles". Stratifying by price would improve the information. Of course there is also the problem of multiple models of the same brand, so one would not want to confound price differences with brand differences. But that is a soluble sampling problem.

One aspect of selection might inadvertently reduce competition. If we select brands to test on the basis of their market share, we reduce the possibility of finding better products or better values which are attempting to get into the market. One offset might be to ask readers to report particularly good experiences (or bad ones) with new purchases. But a more important one would be to purposely include some smaller, newer entrants into the market.

Quality has dimensions, and to assign an overall index of quality requires combining them in some quantitative fashion. The problems are reduced by two scientific facts. First, any one dimension can be

represented by as few as five categories, because the loss of information from grouping is $1 - 1/k^2$ where k is the number of groups. (Table 1). Even non-normal distributions don't change this much.

Table 1.

Number of Groups	$1 - 1/k^2$	% of information in the detail
2	3/4	75%
3	8/9	89%
4	15/16	94%
5	24/25	96%

Second, we know from long experience with price index numbers that rather large changes in the weighting produce trivially small changes in the index. The same goes for the numbers assigned to categories. Hence, we need not be too concerned about weighting in most cases. Indeed, it might reassure the readers to publish occasionally the results of some different weightings, showing that the rankings are mostly unaffected.

But since consumers are interested in different components of quality, and in price and in reliability, and may vary in their concerns, and since many have computers, the availability of a computer file with those details would allow them to do two things: They could assign their own weights, or they could engage in sequential sorting and elimination. The latter would be particularly useful where one element was considered crucial (extreme weight), or where one wanted to examine the price-quality relationship to search for the cost of added quality, and for bargains above the quality-price curve.

Indeed, with the plethora of information from vendors, each presenting in the most favorable way for their product, a major service of consumer organizations might be to convert this information into a file where the information is in comparable format, so one could search sequentially for desired characteristics, including price. Consumenten bond is apparently already doing this with insurance. This would improve competition, rather than having differentiated information as sellers attempt to

make each brand seem unlike any other. Competitors traditionally attempt to make their product seem special, and a major benefit to consumers would be some assessment as to whether the distinguishing characteristic really mattered.

Another improvement in the use of information from surveys or questionnaires sent to readers might be statistical adjustment of non-representative samples for possible selection bias. There are ways of estimating the effect of omitting non-subscribers, non-repliers, or other sources of missing data. The more one knows about the missing elements, the better the correction. No correction is perfect, but some attention to possible bias might be welcome. Volunteered information or complaints is likely to be biased, but a survey of all users of a product or service can compare the relative satisfaction across brands with relatively little bias.

We should all keep in mind that it only takes a few informed consumers to produce vast improvements in the working of competition, and increases in the correlation between price and quality. Hence, the rest of the consumers will be more likely to "get what they pay for." Finally, sophisticated consumers need more understanding of economics than a product testing magazine can provide, and some advice on what to read might be useful. I leave you with some suggestions of my own:

- On life insurance: Read Joseph Belth (1985) or the new booklet from the California Department of Insurance.
- On tort law versus no-fault insurance: Read anything by Jeffrey O'Connell or Alfred Conard.
- On Social Security: Read Dean Leimer in the Summer, 1995, Social Security Bulletin.
- On other consumer policy issues Read: Alan Blinder, (1987). Hard Heads, Soft Hearts and Paul Krugman, (1994) especially Peddling Prosperity and The Economist, excusing their overselling of privatization.
- Ignore the rest, and see Krugman and Blinder to find out why.

References

- Belth, J. (1985). Life insurance: A consumer's handbook. Bloomington, In: Indiana University Press.
- Blinder, A. (1987). Hard Heads, soft hearts: a tough-minded economics for a just society. Reading, Ma: Addison Wesley.

Krugman, P. R. (1994). Peddling prosperity: economic sense and nonsense in the age of diminished expectations. New York: W. W. Norton.

Leimer, D. (1995). Guide to social security money's worth issues. Social Security Bulletin, 58(2), 3.

Endnote

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The Scientific Foundations of Consumer Advice: Some Comments

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For the first time ever, two of the leaders of the world's Consumers Unions, Dr. Peter Sieber and Dr. Erik de Gier, are subjecting their methods to scientific scrutiny. The first step is to describe their methods and invite the criticism of consumer affairs professionals--we in ACCI. The second step is to address the extent to which their quality assessments of products and services meet that quintessential scientific requirement--reproducibility. Will others, performing the same test, achieve the same results? I applaud the willingness of Drs. Sieber and de Gier to share their methods and their experience and, equally, their willingness to subject their methods to criticism. This is in the best scientific tradition. I am confident that the process, continued, will buttress the credibility of their work and result in improvements that will increase its usefulness to consumers. I hope that, soon, Consumers Union USA will join this process and participate in the scientific review of its methods. I thank Drs. Sieber and de Gier also for telling us about the scope and influence of the four leading Consumers Unions of Europe--those in The Netherlands, Germany, the United Kingdom, and Belgium. This reminds us that consumer advice-giving is a global enterprise and that we have much to learn from consumer organizations all across the world.

Cardinal, Not Ordinal Measures of Quality

Assume that a Consumers Union has assessed the quality of a set of products with acceptable accuracy. For this information to be most usefully communicated to a reader, two requirements must be met:

1. The information must be Easily Accessible from an Information-Processing Viewpoint (Russo 1988). That is, the reader must be able to digest the information quickly, accurately, and with little effort.

2. Overall Quality Ratings and the Ratings of Characteristics should be Cardinal, not ordinal in form.

That is, they should convey how much better one variety, or brand-model, is as compared with another. (Ordinal measures show that one variety is better than another without disclosing by how much.)

The preference for Cardinal, as opposed to Ordinal, measures of quality is securely grounded in the mathematics of utility maximization, making the plausible assumption that quality = utility. The same

proposition may be proved in terms that Benjamin Franklin would have understood: a dollar is twice a half dollar or buys four times as much as a quarter. The significance? Suppose that the price of Variety A of a product is 25 percent higher than that of Variety B. One will "naturally" want to know, in choosing, by how much A is better than B. Given this information, the consumer will be able to select the variety that comes closest to maximizing his utility, or quality. Now we test two of our product testing magazines--Consumer Reports and Test, the German "Consumer Reports"--as to their performance on these requirements.

Our first "test" product is Blade Razors, as reported in the October, 1995 issue of Consumer Reports and the Overall Quality (= score) of Men's Blade Razors. You can see, in an instant, that Blade Razors differ substantially in quality, with the best--Gillette "Sensor Excel"--about three times as good as the worst. You can also see that Gillette "Sensor" (without the "Excel") is almost as good as the "Excel." But you cannot discern the extent of the difference because CU believes, correctly, that its measurements of quality are not that precise. So Consumers Union is a winner on both criteria, providing information on Overall Quality that is (1) easily processed and (2) cardinal in form. I salute Consumers Union for finally serving its readers better by publishing readily understood, cardinal Bar Charts for most of its Overall Scores. Now 95 percent of CR's Overall Scores are cardinal (Maynes, tally of January to July, 1995 issues of Consumer Reports); ten years ago 85 percent were ordinal (Maynes, 1988).

However, Consumer Reports has yet to go the second mile when it comes to ratings of Characteristics, for Razors such as "Ease." From an information-processing viewpoint, CR's "blobs" are excellent: the redder the blobs, the better the performance. But the blobs fail the Cardinality criteria in two ways: (1) they are crude, with only five categories; (2) the reader does not know how much "Easier" it to use the varieties with the all-red blobs as compared with those assigned half-red blobs? When will Consumers Union come clean and publish the cardinal information on characteristics that its product testers have already compiled?

For our second test of presentation requirements, we turn to Test, the magazine published in Germany by Stiftung Warentest, the "Testing

Foundation." The product is High-Fidelity VCR's in the February, 1996 issue of Test. Test utilizes five-point scales for both Overall Quality and Ratings of Characteristics. For Overall Quality the scale is verbal: Sehr Gut (very good), Gut, Zufriedenstellend (adequate), Mangelhaft (inadequate), Sehr Mangelhaft. For characteristics the scale is symbolic: ++, +, 0, -, --. Neither scale is cardinal. As in the case of CR's blobs, Test has not told its readers by how much a "Sehr Gut" VCR is better than a "Gut." Worse, assuming the information given me in 1990 still holds, the verbal scale does not divide the underlying 0-to-100 quality scores evenly, 0-19, 20-39, etc. Instead, they have chosen to award the "Sehr Gut" rating only to varieties with underlying quality scores well above 80).

Summing up, I would challenge all the world's consumer product testing organizations to test their own Quality Reporting against the dual requirements of (1) easy information processing and (2) cardinality.

Price And Quality

In buying, the intelligent consumer seeks the price-quality combinations that maximize utility. To understand the choice problem, consider the market for Panty Hose, a price-quality map with which I have entertained you before. And now we see the challenge for consumer product testing organizations. Exploiting Tip O'Neill's aphorism: all prices are local. Note the very considerable variation in prices for particular varieties of Panty Hose. Prices for Variety K run from \$1.70 to \$2.95; M from \$1.80 to \$3.90; C from \$6.95 to \$6.95, etc. etc. And some price variation is missing. The prices quoted are those that retailers would quote and honor for all customers. For some customers and some products, the practice of price discrimination by sellers via sales, "specials," bargaining, coupons, off-peak discounts, discounts to groups, and similar gambits will vastly enlarge the extent of price variation. Unhappily, the publication of the "average" price, a "typical price range, or list price by Consumer Reports fails to provide readers with an accurate picture of the actual price variation, variety constant, they may encounter in their local market.

What to do? CU and the other consumer product testing organizations are national organizations because the products whose quality they assess are distributed nationally. Should the CU's publish illustrative Price-Quality Maps for "representative" markets--large metropolises, small towns, etc--designed to suggest to readers the extent of price variation extant in the local markets where they shop?

Alternatively, do we need Local Consumer

Information Systems to produce and publish Price-Quality Maps? To my knowledge, only one such exists: the Center for the Study of Services which publishes two Consumers' Checkbook magazines (circulation: 50,000 in D.C. and 15,000 in San Francisco). Might the Consumers Unions take the lead in organizing, perhaps franchising such organizations? Or can someone concoct a device that conveys local prices and national quality evaluations? Another challenge for the CUs of the world!

The Problem with "Consumer Satisfaction"

Erik de Gier, urges at the end of his paper that "... 'consumer satisfaction' could be the cornerstone of ... research strategies and ... testing work by Consumers Unions." My reaction? Yes and no!!! I believe--there is not enough time to argue it here--that "consumer satisfaction" and quality assessments converge to the same thing when they are conducted under Full Understanding/Full Information conditions (FU/FI). The Consumers Unions must never forget that it is the FU/FI conditions that give their product testing, policy analysis, and advice credibility: The CU's evaluations come close to "the truth." By contrast, services are not evaluated under FU/FI conditions. Instead, the CU's usually make the second-best assumption that ordinary consumers can make tolerably accurate assessments of the quality of services. This approach presumes that services are simpler than products and hence the quality of services, unlike products, is relatively transparent. For sellers, Consumer Satisfaction, reflecting existing rather FU/FI perceptions, are highly valuable because so many consumers--not "ours," I hope--choose on this basis. My advice: Consumers Unions should look upon the "Consumer Satisfaction" methodology with considerable skepticism before they embrace Consumer Satisfaction as a methodology.

References

- Maynes, E. S. (1988), Weights, Cardinality, and Scaling in Assessing Quality, in E.S. Maynes (ed.), The Frontier of Research in the Consumer Interest, (pp. 177-183), Columbia, MO: ACCI.
- Russo, J. E. (1988), Information Processing from the Consumer's Perspective, in E.S. Maynes (ed.), The Frontier of Research in the Consumer Interest, (pp. 185-217), Columbia, MO: ACCI.

Endnotes

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Geographic Variation in Consumer Prices: Implications for the Local Cost of Living

Previous research has established that considerable variation exists in consumer prices both between states and within states. This paper extends that research by implementing a procedure for estimating a cost-of-living index in localities within on state. The paper tests relationship between local prices and national prices and local structural factors. Strongest predictive relationships are found for national prices and population growth.

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Introduction

It is now well-established that the cost of living varies between states. Published research has found as much as a 35 percent difference between the highest and lowest cost of living states (McMahon, 1991). However, these differences often go unrecognized in comparing the economic status of states, such as comparing per capita incomes or comparing advantages and disadvantages of where to live.

For the same reasons that the cost of living varies between states, it should also vary between locations, such as counties, within a state. If, indeed, there are significant differences in the cost of living within a state and they also go unrecognized, then there are a number of implications. First, if the cost of living is positively correlated with nominal income, then it means income disparities between counties within a state, and particularly disparities between urban and rural counties, aren't as great as unadjusted income numbers indicate. That is, the "rich" counties aren't as rich as they appear, and the "poor" counties aren't as poor as they appear.

Second, omitting cost of living differences between counties misses an opportunity for counties with lower costs to use this fact as an economic development tool. In many states, rural counties have lagged behind urban counties in economic growth. If these rural counties have lower costs of living, then this finding could be used in advertising for new business locations.

Third, many transfer programs, such as Aid to Families with Dependent Children and Food Stamps, pay the same dollar subsidy amount to all recipient households within a state. If, indeed, the cost of living varies within a state, then recipients in different locations

in the state do not receive the same subsidy in terms of purchasing power.

Given this background, there are two purposes of this paper. First, the paper will develop a methodology for estimating the cost of living in local areas (counties) within a state. It is assumed that this methodology will not be direct data collection; instead, the method will be constrained to using existing data. Second, as part of this methodology, the paper will examine local variation in a wide set of consumer prices.

Previous Work

There is now a large body of evidence which suggests substantial variation in the cost of living between localities in the nation. First is evidence from direct surveys of the cost of living in different locations in the country. One part of this evidence comes from the, now discontinued, surveys of family budgets conducted by the Bureau of Labor Statistics (U. S. Bureau of Labor Statistics, 1982). The final report of these budgets for autumn 1981 showed a 12 percent difference in the cost of living between metropolitan and nonmetropolitan areas of the country for a four person family with an intermediate standard of living. The largest difference existed for rent (27 percent), and the smallest difference was found for clothing, transportation, and food at home (each with a 2 percent difference between metropolitan and nonmetropolitan areas). Furthermore, similar differences were found between metropolitan and nonmetropolitan areas in regions of the country.

Other direct evidence of locational cost of living differences comes from the American Chamber of Commerce Researchers Association (ACCRA). Each quarter ACCRA collects price data for 61 products and services in 289 locations across the country. ACCRA

forms a cost of living index by taking a weighted average of these products and services. The first quarter, 1995 report showed a 166 percent difference between the highest cost of living location (Manhattan, New York City) and the lowest cost of living location (Kennett, Missouri). Again, the greatest difference existed for housing, at 526 percent (American Chamber of Commerce Researchers Association, 1995).

The last set of direct evidence comes from housing costs collected by the U.S. Department of Housing and Urban Development (HUD). HUD collects rent data as part of its housing subsidy programs. The rents are for units of a certain size and certain quality. Within North Carolina, for example, the 1993 data showed a 92 percent difference between the highest rent (\$545/month) and lowest rent (\$284/month) for a two bedroom apartment (U. S. Government Printing Office, 1993).

Other evidence comes from studies which estimate cost of living differences between locations. Most of these studies have focused on cost of living differences between states or metropolitan areas (Cebula 1980; Cebula & Smith 1981; Cobas 1978; Grady 1981; Haworth & Rasmussen 1973; Hogan 1984; Izraeli 1977; Langston, Rasmussen, & Simmons 1985; Roback 1988). They also use a common methodology of specifying a reduced form equation determining the cost of living, estimating the equation using available locational cost of living data, and using the results of the estimation to calculate cost of living indices for the states. These studies have found a maximum cost of living difference between the continental states (i.e., excluding Alaska and Hawaii) of 40 percent (McMahon 1991; Nelson 1991).

Only a few studies have focused on intrastate cost of living differences and estimation procedures. McMahon and Chang (1991) regressed ACCRA cost of living indices for 24 metropolitan areas and 4 regional nonmetropolitan areas on per capita personal income, the value of housing, and the percentage change in population. Parameter estimates from the regression were then applied to Illinois county data for the independent variables to derive county cost of living indices. A 60 percent difference was found between the highest cost of living county and lowest cost of living county in Illinois. Urban counties in the Chicago metropolitan area were found to have the highest cost of living.

Kurre (1992) estimated cost of living indices in Pennsylvania. He also used the ACCRA data as the basis of his analysis. Unfortunately, the ACCRA data is not available for all locations (such as counties) in a state. Kurre's research process was similar to that of McMahon and Chang. His dependent variable was the

ACCRA cost of living index for all of the ACCRA communities surveyed. His explanatory variables included the community population density, total income, growth rate of total income, the local electric rate, the local cost of government services, and a regional dummy variable. Parameter estimates from this regression were then applied to data for the explanatory variables for Pennsylvania counties to form cost of living indices. Results showed a 38 percent difference between the highest and lowest cost of living counties. Urban counties, on average, had a 7 percent higher cost of living than rural counties.

Approach and Data

Our approach is similar to that of McMahon/Chang and Kurre. The ACCRA data will be used as the dependent variable in an equation which "explains" differences in the cost of living between localities. Parameter estimates from the regression equation will be applied to values of the explanatory variables for localities to form local cost of living indices.

We have, however, made some important changes to the approach of McMahon/Chang and Kurre. First, our focus is on intrastate cost of living differences in North Carolina, so our goal is to produce cost of living indices for North Carolina counties. However, unlike McMahon/Chang and Kurre, we don't use ACCRA data for a single time period and from locations over the entire country to do this. Instead, we have collected ACCRA data for several time periods (specifically first quarter, 1991 through first quarter, 1994) for the ACCRA locations in North Carolina. This data set has two advantages. First, since it is confined to North Carolina, our regression equation will not need to include factors which account for differences between states and regions in the cost of living. Second, since the data set is over time, it will allow us to test the relationship between national price trends and local price trends. McMahon/Chang and Kurre weren't able to do this.

A second change we made was to use the actual ACCRA price data rather than the ACCRA cost of living indices. One reason was necessity. The ACCRA indices are not dynamic; that is, they are reconstructed each quarter. ACCRA indices for a community can be compared only to other community ACCRA indices for the same date. ACCRA cost of living indices cannot be compared over time, either for the same community or for different communities. We constructed our own cost of living indices from the ACCRA price data. The construction of these indices is described later. A second reason for using the raw ACCRA price data is that this

allowed us to test hypotheses for individual products and services.

There are three steps to our analysis. First, we estimate equations for each of 57 product and service prices.² The individual product or service price is regressed on a comparable national price and structural characteristics of the community. Second, we form a weighted cost of living index from the 57 products and services and regress it on a national index and structural characteristics of the community. Third, the results from the second regression are used to construct the cost of living North Carolina counties. The analysis uses the data set of 57 product and service prices for 20 North Carolina communities over each of the 13 quarters from first quarter, 1991 through first quarter, 1994.

The first regression equation uses the following form:

$$P_{ijk} = f(NP_{ij}, POP_k, LAND_k, POPGRW_k, PROF_k, PROFGRW_k, SAT_k, TAXRT_k), \quad (1)$$

where:

P_{ijk} =	price of product or service i in time period j in community k ;
NP_{ij} =	national price of product or service i in time period j ;
POP_k =	population of community k in July 1993;
$LAND_k$ =	land area in square miles of community k in July 1993;
$POPGRW_k$ =	population growth rate of community k from 1990 to 1993, but not including annexations;
$PROF_k$ =	number of persons in community k in a professional or managerial occupation in 1990;
$PROFGRW_k$ =	the ratio of the percentage of persons in community k having a professional or managerial occupation in 1990 to the same percentage in 1980;
SAT_k =	the Scholastic Aptitude Test total score in 1992 in community k ;
$TAXRT_k$ =	the property tax rate in community k in 1993.

Individual product and service price indices from the national Consumer Price Index (CPI) are the primary source for NP_{ij} . Data were taken from the March report of the Consumer Price Index for the quarter corresponding to the ACCRA data.

However, for two ACCRA prices, other national data were used in equation 1. These were the "total house purchase price" and "mortgage rate". For

the "total house price", the national price index for new one-family houses sold was used (U. S. Bureau of the Census, 1991-94). For the "mortgage rate", the national effective mortgage interest rate was used (Board of Governors of the Federal Reserve System, 1991-94).

It is expected that local price trends will follow national price trends. Therefore, the sign of the regression coefficient on NP_{ij} is expected to be positive.

Other studies, such as Kurre's, include population and population density (population per land area) as regressors in their form of equation 1. However, doing this includes population twice, once standing alone, and second in the numerator of density. Such a form of equation 1 may introduce collinearity problems. In this study we simply include population (POP_k) and land area ($LAND_k$) as individual regressors. We expect the sign of the regression coefficient on $LAND_k$ to be negative. Holding population constant, greater land area will mean less demand per unit of fixed inputs, such as land, and this will lead to lower local prices.

The expected impact of population on local prices is more complicated. On the one hand, holding land area constant, higher population should lead to greater demand for fixed inputs, such as land, which in turn will be passed through in the form of higher prices. But conversely, greater local population can mean more competition in the local production of products and services and to greater economies of scale in production, both of which would lead to lower local prices. Thus, the impact of population on local prices is, a priori, indeterminate.

$POPGRW_k$ should have an unambiguous positive impact on local prices. Ceteris paribus, greater population growth will lead to greater demand for fixed local inputs and to higher local prices. Note that our measure of population growth excludes growth coming from annexation. We expect the regression coefficient on $POPGRW_k$ to be positive in equation 1.

The McMahon/Chang and Kurre studies included per capita income as a regressor in their versions of equation 1. Their reasoning is that higher levels of per capita income should increase the demand for local products and services (i.e., shift the demand curve to the right) and result in higher local prices. However, the variable that should be used is "real" per capita income, that is, per capita income adjusted for a local cost of living index. Obviously, we don't have the local cost of living index. Thus, it is somewhat circular reasoning to include unadjusted per capita income in an equation determining the local cost of living, and then to use the results of that equation to construct a local cost of living index and to further apply that index to adjusting per capita income.

Instead, we include two variables, $PROF_k$ and $PROFGRW_k$, to account for the likely higher demand for products and services of higher income persons. Professional and managerial occupations have the highest average incomes. Controlling for the total local population, a greater number of persons having a professional or managerial occupation should mean higher average local real income and a rightward shift in the demand curve. Similarly, higher values for $PROFGRW_k$, which measures the increase in the percentage of persons having professional or managerial occupations between 1980 and 1990, should be related to greater increases in local real income. On the basis of these associations, the sign of the regression coefficients for both $PROF_k$ and $PROFGRW_k$ should be positive.

The last two variables, SAT_k and $TAXRT_k$, are included to account for possible capitalization effects on local prices of differences in local public output and local tax rates. The well known Tiebout hypothesis suggests that households "vote with their feet" by leaving localities with inefficient public sectors and entering localities with efficient public sectors. This means that localities with high tax rates and not comparably higher public output will have this inefficiency capitalized into lower land values, and consequently lower local prices. Conversely, localities with high public output and not comparably higher tax rates will have this efficiency capitalized into higher land values, and consequently higher local prices.

We use as a representative measure of local public output the Scholastic Aptitude Test total score in 1992 (the last year available) in the local public school system. Clearly this score is not a result of only public school inputs. Considerable research has shown that characteristics of the students, such as parental education, are major contributors to school outcomes. We control for this effect by including $PROF_k$ in equation 1, since professional and managerial occupations require the greatest amounts of education. Therefore, we expect the sign on the regression coefficient of SAT_k to be positive.

We expect the sign on the regression coefficient of the local tax rate, $TAXRT_k$, to be negative. Controlling for the level of local public output, higher local tax rates will be capitalized into lower land values and lower local prices.

In the second equation, we construct local cost of living indices and regress those on a national cost of living index and the same local structural factors as in equation 1. This second regression is thus:

$$COL_{jk} = f(NCOL_j, POP_k, LAND_k, POPGRW_k, PROF_k, PROFGRW_k, SAT_k, TAXRT_k), \quad (2)$$

where:

COL_{jk} = cost of living index in time period j in community k;
 $NCOL_j$ = national cost of living index in time period j;

and the other variables are as defined in equation 1.

The local cost of living index, COL_{ij} , was constructed in the following way. First, the ACCRA prices for each product or service were converted to indices (based on 100 for first quarter, 1991). In doing this, the housing cost was taken as the monthly amortized payment based on the house price, mortgage rate, a 30 year term, and a 25% down payment. Second, the weights used by ACCRA in forming their index were applied to the products and services. The ACCRA weights, rather than CPI weights, were used because the ACCRA products and services don't correspond exactly to the products and services which compose the CPI market basket. Third, the local cost of living index was calculated as the product of the weights and the indices for the products and services.

The same procedure was used in developing the national cost of living index, $NCOL_j$. The CPI indices for each product or service were recalculated to make the base period (index value of 100) be the first quarter of 1991. The weights were the ACCRA weights. The national cost of living index was constructed as the product of the weights and the indices for the products and services.

The results of equation 2 were then used to construct cost of living indices for each of North Carolina's counties. The parameter estimates from equation 2 were applied to values of the regressors for each of North Carolina's counties to calculate estimates of the cost of living indices.

Results

In this section, the results for equations 1 and 2 are presented and discussed, and the county cost of living estimates are given.

Individual Product and Service Regressions

Equation 1 was formulated for each of the ACCRA products and services. The error terms in each equation are likely to be correlated either by location or

time period. For this reason, the equations were estimated using Zellner's seemingly unrelated regression system.

The results are summarized in Table 1. The system weighted R^2 is 0.68. The strongest results are for NCOL. The majority (32 of 57) of the parameter coefficients for NCOL are positive and significant, as expected. Furthermore, over three times as many parameter coefficients are positive and statistically significant as are negative and statistically significant. The results are almost as strong for POPGRW. Twenty-eight of the 57 parameter estimates are positive and statistically significant, and almost four times as many of the coefficients are positive and statistically significant as are negative and statistically significant.

Table 1
Summary of Seemingly Unrelated Regression Results
for All Products and Services.

Regressor	Number of Equation in Which Coefficient is:		
	Positive and Statistically Significant	Negative and Statistically Significant	Not Statistically Significant
NCOL	32	9	16
POP	15	6	36
POPGRW	28	3	26
LAND	11	8	38
PROF	4	10	43
PROFGRW	5	11	41
TAXRT	5	12	40
SAT	12	13	32

Three times as many parameter coefficients for POP are significantly positive as are significantly negative, but the majority are not statistically significant. There's no clear result for LAND, with almost equal numbers of positive and negative coefficients.

The trend for the two demographic variables, PROF and PROFGRW, is for a negative effect among those coefficients which are statistically significant. This is contrary to our expectations. However, an explanation may be the following. If professional households are more knowledgeable shoppers, then communities with a greater proportion of professional households, or with greater growth in their proportion, may have more competition among local businesses and hence lower prices. This "competitive effect" may outweigh the effect of greater demand for goods and services caused by professional households' higher incomes.

There are no consistent results for the public output variable, SAT. However, for the tax variable, TAXRT, over three times as many coefficients are statistically negative as are positive, but the majority of the coefficients are statistically insignificant.

Table 2
COL Regression Results.

Regressors:	Dependent Variable: COL Coefficient Estimates:
Intercept	44.6289*
NCOL	0.4671*
POP (1,000's)	0.0186***
POPGRW	0.7093***
LAND (1,000's)	0.2390
PROF (1,000's)	-0.0355**
PROFGRW	-5.8460*
TAXRT	-9.1844***
SAT	0.0330***

$R^2 = 0.4984$ F - value = 21.869***

- * Significant at 0.10 level.
- ** Significant at 0.05 level.
- *** Significant at 0.01 level.

COL Regression

The results for the aggregate cost-of-living regression are in Table 2. Almost half of the variation in the dependent variable is explained by the regression. All of the parameter estimates are statistically significant except for LAND. The positive coefficient on NCOL of near 0.50 indicates that one-half of every one point change in the national cost-of-living index is passed on to the local index.

The parameter estimates on POP and POPGRW are both positive. The results indicate that the local COL index is almost 0.02 points higher for every additional population count of 1000 persons, and the index is 0.71 points higher for every additional one percentage point in the population growth rate.

The parameter estimates for the two demographic variables are negative, indicating that the greater competitive effect of these households on local prices outweighs any positive income effect they have. The two public sector variables have the expected signs. Higher local property tax rates are capitalized into a lower local COL, and higher local SAT scores are capitalized into a higher local COL.

The parameter estimates in Table 2 were applied to values for the regressors for each of North Carolina's 100 counties to produce county cost-of-living (COL) estimates. A range of 25 percent was found between the highest and lowest cost-of-living counties.

References

- American Chamber of Commerce Researchers Association (1995), ACCRA Cost of Living Index, First Quarter 1995, 28.
- Board of Governors of the Federal Reserve System (1991-94), Federal Reserve Bulletin, Table A37.
- Cebula, R. (1980), Determinants of Geographic Living Cost Differentials in the U. S.: An Empirical Note, Land Economics, 56 (4), 477-481.
- Cebula, R. & Smith, L. (1981), An Exploratory Empirical Note on Determinants of Inter-Regional Living-Cost Differentials in the U. S., 1970 and 1975, Regional Science and Urban Economics, 11 (1), 81-86.
- Cobas, J. A. (1978), A Method to Estimate the Bureau of Labor Statistics Family Budgets for All Metropolitan Statistical Areas, Social Science Quarterly, 59 (4), 546-552.
- Grady, S. T. (1981), Estimation and Evaluation of State Price Indexes for the Period 1967-1978: An Empirical Note, Review of Regional Studies, 11 (1), 51-62.
- Haworth, C. T., & Rasmussen, D.W. (1973), Determinants of Metropolitan Cost of Living Variations, Southern Economic Journal, 40 (2), 182-192.
- Hogan, T. D. (1982), Geographical Living-Cost Differentials in the U. S.: A Disaggregated View, Land Economics, 60 (1), 115-119.
- Izraeli, O. (1977), Differentials in Nominal Wages and Prices Between Cities, Urban Studies, 14 (2), 275-290.
- Kurre, James (1992), The Cost of Living in Rural Pennsylvania, Erie, Pennsylvania: The Center for Rural Pennsylvania.
- Langston, D. D. Rasmussen, W. & Simmons, J.C. (1985), A Note on Geographic Living Cost Differentials, Land Economics, 61 (3), 314-318.
- McMahon, Walter W. (1991), Geographical Cost of Living Differences: An Update, Journal of the American Real Estate and Urban Economics Association, 19 (4), 426-450.
- McMahon, W. W. & Chang, S. (1991), Geographical Cost of Living Differences: Interstate and Intrastate, Update 1991, Normal, Illinois: Center for the Study of Education Finance.
- Nelson, F. H. (1991), An Interstate Cost-of-Living Index, Educational Evolution and Policy Analysis, 13 (1), 103-111.
- Roback, J. (1988), Wages, Rates, and Amenities: Differences Among Workers and Regions, Economic Inquiry, 26 (1), 23-42.
- U. S. Bureau of the Census (1991-94), Price Index of New One-Family Houses Sold, C27.
- U. S. Bureau of Labor Statistics (1982), Family Budgets, Monthly Labor Review, 107 (1), 44-46.
- U. S. Government Printing Office (1993), Federal Register, 58 (189), 51449-51450. Washington, D.C.: author.

Endnotes

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2. We did not include four ACCRA items, apartment rent, commuter fare, monthly electricity cost, and other monthly home energy costs. The first two items weren't included because they weren't available for all North Carolina cities surveyed by ACCRA. The second two items weren't included because they are subcomponents of an included item, total monthly home energy cost.

Self-Employment: A Viable Economic Alternative for the California Hispanic Population

This paper examines the influence of employment sector on income of Hispanics using data from the U.S. Decennial Census. Assimilation theory and human capital theory are combined and income equations are estimated separately for Hispanic self-employed and Hispanic wage earners. The results suggest that self-employment offers economic benefits. The importance of assimilation varies by employment sector. Income differences are due more to differences in worker characteristics between the two employment sectors than to differences in rates of return to these characteristics.

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Due to the current racially unfriendly political climate in California, many Hispanics may be looking for jobs outside the mainstream wage and salary labor market. California's Proposition 187 threatens the Hispanic population, while affirmative action is losing its legal ground in helping minorities get jobs in the dominant white labor market. Self-employment may be considered a viable labor market alternative for Hispanic individuals who perceive barriers in the wage and salary sector, but is self-employment a wise move economically? If an Hispanic individual is more assimilated to the dominant white culture, would this assimilation benefit him/her financially in the self-employed sector?

Historically, self-employment has been considered a viable employment option for minority populations facing barriers to gainful employment in the traditional wage and salary labor market. According to Aronson (1991), various ethnic, religious, and racial groups have achieved upward economic and social mobility by entering the mainstream economy through self-employment and small businesses. Self-employment continues to serve this function especially among recent immigrants. However, empirical research has shown mixed results regarding the economic benefit of self-employment for Hispanic persons. For example, Butler and Herring (1991) found that self-employed Hispanics earned less money than Hispanics who were not self-employed, while Roos and Hennessy (1987) found that Mexican men benefited from self employment.

Differences in income received by self-employed workers and wage and salary workers could be due to differences in productivity related factors between

the two groups. Measures of human capital are often used to capture productivity differences between workers. If workers are rewarded in accordance with their individual marginal productivities, then more productive workers will receive higher earnings. Thus, differences in educational attainment, work experience, or hours worked between the two groups could provide valid explanations for differences in income.

Alternatively, these productivity factors may be more closely correlated with income in one sector than the other. In fact, previous empirical studies report mixed results regarding returns to human capital investments (Aronson, 1991). In some studies, returns to human capital for minority workers have been higher in the self-employed sector, while other studies find higher returns in the traditional wage and salary sector. Demographic characteristics, such as gender, marital status, and presence of young children, could influence labor force attachment or effort expended on the job, thus influencing income.

We also investigate the role of assimilation. Assimilation theory refers to ethnic groups becoming integrated into the mainstream society over time (Roos and Hennessy, 1987) which could influence their economic status. Torres (1988) specified two important components of assimilation. The first component is the process by which members of an ethnic group become more like the majority group and gradually lose their distinctive ethnic identity. Torres (1988) measured this aspect of integration into the mainstream society in the U.S. with variables capturing command of the English language, U.S. citizenship, and time transpired since immigration. Second, Torres suggested that assimilation is facilitated if one has control over means of production,

as opposed to merely supplying labor to the labor market. Torres captured this aspect of assimilation with measures of educational attainment and of amount paid for real estate taxes and property insurance premiums (as a proxy for property ownership).

Previous empirical research has produced mixed results regarding the impact of assimilation on earnings for self-employed Hispanics. Brock, Evans, and Phillips (1986) found a positive relationship between time lapse since immigration and income, and a negative relationship between immigrant status and income for self-employed workers. Torres (1988) found both of these factors to be insignificant in his research on Mexican American business persons, but found a positive relationship between command of the English language and income. He also found that in larger cities, U.S. citizenship was related to lower income of Mexican American business persons.

This paper explores whether self-employment is a viable economic alternative to employment in the traditional wage and salary labor market for Hispanic persons, and whether or not assimilation provides financial benefits to Hispanics selecting self-employment.

Data

Data are from the five percent weighted sample of the 1990 Census of Population and Housing, Public Use Microdata Samples for California. Nearly 34% of the U.S. Hispanic population lives in California, and therefore the California data provide a convenient sample for exploring income differentials by employment sector within the Hispanic population. Persons 16 years of age and over who self-identified Spanish, Mexican, Central or South American, Puerto Rican, Cuban, Dominican, or other Spanish/Hispanic origin, and who were either employed in their own unincorporated business or as wage and salary employees are included in this sample. Individuals who own incorporated businesses are excluded due to differences in reporting self-employed income (Torres, 1988). Individuals employed in the military are excluded due to differences between civilian and noncivilian employment. Individuals involved in farming activity are retained in the sample since separate analyses indicate that the results are not significantly affected by their inclusion. These criteria produced a sample of 16,952 Hispanic persons, 4.7% (N=789) who were self-employed and 95.3% (N=16,163) who were wage and salary employees.

Model

Assimilation theory is combined with a human capital earnings model (Becker, 1993; Blinder, 1973; Oaxaca, 1973) to develop an income model for the Hispanic population. By adding these additional theoretical constructs we propose to better assess the factors which impact Hispanic income in both the self-employed and the wage and salary sectors.

The Hispanic earnings model defines income as a function of human capital, assimilation, and demographic variables.⁴ The dependent variable is the sum of net nonfarm self-employment income and wage or salary income. Negative numbers are allowed in order to represent the full range of possible income reported by the self-employed. Human capital is measured with two continuous variables and a set of six dummy variables for occupation. Age is a continuous variable with the minimum age in the sample being 16 years. Time invested in work is measured by hours worked per year which is constructed by multiplying weeks worked in 1989 by usual hours worked per week in 1989. The dummy variables for occupation are: managerial and professional; technical, sales, and administrative support; service (the omitted category); farming, forestry, and fishing; craft, precision production, and repair; and operators, fabricators, and laborers.

The assimilation variables mirror Torres' (1988) study. Command of the English language and the ability to speak more than one language are measured with a set of five dummy variables: does not speak English; speaks more than one language and; English is not spoken well, English is spoken well, English is spoken very well; and English in the only language spoken (the omitted category). Citizenship is a dummy variable that equals 1 for persons who are U.S. citizens and 0 otherwise. Five dummy variables measure the amount of time since immigration, ranging from recent immigration (between 1980 and 1990) to being born in the United States (the omitted category). Education, a traditional human capital variable,⁵ is categorized in this study with the assimilation variables following Torres (1988). Educational attainment is measured with four dummy variables: less than a high school diploma, high school diploma (the omitted category), some college, and at least a bachelors degree. Taxes and insurance is the total amount paid for real estate taxes and property insurance premiums, which proxies for property ownership.

Three demographic variables are included and all three are dummy variables. Gender is equal to 1 if the individual is male; 0 otherwise. Child is equal to 1 if

children under age 18 are present in the household; 0 otherwise. Married is equal to 1 if the individual is currently married; 0 otherwise. Thus individuals who are widowed, divorced, separated, or never married are all coded as zero.

Analysis

Descriptive statistics

The univariate results on income by occupation within each employment sector suggest that there may be positive economic benefits to self-employment for Hispanic persons. The mean income for the Hispanic self-employed is 25% higher than the mean income for the Hispanic wage earner (\$19,419 and \$15,519, respectively). However, the median income is slightly higher for the Hispanic wage earner than the Hispanic self-employed (\$12,000 and \$11,000, respectively). This result is due to a more skewed distribution of income among Hispanic self-employed persons. Specifically, income is more concentrated at the higher end of the income distribution among Hispanic self-employed persons resulting in a larger difference between the mean and median income relative to Hispanic wage earners. For both the Hispanic self-employed and the Hispanic wage earner, mean income was highest in the managerial and professional occupation group. The lowest mean income for Hispanic self-employed was in the service occupation group, while the lowest mean income for Hispanic wage earners was in the farming, forestry, and fishing occupation group.

Means and standard deviations for the dependent variable and the explanatory variables used in the income equations are summarized by employment sector in Table 1.⁶ Approximately 60% of both Hispanic self-employed and Hispanic wage earners are male. Similarly, 17% of Hispanic self-employed and 18% of Hispanic wage earners have children under age 18 present in their household. However, relative to the Hispanic wage earner, the Hispanic self-employed is slightly older (39 years and 33 years, respectively), more likely to be married (63% and 53%, respectively) and works more hours per year (1,703 hours and 1,684 hours, respectively).

The occupational distribution of the Hispanic self-employed and Hispanic wage earners differ with a higher percentage of Hispanic self-employed in managerial and professional; service; and craft, precision production, and repair occupations, and a higher percentage of Hispanic wage earners in technical, sales, and administrative support; and operator, fabricators, and laborer occupations.⁷ With respect to the assimilation

variables, both the Hispanic self-employed and the Hispanic wage earner have similar characteristics with the exception of time since immigration and amount paid in taxes and insurance. Similar proportions of Hispanic self-employed and Hispanic wage earners were born in the U.S., but among immigrants, Hispanic self-employed

Table 1.
Means and Standard Deviations of Variables by Employment Sector

Variable	Hispanic Self-Employed		Hispanic Wage Earner		Test statistic for difference between samples
	Mean	Std. Dev.	Mean	Std. Dev.	
Income (1989 dollars)	19,419.27	25,499.90	15,518.67	14,383.19	t=4.26***
Human Capital					
Age	39.34	12.72	33.18	11.89	t=13.34***
Hours per year	1702.75	912.07	1,684.09	756.96	t=1.66*
Occupation					$\chi^2=135.20$ ***
Managerial/Prof	0.15	0.36	0.11	0.31	
Tech/Sales/Adm	0.20	0.40	0.24	0.43	
Service	0.28	0.45	0.18	0.38	
Farm/Forest/Fish	0.09	0.29	0.08	0.27	
Craft/Proc/Rep	0.16	0.37	0.14	0.34	
Oper/Fab/Lab	0.11	0.31	0.26	0.44	
Assimilation					
English					$\chi^2=6.99$
Does not speak English	0.08	0.27	0.10	0.30	
Speaks English, not well	0.18	0.38	0.18	0.39	
Speaks English, well	0.20	0.40	0.17	0.38	
Speaks English, very well	0.33	0.47	0.34	0.47	
Speaks only English	0.21	0.41	0.21	0.41	
Citizen	0.56	0.50	0.55	0.50	$\chi^2=0.296$
Immigration					$\chi^2=51.44$ ***
Immigrated 1980-1990	0.23	0.42	0.28	0.45	
Immigrated 1970-1979	0.19	0.39	0.21	0.41	
Immigrated 1960-1969	0.14	0.35	0.08	0.27	
Immigrated before 1959	0.05	0.22	0.03	0.18	
Born in the U.S.	0.39	0.49	0.40	0.49	
Education					$\chi^2=4.05$
Less than high school	0.48	0.50	0.50	0.50	
High school graduate	0.21	0.41	0.21	0.41	
Some college	0.23	0.42	0.22	0.42	
Bachelors degree or more	0.08	0.27	0.06	0.24	
Taxes and Insurance	247.83	350.20	167.00	273.57	t=6.39***
Demographic					
Gender	0.61	0.49	0.59	0.49	$\chi^2=1.59$
Children < 18 yrs. present	0.17	0.37	0.18	0.38	$\chi^2=0.75$
Married	0.63	0.48	0.53	0.50	$\chi^2=33.49$ ***
Number	789		16,163		

*p<.10 **p<.05 ***p<.01

were more likely to have immigrated prior to 1970 and less likely to have immigrated after 1980 relative to Hispanic wage earners.⁸ Hispanic self-employed also paid a higher amount for real estate taxes and property insurance premiums (\$248 and \$167, respectively).

Statistical methodology

To determine if the factors associated with income differed by employment sector within the Hispanic population, OLS multiple regression analysis was used to estimate income equations separately for Hispanic self-employed and Hispanic wage earners. A

Chow test was used to test for differences in estimated coefficients between the two regressions (Chow, 1960).

To determine which individual coefficients were statistically different between Hispanic self-employed and Hispanic wage earners, OLS multiple regression analysis was used to run a fully interacted model on the pooled sample of Hispanic self-employed and Hispanic wage earners (Gujarati, 1970). The dependent variable was the sum of net nonfarm self-employment income and wage or salary income. The explanatory variables included the set of human capital, assimilation, and demographic variables, as well as a dummy variable for employment sector (equal to one if the person was self-employed), and variables constructed by interacting each explanatory variable with the employment sector dummy variable. The statistical significance of these interaction variables was tested by the usual t-test ($p < .05$).⁹ A significant coefficient for the interaction variables indicated that the effect of the explanatory variable on income was different between Hispanic self-employed and Hispanic wage earners.

Results

The income equations for Hispanic self-employed and Hispanic wage earners are summarized in Table 2. The income equation for Hispanic self-employed explains 26% of the variance in income, and seven of the twenty-three explanatory variables are significant at the .10 level or better. The income equation for Hispanic wage earners explains 42% of the variance in income, and twenty of the twenty-three explanatory variables are significant at the .05 level or better.

Two general results emerge from these results. First, there are many similar results between the two groups in the relationship between income and the various independent variables. Age, hours worked per year, having a college degree, amount paid in taxes and insurance, gender, and marital status are positive and statistically significant for both Hispanic self-employed and Hispanic wage earners. For both groups, being in a managerial or professional occupation increases income compared to being in a service occupation (the omitted category). Further, being in the technical, sales, and administrative support; or craft, precision production, and repair; or operator, fabricator, and laborer occupations, relative to a service occupation, increases income for Hispanic wage earners, while being in the farming, forestry, and fishing occupation decreases income.

Second, three of the five assimilation variables provide important explanatory power in the wage earner equation, but not in the self-employed equation. Having

a strong command of the English language, being a U.S. citizen, and having spent a longer period of time in the U.S. since immigrating are all positively associated with income for Hispanic wage earners, but are not statistically significant for Hispanic self-employed.¹⁰

The Chow test for equality of the regression coefficients is significant at the .01 level, indicating the

Table 2.
Determinants of Income for Hispanic Persons by Employment Sector

Variable	Hispanic Self-Employed		Hispanic Wage Earner	
	Coefficient	Std. Error	Coefficient	Std. Error
Human Capital				
Age	120.81*	72.92	150.74***	8.62
Hours per year	††† 5.94***	0.90	7.26***	0.12
Occupation (omitted: Service)				
Managerial/Professional	† 8795.66***	2870.93	6073.56***	369.42
Tech/Sales/Admin	3728.30	2487.73	3023.25***	286.94
Farm/Forest/Fish	-3874.94	3414.34	-810.23**	384.07
Craft/Proc/Rep	2174.57	2868.17	3499.66***	321.94
Oper/Fab/Lab	443.96	3065.74	1489.66***	271.70
Assimilation				
English (omitted: speaks only English)				
Does not speak English	-1553.00	4093.41	-3280.86***	422.37
Speaks English, not well	-5318.66	3305.74	-3415.14***	358.39
Speaks English, well	128.78	3083.42	-1839.48***	332.31
Speaks English, very well	-3025.59	2387.35	-1544.25***	253.54
Citizen	435.50	2488.95	1028.45***	285.72
Immigration (omitted: born in U.S.)				
Immigrated 1980-1990	-848.27	3434.08	-1696.08***	365.40
Immigrated 1970-1979	-199.48	3208.52	-912.28***	336.37
Immigrated 1960-1969	2503.92	3172.76	-33.08	394.61
Immigrated before 1959	-836.89	4160.89	309.83	541.05
Education (omitted: high school grad.)				
Less than high school	-2778.12	2195.36	-1146.74***	243.94
Some college	82.99	2396.02	2290.07***	266.26
Bachelors degree or more	12881.00***	3452.95	8595.28***	419.88
Taxes and Insurance	††† 11.85***	2.37	5.06***	0.33
Demographic				
Gender	††† 10820.00***	2359.90	4645.66***	233.06
Children < 18 yrs. present	93.21	2718.66	291.15	286.94
Married	3872.11**	1783.42	2805.89***	194.80
Constant	-7646.19	4921.10	-7370.61***	537.90
<hr/>				
Adjusted R ²		0.26		0.42
F		13.01		499.56
Number		789		16,163

* $p < .10$ ** $p < .05$ *** $p < .01$

†Estimated coefficients are significantly different between the two samples, $p < .10$

†††Estimated coefficients are significantly different between the two samples, $p < .01$

predictors of income are statistically different between Hispanic self-employed and Hispanic wage earners. In order to determine which estimated coefficients are statistically different, the fully interacted model was estimated. The coefficients which are statistically different from each other between the two equations are indicated with a dagger in Table 2 and include hours worked per year, being in a managerial or professional occupation, amount paid in taxes and insurance, and gender.

Hours worked per year is positively associated with income for both Hispanic self-employed and Hispanic wage earners, but the effect is larger for wage earners. Each additional hour worked increases income by \$7.26 for wage earners, compared to only \$5.94 for self-employed. Occupational category is also an important determinant of income. Being in a managerial or professional occupation compared to a service occupation increases the income of both Hispanic self-employed and Hispanic wage earners, but the effect is much larger for self-employed. The income of self-employed Hispanics in managerial or professional occupations is \$8,796 higher than the income of self-employed Hispanics in service occupations compared to a difference of only \$6,074 among Hispanic wage earners.

The coefficients for the amount paid in real estate taxes and insurance premiums (a proxy for property ownership) are statistically different between Hispanic self-employed and Hispanic wage earners. An additional dollar paid in taxes and insurance increases income of Hispanic self-employed by \$12 compared to approximately \$5 for Hispanic wage earners.

For both Hispanic self-employed and Hispanic wage earners, males have higher income than females, however the gender difference is much larger among Hispanic self-employed. The income of male Hispanic self-employed persons is \$10,820 higher than the income of female Hispanic self-employed persons, compared to a gender difference in income of only \$4,646 among Hispanic wage earners.

Decomposition

As previously noted, the mean income for Hispanic self-employed in this sample is 25% higher than the mean income for Hispanic wage earners (\$19,419 and \$15,519, respectively). Differences in income between Hispanic self-employed and Hispanic wage earners could be due to differences in characteristics of the two samples (for example, Hispanic self-employed are older and work more hours per year on average than Hispanic wage earners). Alternatively, these income differences could be due to differences in how the individual characteristics are rewarded or valued in the labor market (for example, a strong command of the English language and U.S. citizenship were positively associated with income for Hispanic wage earners, but are not statistically significant for Hispanic self-employed).

In order to identify the relative importance of these two different factors, a decomposition method was used to ascertain the extent to which the observed differences in income could be explained by differences

in characteristics between the two samples (mean values of the variables summarized in Table 1) or by differences in the rate of return to these characteristics in the labor market (estimated coefficients in Table 2). Table 3 presents the results of the decomposition.

The first and second columns indicate by how much, in actual dollars and as a percent of the mean income of Hispanic wage earners, the income of

Table 3.
Decomposition of Difference in Income Between Hispanic Self-Employed and Hispanic Wage Earners

	Change in income of Hispanic wage earner*			
	With characteristics of Hispanic self-employed rewarded at the rate for the wage and salary sector		With characteristics of the wage earner rewarded at the rate for the self-employed sector	
	Dollars	% change	Dollars	% change
TOTAL	\$2427	15.6%	\$750	4.8%
Human Capital				
Age	929	6.0	-993	-6.4
Hours per year	397	2.6	-2176	-14.0
Occupation				
Managerial/Professional	243	1.6	299	1.9
Tech/Sales/Admin	-121	-0.8	169	1.1
Farm/Forest/Fish	-8	0.0	-245	-1.6
Craft/Prec/Rep	70	0.5	-186	-1.2
Oper/Fab/Lab	-223	-1.4	-272	-1.8
Assimilation				
English				
Does not speak English	66	0.4	173	1.1
Speaks English, not well	0	0.0	-343	-2.2
Speaks English, well	-55	-0.4	335	2.2
Speaks English, very well	15	0.1	-504	-3.2
Citizen	10	0.1	-326	-2.1
Immigration				
Immigrated 1980-1990	85	0.5	237	1.5
Immigrated 1970-1979	18	0.1	150	1.0
Immigrated 1960-1969	-2	0.0	203	1.3
Immigrated before 1959	6	0.0	-34	-0.2
Education				
Less than high school	23	0.1	-816	-5.3
Some college	23	0.1	-486	-3.1
Bachelors degree or more	172	1.1	257	1.7
Taxes and Insurance	409	2.6	1134	7.3
Demographic				
Gender	93	0.6	3643	23.5
Children < 18 yrs. present	-3	0.0	-36	-0.2
Married	281	1.8	565	3.6

*Positive (negative) numbers indicate the amount by which income of Hispanic wage earners would increase (decrease)

Hispanic wage earners would change if they had the characteristics of the Hispanic self-employed, but these characteristics were rewarded at the rate for the wage and salary sector. Under this situation, total income for the Hispanic wage earner would increase by \$2,427, representing a 15.6 percent increase. Most of this difference is attributable to differences in the age distribution of workers in the two sectors. If Hispanic wage earners had the older age distribution of the Hispanic self-employed workers, all else equal, their income would increase by 6.0 percent (\$929). Other

important effects are the result of the higher number of hours worked and the higher amount paid in taxes and insurance by the self-employed.

The third and fourth columns indicate by how much, in actual dollars and as a percent of the mean income of Hispanic wage earners, the income of Hispanic wage earners would change if their own characteristics were rewarded at the rate for the self-employed sector. Under this situation, total income for the Hispanic wage earner would increase by \$750, representing a 4.8 percent increase. There are several relatively large effects, but these effects offset each other resulting in a total change of less than five percent. The largest effect is due to differences between the two employment sectors in the return to male workers. For both Hispanic self-employed and Hispanic wage earners, males have higher incomes than females, however the gender difference is much larger in the self-employed sector. If the wage and salary sector realized the same gender difference in income as the self-employed sector, Hispanic wage earners would increase their income by 23.5 percent (\$3,643). Additionally, the higher return to the amount paid in taxes and insurance in the self-employed sector (a measure of command of resources) would increase income of Hispanic wage earners by 7.3 percent (\$1,134). More than half of this gain is off-set by the lower returns to hours worked per year and age in the self-employed sector, which would decrease income of Hispanic wage earners by 14 percent (\$2,176) and 6.4% (\$993) respectively. Overall, differences between the two employment sectors in worker characteristics have a larger impact on differences in income than differences in the rate at which the characteristics are rewarded.

Conclusions and Discussion

Self-employment can offer economic benefits to Hispanic workers. The mean income for the Hispanic self-employed in this sample was 25% higher than the mean income for Hispanic wage earners. Hispanic self-employed individuals worked more hours per year, paid a higher amount for taxes and insurance, were slightly older, and more likely to be married than Hispanic wage earners. Higher percentages of Hispanic self-employed persons were in managerial or professional; service; and craft, precision production, and repair occupations. The amount of time since immigration was higher for Hispanic self-employed compared to Hispanic wage earners.

The estimated income equations explained 26% of the variance in income of Hispanic self-employed and 42% of the variance in income of Hispanic wage earners.

Age, hours worked per year, being in a managerial or professional occupation, having a college degree, the amount paid in taxes and insurance, gender and marital status were positive and statistically significant for both Hispanic self-employed and Hispanic wage earners. Assimilation variables affected the income of Hispanic persons, however, the nature of these effects differed between Hispanics in the self-employed and in the wage and salary sector. Having a strong command of the English language, being a U.S. citizen, and a longer period of time transpired since immigrating to the U.S. were all positively associated with income for Hispanic wage earners, but not statistically significant for Hispanic self-employed. The results for Hispanic wage earners are consistent with previous research which shows economic benefits to integrating into the mainstream society. However, similar to Torres (1988) we find that integration into the mainstream society appears to yield no economic benefit for Hispanic self-employed persons.

Four of the predictors of income were statistically different between Hispanic self-employed and Hispanic wage earners. Being in a managerial or professional occupation and being male had much larger positive effects on the income of self-employed relative to wage earners. The positive impact of hours worked per year is larger for Hispanic wage earners relative to Hispanic self-employed. Assimilation variables reflecting control of resources were important in increasing income of both self-employed and wage earners, but the effect of the amount paid in taxes and insurance was larger for self-employed.

The results of the decomposition suggest that income differences between Hispanic self-employed and Hispanic wage earners are due more to differences in worker characteristics between the two employment sectors than to differences in the rate at which the characteristics are rewarded. If Hispanic wage earners had the characteristics of the Hispanic self-employed but these characteristics were rewarded at the rate for the wage and salary sector, their income would increase 16 percent. This difference is attributable to differences in the age distribution, the hours worked per year, and the amount paid in taxes and insurance between the two sectors. On the other hand, if Hispanic wage earners received the rate of return for the self-employed sector, their income would increase by only 4.8 percent.

The finding that the gender difference in income is much larger among Hispanic self-employed compared to Hispanic wage earners justifies additional research. The income of male Hispanic self-employed persons is \$10,820 higher than the income of female Hispanic self-employed persons, compared to a gender

difference in income of \$4,646 among Hispanic wage earners. This corresponds to a ratio of female to male income of 0.44 in the self-employed sector, compared to 0.70 in the wage and salary sector. While the gender difference in earnings is not a surprising finding in itself, it is interesting that the gender difference is much more pronounced in the self-employed sector. Further research should investigate the factors contributing to such a pronounced gender difference in income among Hispanic self-employed persons.

Devine (1994) in a study of the total civilian labor force found larger gender differences among self-employed workers relative to wage and salary workers in average age, years of schooling, usual weekly hours worked, and the proportion employed full-time, year round. Self-employed men were slightly older than self-employed women (44.3, 43.4), while men and women in the wage and salary sector were similar in age (36.5, 36.4). Self-employed men also had more years of schooling than self-employed women (13.6, 13.3), while men and women in the wage and salary sector had the same level of education (13.0). In both employment sectors the usual weekly hours worked was higher for men than women, and higher proportions of men were employed full-time, year round, but the gender differences were larger in the self-employed sector. Average hours worked by men and women were 44.6 and 35.3 in the self-employed sector, compared to 40.9 and 35.5 in the wage and salary sector. The proportions of men and women employed full-time, year round was 71.0 and 45.4 in the self-employed sector, compared to 69.1 and 52.7 in the wage and salary sector. In both sectors, women were less likely than men to be in executive, administrative, and managerial; and craft, precision production, and repair occupations (higher paying occupations), and more likely to be in service occupations (lower paying occupations), but there was more occupational segregation by gender in the self-employed sector than in the wage and salary sector.

These larger gender differences in human capital and occupational structure in the self-employed sector compared to the wage and salary sector in the total labor force are consistent with our findings of a larger gender difference in income among Hispanic self-employed relative to Hispanic wage earners. Separate analyses of the predictors of income for Hispanic self-employed women and men, and decomposition of the gender difference in income into the component due to differences in worker characteristics and the component due to differences in how these individual characteristics are valued in the labor market would provide important information for accurately interpreting the large gender effect on income among Hispanic self-employed

persons.

Several limitations of this research should be noted. First, our data only represent Hispanics from California, limiting our ability to generalize to the total Hispanic population. Second, Hispanics are not a homogenous population and combining the various subgroups which comprise the Hispanic population may lead to misleading findings for individual subgroups (i.e., Mexican Americans, Puerto Ricans, Cubans, etc.). Third, our data did not allow measurement of an individual's work ethic or access to capital which are likely to be important determinants of income for the self-employed.

There are policy implications from this research for small business, diversity education and human capital investment. With respect to small business, self-employment appears to be a viable economic alternative for Hispanics. Therefore, the Small Business Administration and Small Business Development Centers should continue to provide support targeted for Hispanic business persons.

The importance of assimilation into the mainstream culture for Hispanics appears to vary by employment sector. Hispanic self-employed workers do not benefit financially from assimilation, while Hispanic wage earners do benefit. Imposing the mainstream attitudes to become one culture will not necessarily improve the economic status of all Hispanics. Therefore, the continued support of Affirmative Action and diversity education is necessary.

Finally, education benefits both the Hispanic self-employed and the Hispanic wage earner. Therefore, programs which promote education for both the youth and the adult population should be continued and supported.

References

- Aronson, R. L. (1991). Self-employment a labor market perspective. Ithaca, NY: ILR Press.
- Becker, G. S. (1993). Human Capital. Chicago, IL: The University of Chicago Press.
- Blinder, A. S. (1973). Wage discrimination: reduced from and structural estimates. The Journal of Human Resources, 8, 436-455.
- Brock, W.A., Evans, D. S., and Phillips, B. D. (1986). The economics of small business: Their role and regulation in the U.S. economy. New York: Holms and Meier.

Butler, J.S. and Herring C. (1991). Ethnicity and entrepreneurship in America: toward an explanation of racial and ethnic group variations in self-employment. Sociological Perspectives, 34, 79-94.

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. Econometrica, 28(3), 591-605.

Devine, T. J. (1994). Characteristics of self-employed women in the United States. Monthly Labor Review, 117(3), 20-34.

Gujarati, D. N. (1970). Use of dummy variables in testing for equality of sets of coefficients in two linear regressions: A note. American Statistician, 24(1), 50-52.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. International Economic Review, 14, 693-709.

Pitts, J.M. (1990). Income and expenditures of Hispanic households. Family Economic Review, 3, 2-7.

Roos, P.A., & Hennessy, J. F. (1987). Assimilation or Exclusion? Japanese and Mexican American in California. Sociological Forum, 2, 278-304.

Segal, M.N., & Sosa, L. (1983). Marketing to the Hispanic community. California Management Review, 26, 120-134.

Smith, G. (1991). Statistical Reasoning. Boston: Allyn and Bacon.

Torres, D. L. (1988). Success and the Mexican American businessperson. Research in the Sociology of Organization, 6, 313-334.

U.S. Bureau of the Census. (1992). Statistical Abstract of the United States: 1992 (112th edition.) Washington, D.C.

Endnotes

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4. The classification of explanatory variables into human capital, assimilation, and demographic variables is judgmental. Variables placed into one category may well reflect effects related to another category. For example, following Torres (1988), we have included education as an assimilation variable to capture or proxy for control over means of production. Education is also a commonly used measure of human capital. We do not attempt to differentiate between these two effects in this research.
5. See endnote 4.
6. Statistical tests were conducted to determine which characteristics were significantly different between Hispanic self-employed and Hispanic wage earners. The test statistic for continuous variables is constructed as $(X_1 - X_2) / \sqrt{(s_1^2/n_1 + s_2^2/n_2)}$ where X_i , s_i^2 and n_i are the mean, estimated variance and number of observations in the i^{th} sample. This test statistic has a t-distribution. The test statistic for the categorical variables and the dummy variables is constructed as $\sum (O_i - E_i)^2 / E_i$ where O_i and E_i refer to the observed frequency and expected frequency, respectively, for a given cell. This test statistic has a chi-square distribution. The chi-square test for dummy variables is statistically equivalent to use of the test statistic $(P_1 - P_2) / \sqrt{((P_1(1-P_1))/n_1) + ((P_2(1-P_2))/n_2)}$ where P_i and n_i are the sample proportion and number of observations in the i^{th} sample (Smith, 1991, pp. 471-475). This test statistic has a Z-distribution.
7. The chi-square test for the set of occupation variables was significant. Pairwise tests for each occupation variable were statistically significant for all categories except farming, forestry, and fishing. Test statistics are available from the authors.
8. The chi-square test for the set of immigration variables was significant. Pairwise tests for each time period were statistically significant for all categories except for immigration between 1970 and 1979, and U.S. born. Test statistics are available from the authors.
9. A table summarizing these results is available from the authors.
10. Coefficients on the variables measuring command of the English language are interpreted relative to speaking only English (the omitted category). All coefficients are negative and differ in magnitude in a consistent way. Thus the negative effects on income of Hispanic wage earners of not speaking English or speaking English, but not well, are much larger than the negative effect of speaking English well or very well. Similarly, more recent immigration (between 1980 and 1990) has a larger negative impact on income of Hispanic wage earners than earlier immigration (between 1960 and 1969).

Reasons for Retirement: Estimation and Implications

Comparing four different criteria to define when retirement takes place, this research examines five reasons for retirement: personal choice, mandatory retirement, poor health, loss of opportunity, and dissatisfaction with job. Multinomial logit results indicate that both the size and significance of independent variables are sensitive to the criteria used to define when retirement takes place. The only clear policy implications are related to retiring for reasons related to poor health. These individuals appear to be the least likely to be able to maintain adequate incomes in retirement.

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Without a doubt, a better understanding of the behavior of older persons as they move out of the labor market is needed if we are to address continued well-being of individuals as they age. But why take one more look at retirement decisions when there is already a vast literature on the topic? There are several motivating factors. First, with the exception of "voluntary" versus "involuntary" reasons, there has been little research conducted on disaggregated categories of reasons for retirement. Second, much of the research has been descriptive in nature, and thus has not fully examined how antecedents to retirement affect the reason why people retire. Third, of the studies that used longitudinal data (most did not), the most comprehensive used a data stream that ended in 1981. Finally, there is no agreed upon definition of retirement in the literature. These methodological differences have made studies of the retirement decision difficult to compare. Yet, information about why people retire is extremely important for making inferences about the well-being of aging individuals by illuminating their future labor market and income maintenance possibilities.

Review of Literature

Retirement Definitions

A precursor to understanding why people retire is the knowledge of the point in time retirement takes place. What criteria have been used to define that point in time? No consistent definition has been used. Criteria defining full retirement have included self-reports (Kosterlitz, 1986; Chirikos et al., 1989; Gustman et al., 1986; Parnes et al., 1985; Palmore et al., 1985), complete labor force withdrawal (no work hours reported) (Hanoch et al., 1983; Hayward et al., 1985; Honig et al., 1985; Quinn, 1981), receipt of a pension or

social security income (Boaz, 1987; Palmore et al., 1985; Parnes et al., 1985; Sjogren, 1986), working less than a given number of hours, usually between 1,000 and 1,800 during the year before retirement (Holden, 1988; Palmore et al., 1985; Parnes et al., 1985), and combinations of the above (Haug et al., 1992; Parnes et al., 1985; Palmore et al., 1985; Palmore et al., 1984).

Differences in definitions make comparing results of retirement decision studies difficult. Add to this differences in data sets used and a quagmire is quickly entered that leaves one wondering whether we have a handle on the retirement question at all. Nevertheless, several factors have been found to be associated with reasons for retirement.

Why do People Retire?

Much of the literature has attributed the retirement decision to issues surrounding earnings and wealth, mandatory retirement policies, Social Security, private pensions, and health status (see Ransom et al. 1989; Ruhm 1989). Other research has identified changes in earnings, job displacement (unemployment), and policies relating to age discrimination and mandatory retirement as contributing to the retirement decision (Shapiro et al., 1987; Andriasani et al., 1987; Clark, 1987; Johnson et al., 1987; Hanks, 1990).

Some researchers have examined the relationship between health and other variables on the retirement decision. However, the measurement of health status is difficult. Anderson and Burkhauser (1985) found that using self-reported measures of health bias (downward) the effect of wages on retirement. Using the RHS Sickles and Taubman (1986) found positive effects of poor health on retirement and positive effects of Social Security and pension payments on poor health. Sammartino (1987) found that poor health

increases the probability of retirement and that older workers with health limitations do not respond to increases in Social Security payments by retiring later.

The most comprehensive study (Palmore et al., 1982; Palmore et al., 1985) compared findings using seven different data sets, including the National Longitudinal Study of Labor Market Experience (NLS) and found that socio-economic variables including education, occupation, and poverty status are important determinants of retirement. Job characteristics were also important, and include job tenure, pension benefits, and retirement policy. This is one of the few studies that compared self reports of retirement with objective definitions.

Ozawa and Law (1992) used the 1982 New Beneficiary Study to examine reason for retirement. Although they had information on several different reasons for retirement, chose to estimate the probability of retirement based on voluntary versus involuntary reasons. They found that non-white, less educated, and lower income individuals had a higher probability of reporting being retired due to involuntary retirement. Those with pensions and having asset income had lower probabilities. Interestingly, this study included gender as a dummy variable and found that being a women decreased the probability of retiring for involuntary reasons. However, given women's different experience with the labor market, it is most likely that simply treating gender as an intercept shifter is not sufficient for analysis.

None of the studies reviewed above disaggregated reason for retirement farther than retire/not retire or voluntary/involuntary retirement. The few studies that have categorized retirement reason can be classified as either being descriptive or predictive. Three are descriptive studies. Sherman (1985) compiled data from the 1982 New Beneficiary Survey and found that the majority (40%) of individuals report retiring because they wanted to. Twenty-seven percent reported health problems, 10% lost their job, 7% were subject to mandatory retirement, 5% retired because of pension eligibility, and 3% retired for family reasons. Parnes et al. (1985) used the NLS to examine reasons for retirement by race. Fifty-eight percent of white males retiring between 1976 and 1981 reported retiring voluntarily, 31% for health reasons, 7% because of being discouraged from the work force, and 4% faced mandatory retirement. The figures for black males are 42%, 48% 7% and 3%, respectively. Quinn (1981) compiled a trend in reasons for retirement and found that in 1980 almost 50% of men reported retiring because they wanted to, 20% for health reasons, 20% because they lost their job, and about 10% for other reasons.

Compared to those that retired in 1940, the percentage retiring because they lost their job or retired for health reasons fell by more than one half, while wanting to retire as a reason increased five fold.

Two studies are predictive. Palmore et al. (1985) used canonical correlation analysis to analyze retiring for health and compulsory reasons as compared to personal choice using both the NLS (1966-76) and the Duke Longitudinal Study (1969-76). The strongest predictor of retiring for health reasons is having a work limiting health condition. Low socioeconomic status and being younger are also predictors. Older age, liking one's job, and not being self-employed are predictors of compulsory retirement. The researchers conclude that those who like their jobs work until they are required to leave. Results were consistent across both data sets.

Henretta et al. (1992) estimated how various retirement antecedents impact on reason for retirement (lost job, voluntary, health, compulsory). Using the 1982 New Beneficiary Study, a proportional hazard model, and a definition of retirement of "non-continuous work for more than 100 days," they found that voluntary retirees are affected by family situations including having a spouse or school age children at home. In addition, they found that those that retire because they have lost their job have shorter work force tenures and lower incomes. Health status was found to impact all reasons for retirement.

Based on previous literature, we clearly do not have a handle on how antecedents to retirement impact on the reasons why people retire. This study attempts to fill that void by constructing profiles of individuals before they retire, using four different definitions of retirement, and estimating the probability of retiring for health reasons, mandatory retirement policies, lost job opportunities, and job dissatisfaction compared to wanting to retire.

Methodology

Data

Because men and women have traditionally followed very different labor market patterns, this study used only data from the Older Men cohort of the National Longitudinal Survey of Labor Market Experience (NLS). This is a panel data set collected from 1966 through 1990 by the Bureau of Labor Statistics, U.S. Department of Labor. Data forming part of the older men cohort include an original sample of 5,020 men who were 45-59 years in 1966. The original samples were drawn by the Bureau of the Census and were representative of the civilian population residing in the 50 states. The surveys monitor the pre- and post-retirement years with measures of type of employment of

the respondent, work circumstances, income, educational attainment, and family structure and change.

Defining Retirement

By tracking an individual from 1966 through 1990, a detailed description of the when the retirement transition takes place can be made. Establishing criteria to describe this point in time has been difficult for researchers. This study estimates the probability of retiring for a number of different reasons and compares the sensitivity of these estimates across 4 retirement criteria groups. These include: 1. Self reported retirement; 2. Worked fewer than 1,000 hours/year; 3. Receipt of Social Security or pension; and 4. Receipt of Social Security or pension and worked fewer than 1,000 hours per year.

The way retirement is defined depends on the purpose of the results. Retirement can be considered an event, a status (Parnes et al., 1985), or a process (Kolodinsky and Avery, 1995). For this research, all persons defined as retired, regardless of the criteria used, have gone through a process and reached a status of being retired according to the data. In other words, we tracked individuals until they met the criteria being used. For example, a person could work fewer than 1,000 hours in a given year and then become employed full time again, and then work fewer than 1,000 hours in another year. This individual would not be considered retired under definition 2 until the work hours were below 1,000 continuously through the last year of data available in 1990. Defining retirement as "last retirement" and tracking individuals' process of retirement allows us to use the results to examine policy issues relating to economic well-being during the retirement years. With the exception of self reports, objective definitions include most labor market experience that previous research has classified as "post-retirement."

Dependent Variable

The dependent variable is reason for retirement. This study includes five different reasons for retirement: individual choice, mandatory retirement, health reasons, job discouragement, and pressure of job/job dissatisfaction/other.

Independent Variables

Variables chosen for the analysis are those found by previous research to be important predictors of the retirement decision. They include several economic variables, including salary of the respondent (SALR), social security income (SOCSEC), non-wage income, including transfer payments (NWINC), age (AGE),

years of education (EDUC), whether poor health limits working ability (HLIM), whether an individual's spouse, if present, has poor health that limits working ability (HLIMSP), job satisfaction (JOBSAT), race (RACE), union participation (UNION), the unemployment rate in the region (UNEMP), self employment status (SELFEM), and plans to work after retiring (RETPLAN). It is important to note that variables representing salary of respondent (SALR) and job satisfaction (JOBSAT) are measured the *survey year before the individual is classified as being retired*. All monetary variables are reported using 1989 dollars, the most recent year of data available to define the retirement process. One dummy variable representing birth/retirement cohorts is included. Other studies using the NLS data have not included cohort effects. (COHORT) was chosen out of five cohort variables originally formed.³ Descriptive statistics are provided in Table 1. Note that because the groups are not mutually

Table 1. Mean and Standard Deviation of Variables

Variable	SELF RPT	<1000 HOURS	PENSION/S	PEN/SS &<1000
RACE	0.26 (0.44)	0.31 (0.46)	0.30 (0.46)	0.29 (0.45)
AGE	62.27 (4.10)	61.06 (3.99)	60.65 (3.30)	62.93 (3.76)
EDUC	9.43 (3.76)	9.08 (3.98)	9.40 (3.92)	9.74 (3.86)
UNION	0.36 (0.48)	0.30 (0.46)	0.34 (0.47)	0.42 (0.49)
PENSION	0.44 (0.50)	0.30 (0.46)	0.51 (0.50)	0.45 (0.50)
SALARY	23440.00 (18960.0)	0.19E+05 (0.18E+05)	23840.00 (19580.00)	24060.00 (19270.0)
SOCSEC	2414.00 (4195.00)	2820.00 (4393.00)	2309.00 (4015.00)	4420.00 (5005.00)
NWY	11050.00 (15180.0)	0.13E+05 (0.18E+05)	11040.00 (17300.00)	13070.00 (15200.0)
HLIM	0.42 (0.49)	0.47 (0.50)	0.40 (0.49)	0.45 (0.50)
HLIMSP	0.25 (0.43)	0.29 (0.45)	0.25 (0.43)	0.27 (0.45)
DEP	0.25 (0.43)	0.27 (0.45)	0.30 (0.46)	0.24 (0.43)
SELFEM	0.10 (0.30)	0.17 (0.37)	0.12 (0.33)	0.06 (0.23)
RETPLA	0.08 (0.26)	0.60E-01 (0.24)	0.09 (0.29)	0.07 (0.25)
JOBSAT	0.78 (0.42)	0.67 (0.47)	0.76 (0.43)	0.65 (0.48)
UNEMPL	7.11 (2.91)	6.68 (3.03)	6.85 (2.80)	7.70 (3.10)
COHORT	0.38 (0.49)	0.27 (0.45)	0.29 (0.45)	0.33 (0.47)
N	1105	930	1141	512

Results

exclusive, that is, an individual who is reported as being retired by one definition may or may not be reported as retired using another definition, the usual bivariate tests of significance can not be used to identify significant differences in descriptive variables across retirement timing criteria.

Empirical Specification

Given there are five categories ($y=0,1,2,\dots,5$) of reason for retirement, a multinomial logit model is used to estimate the parameters. Let P_0, P_1, \dots, P_5 be the probabilities associated with these categories. The object is to express the probabilities in binary form. To estimate the model, consider that an individual falls into one of 5 categories ($y=0,1,\dots,5$) with the probabilities given above. These probabilities can be expressed in linear form as where X is a vector of independent variables.

$$\log \frac{P_1}{P_0} = \alpha_{10} + \alpha_{11}X \quad (1.a)$$

$$\log \frac{P_2}{P_0} = \alpha_{20} + \alpha_{21}X \quad (1.b)$$

$$\log \frac{P_3}{P_0} = \alpha_{30} + \alpha_{31}X \quad (1.c)$$

$$\log \frac{P_4}{P_0} = \alpha_{40} + \alpha_{41}X \quad (1.d)$$

Statements for $\log(P_3/P_2)$, etc., can be derived from the above equations; for example,

$$\alpha_{32} = \alpha_{31} - \alpha_{21} \quad (2)$$

Equations 1a through 1d are represented empirically by:

$$\begin{aligned} \text{RETIREMENT REASON CATEGORY} = & \alpha_0 + \alpha_1 \text{AGE} + \\ & \alpha_2 \text{RACE} + \alpha_3 \text{EDUC} + \alpha_4 \text{UNION} + \alpha_5 \text{PENSION} + \\ & \alpha_6 \text{SALARY} + \alpha_7 \text{SOCSEC} + \alpha_8 \text{NWY} + \alpha_9 \text{HLIM} + \alpha_{10} \text{HLIMS} \\ & + \alpha_{11} \text{DEP} + \alpha_{12} \text{SELFEM} + \alpha_{13} \text{RETPLAN} + \alpha_{14} \text{JOBSAT} + \\ & \alpha_{15} \text{UNEMP} + \alpha_{16} \text{COHORT} + \text{ERROR} \end{aligned}$$

where the five retirement reason categories include individual choice, mandatory retirement, health reasons, job discouragement, and job dissatisfaction/other. This model is estimated using each of the four different criteria used to define when retirement takes place and a maximum likelihood, multinomial logit procedure available in the statistical software package LIMDEP (Greene, 1985). No hypotheses are formulated as to the expected direction of effect of the independent variables on retirement reason, as previous research has shown that different retirement criteria lead to different empirical results.

A first look at the data reveal that the percentage of persons reporting retiring for various reasons is sensitive to the criteria used to define retirement. Table 2 identifies the percentages and compares our findings to those of other researchers. Clearly, the way one defines *when* retirement takes place has implications for how people respond to questions asking *why* they retire. And, not only do the percentages differ from other research, other researchers' findings differ from each other (Parnes et al., 1985; Quinn, 1991; Sherman, 1985). A few of the figures can be explained. First, the relatively low percentage of persons reporting retiring for health reasons in the <1,000 Hrs + Pension/Social Security column is explained by the fact that many persons who retired due to health limitations are missed in this category if they retired before being eligible for social security or pension benefits. Second, the relatively low percentage of persons reporting retiring for mandatory reasons by Parnes et al. (1985) were not based on actual reasons given by individuals, but were imputed based on information available. Third, the relatively low percentage of persons reporting retiring for mandatory reasons in the Sherman (1985) study retired June 1980-May 1981, years after mandatory retirement policy was outlawed at the national level.

Tables 3 through 6 present results from the multi-nomial logit estimation. The log-odds of retiring for a given reason compared to retiring voluntarily are given in each column under the reason for retirement. The ME columns indicates the marginal effect of each of the significant independent variables on that reason for retirement. For example. For those who self reported retirement and retired for compulsory reasons, men who belonged to a union were 1.41 times more likely to report being compared to retiring for voluntary reasons.

A few generalizations can be made from the results. First, regardless of the criteria used to define when retirement takes place, results indicate that younger individuals of a lower socio-economic status are more likely to retire due to poor health than to retire voluntarily. Second, for those reporting mandatory retirement, once the cohort variable is held constant (the oldest individuals who retired earliest) there are no variables that significantly affect this reason for retirement for each of the objective criteria. However, for self reporters of retirement belonging to a union, being eligible to receive a pension and planning to work after retirement increase the likelihood of reporting mandatory retirement compared to voluntarily leaving the labor force, while self employed individuals have

Table 2. Percent of Respondents Reporting Various Reasons for Retirement.

	SELF REPORT	< 1000 HRS	PENS/SS	<1,000 + PENS/SS	Sherman (1981 data- NBS)	Parnes et al. (1966- 1981 data-NLS) ^a	Quinn (1980 data)
Voluntary	44.0	45.8	47.3	50.5	40.0	58.0	45.0
Health	31.5	29.2	33.2	24.2	27.0	31.0	20.0
Mandatory	11.4	12.2	9.4	13.0	7.0	4.0	
Discouraged	13.4	12.7	10.0	12.3	10.0	7.0	22.0
Dissatisfied/ Other	3.5	5.4	6.5	4.2	16.0		13.0
N	1105	930	1141	512	496,000	860	7 ^b

^aReasons are imputed from data.

^bCompiled from various sources.

a lower likelihood of reporting mandatory retirement. Third, reason for retirement is affected by the health variable for many of the criteria defining retirement and for reason for retirement. This is in contrast to the findings of Palmore et al. (1982) who found that overall, retirement is not affected by health status. Finally, overall, note that both the size and significance of variables are sensitive to the criteria used to define retirement.

The above results invite an intriguing policy discussion. If one is interested in issues of income maintenance after retirement, it does not matter which criteria is used to define when retirement takes place when health is given as a reason. As these individuals are more likely to report health problems, tend to retire earlier and are of lower socio economic status, it appears that their ability to support themselves by labor force participation after retirement is limited. And, the self

report criteria also indicates that these individuals are less likely to have a pension to rely on. To the extent that these individuals are younger, they may not be able to tap into the social security system when they retire. There are real questions of economic well-being for this group of retirees. Compared to other research, Ozawa and Law (1992) and Palmore et al. (1985) found similar results for those persons not retiring voluntarily. The most restrictive criteria of when retirement takes place also gives an indication that these individuals were dissatisfied with their jobs and thus may be more likely to be in non-professional occupations. This is supported by Henretta et al. (1992) who specifically included white collar occupation in their analysis.

With the exception of retiring due to poor health, there are few policy recommendations that can be made for those that retire involuntarily for other reasons. One other study analyzed retiring due to job discouragement (Henretta et al., 1992). Our results differ from this study. In addition, there is no

Table 3. Estimates of Reasons for Retirement: Self Report

VARIABLE	Mandatory	ME	Health	ME	No Opportunity	ME	Dissatisfied	ME
Intercept	-3.52*	.03	8.9***	2.18	-1.6		-3.4	
RACE	-.189		.18		-.58*	.56	-.07	
AGE	-.037		-.13***	.88	-.01		.03	
EDUC	-.036		-.07***	.93	.02		.02	
UNION	.346*	1.41	-.11		-.27		.59**	1.80
PENSION	.392*	1.48	-.66***	.60	-.51**	.60	-.54*	.58
SALARY	.501E-05		-.15E-04***	.99	.91E-05		-.22E-04**	.99
SOCSEC	-.998E-05		.22E-05		-.13E-04		-.12E-03***	.99
NWINC	-.261E-05		-.38E-05		-.20E-05		-.13E-04	
HLIM	.095		.82***	.44	.04		.32	
HLIMSP	-.002		.32*		.23		.002	
DEP	.051		-.06		.48**	1.62	.04	
SELFEMP	-2.28**	.10	-.07		.73**	2.07	-.61	
RETPLAN	.969***	2.63	.11		.13		.50	
JOBSAT	-.396		-.39**	.68	.09		-.51*	.60
UNEMP	-.001		.02		.06		.07*	1.07
COHORT	1.14***	3.12	.21		.38		.82*	2.27
Log Likelihood	-1319.8		-1391.5		-1391.5		-1391.5	
N=1105	127		349		149		39	

consistency in results across retirement criteria for retirement reasons other than health. This leads one to question Ozawa and Law's (1992) conclusions about involuntary retirement as a classification without further breakdown. Thus, our results are most useful to suggest strategies for improving future research in this area.

The bottom line is that we need to first agree on a policy that sets up the standards as to when a person is officially retired. Until that decision is made, we will continue struggle with comparison of research findings and their meanings. Chirikos and Nestel (1992) have

suggested researchers use a most restrictive definitions of retirement (< 1,000 hours + receipt of social security and/or pension). Kolodinsky and Avery (1995) suggest that objective criteria be used to define the point in time when an individual is retired, and choose either an hours criteria or a receipt of pension or social security criteria. This study has shown that although results are sensitive to all criteria used, the objective definitions of retirement lead to the most comparable results. Thus, we suggest that objective criteria be used in future studies of the retirement decision.

Table 4. Estimates of Reasons for Retirement: < 1,000 Hours

VARIABLE	Compulsory	ME	Health	ME	No Opportunity	ME	Dissatisfied	ME
Intercept	-3.44		8.6		-2.1		.52	
RACE	.21		-.03		-.18		.46	
AGE	-.037		-.13***	.88	.01		-.05	
EDUC	.013		-.08***	.92	.07**	1.07	-.07	
UNION	.122		-.28		-.08		.28	
PENSION	.188		-.28		-.22		-1.0***	.36
SALARY	-.40E-05		-.25E-04***	.99	-.79E-05		-.13E-04	
SOCSEC	-.20E-04		-.22E-04		-.22E-04		-.69E-04*	.99
NWINC	-.45E-05		-.93E-05**	.99	-.17E-04***	.99	-.51E-05	
HLIM	-.28		1.3***	3.65	-.01		-.17	
HLIMSP	-.47*	.63	.1		-.07		-.2	
DEP	-.04		-.14		.45*	1.56	.21	
SELFEMP	-1.23**	.29	-.34		.55*	1.73	-.55	
RETPLAN	.45		.17		.33		.59	
JOBSAT	.11		-.16		-.09		.41	
UNEMP	-.02		.01		.007		.17***	1.18
COHORT	.73**	2.07	-.09		.59*	1.80	.90*	2.45
Log Likelihood	-1176.1		-1176.1		-1176.1		-1176.1	
N=930	114		272		119		51	

Table 5. Estimates of Reasons for Retirement: Pension/Social Security Recipient

VARIABLE	Mandatory	ME	Health	ME	No Opportunity	ME	Dissatisfied	ME
Intercept	-11.69***	.00	6.1***	4.45	-1.4		5.8*	330
RACE	.001		-.004		-.69***	.50	-.23	
AGE	.155***	1.16	-.08***	.92	-.77E-03		-.11**	.89
EDUC	.72E-04		-.08***	.92	.04		-.13**	.88
UNION	.038		-.005		.18		.37	
PENSION	.244		-.17		-.13		-.46	
SALARY	.38E-05		-.32E-04***	.99	.17E-05		-.40E-04***	.99
SOCSEC	-.35E-05		-.29E-05		-.79E-05		.38E-05	
NWINC	.25E-05		-.45E-05		.42E-06		-.11E-04	
HLIM	-.169		1.2***	3.3	.02		-.38	
HLIMSP	-.014		-.07		.26		-.52	
DEP	.235		.34*		.28		.56	
SELFEMP	-1.67**	.18	-.1		.82***	2.27	-.50	
RETPLAN	.459		.56*	1.75	.12		-.81	
JOBSAT	-.50*	.60	-.53***	.59	-.59		-.46	
UNEMP	.11		.06**		.04		.15***	1.16
COHORT	.273		.24		-.59		.59	
Log Likelihood	-1391.5		-1319.8		-1319.8		-1319.8	
N=1141	108		379		115		75	

Table 6. Estimates of Reasons for Retirement: Pension/ Social Security and < 1,000 Hours

VARIABLE	Mandatory	ME	Health	ME	No Opportunity	ME	Dissatisfied	ME
Intercept	-5.15*	.005	11.0***		-2.4		-.13	
RACE	.467		.14		.11		.68	
AGE	.051		-.17***	.84	.91E-03		-.06	
EDUC	.018		-.11***	.89	.09**	1.09	-.05	
UNION	-.106		-.11		.26		.38	
PENSION	.452		-.30		-.63**	.53	-.67	
SALARY	.108E-04		-.28E-04***	.99	-.12E-04		-.14E-04	
SOCSEC	-.464E-05		-.27E-04		-.14E-04		-.11E-04	
NWINC	-.143E-04		-.14E-04*	.99	-.46E-05		-.13E-04	
HLIM	-.141		1.6***	4.95	-.14		.20	
HLIMSP	-.303		.38		.04		.01	
DEP	-.124		-.29		.37		1.2***	3.3
SELFEMP	-8.81		-.44		.44		.70	
RETPLAN	-.085		-.25		1.0*	2.72	1.34	
JOBSAT	-.084		-.06		.09		.16	
UNEMP	.013		.02		.04		.19***	1.2
COHORT	.92**	2.50	-.43		.38		1.5	
Log Likelihood	-696.1		-696.11		-696.11		-696.11	
N= 512	67		124		63		22	

References

- Anderson, K. H., & Burkhauser, R. V. (1985). The retirement-health nexus: a new measure of an old puzzle. *The Journal of Human Resources*, 20(3), 315-330.
- Andriasani, P., & Daymont, T. (1987). Age Changes in Productivity and Earnings among Managers and Professionals. In S. Sandell (Ed.), *The Problem Isn't Age: Work and Older Americans*. (pp. 52-70). New York: Praeger.
- Boaz, R. F. (1987). Work as a Response to Low and Decreasing Real Income During Retirement. *Research on Aging*, 9(3), 428-440.
- Chirikos, T. N., & Nestel, G. (1989). Occupation, Impaired Health, and the Functional Capacity of Men to Continue Working. *Research on Aging*, 11(2), 174-205.
- Clark, R. (1987). Aging and Relative Earnings. In S. Sandell (Ed.), *The Problem Isn't Age: Work and Older Americans*. (pp. 71-83). New York: Praeger.
- Greene, W. (1985). *LIMDEP: Users Manual*. New York: William Greene.
- Gustman, A. L., & Steinmeier, T. L. (1986). A Disaggregated, Structural Analysis of Retirement by Race, Difficulty of Work and Health. *The Review of Economics and Statistics*, 68(3), 509-513.
- Hanks, R. S. (1990). The Impact of Early Retirement Incentives on Retirees and Their Families. *Journal of Family Issues*, 11(4), 424-437.
- Hanoch, G., & Honig, M. (1983). Retirement, Wages, and Labor Supply of the Elderly. *Journal of Labor Economics*, 1(2), 131-151.
- Haug, M. R. P., Belgrave, L. L. P., & Jones, S. P. (1992). Partners' Health and Retirement Adaptation of Women and Their Husbands. *Journal of Women & Aging*, 4(3), 5-29.
- Hayward, M. D., & Hardy, M. A. (1985). Early Retirement Processes Among Older Men. *Research on Aging*, 7(4), 491-515.
- Henretta, J., Chan, C., & O'Rand, A. (1992). Retirement Reason Versus Retirement Process: Examining the Reasons for Retirement Typology. *Journal of Gerontology: SOCIAL SCIENCES*, 47(1), s1-7.
- Holden, K. C. (1988). Physically Demanding Occupations, Health, and Work After Retirement: Findings from the New Beneficiary Survey. *Social Security Bulletin*, 51(11), 3-15.
- Honig, M., & Hanoch, G. (1985). Partial Retirement as a Separate Mode of Retirement Behavior. *Journal of Human Resources*, 20, 21-46.
- Johnson, T., Dickinson, K., & West, R. (1987). Older Workers, Job Displacement, and the Employment Service. In S. Sandell (Ed.), *The Problem Isn't Age: Work and Older Americans*. (pp. 100-120). NY: Praeger.

- Kolodinsky, J. & Avery, R. (1995). Retirement Timing Decisions of American Men. In K. Folk, (Ed.), Consumer Interests 41st Annual Conference, (pp. 34-41).
- Kosterlitz, J. (1986). Getting Out Early. National Journal, 2374.
- Ozawa, M. N. P., & Law, S. W. (1992). Reported Reasons for Retirement: A Study of Recently Retired Workers. Journal of Aging & Social Policy, 4(3/4), 35-51.
- Palmore, E. B., George, L. K., & Fillenbaum, G. G. (1982). Predictors of retirement. Journal of Gerontology, 37(6), 733-742.
- Palmore, E. B., Fillenbaum, G. G., & George, L. K. (1984). Consequences of retirement. Journal of Gerontology, 39(1), 109-116.
- Palmore, E. B., Burchett, B. M., Fillenbaum, G. G., George, L. K., & Wallman, L. M. (1985). Retirement Causes and Consequences. New York: Springer Publishing Co.
- Parnes, H., Crowley, J., Haurin, R., Less, L., Morgan, W., Mott, F., & Nestel, G. (1985). Retirement Among American Men. Lexington, MA: Lexington Books.
- Quinn, J. F. (1981). The Extent and Correlates of Partial Retirement. Gerontologist, 21, 634-643.
- Quinn, J. F. (1991). The Nature of Retirement: Survey and Econometric Evidence. In A. H. Munnell (Ed.), Retirement and Public Policy. (pp. 115-137). Dubuque, Iowa: Kendall/Hunt Publishing Company.
- Sammartino, F. J. (1987). The Effect of Health on Retirement. Social Security Bulletin, 50(2), 31-47.
- Shapiro, D., & Sandell, S. (1987). The Reduced Pay of Older Job Losers: Age Discrimination & Other Explanations. In S. Sandell (Ed.), The Problem Isn't Age: Work and Older Americans. (pp. 37-51). New York: Praeger.
- Sherman, S. R. (1985). Reported Reasons Retired Workers Left Their Last Job: Findings From the New Beneficiary Survey. Social Security Bulletin, 48(3), 22-30.
- Sickles, R. C., & Taubman, P. (1986). An Analysis of the Health and Retirement Status of the Elderly. Econometrica, 54(6), 1339-1356.
- Sjogren, J. (1986). Retirement Age Women and Men: Income Sources and Work. Eastern Economic Journal, XIII(3), 283-290.

Endnotes

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3. See Kolodinsky and Avery (1995) for a complete review of how the cohort variables were formulated.

Estimates of Income and Wealth Inequality Among Elderly Households

Based on the Gini coefficient and the Lorenz curve approach, this paper analyzes both income and wealth distribution of elderly households using the 1989 Survey of Consumer Finance data. The results suggest that wealth is distributed more unequally among elderly households than is household income. Those elderly households who have almost no wealth to access beyond government welfare support may be vulnerable to any financial uncertainty in life. It is important for public policy makers to recognize this fact and to better target the social welfare programs to the most needy people.

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Introduction

A sharp change in social and demographic structures in the United States in the 1990s is the increasing population of the elderly. People 65 or over comprised 8.6% of the total population by 1960 (U.S. Bureau of the Census, 1989a). This percentage had increased to 12.6% in 1991 (U.S. Bureau of the Census, 1992) and it will jump to 23% by the year 2080 (U.S. Bureau of Census, 1989b). Meanwhile, the expectations by many Americans for future financial deprivations after retirement continued to rise (Crystal and Shea, 1990). Almost 30 percent of the individuals age 45 to 54 in a 1988 Transamerica survey believed that their income sources would not be able to meet their retirement consumption needs (Transamerica, 1988).

Where do the elderly stand economically? Many different economic indicators have been used to analyze economic well-being. Money income is the most frequently used measure of household economic status. However, two households at the same income level but different wealth holdings could access different consumption bundles (Burkhauser et al., 1985). Since a large proportion of the elderly's resources is in the form of assets, including home equity, Crystal (1990) suggested that measuring economic status of the elderly by annual income alone may be misleading. Ownership of a house represents a certain amount of liquid assets, as well as, a current economic resource by means of households avoid the need for income to pay rent or make mortgage payments. However, few studies of economic status of the elderly have incorporated asset measures.

Crystal (1990) stated that, for households aged 65 and over, wealth is more unequally distributed than for younger ones, whereas income is distributed more equally. The primary reason is that the government-

sponsored Social Security and other pension plans are viewed as beneficial to the elderly. Slesnick (1994) mentioned that as the income inequality fell, the rise in earnings inequality was offset by the increase in government transfers to the poor. Consequently, the economic well-being as well as the relevant social policy and welfare systems used to finance social security and other pension plans is a matter of intensive public concern.

According to the U.S. Department of Health and Human Services (1994), asset income becomes an important part of retirement income in addition to Social Security and labor income. Thus, income and wealth together are the important economic indicators in formulating public policies for the aged population. If the asset income plus settled estates of the elderly can contribute a fair amount of support for their own living, the cost of supporting the elderly may not be a big fiscal burden, given the fact that there is an increased proportion of elderly population to working age cohorts in our society. Therefore, the objectives of this study are to test income and wealth distributions among the elderly and to further analyze their economic status.

Review of Literature

A widely used method for conducting research on inequality relies upon the Gini coefficient. For example, Danziger (1980) studied the effect of the wives' labor force participation on the family income distribution in 1975 based on the Gini coefficient method. The Current Population Survey data revealed that for white families, the Gini coefficient was increased 5% by the wives' earnings. However, for nonwhite families, the Gini coefficient was not affected by the wives' earnings. Thus, the wives' earnings increased family income inequality slightly for whites and had no

effect on the family income inequality of blacks during the entire 1959 to 1974 period.

Based on the Gini coefficient approach, Wolef (1987) estimated household wealth inequality in the U.S. from 1962 to 1983. Using the data from the 1962 Survey of Financial Characteristics of Consumers and the 1983 Survey of Consumer Finances, Wolef demonstrated that wealth inequality remained relatively constant between 1962 and 1973, declined rather substantially between 1973 and 1979, but increased quite dramatically between 1979 and 1983. Moreover, fungible wealth was distributed uniformly more unequally than total household wealth, and the inequality of financial wealth was higher than that of fungible wealth each year from 1973 to 1983. The dispersion of mean total household wealth across age groups appeared the highest in 1983.

A more recent study by Weicher (1994) tested changes in the distribution of wealth by using the 1983 and 1989 SCF data. The findings indicated that both the income and wealth were more unequally distributed in 1989 than in 1983. Moreover, the Gini coefficient for income rose more than that for wealth. The author further concluded that the increase in income inequality caused the increase in wealth inequality, or vice versa. The results also revealed that when automobiles, home equity and the present value of future pensions are excluded from wealth, the Gini coefficient showed a higher value than when these assets are included.

Wolef's 1994 study again tested for trends in household wealth in the United States, focusing on the two subperiods of 1962 to 1963 and 1983 to 1989. Based upon the 1983 and 1989 SCF data, the results showed a sharp increase in the inequality of household wealth between 1983 and 1989. Whereas the average wealth (in 1989 dollars) of all households increased by 23 percent from 1983 to 1989, that of the top one percent ("super-rich" group) grew by 47 percent. The Gini coefficient for the super-rich group showed a high increase, from 0.80 to 0.84. Meanwhile, the bottom four quintiles all lost in relative terms, as their share of total wealth declined from 19 to 15 percent. In comparison, there was no significant difference in wealth inequality between 1983 and 1962.

Crystal and Shea's study (1990) examined income and wealth inequality among the elderly based on the Gini coefficient method. This study used the data from the 1983-84 Census Bureau's Survey of Income and Program Participation. By adding the annual household income with an annuity adjusted from home equity, interest bearing assets, and corporate equities, Crystal and Shea indicated that the mean adjusted income was significantly higher for the elderly than for

other population groups. However, the adjusted income was distributed more unequally among the elderly than the rest of the population even after considering the large increases in benefit programs.

Hurd and Shoven (1985) examined the effects of government welfare programs on income and wealth distributions of elderly households and their inflation vulnerability. Applying the 1969 Longitudinal Retirement History Survey data, they found that the income of the aged kept up during the period of growing inflation, and their nonhuman wealth even increased slightly in real terms. Government programs, such as indexing Social Security, should take the credit for much of the inflation protection. This was especially true for the poor elderly.

In summary, income and wealth are important economic resources, and the distributions of these resources are affected by the relevant social welfare programs. The previous studies have shown that the average wealth of all households has increased from the 1970s to the 1980s, and, consequently, wealth distribution has changed as well. These changes of income and wealth holdings can affect the economic well-being of elderly households.

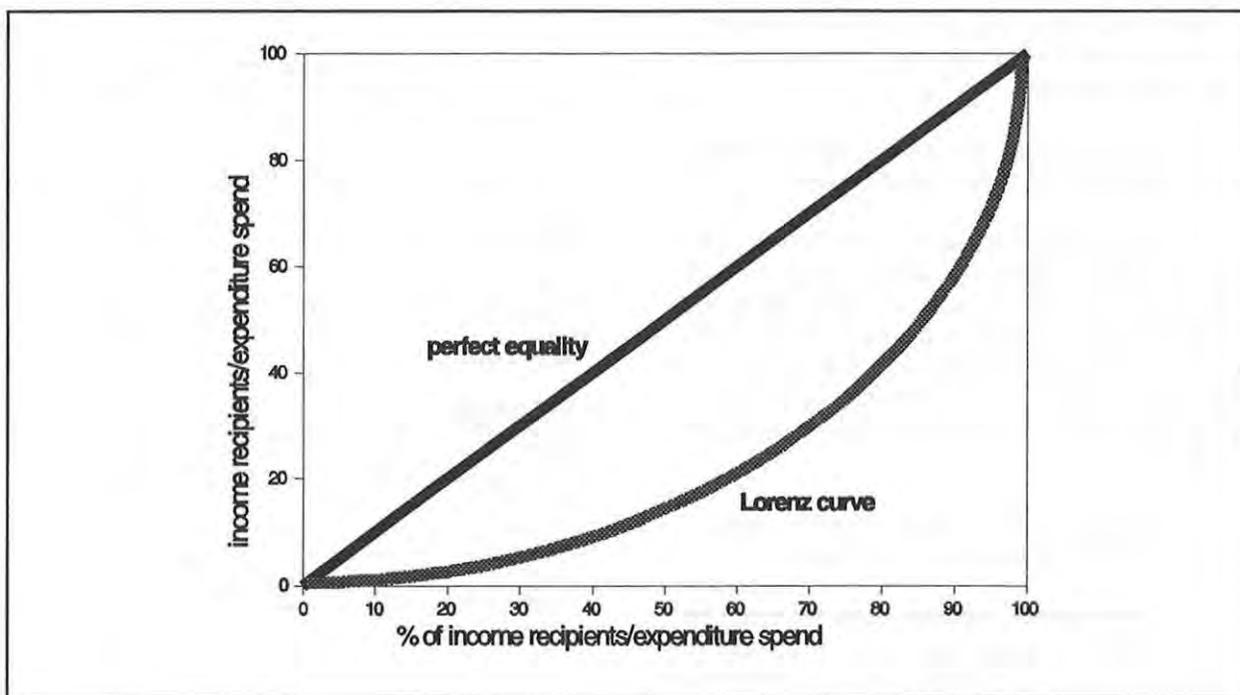
Methodology

There are different approaches to measure income and wealth inequalities. Most of the measures were derived from the Lorenz curve (Gastwirth, 1972); and the Gini index was the best single measure of inequality due to its easy interpretation (Morgan, 1962). In this study, both the Lorenz curve and the Gini index are calculated in order to measure income and wealth inequalities among the elderly households.

In the Lorenz curve approach, households are ranked from the lowest to the highest according to their annual money income or level of wealth. Households are then divided into equal population groups, typically quintiles. As shown in Figure 1, the vertical axis of the Lorenz curve represents the cumulative share of aggregate income or wealth from each quintile; and the horizontal axis represents the cumulative share of income or wealth that households received.

The Lorenz curve describes the relationship between the percentage of income receipts and the percentage of income. Perfect equality is represented by the 45° diagonal line passing through the origin. If the 45° line described the distribution, then each household would receive the same amount of income or own the same amount of wealth. Perfect inequality can be represented by a right-angle Lorenz curve that coincides with the horizontal and vertical axes, which means only

Figure 1
Example of Lorenz Curve



one household receives all the money income or owns the whole amount of wealth.

The Gini ratio, which is closely related to the Lorenz curve approach, is twice the area between the 45° diagonal line and the Lorenz curve to the area under the 45° line. The range of the Gini coefficient is from 0, indicating a perfect equality, to 1, indicating a perfect inequality. A Gini of 1 means all of the wealth is owned by just one household, while a Gini of 0 means every household owns an equal share of wealth (Pen, 1971).

Data and Variables

The data used in this study are from the 1989 Survey of Consumer Finance (SCF), which was conducted by the Survey Research Center of the University of Michigan for the Federal Reserve Board. The survey contains a nationally representative cross-sectional sample and a supplementary representative high-income sample drawn from IRS records. The high income sample concentrates in the top few percent of the wealth distribution.

Avery, Eliehausen and Kennickell (1988) suggested that wealth estimates based on household survey data have been significantly lower than those based on independent institution estimation. This

underestimation of wealth can be attributed to an undersampling of wealthy households. Including additional high-income households in the sample overcomes this limitation. Consequently, relative weights for the cross-sectional data were constructed so that the sample households can adequately represent the universe of all households.

According to Garman and Forgue (1994), household wealth is defined as the value of assets minus the value of liabilities. Household liabilities include home mortgage debt, such as home equity lines of credit, debt on other real estate, lines of credit other than home equity loans, outstanding credit card debt, education loans, automobile loans, etc.

For household wealth, different measures are used for the analysis in this study:

$$(1) \text{ total household wealth} = \text{financial assets} + \text{real estimate assets} + \text{automobiles and other vehicles} - \text{household liabilities},$$

where financial assets contain the following household holdings: liquidity assets, such as, checking accounts, savings accounts, money market accounts and certificates of deposit; investment assets: such as, publicly traded corporate stocks, bonds, such as

government bonds, U.S. savings bonds, corporate bonds, municipal and foreign bonds, mutual funds, IRAs and Keoghs, trusts, the cash value of life insurance policies, the current value of pensions, real estate assets, business ownership, limited partnership and the future value of Social Security benefits.

(2) financial wealth = total wealth - real estate assets - automobiles and other vehicle assets.

Financial assets reflect the assets which can be easily converted into cash, while owner-occupied housing, automobiles and other vehicles assets are generally held for consumption purposes. Wolef (1994) suggested: "Although owner-occupied housing is relatively easy to sell and often held for capital gains, housing cannot be sold without some suitable substitute provided."

(3) capital wealth = financial wealth - liquidity assets - cash value of pension and insurance

Capital wealth primarily holds the assets for long-term financial gains and capital investment. It excludes the ones for the purposes of consumption and retirement. In general, capital wealth is held by those households in the upper wealth distribution (Wolefe, 1983).

Elderly households are defined as (1) a two-person household (including a husband and wife family) with both being 60 or over; and (2) a single-person household with the reference person being 60 or over. Elderly people living in nursing homes or living with people who are under 60 are excluded from the study. Given these restrictions, the sample size is 868.

Findings and Discussion

Figure 2 shows the wealth composition of the elderly households. Home (owner-occupied housing) is the most important asset category, comprising 47%, 48%, and 58% of gross assets for single male households, single female households, and married couple households each. On average, the elderly households hold about 12% of liquid assets. Among different types of households, married couple households hold the least amount of liquid assets whereas single male households hold the highest level of liquid assets. Financial securities comprise 22% of total household assets for single female households; while this proportion is only 14% for single male households. The average debt to asset ratio is about 8% for all elderly households.

Table 1
Distribution of income and wealth by types of elderly households, 1989.

	One-person Female	One-person Male	Married Couple	All Households
Income				
25th percentile	\$6,000	\$6,000	\$13,000	\$7,000
median	8,000	10,000	21,000	15,000
75th percentile	15,000	17,000	32,000	27,000
Total wealth				
25th percentile	\$2,000	\$3,000	\$49,000	\$16,630
median	17,000	44,250	108,330	78,810
75th percentile	90,180	112,030	256,001	190,009
Financial wealth				
25th percentile	\$200	\$200	\$1,946	\$600
median	1,200	5,700	21,001	12,000
75th percentile	37,000	43,946	76,000	64,000
Capital wealth				
25th percentile	\$0	\$0	\$0	\$0
median	0	0	0	0
75th percentile	2,800	9,964	10,000	8,000
sample size	238	74	556	868

The information based on the composition of household wealth suggests that the value of home equity, liquidity assets, and financial securities should be taken into account when analyzing household wealth distribution. Therefore, all three types of wealth - total household wealth, financial wealth, and capital wealth are used in this analysis.

Table 1 shows the quantiles of income and wealth by the types of elderly households. Annual incomes for single female households are the same as those for single male households at the 25th percentile. However, single female households earn slightly less than single male households at the median and 75th percentile levels. Married couple households own a much higher level of total wealth than single male or single female households. At the 25th percentile, both single male and single female households hold extremely low levels of financial wealth. Moreover, capital wealth is only held by those elderly households at the upper part of the wealth distribution. The data in the table show that at least half of the households do not hold any capital wealth at all. These descriptive statistics provide some information about income and wealth distribution of elderly households, but they are not enough to reveal the income and wealth inequality among elderly households.

Table 2 reports the Lorenz curve ordinates by

Figure 2

Composition of household wealth by different types of elderly households, 1989.

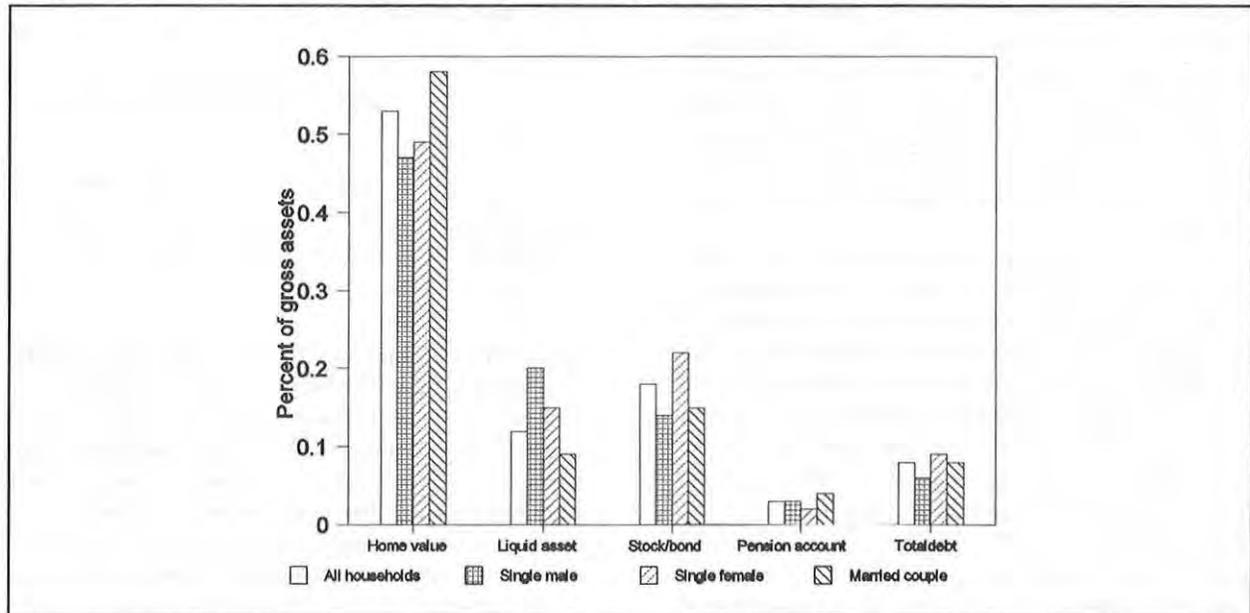


Table 2

Lorenz decile of income and wealth distribution by types of elderly households, 1989.

	Single Male	Single Female	Married Couple	All
Income				
Top quintile	0.5295	0.5442	0.7388	0.6365
2nd quintile	0.2089	0.2018	0.1010	0.1688
3rd quintile	0.1252	0.1286	0.0791	0.1044
4th quintile	0.0923	0.0854	0.0552	0.0626
bottom quintile	0.0437	0.0400	0.0259	0.0278
Household total wealth				
Top quintile	0.8706	0.7215	0.9278	0.8893
2nd quintile	0.0946	0.1751	0.0566	0.0695
3rd quintile	0.0266	0.0812	0.0419	0.0319
4th quintile	0.0068	0.0217	0.0093	0.0086
bottom quintile	0.0014	0.0005	0.0014	0.0007
Financial wealth				
Top quintile	0.8599	0.8657	0.9346	0.9087
2nd quintile	0.0802	0.1027	0.0321	0.0434
3rd quintile	0.0347	0.0233	0.0211	0.0384
4th quintile	0.0173	0.0062	0.0103	0.0073
bottom quintile	0.0079	0.0021	0.0019	0.0004
Capital wealth				
Top quintile	0.9780	0.9308	0.9886	0.9849
2nd quintile	0.0144	0.0687	0.0101	0.0136
3rd quintile	0.0037	0.0049	0.0007	0.0009
4th quintile	0.0027	0.0018	0.0005	0.0004
bottom quintile	0.0017	0.0003	0.0001	0.0002

deciles of income and wealth distributions for different types of elderly households. As indicated in column 4, the income share received by the top quintile of elderly households is 63.7%, while the share received by the lowest quintile is only 2.7%. Thus, the income share of the top quintile is almost 26 times that of the lowest quintile. In the middle of the distribution, the income share received by 60% of the households is 33.6%, which is about half that received by the top 20% of the households.

The Lorenz ordinates by deciles of wealth distribution are also shown in Table 2. The top quintile of elderly households accounts for more than 89% of household total wealth, while the lowest 20% of the households hold less than 1% of household total wealth. When comparing the distributions of financial wealth to household total wealth, the top 20% of elderly households hold 91% of all financial wealth, while the bottom quintile of households hold less than 1% of all financial wealth as well. The distribution of capital wealth shows that the top quintile of households own about 98% of household capital wealth in comparison to only 2% owned by the bottom 80% of households.

Gini coefficients of inequality among the elderly are shown in Table 3. As indicated, for all elderly households, the Gini coefficient based on household total wealth is 0.8593, which is larger than the Gini coefficient of 0.8453 based on household financial wealth. Moreover, the Gini coefficient of 0.8453 for financial wealth is larger than the one of 0.9024 for capital wealth. It is clear that the inequality based on capital wealth is much larger than that based on household total wealth or financial wealth, while the inequality based on financial wealth is larger than that based on household total wealth. This result is consistent with the study by Crystal and Shea (1990), which also found smaller Gini coefficient based on household total wealth than based on financial wealth or tangible wealth.

The top quintile of married couple households receives about three-quarters of the total income, whereas the lowest quintile of households receives only 3% of the total income. Similarly, for single male and single female households, the top quintile receives 54.8% and 53% of the total income each, while the lowest twentieth receives about 4% and 4.4% of the total income respectively. The income share received by the middle 60% of the households is about 42% for both single male and female households.

For one person households, the differences in income and wealth shares between single female and single male households at the top and bottom quintiles lead to larger Gini coefficients of income, total wealth, financial wealth, and capital wealth for single male

Table 3
Gini coefficient of income and wealth of elderly households, 1990-91.

	Single Male	Single Female	Married Couple	All Households
Income	0.4546	0.4261	0.4852	0.4612
Total wealth	0.7569	0.6933	0.8867	0.8593
Financial wealth	0.7734	0.7980	0.8671	0.8453
Capital wealth	0.8851	0.8454	0.9321	0.9024

households in comparison to single female households, as reported in Table 3. Meanwhile, the Gini coefficients of income and wealth distributions show the largest for married couple households, which suggests more unequal income and wealth distributions among married couple households than single person households.

The above empirical results indicate that there may exist a positive relationship between income and wealth, since both income and wealth are most unequally distributed among married couple households but most equally distributed among single female households. Table 4 lists the results of regressing household total wealth on income and income square. As indicated, there exist significant positive relationships between wealth and income for types of households.

Table 4
The regressing of total wealth on income and income square by different types of households, 1989.

	Single Male	Single Female	Married Couple	All Households
Intercept	-229057	14498	62273	-48931
Income	25.52	6.49	12.15	11.61
Income square	-9.22E-6	2.35E-6	-1.58E	-1.50E-6
Adjusted R-square	0.7521	0.0846	0.2609	0.2704

Wealth is the accumulation of savings from the past income, and it depends on the age of the household. Older people have higher levels of wealth than younger people at a given level of income due to the fact that they have had a longer time to accumulate it. Although the relationship between income and wealth is complicated, it is quite strong (Weicher, 1994). According to the U.S. Department of Health and Human Services (1994), asset income provides 21% of total money income for the population 65 or older. The association between income

and wealth may suggest that increase in income inequality causes the increase in wealth inequality, or vice versa.

Conclusion and Implications

This study explores the income and wealth distribution of elderly households. The findings suggest that household wealth is distributed much more unequally among elderly households than are household incomes. Moreover, inequality of financial wealth is higher than that of total net wealth, and capital wealth is distributed more unequally than household financial wealth. Among different types of elderly households, married couple households show the greatest inequality of wealth and income distributions, whereas wealth and income are most equally distributed among single female households.

The life cycle hypothesis assumes that the elderly dissave out of their accumulated wealth in order to maintain a constant level of consumption over their lifetime (Modigliani, 1980). This probably is the case for many elderly who have adequate holdings of private wealth augmented with Social Security and Medicare. Clearly, the economic status of those aged households will be better off. But at the same time, some elderly who have almost no wealth to access beyond government welfare support may be vulnerable to any uncertainty that may occur, such as a serious illness. Economic inequality based on household wealth does pose the question of whether the aged who have low income and low wealth would be able to pay for increased medical expenses or handle the occurrence of income loss.

The findings presented here suggest that the social welfare programs should justify their funding criteria to better improve the economic status of the elderly. For example, many government housing subsidy programs target those households at the lower end of income distribution. It is clear that economic resources include income as well as wealth; therefore, income alone may not be an appropriate measure of the ability of a household to own adequate housing in the private housing market. Therefore, it is crucial for government policies to target elderly people who are in most need of welfare transfers, especially when the government fiscal budget is tight and there is an increasing proportion of the elderly in our society.

One limitation of this study is that the SCF do not provide information regarding the value of consumer durables other than automobiles and other vehicles.

Consumer durables constitute a substantial part of a lower income household's possessions, thus, data imputation from other data sources may be necessary.

References

- Avery, B., Elliehausen, G. & Kennickell, A. (1988). Measuring wealth with survey data: an evaluation of the 1983 survey of consumer finances. Review of Income and Wealth, 34, 339-369.
- Burkhauser, R., Butler, S. & Wildinson, J. (1985). Estimating changes in well-being across life: a realized versus comprehensive income approach, in M. David and T. Smeeding, (eds), Horizontal Equity, Uncertainty, and Economic Well-Being. Chicago: University of Chicago Press.
- Crystal, S. & Shea D. (1990). The economic well-being of the elderly. Review of Income and Wealth, 36, 2227-247.
- Danziger, S. (1980). Do working wives increase family income inequality? Journal of Human Resources, 15, 444-451.
- Garman, T. & Fogue, R. (1994). Personal Finance. Princeton, NJ: Houghton Mifflin Company.
- Gastwirth, J. L. (1972). The estimation of the Lorenz curve and Gini index. Review of Economics and Statistics, 54, 306-316.
- Hurd, M. & Shoven, J. (1985). Inflation vulnerability, income, and wealth of the elderly, 1969-1979, in M. David and T. Smeeding, (eds), Horizontal Equity, Uncertainty, and Economic Well-Being. Chicago: University of Chicago Press.
- Modigliani, F. (1980). The life-cycle hypothesis of saving twenty years later, in The Collected Papers of Franco Modigliani. Cambridge, MA: MIT Press.
- Pen, J. (1971). Income Distribution: Facts, Theories, Policies. New York: Praeger Publishers.
- Transamerica, (1988). The Transamerica Report on American Retirement Perspectives. Los Angeles: Transamerica.
- U.S. Bureau of Census. (1989a). Statistical Abstract of the United States: 1989. (109th edition.) Washington DC: U.S. Government Printing Office.
- U.S. Bureau of Census. (1989b). Statistical Abstract of the United States: 1989. (110th edition.) Washington DC: U.S. Government Printing Office.

U.S. Bureau of Census. (1992). Statistical Abstract of the United States: 1992. (112th edition.) Washington DC: U.S. Government Printing Office.

Weicher, J. (1994). Changes in the Distribution of Wealth: Increasing Inequality? Federal Reserve Bank of St. Louis, 5-23.

Wolfe, E. (1987). Estimates of household wealth inequality in the U.S., 1962-1983. Review of Income and Wealth, 33, 231-257.

Wolfe, E. (1994). Trends of household wealth in the United States, 1962-1983 and 1983-1989. Review of Income and Wealth, 40, 143-174.

Endnotes

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Consumer Attitudes Towards Fat Contents in Food: The Case of Whole Milk vs. Lower Fat Milk

In this paper, the differences in consumer attitudes toward milkfat in fresh milk are investigated for different representative households defined on the bases of income, race, residential location, or family type. The percentages of households purchasing either fresh whole milk or other fresh milk, computing from the Consumer Expenditure Surveys, were used as proxies of the consumer attitudes and a linear trend model was derived to provide specific parameters measuring the changes in consumer attitudes. The estimation results show that the patterns of changes in consumer attitude toward milkfat differ significantly among demographic groups.

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Introduction

Due to the public's increasing concerns about fat content in food, more and more consumers are likely to purchase those food products with less fat or even that are fat free. During the last decade, the food industry has reshaped its product mix and marketing strategies in order to catch up with the changes in consumer attitudes towards fat content in food. Therefore, it is crucial for the food industry to understand the consumption patterns of those foods containing more or less fats.

Fresh milk, a traditional food in U.S. households, has experienced the same changes in consumer attitudes since the early 1970s. As one can see from Figure 1, per capita consumption of fresh whole milk (containing higher fat content, i.e., 3.25% milkfat) was declining during the period of 1970-1992, while per capita consumption for other fresh milk (containing lower fat content, i.e., 1% or 2% milkfat, or skim milk) increased steadily. The decline for fresh whole milk was a significant magnitude of 135 pounds from 219.1 pounds in 1970 to 84.1 pounds in 1992, compared to the increase of 84.4 pounds in other fresh milk from 50 pounds to 134.4 pounds during the same period. This consumption pattern provides a very interesting profile of consumer attitudes towards fat content in food. To some extent, analysis of fresh milk consumption pattern can provide some useful information for understanding the changes of consumer attitude toward fat and cholesterol.

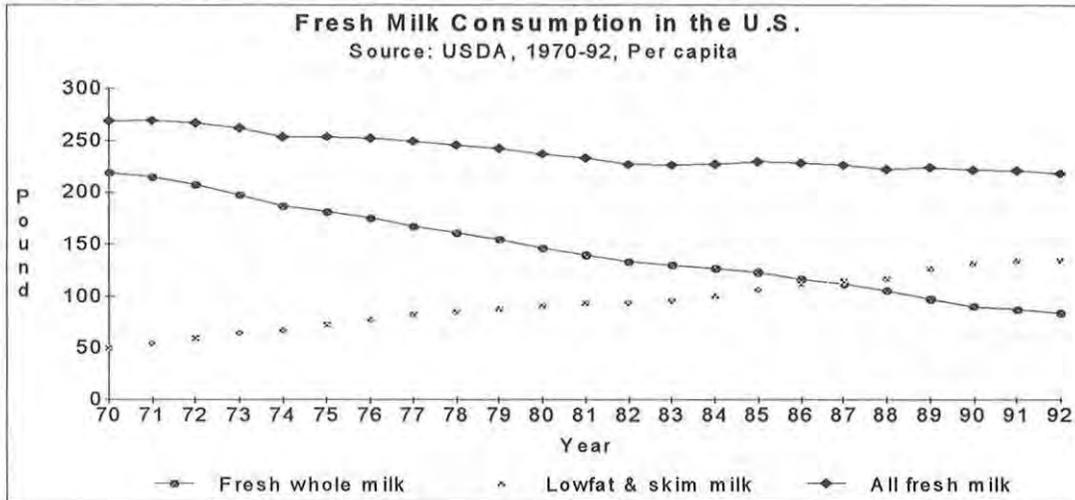
This study focuses on the anatomy of this profile of consuming fresh whole milk vs. other fresh milk by introducing two attitude variables and three

parameter indicators to capture the characteristics and differences of attitude change among different representative households. Two aggregate attitude variables are defined as the percentages of households who purchased either fresh whole milk or other fresh milk based on monthly time series data calculated from the public use tapes of the Consumer Expenditure Survey (1980-1993) from the Bureau of Labor Statistics (BLS). Three parameter indicators are defined based on a linear trend model which is used to capture the evolution of two attitude variables over time. The first indicator is growth rate or decline rate of the two attitude variables. It can be used to represent the changing pattern of consumer attitude toward fats in fresh milk. The second indicator is the intercept attitude level measured by these two percentages when they are equal. The third indicator is the cross over time when both percentages are equal. It might be used as an approximate indicator of time for awareness about fat related health risks for a specific representative household.

Furthermore, a detailed profile will be presented in this paper to compare those characteristics among different representative households, which are defined as having different income levels, races, residential locations, or family types.

The paper is arranged as follows: 1) aggregate attitudes and linear trend model; 2) data and representative households; 3) testing and estimation; 4) analysis and comparison; and 4) summary.

Figure 1
Per Capita Consumption of Fresh Milk in the U.S.



Aggregate Attitudes and Linear Trend Model

Aggregate Household Attitudes toward Fresh Milk

When a household purchases only fresh whole milk at a given time, the household is considered as a household which may not be concerned about the higher fat content in milk or not in need for nutritional reasons. On the other hand, when a household purchases only other fresh milk (i.e., lower fat milk) at a given time, the household is assumed to be concerned about fat content in milk.

Suppose, in time t , there are H_t households, in which h_t households purchase only fresh whole milk and l_t households purchase only other fresh milk. The aggregate household attitude toward both fresh milk at time t can be captured by the following two percentage variables:

$$r_t^h = (h_t / H_t) * 100 \quad (1)$$

and

$$r_t^l = (l_t / H_t) * 100 \quad (2)$$

where r_t^h is the percentage of households that purchase only fresh whole milk at time t and r_t^l is the percentage of households that purchase only other fresh milk at time t . For the purpose of aggregation, r_t^h and r_t^l can be regarded as the indicators of attitude toward fats in milk for a specific representative household in time t , if H_t is considered as the population of the specific representative household. More specifically, r_t^h is defined as the percentage of households who may not be concerned about fat content, while r_t^l refers to the

percentage of households who are concerned about fat content in fresh milk.

Linear Trend Model

Because the consumption of fresh whole milk has declined steadily while the consumption for other fresh milk increased continuously, as showed in Figure 1, the long-run changes in r_t^h and r_t^l may be represented using a linear trend model if they follow a random walk pattern with a drift (i.e., having a unit root with a drift) expressed as (Harvey 1989):

$$r_t^h = r_{t-1}^h + b_h + e_t^h \quad (3)$$

and

$$r_t^l = r_{t-1}^l + b_l + e_t^l \quad (4)$$

where e_t^h and e_t^l are disturbance terms and b^h and b^l are drift parameters.

If equations (3) and (4) hold, which can be examined using the Dickey-Fuller test or Augmented Dickey-Fuller test (Cromwell et al 1994), the linear trend

models for r_t^h and r_t^l can be written as:

$$r_t^h = a_h + b_h t + u_t^h \quad (5)$$

and

$$r_t^l = a_l + b_l t + u_t^l \quad (6)$$

where b_h and b_l are parameters that capture the decline rate of r_t^h and growth rate of r_t^l respectively, i.e., $b_h = d r_t^h / dt$ and $b_l = d r_t^l / dt$; a_h and a_l are parameters that capture the initial level of percentages at a starting point;

and u_t^h and u_t^l are disturbance terms that capture the effects of those random factors.

After estimating equations (5) and (6), we can obtain the regression lines of r_t^h and r_t^l with respect to time t . Setting $r_t^h = r_t^l$ which the predicted percentage of households purchasing fresh whole milk is equal to the predicted percentage of households purchasing other fresh milk, we can obtain both the estimated cross-over time, t_e , and the estimated intercept attitude level, t_e , as follows (shown in Figure 2):

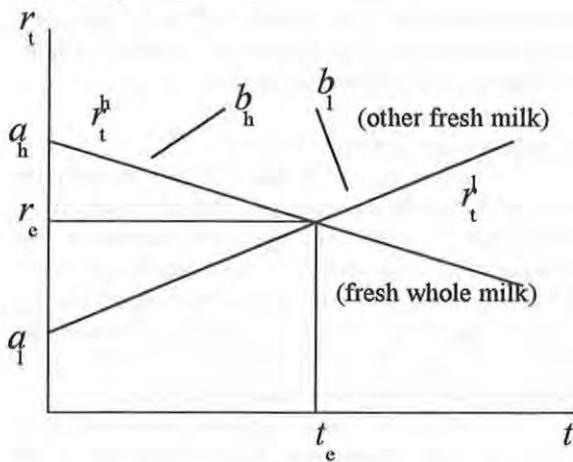
$$t_e = (a_h - a_l) / (b_l - b_h) \quad (7)$$

and

$$r_e = a_h + b_h t_e = a_l + b_l t_e \quad (8)$$

The cross-over time may be used to compare the changing patterns of consumer attitudes for fresh whole milk vs. other fresh milk among different representative households, while the intercept attitude level can be used to measure the relative market participation rate for consuming two kinds of fresh milk for a specific representative household.

Figure 2
Linear Trend Model for Percentages of Households Consuming Fresh Milk.



Data and Representative Households

The data on the percentages of different representative households who purchased only fresh whole milk or other fresh milk are derived from the public use tapes of the Consumer Expenditure Survey (Diary) for 1980-1993. The survey has been conducted annually by the Bureau of Labor Statistics. Based on the status of individual household purchases for fresh milk in the monthly samples, the monthly percentages are calculated using weights provided from the Survey. Four groups of representative households are defined in this

study based on income level, race, region, and household structure.

For income, there are three representative households: households with income (before taxes) in the lower one-third of the monthly sample; households with income in the middle one-third; and households with income in the upper one-third. The INGP1, INGP2, and INGP3 are used to represent these three different representative households, respectively. For the household head's race, there are two representative households: white and black households, denoted as RACE1 and RACE2, respectively. Representative households related to region are defined as follows: households in the northeast (REGN1), in the Midwest (REGN2), in the south (REGN3), and in the west (REGN4). For household structure, two representative households are considered: parents (single or couple) with at least one child under 18 years of age (FAMT1) and all other households (FAMT2). Finally, an overall representative household is defined to represent all households in the U.S. and is denoted as TOTAL.

Table 1
Representative Households in the U.S.

Households	Definition
TOTAL	All households in the U.S.
INGP1	Households with low income
INGP2	Households with middle income
INGP3	Households with high income
RACE1	Households in which heads of households are white
RACE2	Households in which heads of households are black
FAMT1	Households of parent(s) with children, at least one under 18
FAMT2	Households of all other types
	Region
REGN1	Households in northeast region
REGN2	Households in Midwest region
REGN3	Households in south region
REGN4	Households in west region

The definitions of these representative households are summarized in Table 1 and the historical trends of the two percentage variables for each representative household are displayed using twelve graphs (Figures 3). These figures show that the consumption patterns of whole milk vs. other fresh milk differ notably among different representative households during the sample period of 1980-1993.

Testing and Estimation

Testing for Unit Root

The Dickey-Fuller (DF) test and Augmented Dickey-Fuller (ADF) test are the most popular approaches to check whether a time series variable behaves in random walk or has a unit root. Based on (3) and (4), the regression equations for the DF and ADF tests can take the following forms:

$$(DF) \quad Dr_t = k r_{t-1} + b + e_t \quad (9)$$

or

$$(ADF) \quad Dr_t = k r_{t-1} + b + P_j(Dr_{t-j}) + e_t \quad (10)$$

where Dr_t is the difference of r_t and $P_j(Dr_{t-j})$ is the polynomial function of lags of Dr_t . The null hypothesis that the r_t series is generated by a random walk with a drift is that $H_0: k = 0$ and it can be rejected if the t -ratio (absolute value) of k is greater than a critical value (absolute value) provided by Dickey and Fuller (1979) or MacKinnon (1991). The lag structure in (10) enables the ADF test to account for a more dynamic specification of the regression than the DF test due to possible existence of serial correlation for e_t .

Table 2
Estimated t -ratios of k in Equation (10) for Different Representative Households

Household	r^h	r^l
TOTAL	-0.755	-0.954
INGP1	-1.253	-1.376
INGP2	-0.893	-1.014
INGP3	-1.231	-1.714
RACE1	-0.891	-1.189
RACE2	-1.924	-1.913
FAMT1	-0.823	-1.805
FAMT2	-1.319	-1.184
REGN1	-1.163	-1.214
REGN2	-1.518	-3.237
REGN3	-1.114	-1.258
REGN4	-2.282	-1.828

In this paper, the ADF test with four lags is applied to the different percentage data for different representative households. Table 2 shows the t -ratios of k for all cases. As one can see, all values in the Table 2 are smaller than the critical value (-3.51) at 0.01 significant level in terms of absolute scale. Therefore, equations (5) and (6) can be used to capture the long-run trends of consumer attitudes toward whole milk vs. other fresh milk.

Estimation

The ordinal least square (OLS) method is used to estimate equations (5) and (6) using different data sets for different representative households. The results are displayed in Table 3 where all estimated parameters are statistically significant at the confidence level of 99%. Based on the estimated coefficients, the annual decline rate for households consuming fresh whole milk, the annual growth rate for households consuming other fresh milk, the crossover time, and the "intercept" consumption percentage (intercept attitude level) are calculated and shown in Table 4.

Analysis and Comparison

All Households

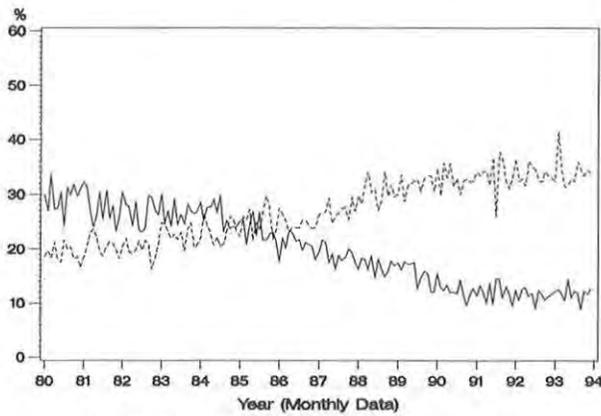
The decline rate of purchasing fresh whole milk is about 1.6% per year from 1980 to 1993 for all U.S. households. On the other hand, the growth rate of consuming other fresh milk for the overall representative household is about 1.3% per year. Also, it is worth noting that the decline rate is higher than the growth rate. The cross-over time for all households purchasing either fresh whole milk or other fresh milk is around August, 1984, which is about two years earlier than the previous estimates based on per capita consumption data (Jacobson 1989 and Figure 1). Part of the reason may be that a large amount of fresh whole milk were consumed away from home, e.g., consumption at schools by pupils, and these was not reflected in the Survey data.

Households with Different Income

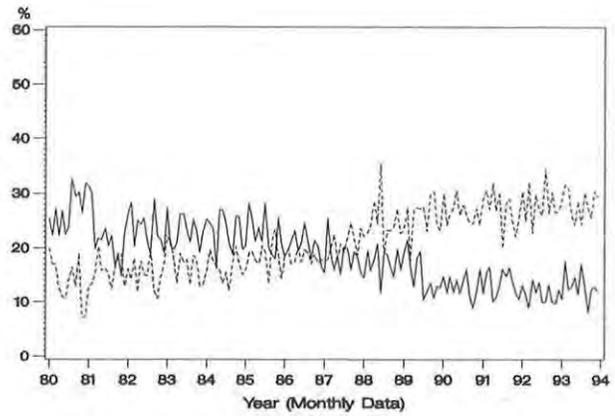
High income and middle income households have nearly the same decline rates for purchasing fresh whole milk (at 1.7%) and the same growth rate for drinking other fresh milk (at 1.4%), both of which are higher than those of low income households (1.1% and 1.2%, respectively). For low income households, the decline rate is a little bit smaller than the growth rate, a different pattern from the overall households.

The high income households have a very early cross-over time (November, 1981), compared to the cross-over time in late 1985 for low income and middle income households. This statistic may imply that high income households became accustomed to buying lower fat milk much earlier than lower income households. However, the high income households have the highest intercept percentage level (27%), compared to 24% for middle income households and 19% for low income households, indicating that higher income households consumed more fresh milk overall.

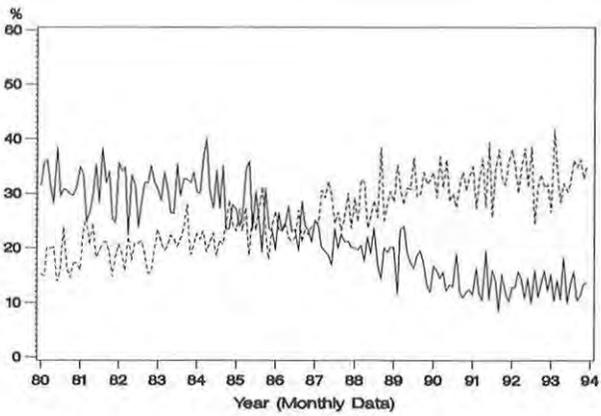
Figure 3
Percentages of Representative Households Purchasing Whole Milk vs. Other Fresh Milk



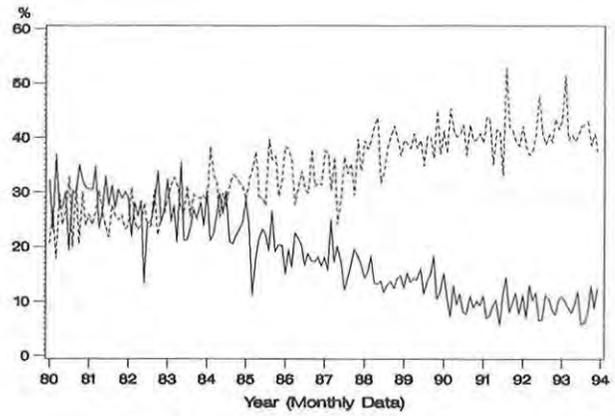
(a) 'TOTAL' Households: All Households



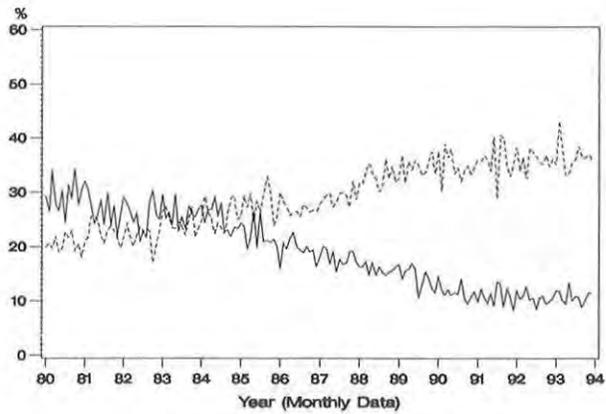
(b) 'INGP1' Households: Low Income



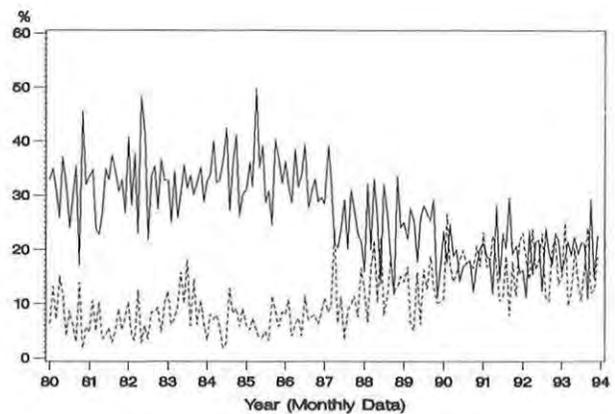
(c) 'INGP2' Households: Middle Income



(d) 'INGP3' Households: High Income



(e) 'RACE1' Households: White



(f) 'RACE2' Households: Black

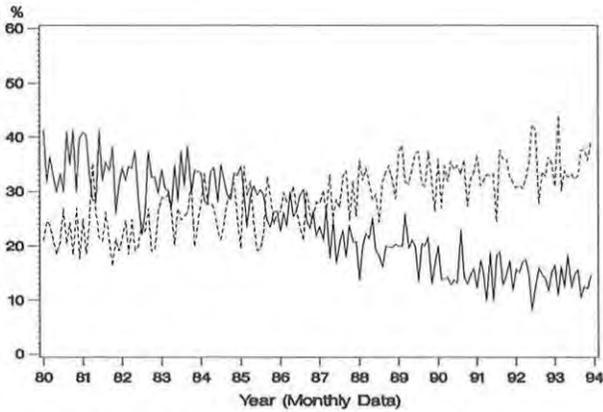
Solid Line: Fresh Whole Milk Only

Dot Line: Other Fresh Milk Only

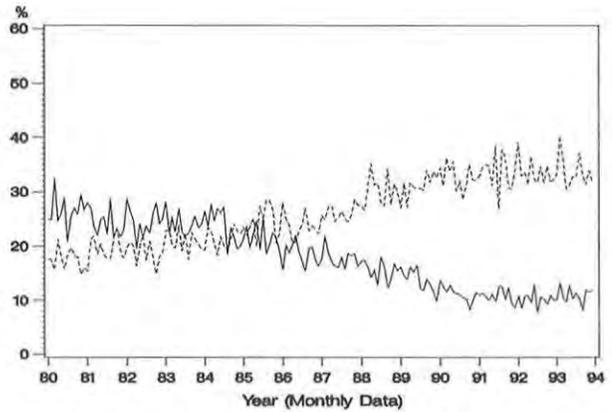
Note: The weighted monthly percentages are calculated based on individual household data from the 1980-1993 Consumer Expenditure Surveys (Diary).

Figure 3 (continued)

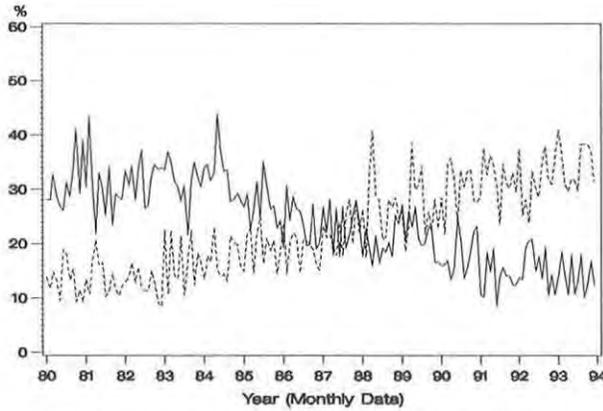
Percentages of Representative Households Purchasing Whole Milk vs. Other Fresh Milk



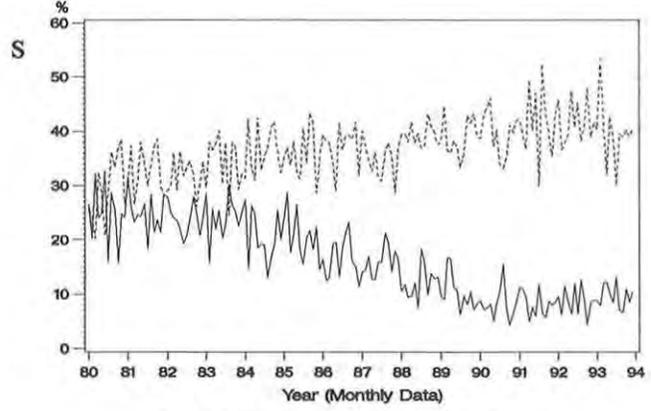
(g) 'FAMT1' Households: Parent(s) with Children



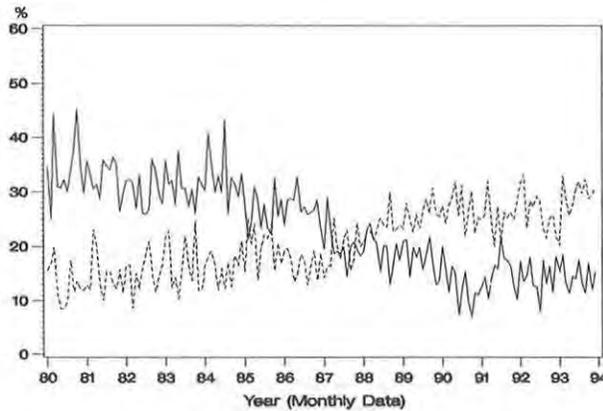
(h) 'FAMT2' Households: Without Children



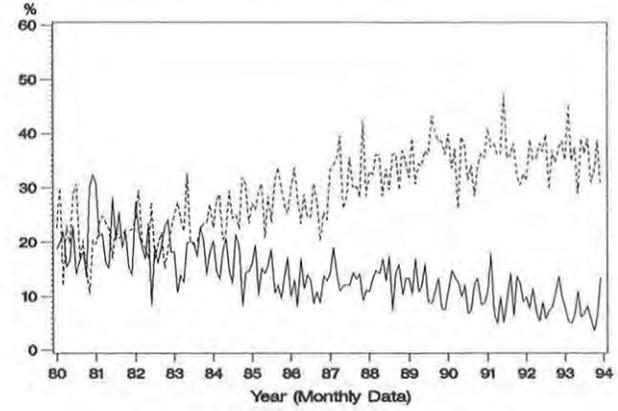
(i) 'REGN1' Households: Northeast



(j) 'REGN2' Households: Midwest



(k) 'REGN3' Households: South



(l) 'REGN4' Households: West

Solid Line: Fresh Whole Milk Only

Dot Line: Other Fresh Milk Only

Note: The weighted monthly percentages are calculated based on individual household data from the 1980-1993 Consumer Expenditure Surveys (Diary).

Table 3
Estimated Parameters from (5) and (6) for Various Representative Households

Household	r_t^h			r_t^l		
	a_h	b_h	R^2	a_l	b_l	R^2
TOTAL	31.07	-0.131	0.892	17.92	0.108	0.846
INGP1	26.05	-0.093	0.669	12.17	0.104	0.697
INGP2	35.23	-0.148	0.811	16.80	0.111	0.743
INGP3	30.37	-0.145	0.795	24.59	0.117	0.687
RACE1	30.36	-0.134	0.892	19.85	0.112	0.838
RACE2	36.32	-0.109	0.428	4.69	0.077	0.409
FAMT1	37.35	-0.157	0.813	21.32	0.088	0.560
FAMT2	26.79	-0.116	0.851	16.89	0.121	0.804
REGN1	35.05	-0.131	0.683	10.05	0.149	0.745
REGN2	27.10	-0.128	0.732	30.91	0.068	0.359
REGN3	36.25	-0.151	0.759	11.98	0.103	0.661
REGN4	21.01	-0.084	0.547	19.73	0.116	0.624

Table 4
Decline Rate, Growth Rate, Cross-over Time, and Intercept Percentage

Household	Decline rate (% per year)	Growth rate (% per year)	Cross-over time (Date)	Intercept percentage (%)
TOTAL	1.57	1.29	AUG 84	23.86
INGP1	1.12	1.24	NOV 85	19.49
INGP2	1.78	1.33	DEC 85	24.68
INGP3	1.74	1.41	NOV 81	27.17
RACE1	1.60	1.34	JUL 83	24.63
RACE2	1.30	0.92	MAR 94	17.78
FAMT1	1.88	1.06	JUN 85	27.11
FAMT2	1.39	1.45	JUN 83	21.94
REGN1	1.57	1.78	JUN 87	23.33
REGN2	1.54	0.82	MAY 78	29.58
REGN3	1.81	1.24	DEC 87	21.82
REGN4	1.00	1.40	JUL 80	20.47

Households with Different Races and Different Family Types

The differences and implications between white vs. black households are nearly the same as those between high income households vs. low income households. The exception is that the black households have a much lower growth rate (0.9%) for lower fat milk consumption and a much later cross-over time (around March, 1994, a predicted cross-over time)).

The households with children have a much higher decline rate for purchasing fresh whole milk (1.9%) and a much lower growth rate for consuming other fresh milk (1.0%). These patterns of change may be caused by the already high initial consumption percentage levels for both fresh whole milk (37%) and other fresh milk (21%) in 1980. Therefore, it is not

surprising for these households to have a high intercept percentage level (27%). However, the cross-over time for these households is two years behind that of households without children.

Households in Different Regions

Households in different regions have different patterns of choice between fresh whole milk and other fresh milk. In the Midwest region, households have their early cross-over time in May, 1978 due to a higher initial percentage level for consuming other fresh milk. They also have the highest intercept percentage level (30%) with the lowest growth rate of 0.8%. Households in the south have the latest cross-over time (December, 1987) and a much lower intercept percentage level (21%) with the highest decline rate of 1.8%. The growth rates for households in both the northeast and west are higher

than the decline rates for both, but households in the west have an earlier cross-over time (July, 1980) with a much lower decline rate (1.0%).

Summary

This study investigated the differences in consumer attitudes toward fats in fresh milk for different representative households according to different demographic profiles. The percentages purchasing either only fresh whole milk or only other fresh milk were used to approximate the attitudes. A linear trend model was derived to examine and compare the consumer attitudes for different representative households.

The major findings from the investigation are summarized below:

1) The cross-over time, in which the percentages of purchases for fresh whole milk and other fresh milk were equal, for all households in the U.S. was around August 1984. This timing was about two years earlier than previous estimates based on per capita consumption data. Also, on the average, 1.6% of all households gave up drinking fresh whole milk every year, and in the mean time, 1.3% of households began to drink other fresh milk.

2) High income households had a very early cross-over time, about four years earlier than those of low and middle income households. This pattern may imply that high income households have become aware of health risks associated with fat content in food earlier than low income households. Also, high income households had higher percentage levels for consuming both fresh whole milk and other fresh milk than did lower income households.

3) Black households had a very late predicted cross-over time (March, 1994), about ten years later than that of white households. Therefore, black households appeared to have a deferred awareness for health concerns relative to the fat content in food.

4) Households with children had higher percentage levels in consuming both fresh whole milk and other fresh milk than did households without children. Households with children had a cross-over time that lagged two years as compared to households without children.

It is noted that consumer attitudes toward fat content in fresh milk are greatly affected by health information related to fat and cholesterol provided by medical articles, media, and health professionals. Therefore, the consumption data used in this paper may be used as a revealed health information indicator about fat and cholesterol for different representative households (Chern and Zuo 1995).

References

- Chern, W. S., & Zuo, J. (1995). Alternative measures of changing consumer information on fat and cholesterol. 1995 Annual Meeting of AAEA, Indianapolis, Indiana.
- Cromwell, J. B., Labys, W. C., & Terraza, M. (1994). Univariate tests for time series models, London: Sage Publications.
- Dickey, D.A., & Fuller, W.A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74, 427-431.
- Harvey, A. C. (1989). Forecasting, structural time series models and the Kalman filter, Cambridge: Cambridge University Press.
- Jacobson, R. E. (1989). Dairy product consumption and demand. Dairy policy issues and options for the 1990 farm bill, New York: National Institute for Livestock and Dairy Policy.
- MacKinnon, J. (1991). Critical Values for cointegration tests. In R. F. Engle & C.W.J. Granger (Ed.), Long-run economic relationships: readings in cointegration (pp.267-276), Oxford: Oxford University Press.

Endnote

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Economic and Sociodemographic Determinants of "Healthy Eating" as Measured by USDA's Healthy Eating Index

The U.S. Department of Agriculture has a strong interest in the healthfulness of Americans' total or overall diet. In order to better monitor, assess, and, if necessary, help improve the overall diet, the Department's Center for Nutrition Policy and Promotion, and other parties, recently developed an overall-diet-based Healthy Eating Index. The Index reflects compliance with the Dietary Guidelines for Americans, and the USDA/DHHS Food Guide Pyramid. Using the Healthy Eating Index and data from USDA's 1989-90 Continuing Survey of Food Intakes by Individuals, this study provides preliminary findings of the relationships between Americans' overall diet and selected economic and sociodemographic characteristics.

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Introduction

People's diets are complex. Every day in the United States, individuals choose--and consume--from a staggering array of foods available to them. The USDA nutrient data bank currently contains food composition data on almost 7,000 different foods. At the same time, the importance of diet in maintaining good health is quite clear (U.S. Department of Health and Human Services, National Academy of Sciences). A good, or healthy, diet can help people live longer and healthier lives, with enhanced well-being. It also means better economic productivity and lower health care costs. Thus, the Federal Government has a strong incentive to monitor the population's diets (typically, through national food consumption surveys) and, when necessary, to help improve dietary status through food assistance, nutrition education, and other efforts.

This raises two interesting questions for nutrition educators and others concerned with assessing diets and their determinants. First, what exactly is a good or healthy diet? and second, how can a person's or a group's diet be evaluated?

To answer the first question, since 1980 the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS) have issued principles of a healthful diet called the "Dietary Guidelines for Americans" (U.S. Department of Agriculture and U.S. Department of Health and Human Services). These Guidelines focus on obtaining a diet both sufficient in nutrients and without excesses, since excess intakes of certain food components have

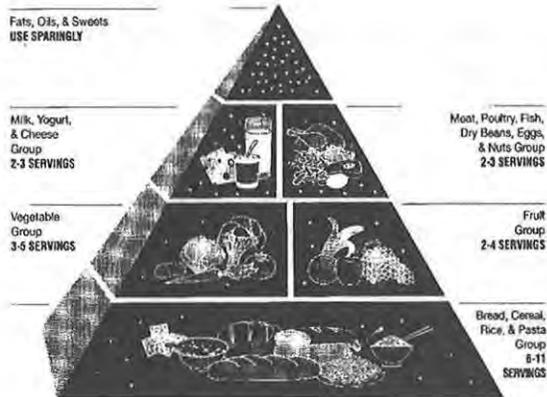
been linked to chronic diseases (U.S. Department of Health and Human Services, National Academy of Sciences). The current (1995) Guidelines are:

- ▶ Eat a variety of foods
- ▶ Balance the food you eat with physical activity--maintain or improve your weight
- ▶ Choose a diet with plenty of grain products, vegetables, and fruits
- ▶ Choose a diet low in fat, saturated fat, and cholesterol
- ▶ Choose a diet moderate in sugars
- ▶ Choose a diet moderate in salt and sodium
- ▶ If you drink alcoholic beverages, do so in moderation

The Dietary Guidelines do not give specific and detailed recommendations on which foods to eat every day and how much. This is done by USDA's Food Guidance System and the graphic representation of USDA's Food Guide Pyramid (FGP) (U.S. Department of Agriculture, 1992), shown in Figure 1. To come up with these specific recommendations, USDA scientists considered, among other things, the number of servings per day from major food groups and subgroups that would embody the dietary guidelines as well as possible (Welsh et al.).

The answer to the second question--how can a person's or group's diet be evaluated?--had to await the answer to the first--what is a good or healthy diet? Because a diet comprises many components, it is difficult to judge one overall. Still, those wanting to

Figure 1
The Food Guide Pyramid



relate overall diets to factors influencing those diets need a summary measure, or index, of the overall diet. Otherwise, researchers are required to consider multiple aspects of the diet, one at a time, greatly complicating inferences on determinants of the overall diet quality (e.g., Basiotis et al, 1983, 1987, Basiotis 1991, Capps and Havlicek, Haines et al., Hama and Chern, Morgan et al.).

In this study, we use guidance from theory and previous research to estimate relationships between a newly developed measure of the overall diet (see below) and selected economic and sociodemographic variables available in USDA's 1989-90 Continuing Survey of Food Intakes by Individuals (CSFII). The results, although preliminary at this point, may be of interest to nutritionists and nutrition educators, some government agencies, public health professionals, academics, and the public at large.

The Healthy Eating Index

In order to facilitate monitoring and assessment of dietary status and if necessary, help improve it through nutrition education and nutrition promotion, the USDA Center for Nutrition Policy and Promotion, in cooperation with the Department's Food and Consumer Service and private industry, has developed a state-of-the-art measure of "Healthy Eating" as defined by the Dietary Guidelines and the Food Guide Pyramid, called the Healthy Eating Index (HEI) (Kennedy et al., USDA, 1995).

Even though a limited number of indices focusing on the total diet exist (Basiotis et al. 1995, Patterson et al., Sorenson et al., Abdel-Ghany) none comes as close to measuring the healthfulness of the overall diet relative to the Dietary Guidelines as the HEI. The main reason is that practically all prior research on

Diet Index construction focused exclusively on consumption of nutrients, as opposed to consumption of foods. (The exception is Patterson et al., whose work related a diet quality index to the recommendations given in the National Academy of Sciences Diet and Health Report).

The Healthy Eating Index has 10 components, which are based on different aspects of a healthful diet. For each component, individuals receive a score ranging from 0 to 10. Thus, the overall index has a range from 0 to 100. The components are defined as follows:

Components 1 through 5 measure the degree to which a person's diet conforms to the USDA FGP serving recommendations for 5 major food groups: grains, vegetables, fruits, milk, and meats; component 6 is based on overall fat consumption as a percentage of total food energy intake; component 7 is based on saturated fat consumption as a percentage of total food energy intake; component 8 is based on cholesterol intake; component 9 is based on sodium intake; and component 10 is based on the amount of variety in a person's diet.

The exact score that an individual receives in any of the food group categories is determined as a proportion of the recommended number of servings for a given energy intake level. For instance, the average energy allowance for a 40-year-old female is 2,200 kilocalories and the FGP indicates that at this energy level, 4 servings of vegetables per day are recommended. Thus, for a 40-year-old female, the number of servings to get the maximum score of 10 in the vegetable category is 4.

A person who consumed the recommended number of servings from any food group would receive a score of 10; conversely a person consuming no servings within a food group would receive a score of 0. Between 0 and 10, the score is calculated proportionately; for example, a person needing 6 servings from the grain category who consumed 3 would be given a score of 5. Food serving amounts were computed from food consumption data using factors derived from the serving size assumptions given in the USDA FGP.

Calculation of scores for the other food groups followed a similar procedure. Actual servings were compared to recommended servings based on the USDA FGP.

In each food group, when the optimum number of servings was achieved, no further credit was given for additional servings nor were any points deducted for being beyond a certain number of servings.

Components 6 to 10 were scored differently. For component 6, a score of 10 was given if a person's total fat intake as a proportion of energy intake was 30%

or less. The score declined to 0 when this proportion reached 45%. Between these two points, the scores declined proportionately.

The score for saturated fat (component 7) was computed analogously to that for total fat, with a maximum score achieved at a ratio of 10% or less of total saturated fat/energy and 0 when the ratio was 15% or greater.

The scores for cholesterol and sodium are each based on milligrams consumed. The cutoff points for a perfect score of 10 are set at 300 mg for cholesterol and 2,400 mg for sodium. The corresponding 0 points are 450 mg and 4,800 mg for cholesterol and sodium respectively. There was little indication from prior research how the limits for a 0 score for total fat, saturated fat, cholesterol, and sodium should be determined. The upper limits for setting the 0 score were based on consultation with nutrition researchers and exploration of the distributions of consumption of these component parts using USDA's 1989-90 CSFII data.

The Dietary Guidelines as well as the National Academy of Sciences Diet and Health Report stress the importance of variety in the diet. To assess variety, the HEI counted the total number of different foods eaten by an individual that contribute substantially to meeting 1 or more of the 5 food group requirements. In operationalizing this principle, foods were counted only if they were eaten in amounts sufficient to contribute at least one half a serving in any of the food groups. Identical food items eaten on separate occasions were aggregated before imposing the one-half serving cut-off.

Foods that were similar, such as two different forms of potatoes or two different forms of white bread, were counted only once in the variety category. Mixtures were broken down into their component parts, so that a single item could contribute 2 or more points to the variety index. For example, lasagna might contribute to both the grain and meat groups.

In the variety category a person was allocated a score of 10 if 16 or more different foods were eaten over the 3-day period. A score of 0 was given if 6 or fewer distinct foods were eaten over the 3-day period. Here again, little guidance was available to suggest upper or lower limits in scoring variety; similar to categories 6 to 9, the limits for variety were derived by exploration of the consumption data and consultation with researchers. For a more detailed description of the construction of the HEI, see either Kennedy et al. or USDA (1995).

Theoretical Issues and Statistical Model

Applied econometric models of demand for food or nutrients are typically guided by economic theory, usually either classical or household production theory. Choice of the appropriate theoretical framework can be very important for estimation because severe statistical biases may result if the researcher does not choose prudently. In practice, however, the researcher is often limited by the available data. This has resulted in approximately the same set of available variables being included in such models regardless of theoretical framework. (Basiotis, 1991).

A consequence of this is that, depending on choice of theoretical framework, a given available variable may be thought of as being a proxy for several unrelated and unobservable economic variables. For example, the observed variable "age" can stand as a proxy for human capital in the form of experience. It affects the demands for food in general, and a healthy diet in particular, through its effects on the household production function by which households combine market-bought foods and their own labor and time to produce "healthy diets" that in turn help produce "health" (Basiotis et al., 1987). It can also be thought of as proxy for preferences unique to cohorts. As such it would affect the demand for food and healthy diet through the utility function in either theoretical framework. Thus, interpretation of estimated coefficients will be affected by choice of theoretical framework. However, assuming that the same observable (proxy) variables are included in the analysis, the estimates themselves will not be affected by choice of theoretical framework.

These observations are relevant to the present study since the recent availability of the HEI, which embodies a host of food choice characteristics, allows for a somewhat less restrictive model specification (i.e., there is no need to simultaneously estimate demands for individual foods or nutrients). The Ad Hoc reduced form specification employed here was guided by household production theory and previous studies of food and nutrient consumption in order to estimate net effects of the independent variables on the HEI. Thus, estimated coefficients should be interpreted accordingly. Specifically, individuals' HEI was related to household income as percent of the poverty threshold, participation in the food stamp program, and a number of sociodemographic characteristics. Estimation was by Ordinary Least Squares which, for ease of interpretation, was carried out separately for males and females. The software package used to perform the estimation was the Statistical Analysis System (SAS) version 6.10.

Data and Variables Definitions

Data from USDA's 1989-90 CSFII were used in this analysis. The CSFII collected dietary and other information on U.S. households and individuals within sample households. The dietary information (collected by a 1-day recall followed by a 2-day diary) was used to construct the HEI for all individuals in the data set who provided complete 3-day dietary data (Kennedy et al.). The data file used for this study was the same as the file used to construct the HEI, and it contained information on 7,463 individuals ages 2 to 97. In addition to the HEI, which was the dependent variable, the independent variables included in the model were: Annual household income as percent of the poverty threshold, its square and its cube; age, its square and its cube; food stamp program participation and amount of food stamps; self reported food sufficiency status; headship; geographic region and urbanization; race; ethnic origin; and tenancy status. The sample means presented were weighted by USDA- provided weights to be representative of the U.S. population. Survey weights were not used in regression estimation since many of the variables used to construct weights were used in the regression themselves (DuMouchel and Duncan).

Limitations

As in all applied econometric studies, several limitations must be borne in mind when interpreting the results reported here. To begin with, the nature of the study was exploratory. However, household production theory and past analyses on the demand for foods or nutrients guided model specification and selection of variables. Thus, the possibility of committing gross errors was reduced.

Several problems remain, however. A major limitation is that the OLS reduced form specification was used as opposed to a system of equations reflecting the usual derived demands for inputs in the household production function, the household production function itself, and the final demand for health and healthy eating. The range of the dependent variable is constructed to be between 0 and 100, which may imply the usual estimation problems with linear probability models (Fomby et al.). The sample consisted of all ages in order to capture variations in healthy eating by life cycle stage. This could result in inappropriate interpretation of estimated coefficients since, for example, young children tend to eat what is offered to them, but older children and adults tend to make more independent food choices. Because "healthy eating" is likely to be a very complex function of income and age, rather than include dummy

variables or use a more complicated econometric technique, such as cubic splines, at major life cycle points, we thought it best to include age and income as cubic polynomials and let the data indicate turning points. Because we did not explicitly account for the survey's design effects on statistical hypothesis testing, we considered estimated coefficients to be different from zero by carrying out the test at the 0.01 level of statistical significance. However, estimated "prob" values near 0.01 could result in either outcome, if tested more appropriately. As several variables of potential importance in influencing "healthy eating" were not available or, perhaps, ignoring self selection to, say, the food stamp program, the results may well suffer from specification biases. On the content side, the 1989-90 CSFII was conducted before the 1990 and 1995 Dietary Guidelines for Americans and the Food Guide Pyramid were published, the Nutrition Labeling and Education Act of 1990 took effect, and the USDA increased its nutrition promotion efforts targeting food assistance program participants. Thus, there may have been a structural change in later years that would be reflected in estimated relationships from later survey data. Given the size and number of these limitations, results should be interpreted with caution. Until further confirmation, they should be considered preliminary.

Results

Estimated population means and sample regression coefficients for males and females are shown in Table 1. The means of the binary independent variables represent proportions in the population. The 2-year mean value of the HEI was 62.3 for the males and 65.5 for the females. The mean income as a percent of the poverty threshold was 372 for the males and, at 342, substantially lower for the females.

The estimated regression coefficients and their associated probvalues are given next. The effects of income and age are complicated and depend on the estimated coefficients, the level of household income, as well as the age of the individual. Marginal income and age effects as well as elasticities estimated at the mean values for income and age and the HEI were calculated. The marginal effect of income for males at the average on the HEI is 0.006 and for females, 0.008. The marginal effect of age is 0.06 for males and 0.21 for females. The income elasticity of the HEI for males is 0.037, and for females it is 0.043. Thus, if income were to increase by 10%, the HEI would increase by .37% (*not* percentage points) for males and by .43% for females. The age elasticity of the HEI is 0.03 for males and 0.11 for

Table 1

Estimated Determinants of Healthy Eating: Ordinary Least Squares Coefficients and Weighted Sample Means, CSFII 1989-90, By Sex.

Variable	MALES (N=3,338)			FEMALES (N=4,106)		
	Mean	Coefficient	Probvalue	Mean	Coefficient	Probvalue
Healthy Eating Index	62.26			65.48		
Intercept		75.644911	0.0001*		72.777654	0.0001*
Income as % of poverty threshold	372.30	0.004833	0.1901	342.38	0.008918	0.0155
Income as % of poverty squared		-0.00000748	0.0715		-0.00000804	0.0598
Income as % of poverty cubed		1.40327E-9	0.2281		1.37203E-9	0.2501
Income X Age Interaction	13603.27	0.000188	0.0001*	12865.48	0.000122	0.0140
Age in years	34.20	-1.304743	0.0001*	36.29	-1.029269	0.0001*
Age in years squared		0.026735	0.0001*		0.025372	0.0001*
Age in years cubed		-0.000151	0.0001*		-0.000164	0.0001*
Food stamps: value	10.44	0.006015	0.2842	13.96	0.006140	0.1456
Household participates in FSP	0.06	-2.581720	0.0342	0.08	-1.346021	0.1365
Enough food but not the kind we want	0.21	-0.609253	0.1977	0.19	-1.311430	0.0027*
Often or always not enough food	0.03	-3.488648	0.0003*	0.02	-2.683166	0.0034*
African American	0.11	-0.290403	0.6798	0.12	-2.564748	0.0001*
Asian American	0.01	7.076303	0.0001*	0.01	5.800087	0.0004*
Other race	0.03	-1.216316	0.2676	0.03	-1.488746	0.1438
Hispanic ethnic origin	0.08	1.178308	0.1235	0.07	1.482980	0.0323
Household in Midwestern region	0.25	-0.908211	0.1439	0.23	-1.906544	0.0010*
Household in Southern region	0.34	-1.972224	0.0009*	0.35	-2.377510	0.0001*
Household in Western region	0.21	1.496223	0.0191	0.19	-1.093474	0.0638
Household in the suburbs	0.48	-0.286584	0.5536	0.46	-0.055282	0.9005
Household in a nonmetro area	0.23	-1.335222	0.0152	0.22	0.125743	0.8024
Household rents dwelling	0.30	-0.506630	0.3150	0.31	-0.489652	0.2817
Occupies dwelling w/o payment	0.02	1.832123	0.1712	0.01	-0.761558	0.5636
Female head only	0.06	-1.146687	0.1253	0.28	0.208381	0.6444
Male head only	0.18	-0.549283	0.3801	0.01	-0.335309	0.9085

Adjusted R²=0.17

Adjusted R²=0.14

* Statistically Significant at the .01 Level

Figure 2
Estimated Age Effects on HEI at Four Income Levels as a Percent of Poverty Threshold: Males

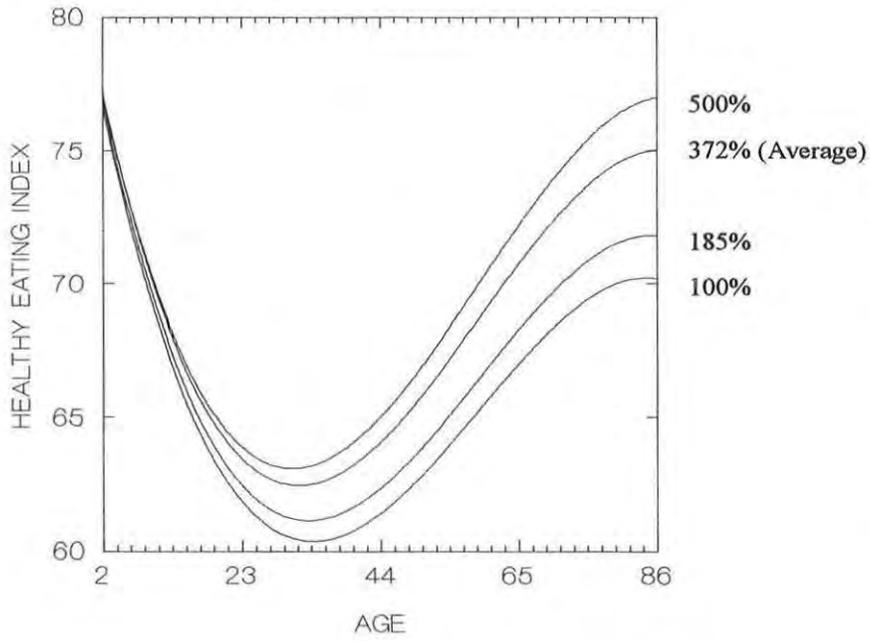
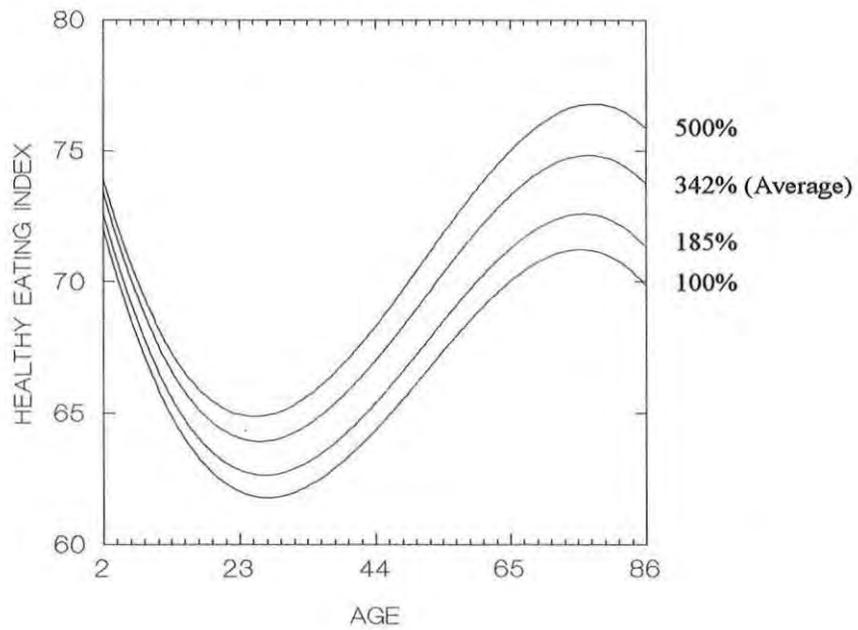


Figure 3
Estimated Age Effects on HEI at Four Income Levels as a Percent of Poverty Threshold: Females



females. Thus, females are estimated to improve their diets faster than males as they grow older. These small but positive income and age effects on the HEI are in agreement with previous findings (Morgan). Note that although the estimated coefficients of age as well as those of the interaction term are highly significant, the income coefficients for the most part are not. These findings regarding income and age are further elucidated in Figures 2 and 3. There, it can be seen that younger individuals have higher scores, for given levels of household income (and at mean values for all other variables), and that these scores decline with age. At average household income levels (372% of poverty for males and 342% of poverty for females) the HEI score reaches a minimum at about age 31 years for males and 26 years for females. It then increases steadily with age.

Starting with the 1977-78 Nationwide Food Consumption Survey, the USDA includes a food sufficiency question in its surveys. With minor wording variations from survey to survey, this question asks household respondents to classify their food supply according to: "enough and the kinds of food we want to eat," "enough but not always the kinds of food we want to eat," "sometimes not enough food to eat," and "often not enough food to eat." The last two options were coded together in this study, while the first was the omitted category. For both sexes, those whose household respondent said "enough but not always the kind of food we want to eat" tended to have lower levels of the HEI, even though the estimated effect was significant only for the females. For both sexes, answering "sometimes not enough to eat" or "often not enough to eat" was associated significantly and substantially with lower HEI average scores. These findings are consistent with the concept of the Food Sufficiency Curve illustrated by Basiotis (1992), where he hypothesized that as economic resources dwindle, household members gradually economize by first eating less nutritious food, and then by eating less food.

Race had mixed effects on HEI scores. African American women had substantially lower scores, on average, than their White counterparts, other things equal. Both male and female Asian Americans had substantially higher HEI scores, on average. "Other" races did not differ significantly from their White counterparts, other things being equal. Hispanic origin was statistically insignificant.

Compared with residents of the Eastern United States, female residents of the Midwestern region, and male and female residents of the Southern region had lower HEI scores, on average. Urbanization status did

not seem to be significantly associated with the HEI. This finding is in general agreement with those of previous studies (Morgan).

Tenancy and household headship had no statistically significant association with the HEI.

Summary and Conclusions

A preliminary model relating a previously published measure of "healthy eating," USDA's Healthy Eating Index, was related through OLS regression analysis to a number of economic and sociodemographic variables available in USDA's 1989-90 Continuing Survey of Food Intakes by Individuals. As is typical of such studies, selection of independent variables is heavily influenced by their availability. The interpretation of their estimated coefficients can vary substantially depending on the theoretical model the researcher believes is most appropriate for the task at hand. We were broadly guided by the well known household production theory and past research in selection of variables.

A novel contribution to the literature is that the dependent variable reflects individuals' overall or total diet. Further, it is a measure of the healthfulness of the overall diet, since healthy eating was defined as complying with the Dietary Guidelines and the Food Guide Pyramid.

Results tended to be in general agreement with previous studies of diets that were based on components of the total diet, mostly nutrient intakes. There were some new findings, however. A statistically strong U-shaped relationship between individuals' age and their HEI score was demonstrated. This relationship varied with household income. Asian Americans, on average, had much higher HEI scores than non-Asians, other things equal. This could be explained by the fact that most previous studies collapsed the "Aleut, Eskimo, American Indian" and "Other" categories with the "Asian/Pacific Islander" category.

These results can help in focusing dietary monitoring, assessment, and if necessary, food assistance and nutrition education and promotion activities on segments of the population who may be most in need. Based on this study, such individuals would be: Younger or middle age, lower income, living in the South, and reporting not enough to eat. In addition, African American females living in the Midwest or the South who share the above characteristics were estimated to have even lower HEI scores than those above.

References

- Abdel-Ghany, M. (1978). Evaluation of household diets by the index of nutritional quality. Journal of Nutrition Education, 10(2), 79-81.
- Basiotis, P.P. (1991). Estimated income, age, and selected demographic characteristics elasticities for food groups from USDA's 1985 and 1986 Continuing Survey of Food Intakes by Individuals. In V. Haldeman, (ed.), American Council on Consumer Interests 37th Annual Conference: The Proceedings, Columbia, MO: ACCI.
- Basiotis, P.P. (1992). Validity of the self-reported food sufficiency status item in the U.S. Department of Agriculture's food consumption surveys. In: V. A. Haldeman, (ed.), American Council on Consumer Interests 38th Annual Conference: The Proceedings, Columbia, MO: ACCI.
- Basiotis, P.P., Brown, M., Johnson, S. R., & Morgan, K. J. (1983). Nutrient availability, food costs, and food stamps. American Journal of Agricultural Economics, 65, 685-693.
- Basiotis, P.P., Guthrie, J.F., Bowman, S.A., & Welsh, S.O. (1995). Construction and evaluation of a Diet Status Index. Family Economics & Nutrition Review, 8(2), 2-13.
- Basiotis, P.P., Johnson, S.R., Morgan, K.J., and Chen, J.-S.A. (1987). Food stamps, food costs, nutrient availability, and nutrient intake. Journal of Policy Modeling, 9(3), 383-404.
- DuMouchel, W.H., & Duncan, G.J. (1983). Using sample survey weights in multiple regression analyses of stratified samples. Journal of the American Statistical Association, 78(383), 535-543.
- Fomby, T.B., Hill, C.R., & Johnson, S.R. (1984). Advanced econometric methods. New York: Springer-Verlag.
- Haines, P.S., Guilkey, D.K., & Popkin, B.M. (1989). Modeling food consumption decisions as a two-step process. American Journal of Agricultural Economics, 71, 543-552.
- Hama, M.Y. & Chern, W.S. (1988). Food expenditure and nutrient availability in elderly households. Journal of Consumer Affairs, 22(1), 3-19.
- Kennedy, E.T., Ohls, J., Carlson, S., and Fleming, K. (1995). The Healthy Eating Index: Design and applications. Journal of the American Dietetic Association, 95, 1103-1108.
- Morgan, K.J., Johnson, S.R., Lee, Y.Y., & Goungetas, B. (1985). Use of 12 groups in foods in households differing in size, income and receipt of food stamps. Journal of Consumer Studies & Home Economics, 9, 113-131.
- Morgan, K.J. (1986). Socioeconomic factors affecting dietary status: an appraisal. American Journal of Agricultural Economics, 68, 1240-1252.
- National Academy of Sciences, National Research Council, Food and Nutrition Board. (1989). Diet and health: implications for reducing chronic disease risk. Washington, DC: National Academy Press.
- Patterson, R.E., Haines, P.S., & Popkin, B.M. (1994). Diet Quality Index: Capturing a multidimensional behavior. Journal of the American Dietetic Association, 94(1), 57-64.
- SAS User's Manual, Version 6. SAS Institute, Research Triangle Park, NC.
- Sorenson, A.W., Wyse, B.W., Wittwer, A.J., & Hansen, R.G. (1976). An Index of Nutritional Quality for a balanced diet. Journal of the American Dietetic Association, 68, 236-242.
- U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. (1995). The Healthy Eating Index. Report No. CNPP-1.
- U.S. Department of Agriculture, Human Nutrition Information Service. (1992). The Food Guide Pyramid. Home and Garden Bulletin No. 252.
- U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1995). Nutrition and your health: Dietary Guidelines for Americans. Home and Garden Bulletin No. 232.
- U.S. Department of Health and Human Services, Public Health Service. (1988). The surgeon general's report on nutrition and health. Summary and recommendations. DHHS (PHS) Publication No. 88-50211.
- Welsh, S., Davis, C., & Shaw, A. (1992). Development of the Food Guide Pyramid. Nutrition Today, November/December, 12-23.

Endnotes

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Analysis of Consumer Demand for Fresh Fruits and Vegetables in the United States

Price and expenditure elasticities at retail level for 11 fresh fruits and 10 fresh vegetables were estimated by employing a composite demand system approach and using annual data. Most fresh fruits and vegetables were found to respond significantly to changes in their own prices but insignificantly to changes in expenditures. The study partially incorporated the interdependent demand relationships between fresh fruits (vegetables) and all other commodities, yet effectively avoided the problems of insufficient degrees of freedom.

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Per capita annual consumption of fresh fruits and vegetables (excluding fresh potatoes) in the United States reached an average of 114 and 103 pounds during 1991-93, an increase of 21.3% and 30.4%, respectively, over the period of 1970-72 (*Food Consumption, Price, and Expenditures*, USDA, 1994a). The rise, however, was not uniform among fresh fruits or vegetables. The overall increase in fresh fruit consumption was due entirely to sharp increases in consumption of fresh noncitrus fruits and melons, while the overall gains in fresh vegetable consumption were mainly due to increased consumption of onions, bell peppers, tomatoes, cucumbers, carrots, broccoli and head lettuce.

Among other factors, own price, prices of closely related products and per capita income have long been regarded as major determinants of demand for a commodity. Knowledge of price and income elasticities for fresh fruits and vegetables is thus very useful to both producers and researchers. For instance, price elasticity estimates are sometimes used to derive demand functions for given products. The lack of good estimates for price elasticities for fresh vegetables has caused researchers to make rather strong assumptions about such values (e.g., Epperson and Lei, 1989; and Chien and Epperson, 1990).

In spite of the long recognition of the interdependence among food commodities of similar tastes and uses, most early U.S. fresh fruit and vegetable demand studies involved only one or a small number of products, as indicated in two reviews by Nuckton (1978, 1980). Price and Mittelhammer (1979) estimated demand elasticities at the farm level for 14 fresh fruits by mixed two-stage least squares incorporating available prior information, but not within the framework of a complete demand system. Two early works, Brandow

(1961) and George and King (1971), involved the estimation of matrices of demand elasticities for a large number of agricultural commodities by using a synthetic method. However, there were only three fresh fruits and six fresh vegetables included in George and King's (1971) study, and Brandow's (1961) matrix had even less detail.

One practical problem in directly estimating a complete large-scale demand system is insufficiency of degrees of freedom. In George and King's (1971) classic study, all foods were classified into 16 separable groups and the demand equation for a single commodity within a group was specified as a function of prices of all commodities within the group, price indices for other groups, and income. This procedure may not be very effective in overcoming the problem of insufficient degrees of freedom if the number of commodity groups classified is large and individual groups consist of a great number of individual commodities. In George and King's (1971) study, some cross-price elasticities within each food group were not estimated directly. In addition, cross-price elasticities showing the effect of individual commodity prices on the commodities outside the group were generated by applying the homogeneity and symmetry conditions. The results of this procedure are affected by the ordering of the food categories in the demand matrix. By carrying out sequential estimations, however, Huang (1985, 1993) estimated the complete demand elasticity matrix directly, and therefore provided a partial, but empirically feasible solution to the above problem.

The purpose of this study is to estimate directly the U.S. demand for fresh fruits and vegetables at the retail level for the period 1960-93. Specifically, this study estimates demand elasticity matrixes for 11 fresh

fruits and 10 fresh vegetables, which represents a significant expansion in the availability of demand estimates for individual produce items at the retail level and provides updated demand estimates based on the most recently available data. The empirical estimation procedures, as proposed by Huang (1985, 1993), follow two sequential steps. First, a proposed aggregate demand system consisting of 11 food groups and a nonfood sector was estimated. The price effects of commodity groups other than fresh fruits (vegetables) were then excluded in the estimation of the demand coefficients for individual fresh fruits (vegetables) within respective demand subsystems. Therefore, the possible interdependent demand relationships between fresh fruits (vegetables) and other commodity groups were partially isolated in the estimation, yet without causing the problem of insufficient degrees of freedom.

Methodology and Estimation Procedures

Let the demand system derived from a consumer's utility maximization be:

$$q_i = f_i(p, m), \quad i = 1, 2, \dots, n. \quad (1)$$

Where, n is the number of commodities consumed, q_i the quantity demanded for commodity i , p an n -coordinate vector of the prices, and m the consumer expenditure. By taking the total differential of (1), one obtains:

$$dq_i = \sum_{j=1}^n (\partial q_i / \partial p_j) dp_j + (\partial q_i / \partial m) dm, \quad i = 1, 2, \dots, n. \quad (2)$$

Dividing both sides of (2) by q_i and expressing the price slopes in terms of elasticities, one obtains the following differential-form demand system:

$$dq_i / q_i = \sum_{j=1}^n \eta_{ij} (dp_j / p_j) + \epsilon_i (dm / m), \quad i = 1, 2, \dots, n. \quad (3)$$

Where $\eta_{ij} = (\partial q_i / \partial p_j)(p_j / q_i)$ is a price elasticity of the i th commodity with respect to a price change of the j th commodity, and $\epsilon_i = (\partial q_i / \partial m)(m / q_i)$ is the expenditure elasticity of the i th commodity. Empirically, the derivatives in (3) are approximated by the relative changes in commodities' quantity and price and per capita expenditure, respectively, and equation (3) is thus expressed as:

$$q_i' = \sum_{j=1}^n \eta_{ij} p_j' + \epsilon_i m', \quad i = 1, 2, \dots, n. \quad (4)$$

For time-series data, variables q_i' , p_j' and m' are defined as the first-order differences $(q_{i,t} - q_{i,t-1}) / q_{i,t-1}$, $(p_{j,t} - p_{j,t-1}) / p_{j,t-1}$ and $(m_t - m_{t-1}) / m_{t-1}$, respectively.

To ensure theoretical consistency with classical demand theory, the following parametric constraints are imposed on the demand system (4):

$$\text{Engel aggregation:} \quad \sum_{i=1}^n w_i \epsilon_i = 1; \quad (5)$$

$$\text{Homogeneity:} \quad \sum_{j=1}^n \eta_{ij} + \epsilon_i = 0, \quad i = 1, 2, \dots, n; \quad (6)$$

$$\text{Symmetry:} \quad \eta_{ij} / w_j + \epsilon_i = \eta_{ji} / w_i + \epsilon_j, \quad i, j = 1, 2, \dots, n. \quad (7)$$

Where w_i ($i=1, \dots, n$) is a fixed expenditure weight of the i th commodity at the selected base period. Note that the Engel aggregation and symmetry restrictions are only enforced locally at the point where the selected fixed expenditure weights refer. While there are other demand models such as the Rotterdam and the almost ideal demand system (AIDS), for which global enforcement of the neoclassical restrictions can be accomplished, an advantage of using demand system (4) is that its dependent variables, defined as relative changes of quantities demanded, can be easily quantified by using available time series data expressed as index numbers. In addition, one can directly interpret demand parameters in model (4) as elasticities.

Incorporating restrictions (5)-(7) reduces the total demand parameters to be estimated in the demand system (4) from $n(n+2)$ to $[n(n+3)/2-1]$ (including n constants), which is still intractable if n is large. To overcome the problem of degrees of freedom, George and King (1971) modeled consumer choices in a two-stage maximization process. Suppose that n commodities consumed belong to G separable groups. In the first stage, the total expenditure m is allocated among the G commodity groups such that the utility is maximized. The expenditure allocated for a particular commodity group m_I ($I=1, \dots, G$) is expressed as a function of the group price indexes and the total expenditure. In the second stage, each group expenditure is split into individual commodity

expenditures such that the utility generated from each commodity group is maximized. A demand equation for the j th commodity belonging to group I is then expressed as

$$q_j^I = q_j^I [p_1^I, p_2^I, \dots, p_{n_I}^I, m_I(p_1, p_2, \dots, p_G, m)] \quad (8)$$

or simply,

$$q_j^I = q_j^I (p_1^I, p_2^I, \dots, p_{n_I}^I, P_1, P_2, \dots, P_G, m), \quad (9)$$

$j = 1, \dots, n_I; I = 1, \dots, G.$

where p_j^I ($j=1, \dots, n_I$) represents the price of the j th commodity in the I th group, P_I ($I=1, \dots, G$) stands for the price index of commodity group I , and $n_1 + \dots + n_G = n$. The first difference form of (9) for each commodity, similar to (4), is estimated by single-equation regression. Evidently, George and King's (1971) procedure overcomes the problem of insufficient degrees of freedom and makes the estimation feasible. However, this procedure is not sufficient if the number of commodity groups (G) and the number of single commodities in an individual group (n_I) are relatively large.

Huang (1985, 1993) conducted a sequential estimation procedure in another manner to overcome the problem of degrees of freedom in the direct estimation of a large-scale demand system. In the first step, all commodities consumed are partitioned into $G-1$ food groups and a composite nonfood sector. Thus, the demand system (4) is re-specified as:

$$Q_I' = \sum_{J=1}^G H_{IJ} P_J' + E_I m', \quad (10)$$

$I = 1, 2, \dots, G.$

Where Q_I' and P_J' are, respectively, relative changes in aggregate quantity and price for commodity groups I and J , which are usually expressed as the Laspeyres quantity index and the consumer price index. Various parameters H and E represent corresponding direct- and cross-price and expenditure elasticities of the aggregate commodity groups. The aggregate demand system (10) is estimated directly while incorporating the parameter restrictions (5)-(7).

In the second step, the demand parameters within each food group are estimated group by group, using the aggregate parameter estimates obtained from (10) as information to represent approximately the price effects outside the food group under estimation. The

demand subsystem for a food group, say group I , is defined as:

$$\tilde{q}_i^I = \sum_{j \in I} \eta_{ij} p_j^I + \epsilon_i m^I, \quad i \in I \quad (11)$$

where $\tilde{q}_i^I = q_i^I - \sum_{J=1}^G H_{IJ} P_J'$ for $J \neq I$. The

dependent variable \tilde{q}_i^I is the adjusted quantity (in difference-form) for the i th commodity belonging to group I and is obtained by subtracting the price effects of those food and nonfood prices outside the group from q_i^I . In estimating the within-group demand subsystem (11), the symmetry condition (7) is imposed.

Data Sources

The basic data used in this study were the time series data of quantities and retail prices of individual fresh fruits and vegetables, quantity and price indexes for food groups and the nonfood sector, and per capita total expenditure. Annual data covering 1960-93 for 11 food categories, 1 nonfood sector, 11 fresh fruits and 10 fresh vegetables were obtained. George and King (1971) used proportionality factors, developed by DeJanvry (1966), to group food commodities. However, in order to calculate proportionality factors, one needs information on income elasticities and budget shares for all individual food commodities. For simplicity, the breakdown of food groups in this study was based on data availability. The 11 food categories used correspond to the major food groups published in various issues of *Food Consumption, Prices, and Expenditures* (USDA, 1994a) and are very similar to the classifications in Huang (1993) and Huang and Haidacher (1983): (1) red meats, poultry and fish, (2) eggs, (3) dairy products, (4) fats and oils, (5) caloric sweeteners, (6) flour and cereal products, (7) fresh fruits (including melons), (8) fresh vegetables (including fresh potatoes), (9) processed fruits, (10) processed vegetables, (11) other foods. The food category and nonfood price indexes were obtained from the *CPI Detailed Report* by the U.S. Department of Labor (1994)⁴. The quantity indexes for each food group were collected from various issues of *Food Consumption, Prices, and Expenditures* (USDA, 1994a)⁴. Per capita total expenditure was calculated by dividing the personal consumption expenditures (obtained from the U.S. Department of Commerce, 1994)⁴ by the midyear U.S. civilian population. The

quantity index for the nonfood composite sector was derived by dividing the current value of per capita expenditure on nonfood by the CPI of all items less food.

The fresh fruit subsystem estimated consisted of apples, bananas, cherries, grapefruits, grapes, lemons, oranges, peaches, pears, strawberries and watermelon. The fresh vegetable subsystem included asparagus, cabbage, carrots, celery, cucumbers, lettuce, onions, peppers, potatoes and tomatoes. The data on per capita consumption and retail prices (or price indexes) for individual fresh fruits and vegetables were collected from *Food Consumption, Prices, and Expenditures* (USDA, 1994a), *U.S. Fresh Market Vegetable Statistics, 1949-80* (Pearrow and Davis, 1982), *Fruits and Tree Nuts* (USDA, 1994b), and *Vegetables and Specialties* (USDA, 1994c). No retail prices (or price indexes) were reported for cabbage, carrots, celery and onions in 1979, for grapes, grapefruits, lemons and strawberries in 1978-79, and for cucumber and peppers in 1960-62 and 1979. For asparagus, cherries, watermelon, and pears and peaches, the data on retail prices were only available in years 1963-78, 80-91, 53-77, and 80-93, respectively. The missing data were estimated from a set of price linkage equations between retail price and grower price and the CPI of food, which generated quite reasonable predictions. The quantity data used for estimating the demand systems were defined as the retail-weight equivalents of civilian food disappearance. As all food is not sold through retail foodstores, it should be pointed out that the price and quantity data series may not correspond exactly. However, it was the best one can achieve, given the limited availability of data sources.

The remaining data needed were the fixed expenditure weights for each of the 12 commodity groups and for those individual fresh fruits and vegetables used to impose parametric constraints. The expenditure weights between food and nonfood groups were calculated from the personal consumption expenditures reported by the U.S. Department of Commerce, and the averages over the period of 1960-1993 were used. As in Huang (1993), the expenditure weight for total food was then allocated proportionally to each food group in accordance with its value in 1967-69, as reported in Table 3 of the 1979 issue of *Food Consumption, Prices, and Expenditures* (USDA, 1994a). Although shares of expenditures on some food groups have changed differently over time, the expenditure weights of 1967-69 are the only available complete data. Finally, the average expenditure share of each fresh fruit (vegetable) as a percentage of the considered fresh fruit (vegetable) group over the period of 1960-1993 was calculated by using the available

quantity and price data as described above. The expenditure weight obtained for the fresh fruit (vegetable) group with respect to the total per capita expenditure in the second step was then further allocated proportionally to each single fresh fruit (vegetable) in accordance with the estimated average expenditure shares.

Empirical Results

The demand systems of (10) and (11) were estimated in two sequential steps. In the first step, the aggregate demand system (10) was estimated incorporating the Engel aggregation, homogeneity and symmetry conditions. All direct-price elasticities except for the flour and cereal products group are negative as expected (Table 1). Nine of 12 coefficients are different from zero at a significance level of 5% or better. The positive estimate of the direct-price elasticity for the flour and cereal products group is not statistically significant. The magnitudes of the (negative) direct-price elasticities range from -0.0288 for fresh vegetables to -0.987 for nonfood commodities. The expenditure elasticities for all food groups are less than 1. Six of 12 coefficients differ from zero at a significance level of 10% or better. The negative expenditure elasticities obtained for the eggs, flour and cereal products, and fresh fruits food groups do not necessarily imply that they are inferior goods since the estimates are statistically insignificant.

The aggregate parameter estimates obtained in the first step were used to estimate the fresh fruit and vegetable demand subsystems. The quantity variable in the fresh fruit (vegetable) demand subsystem was adjusted by subtracting the price effects of all other food groups and the nonfood sector outside the fresh fruit (vegetable) group in estimation, which are represented approximately by the aggregate cross-price parameters of the aggregate demand equation for fresh fruit (vegetable) group. Equation (11) was estimated while imposing the symmetry condition. Nine of 11 estimated own-price elasticities for fresh fruits are negative (exceptions are cherries and pears), and among them 8 coefficients are significant statistically at a level of 10% or better (Table 2). Except grapes and oranges, all estimated own-price elasticities are less than unity. Most estimated expenditure elasticities for fresh fruits are positive with the exceptions of apples, cherries, grapefruit and strawberries, but none of them are statistically significant.

All estimated own-price elasticities for freshvegetables are negative except cabbage (Table 3). Except those for celery and lettuce, all estimated own-price elasticities are significant at a level of 5% or better.

Table 1
Demand Elasticities for Food Groups and Nonfood

Commodities	Price												Exp
	Meats	Eggs	Dairy	Fats	Sweeten	Flour	F.fruit	F.veg	P.fruit	P.veg	O.food	N.food	
Meats	-.3816 (5.83)	.0096 (1.14)	-.0010 (0.03)	.0161 (1.50)	-.0044 (0.35)	-.0036 (0.13)	-.0077 (0.36)	-.0294 (1.39)	.0089 (0.66)	-.0077 (0.57)	-.0206 (0.89)	-.0838 (0.69)	.5053 (3.68)
Eggs	.1154 (1.70)	-.1173 (4.12)	.0100 (0.12)	-.0112 (0.37)	-.0584 (2.00)	-.0612 (0.77)	-.0207 (0.48)	.0547 (1.20)	.0102 (0.36)	.0930 (2.49)	.0036 (0.12)	.0952 (0.72)	-.1134 (0.86)
Dairy	.0077 (0.10)	-.0012 (0.05)	-.2476 (2.09)	-.0601 (1.82)	.0163 (0.52)	.1094 (1.27)	-.0387 (0.90)	-.0322 (0.70)	-.0417 (1.43)	.0334 (0.74)	-.0018 (0.05)	-.0968 (0.60)	.3535 (2.32)
Fats	.1500 (1.55)	-.0163 (0.49)	-.2514 (1.82)	-.1697 (2.03)	.1228 (2.27)	-.2102 (1.20)	-.0421 (0.66)	-.1737 (2.59)	-.0331 (0.73)	.1268 (1.76)	-.0328 (0.69)	.1669 (0.80)	.3629 (1.85)
Sweeten	.0135 (0.27)	-.0293 (2.06)	.0392 (0.67)	.0555 (2.35)	-.1524 (4.90)	-.1324 (1.90)	.0157 (0.54)	.0547 (1.86)	.0339 (1.67)	.0524 (1.85)	.0152 (0.63)	-.0035 (0.03)	.0375 (0.33)
Flour	.0331 (0.33)	-.0256 (0.75)	.1936 (1.38)	-.0772 (1.13)	-.1143 (1.85)	.3121 (1.39)	.0422 (0.65)	.0192 (0.29)	.0390 (0.86)	-.1172 (1.50)	-.0003 (0.01)	-.1064 (0.49)	-.1981 (1.02)
F.fruit	-.0160 (0.10)	-.0191 (0.48)	-.1210 (0.80)	-.0318 (0.60)	.0333 (0.61)	.0904 (0.64)	-.2730 (2.24)	.1536 (1.62)	.0234 (0.39)	.0630 (0.90)	.0105 (0.14)	.2185 (0.68)	-.1317 (0.41)
F.veg	-.1563 (1.18)	.0400 (1.15)	-.0871 (0.66)	-.1190 (2.59)	.0857 (1.86)	-.0278 (0.24)	.1243 (1.59)	-.0288 (0.26)	-.0983 (1.97)	.0542 (0.97)	-.0652 (1.03)	.0705 (0.26)	.1520 (0.55)
P.fruit	.1085 (0.73)	.0105 (0.27)	-.2106 (1.41)	-.0398 (0.73)	.0912 (1.62)	.1137 (0.81)	.0302 (0.35)	-.1742 (1.97)	-.2900 (3.70)	-.1715 (2.53)	.0805 (1.12)	.1614 (0.50)	.2900 (0.90)
P.veg	-.0398 (0.46)	.0700 (2.37)	.0992 (0.73)	.0907 (1.77)	.0810 (1.75)	-.2276 (1.58)	.0493 (0.83)	.0536 (0.92)	-.1011 (2.54)	-.1091 (1.25)	-.0644 (1.65)	-.2734 (1.52)	.3718 (2.28)
O.food	-.0881 (0.96)	-.0044 (0.30)	-.0122 (0.20)	-.0164 (0.79)	.0051 (0.22)	-.0163 (0.32)	-.0013 (0.03)	-.0464 (1.17)	.0268 (1.06)	-.0422 (1.80)	-.2959 (4.79)	-.1518 (0.70)	.6431 (2.72)
N.food	-.0496 (8.13)	-.0095 (9.34)	-.0288 (6.26)	-.0044 (3.10)	-.0193 (12.0)	-.0285 (7.57)	-.0090 (3.73)	-.0099 (3.86)	-.0041 (2.55)	-.0117 (6.71)	-.0121 (4.18)	-.9873 (62.9)	1.174 (74.7)
Weights	.06432	.00814	.03060	.00733	.01693	.01894	.00872	.01056	.00601	.01024	.01672	.8015	

Note: 1) Numbers in parentheses are t-ratios; 2) Some notations are Meats (red meat, poultry, fish and eggs), Fats (fats & oils), Sweeten (caloric sweeteners), Flour (flour and cereal products), F.fruit (fresh fruits), F.veg (fresh vegetables), P.fruit (processed fruits), P.veg (processed vegetables), O.food (other foods), N.food (nonfood), Exp (Expenditures), Weights (expenditure weights).

The magnitudes for negative own-price elasticities range from -0.0115 for lettuce to -0.650 for asparagus. The expenditure elasticities obtained from this study are all positive and less than 1, but only those estimates for celery and tomatoes are statistically significant ($p < .10$).

The elasticity estimates and their statistics from this study are quite similar to those of Huang's study (1993), yet about twice the number of fresh produce items were included in this study. In general, fresh fruits and vegetables were found to respond significantly to changes in their own prices, but not to changes in income, implying that price was a more important factor than income in determining U.S. fresh fruits and vegetable demand.

To determine if the employed sequential estimation procedure performs better than some of the other alternative estimation approaches, model (9) expressed in first-difference form was used to estimate the fresh fruit (vegetable) demand system. Since the

price indexes of 12 commodity groups were included as independent variables in (9), the degrees of freedom dropped considerably, and multicollinearity was more likely to occur. As a result, parameter estimates obtained while imposing the symmetry restriction on the cross-price coefficients for individual fresh fruits (vegetables) were much less significant than those obtained from the sequential estimation procedure. Indeed, George and King (1971) omitted a number of price indexes in their estimation by single-equation regression. However, such does not apply to a joint estimation of a demand system. Instead of classifying commodities, other than fresh fruits (vegetables), into a number of separable groups, one can also assume that all the other commodities have the same impacts on fresh fruit (vegetable) consumption and therefore treat them as one single non-fresh-fruit (vegetable) group. The fresh fruit (vegetable) demand system established in this manner was also estimated with the restrictions of (5)-(7)

Table 2
Demand Elasticities for Selected Fresh Fruits

Fruits	Price											
	Apples	Bananas	Cherries	Gfruit	Grapes	Lemons	Oranges	Peaches	Pears	Sberries	Wmelon	Exp
Apples	-.1962 (1.31)	.0735 (0.96)	-.0264 (1.30)	-.0357 (0.67)	.1682 (2.30)	-.0157 (0.50)	.0567 (0.73)	.1187 (2.19)	-.0516 (1.15)	.0863 (2.53)	.0354 (0.70)	-.1482 (0.21)
Bananas	.1050 (0.95)	-.3341 (1.90)	.0243 (1.16)	.0446 (0.56)	-.0643 (0.65)	-.1181 (1.95)	-.0018 (0.02)	.1120 (1.36)	.0018 (0.02)	-.1270 (2.06)	-.1735 (2.07)	.6251 (1.27)
Cherries	-.5661 (1.29)	.3645 (1.17)	.0911 (0.80)	-.0865 (0.40)	-.0430 (0.14)	-.1679 (1.35)	-.1540 (0.50)	.1751 (0.75)	.0817 (0.43)	-.2266 (1.64)	.3734 (1.78)	-1.931 (0.74)
Grapefruit	-.1317 (0.67)	.1146 (0.57)	-.0150 (0.40)	-.8856 (4.92)	.2595 (1.56)	.0052 (0.06)	.2701 (1.89)	.0513 (0.40)	.0273 (0.22)	.0381 (0.40)	-.1249 (0.94)	-.1586 (0.16)
Grapes	.4239 (2.29)	-.1126 (0.65)	-.0053 (0.15)	.1775 (1.56)	-1.034 (4.90)	-.0781 (1.03)	-.2903 (2.17)	.2023 (1.75)	-.0735 (0.68)	-.0109 (0.14)	.1612 (1.37)	.7397 (0.83)
Lemons	-.0950 (0.51)	-.4889 (1.95)	-.0469 (1.35)	.0081 (0.06)	-.1850 (1.03)	-.3695 (1.68)	.0834 (0.57)	.3812 (2.50)	-.0940 (0.53)	-.2570 (2.04)	.3393 (2.13)	.5478 (0.72)
Oranges	.1077 (0.72)	.0026 (0.02)	-.0139 (0.51)	.1402 (1.88)	-.2200 (2.17)	.0267 (0.57)	-1.036 (7.55)	.1592 (2.17)	.0009 (0.01)	.0942 (2.02)	.03418 (0.49)	.4636 (0.49)
Peaches	.4197 (2.18)	.2745 (1.36)	.0286 (0.74)	.0489 (0.39)	.2837 (1.75)	.2256 (2.49)	.2942 (2.17)	-.8180 (4.60)	-.0334 (0.25)	.0969 (1.04)	-.3599 (2.79)	.6823 (0.73)
Pears	-.3174 (1.16)	.0077 (0.02)	.0230 (0.42)	.0449 (0.21)	-.1778 (0.68)	-.0960 (0.53)	-.0031 (0.02)	-.0576 (0.25)	.3038 (0.94)	-.4419 (2.61)	.3676 (1.62)	.6789 (0.57)
Strawberries	.4544 (2.53)	-.4602 (2.06)	-.0555 (1.64)	.0544 (0.40)	-.0219 (0.13)	-.2252 (2.04)	.2590 (2.03)	.1441 (1.05)	-.3793 (2.61)	-.2640 (1.80)	.1471 (1.03)	-.3697 (0.49)
Watermelon	.0938 (0.69)	-.3234 (2.06)	.0465 (1.77)	-.0917 (0.94)	.1718 (1.37)	-.1525 (2.13)	.0478 (0.49)	-.2735 (2.79)	.1619 (1.62)	.0750 (1.02)	-.6143 (4.35)	0.7524 (1.27)
Weights	.00175	.00121	.00008	.00047	.00069	.00029	.00091	.00049	.00029	.00033	.00065	

Note: 1) Numbers in parentheses are t-ratios; 2) Some notations are Exp (total expenditures), Weights (expenditure weights).

imposed. Many of the parameter estimates were rather close to those obtained by the sequential estimation procedure. This is not surprising as estimates of most aggregate cross-price parameters for the fresh fruit (vegetable) group were not significant statistically (Table 1). In other words, the advantage (or necessity) of applying a two-step sequential estimation procedure partly depends on how the commodity group under estimation is interrelated with the remaining commodities with respect to demand.

Conclusions

Demand responses for 11 fresh fruits and 10 fresh vegetables to changes in prices and income (expenditures) were modeled using a composite demand system approach. The estimation followed two sequential steps. First, an aggregate demand system consisting of 11 food groups and a nonfood sector was estimated. The parameter estimates obtained in this fashion were then used in the estimation of fresh fruit and vegetable demand subsystems to exclude the price effects of other food groups and the nonfood sector. The

analysis of fresh fruit and vegetable demand, thus, partially incorporated the interdependent demand relationships among all commodities. Since the price and expenditure elasticities were obtained directly from estimating the demand systems specified, their statistical inferences were straightforward.

Most fresh fruits and vegetables as well as aggregate commodity groups were found to respond significantly to changes in their own prices and in the directions as expected. All own-price elasticities obtained (except for grapes and oranges) were less than unity. The demand for all fresh vegetables and most fresh fruits was found to increase when per capita total expenditures rose. However, few estimates of expenditure elasticities were statistically significant. The estimates are quite close to those of Huang's study (1993), yet more fresh produce items have been included in this estimation. The study, therefore, provides more detailed information about the U.S. retail demand for fresh fruits and vegetables.

Table 3
Demand Elasticities for Selected Fresh Vegetables

Vegetables	Price										Exp
	Aspara	Cabbage	Carrots	Celery	Cucumb	Lettuce	Onions	Peppers	Potatoes	Tomatoe	
Asparagus	-.6503 (2.36)	-.1941 (1.63)	.2062 (0.63)	.5714 (2.32)	.0022 (0.01)	-.0581 (0.26)	.1112 (0.69)	-.5163 (2.07)	.4117 (2.24)	-.1553 (0.38)	.7611 (0.62)
Cabbage	-.0422 (1.62)	.0197 (0.58)	-.0211 (0.35)	.0256 (0.63)	-.0622 (1.62)	.1081 (2.09)	.0436 (1.22)	-.0546 (1.26)	-.0273 (0.62)	.1265 (1.58)	.2129 (0.72)
Carrots	.0422 (0.63)	-.0198 (0.35)	-.4685 (2.30)	-.1947 (1.99)	.0840 (0.88)	-.0494 (0.40)	.0651 (0.78)	-.0410 (0.39)	.0700 (0.65)	.1499 (0.75)	.1550 (0.22)
Celery	.1036 (2.32)	.0210 (0.63)	-.1729 (1.99)	-.0325 (0.37)	.1290 (2.06)	-.0439 (0.68)	-.0618 (1.34)	-.1307 (2.07)	.0682 (1.25)	.0795 (0.71)	.8605 (2.38)
Cucumbers	.0006 (0.01)	-.0762 (1.62)	.1093 (0.88)	.1899 (2.06)	-.3022 (2.61)	.0735 (0.74)	-.1199 (1.83)	.0749 (0.78)	-.0102 (0.12)	.0290 (0.18)	.4003 (0.72)
Lettuce	-.0023 (0.26)	.0198 (2.08)	-.0098 (0.40)	-.0095 (0.67)	.0111 (0.74)	-.0115 (0.13)	-.0037 (0.18)	-.0102 (0.56)	-.0481 (0.90)	.0512 (1.56)	.3628 (0.70)
Onions	.0149 (0.69)	.0267 (1.22)	.0424 (0.78)	-.0455 (1.33)	-.0602 (1.83)	-.0129 (0.19)	-.1588 (3.02)	-.0327 (0.81)	-.0625 (1.07)	-.0178 (0.24)	.6017 (1.51)
Peppers	-.1024 (2.07)	-.0499 (1.26)	-.0400 (0.39)	-.1429 (2.07)	.0557 (0.78)	-.0511 (0.56)	-.0486 (0.81)	-.2535 (2.47)	-.0081 (0.10)	.0109 (0.08)	.5661 (1.08)
Potatoes	.0186 (2.24)	-.0057 (0.62)	.0153 (0.65)	.0172 (1.27)	-.0017 (0.13)	-.0541 (0.90)	-.0209 (1.07)	-.0018 (0.10)	-.1552 (2.22)	.0134 (0.41)	.4048 (0.82)
Tomatoes	-.0085 (0.38)	.0315 (1.57)	.0397 (0.75)	.0240 (0.71)	.0058 (0.18)	.0689 (1.55)	-.0073 (0.24)	.0030 (0.08)	.0157 (0.40)	-.3790 (4.03)	.6581 (2.49)
Weights	.00009	.00039	.00042	.00047	.00032	.00213	.00064	.00043	.00190	.00157	

Note: 1) Numbers in parentheses are t-ratios; 2) Some notations are Exp(total expenditure), Weights (expenditure weights).

The composite demand system approach, as conducted in two sequential steps, overcomes the problem of insufficient degrees of freedom and appears to be a promising approach in estimating a large scale demand system. However, the cross-price parameters of commodity groups represent only approximately the effects of other prices outside a particular commodity group under estimation; and, therefore, sufficient care should be given in grouping commodities in order to achieve a high degree of isolation of the price effects of all other commodity groups in the estimation of a demand subsystem. Finally, note that the matrixes of demand elasticities were estimated when the neoclassical restrictions were enforced locally at the point of reference for the selected fixed expenditure weights. When data become available, a functional form which allows global enforcement of the restrictions may apply.

References

- Brandow, G. E. (1961). Interrelationships Among Demands for Farm Products and Implications for Control of Market Supply (Tech. Bulletin No. 680). University Park, PA: Pennsylvania State University.
- Chien, M. C., & Epperson, J. E. (1990). An Analysis of the Competitiveness of Southeastern Fresh Vegetable Crops Using Quadratic Programming. Southern Journal of Agricultural Economics, 22 (2), 57-62.
- DeJanvry, A. C. (1966). Measurement of Demand Parameters under Separability. Unpublished doctoral dissertation, University of California, Berkeley.

- Epperson, J. E., & Lei, L. F. (1989). A Regional Analysis of Vegetable Production with Changing Demand for Row Crops Using Quadratic Programming. Southern Journal of Agricultural Economics, 21 (1), 87-96.
- George, P. S., and King, G. A. (1971). Consumer Demand for Food Commodities in the United States With Projections for 1980 (Giannini Foundation Monograph No. 26). Berkeley, California: University of California.
- Huang, K. S. (1985). U.S. Demand for Food: A Complete System of Price and Income Effects (Tech. Bulletin No. 1714). Washington, DC: U.S. Department of Agriculture, Economic Research Service.
- Huang, K. S. (1993). A Complete System of U.S. Demand for Food (Tech. Bulletin No. 1821). Washington, DC: U.S. Department of Agriculture, Economic Research Service.
- Huang, K. S., & Haidacher, R.C. (1983). Estimation of a Complete Food Demand System for the United States. Journal of Business & Economic Statistics, 1, 285-291.
- Nuckton, C. F. (1978). Demand Relationships for California Tree Fruits, Grapes, and Nuts: A Review of Past Studies (Division of Agricultural Science Special Publication No. 3247). Davis, CA: University of California.
- Nuckton, C. F. (1980). Demand Relationships for Vegetables: A Review of Past Studies (California Agricultural Experiment Station, Giannini Foundation Special Report No. 80-1). Davis, CA: University of California.
- Pearrow, J., & Davis, W. (1982). U.S. Fresh Market Vegetable Statistics, 1948-80 (Statistical Bulletin No. 688). Washington, DC: U.S. Department of Agriculture, Economic Research Service.
- Price, D. W., & Mittelhammer, R. C. (1979). A Matrix of Demand Elasticities for Fresh Fruit. Western Journal of Agricultural Economics, 4, 69-86.
- U.S. Department of Agriculture. (1994a). Food Consumption, Prices, and Expenditures (Statistical Bulletin No. 915). Washington, DC: Author.
- U.S. Department of Agriculture. (1994b). Fruits and Tree Nuts: Situation and Outlook Report (FTS-271). Washington, DC: Author.
- U.S. Department of Agriculture. (1994c). Vegetables and Specialties: Situation and Outlook Report (VGS-263). Washington, DC: Author
- U.S. Department of Commerce (1994). Survey of Current Business. Washington, DC: Author.
- U.S. Department of Labor (1994). CPI Detailed Report. Washington, DC: U.S. Government Printing Office.

Endnote

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Consumer Satisfaction with Managed Health Care

This study estimates the effects of four categories of variables hypothesized to influence consumer satisfaction with a managed care health benefits plan. Ordinal probit is used to utilize the full spectrum of information available on the satisfaction measure. Results show that personal experience, expectations, and judgements about provisions of the plan all influence overall satisfaction. If managed care health plans are "here to stay" steps can be taken by administrators of the plan to increase consumer satisfaction.

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Key in the search for an answer to whether managed care health benefits plans will solve the nation's health care woes is knowledge of *consumers'* perceptions of how they fare when covered by these plans. Managed care, in general, describes insurance plans that base themselves on networks of providers (Miller et al., 1994). In this study, managed care means a plan in which consumers must choose a primary care physician from a network. To obtain medical services, a chosen primary care physician must be seen first. This medical professional acts as gatekeeper to further medical services.

Steele (1992) summarized the role of the consumer in shaping health services:

In order to provide health services which are responsive to consumers' needs, those organizations whose role it is to purchase, provide, or assess health services have a duty to carry out consumer appraisal work. Consumers are experts. They are experts on their own priorities, their own needs, and their own experiences, and they should be consulted as should any other expert group (p. 37).

This study examines how utilization of services, consumer experiences that impact their expectations of plan provisions, and individual differences influence consumer judgements of satisfaction with managed care.

Literature Review

Several researchers have considered the concept of patient satisfaction. Luft (1981) characterized satisfaction as being related to access, availability of resources, continuity of care, information transfer, humanness, and quality, having reviewed some of the earlier (pre 1975) literature in the area of patient satisfaction. Higgins et al. (1991) suggest ten

dimensions of quality that are specific to Health Maintenance Organizations (HMOs): reliability, responsiveness, competence, access, courtesy, communication, credibility, security, knowing the customer, and tangibles.

Researchers who empirically examined consumer satisfaction with health care have suggested that satisfaction is influenced by aspects of care that are specific to the health care experience (Abramowitz et al., 1987; Strasser et al., 1993; Cleary et al., 1988; Doering, 1983; Russell, 1990; Ware et al., 1975; Woodside et al., 1980), and that consumers are able to form summary measures of their satisfaction based on their satisfaction with components of care (Aharony et al., 1993; Luft, 1981; Strasser et al., 1993). Quality of care, access to care, availability of resources, and continuity of care accounted for 72% of the variance in satisfaction in a study by Ware and Snyder (1975), while Russell (1990) found that quality of care and accessibility accounted for 64% of the variance. Ward (1990) found that older persons, increases in acceptance of providers other than the primary care physician, ability to see the primary care physician and plan familiarity all positively influenced consumer satisfaction with HMO services.

Some researchers have focused specifically on the process of health care delivery (distinct from the physical outcome) as being a major influence in consumer perceptions of satisfaction with medical services (Buller et al., 1987; Street et al., 1995; Woolley et al., 1978). Swan (1992) has suggested that the formation of patient satisfaction perceptions are based on a reciprocal process that is influenced by both the consumer and provider of medical services. This is an extension of the expectation/disconfirmation model (Cardozo, 1965), and is complementary to the work of Woodruff et al. (1983) and Oliver (1989) in which it is asserted that consumers develop a set of experienced

based norms on which they judge whether expectations are disconfirmed. It is Swan's (1992) proposition that "patient expectations and standards for performance are negotiated as health care providers attempt to change unrealistic patient expectations/performance standards" (p 69). This idea is of potentially great importance when examining consumer satisfaction with managed care, as consumers in the U.S. may have preconceived perceptions of how health care systems should work based on the typical free choice, third party payer system that has been common in the United States.

Recent research has focused specifically disenrollment from managed care health benefits plans (Long et al., 1988; Solnick et al., 1992; Weiss et al., 1990). Weiss and Senf (1990) found that the number one reason for disenrollment from a plan was the desire for a different primary care physician. Issues such as appointment scheduling and difficulty in getting referrals to specialists ranked seven and eight out of ten reasons.

Other research has focused on the market performance of managed care plans using supply side measures such as the provision of care, length of hospital stays, number of physician office visits, and cost structures (Fielding, 1984; Miller et al., 1994). Miller and Luft (1994) included an evaluation of five studies that focused on consumer satisfaction with managed care plans and found that with only one exception, consumers tend to be satisfied with perceived quality of care, patient-physician interactions, and financial aspects of health care plans when compared with traditional fee for service, third party payer plans.

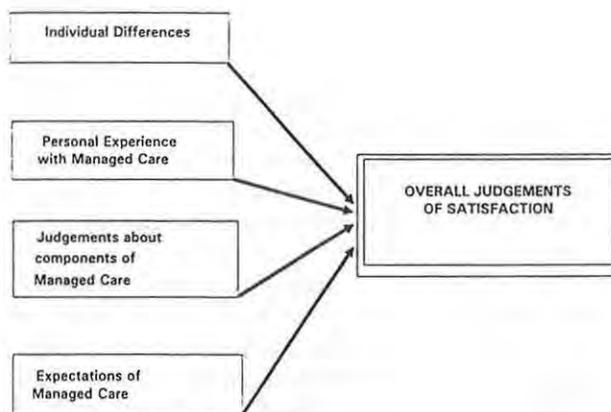
The above literature review reveals that there are many dimensions of medical care that can influence consumers' satisfaction. In addition to these dimensions that are either directly or indirectly associated with satisfaction, there are variables specific to the individual consumer or situation that can impact on satisfaction. It is also clear that there is a gap in our knowledge of how managed care health benefit plans and their configurations help shape the satisfaction of consumers enrolled in such plans. There is no current research that examines how various parts of a managed care plan, how consumer satisfaction with various the parts and how experience and socio-demographic factors influence overall satisfaction.

Conceptual Framework

Based on the many models of consumer satisfaction in general, and patient satisfaction in particular, the model in Figure I is proposed to explain the process of consumer satisfaction with managed care health benefits plans. It incorporates the known

influences on consumer satisfaction and dissatisfaction including expectations and disconfirmation of those expectations, individual differences, subjective judgements about individual components health services, and personal experience (with the health care delivery system) (Oliver, 1989; Parasuraman et al., 1988; McKelvey et al., 1975; Swan et al., 1980; Woodruff et al., 1983).

FIGURE 1. Conceptual Framework to Examine Consumer Satisfaction with Managed Care



Estimation

Ordered Probit Model

The dependent variable is consumer satisfaction with managed care, an ordinal construct. Despite the fact that the measurement of satisfaction can be conceptualized on an interval scale, differences in people's perceptions of that scale makes measurement on that level non-operational. In order to use a multivariate regression type of analysis, this limitation in the measurement of the dependent variable is an important consideration. Therefore, an ordered probit model is used (McKelvey et al., 1975; Winship et al., 1984). If the probability that the dependent variable increases slowly at low and high levels and increases more quickly at intermediate levels, the cumulative normal probability function is an appropriate representation of the underlying, unmeasurable scale for satisfaction and an ordered probit specification is preferable to the linear model because it takes into account the floor and ceiling effects of the dependent variable (Hanushek et al., 1977).

Because the cumulative normal transformation is non linear, we must obtain estimates for the parameters that influence satisfaction using maximum likelihood methods (Pindyck et al., 1981).

Data

The population included 2955 employees eligible for health care benefits at a medium sized university. The health benefits choices for these employees changed in July 1993. Data were collected in October 1994. Previous to the change, 95% of employees chose a fee for service plan where any physician or specialist could be chosen and there was no co-payment. Five percent chose an HMO which charged a \$5.00 co-payment and 100% of the cost of seeing a physician other than the chosen primary care provider. This study concentrates on the employees who were forced to change to a managed care plan if they wished to be insured by the University. These employees had three choices: an "in-network" managed care plan, where a \$2.00 co-payment is required for office visits and a 20% out of network charge, and "out-of-network" plan where the individual can choose any physician and pay 10% of the cost, and the originally offered HMO plan, now with a \$2.00 co-pay. Completed questionnaires were received from 1238 employees, for an overall response rate of 42%. The responses received were representative of actual enrollments in the three plans, with the majority (86.5%) of respondents enrolled in the in-network plan, 5% in the out-of-network plan, and 8.5% in the HMO. For this particular study, we focus on those employees enrolled in the managed care plan, either in- or out-of-network. These respondents faced a change in their health care plan. Less than 2% of the employees facing a change in plan chose the HMO previously offered. The final number of respondents who had complete information on all the variables included in this analysis is 1120.

Variables Measured

The dependent variable is *general* satisfaction with managed care, created from a five point ordinal Likert scale that included categories from strongly disagree to strongly agree for the statement, "I am satisfied with my health benefits choice" (See, for example, Aharony 1991; Lutz 1981; Strasser et al. 1993). Independent variables include measures related to the four categories of variables outlined in Figure 1: individual differences, personal experiences with managed care, judgements about individual components of managed care, and expectations of managed care. Measures of individual differences include the demographic variables age of respondent (AGE), measured using actual age, two dummy variables representing income level categories of less than \$15,000 and greater than \$50,000 (LOWINC, HIGHINC), a dummy variable representing gender, with

female as the omitted category (MALE), and employee type (a proxy for educational level), measured as a 0/1 dummy variable where the omitted category is faculty/officer of administration and the included category is support staff (STAFF).

Personal experiences with managed care include measures of the number of problems actually experienced with various components of the health benefits plan during the previous twelve months if an individual used the health plan, and whether a respondent was dissatisfied with their most recent experience. Using both of these measures allows an evaluation of how quantity of dissatisfaction about specific components of a health plan and how salience of a dissatisfactory experience benefits plan impact on overall satisfaction. The measures of the actual number of dissatisfactory experiences, if the plan was used, include the benefits plan components of primary care physicians (NPRPCP), mental health care providers (NPRPROV), and managed care representatives (NPRADM). The same components are used in the dissatisfaction with most *recent* experience variables (DISPCP, DISPROV, DISADM), measured as 0/1 dummy variables.

Factor analysis was used to create variables to measure judgements about individual aspects of the plan. Identified factors include quality and availability of resources related to primary care physicians (PCPQUAL), physical health benefits in general (PHYSQUAL), prescription drug services (DRUGQUAL), the administration of benefits by the benefit office (BENQUAL), and mental health services (MENTQUAL). Access to care in general (ACCESS) also revealed itself as a factor. One additional factor (CHANGES) is more applicable as a measure of expectations and is discussed below. Table 1 identifies the factor loadings after varimax rotation (See Green et al. 1988). Given the measures available, these results are consistent with the factors described by Ware and Snyder (1975) and Russell (1990). Expectations consumers have of a health benefits plan are measured using three variables. (CHANGES), identified in the factor analysis, addresses how a consumer feels about adequacy of services that changed when a move to managed care was made, and includes issues of subjective comparison of the old and new plans in general, and adequacy of specialty and emergency care. Services related to emergency and specialty care are restricted under the managed care plan and require a referral. Under the old plan, a consumer could visit any specialist or emergency room at any time and have the services covered. Whether a consumer is covered by another plan (OTHERPL) and whether the consumer

Table 1. Formulation of Factors

VARIABLE	BENQUAL	ACCESS	MENTQUAL	DRUGQUAL	PHYSQUAL	PCQUAL	CHANGES
Benefits office is professional.	.36						
Benefits office is informed.	.40						
Benefits office solves problems.	.39						
Appointment scheduling is difficult.		.52					
Time between making appointment and seeing M.D. is too long.	.51						
Co-payment limits my ability to seek care I need.	.24						
Mental health benefits are convenient to use.			.58				
Mental health benefits are adequate.			.56				
Prescription drug benefits are convenient to use.				.54			
Prescription drug benefits are adequate.				.60			
Physical health benefits are convenient to use.					.49		
Physical health benefits are adequate.					.58		
I am satisfied with my primary care physician.						.55	
Emergency care is adequate.						.58	
Specialty care is adequate.						.42	
Eigen value		3.37	2.42	1.65	1.10	1.04	1.01
N=1120							

was employed at the University when the health care plan choices changed (HERECHN) are measures of consumer familiarity with different types of plans. This knowledge may influence their expectations of a health care plan. Finally, the type of plan the consumer is enrolled in, whether in- or out-of-network could also influence expectations. Being enrolled in the out-of-network plan is the left out variable (INNET). Table 2 provides descriptive statistics of the measured variables.

Empirical Model

The equation to be estimated is:

$$\text{SATISFACTION} = \alpha_0 + \alpha_1 \text{AGE} + \alpha_2 \text{LOWINC} + \alpha_3 \text{HIGHINC} + \alpha_4 \text{MALE} + \alpha_5 \text{STAFF} + \alpha_6 \text{PCQUAL} + \alpha_7 \text{PHYSQUAL} + \alpha_8 \text{DRUGQUAL} + \alpha_9 \text{BENQUAL} + \alpha_{10} \text{MENTQUAL} + \alpha_{11} \text{ACCESS} + \alpha_{12} \text{CHANGES} + \alpha_{13} \text{OTHERPL} + \alpha_{14} \text{HERECHN} + \alpha_{15} \text{OUTNET} + \alpha_{16} \text{PRPCP} + \alpha_{17} \text{DISPCP} + \alpha_{18} \text{NPRADMS} + \alpha_{19} \text{DISPROV} + \alpha_{20} \text{NPRADMS} + \alpha_{21} \text{DISADMS} + \text{ERROR}$$

The model is estimated using 1/2 of the sample and several different permutations of the dependent variable to identify the best fit. To test the specification, the best fitting model is estimated using the second half of the sample.

Results

Results from the first half of the estimation are found in Table 3. These coefficients are interpreted as "the increment in probability of being in a higher response category brought about by a unit change in the independent variable" (McKelvey and Zavoina 1975, p 114).

Note there are three different measures of the dependent variable. The first uses all the information available on the Likert scale, thus the dependent variable represented in column 1 of Table 3 has five different levels of measurement from strongly agree, coded as 5 to strongly disagree, coded as 1. There is a neutral category. Column 2 of Table 3 represents results using a four level measure. The neutral category is left out (note fewer observations are used). Leaving out the neutral category is analogous to McKelvey and Zavoina counting abstentions from voting for a particular bill as missing data instead of neutral votes in their 1975 examination of ordinal probit. Column 3 presents the results using a two level, agree/disagree measure. This is the standard bi-nomial Probit.

The two ordered probit models performed similarly. The same variables are significant, and are of the same sign. Both the five and four level specifications were included to test whether persons answering neutral could really be considered as being in the middle of the Likert Scale or answered so because they did not know. In this survey, the neutral category is significant. The

binomial probit model, however, paints a different picture about the variables that affect satisfaction with managed care health benefits plans. Interesting are the results that indicate in the binomial model that demographic variables including being male, having an income greater than \$50,000, and being a staff member rather than faculty or an officer of administration affects satisfaction. None of these demographic variables are significant when full use is made of the information about the dependent variable.

Table 2. Summary Statistics

VARIABLE	DEFINITION	MEAN	σ
SATISFIED	1=SD 2=D 3=N 4=A 5=SA	2.89	.91
AGE	Age of respondent	44.71	10.30
MALE	Respondent is male ^D	.35	.48
INNET	Enrolled in-network ^D	.92	.26
LOWINC	income < \$15,000 ^D	.06	.23
HIGHINC	income > \$50,000 ^D	.14	.35
OTHER	Has other health insurance	.12	.33
NPRPCP	# problems with primary care M.D.	.54	1.5
DISPCP	Dissatisfied with last PCP experience ^D	.09	.29
NPRPROV	# problems with mental health provider	.34	1.4
DISPROV	Dissatisfied with last mental health provider experience ^D	.05	.23
NPRADM	# problems with plan administration	.74	2.5
DISADM	Dissatisfied with last adms. experience ^D	.13	.34
STAFF	Staff, not faculty or officer of adms. ^D	.67	.47
HERECHN	Experienced previous health care plan ^D	.84	.36

N= 1120

The three estimated variables MU1-MU3 in the five level model and MU1-MU2 in the four level model identify the positions on the underlying interval scale of the ordinal measures strongly agree to strongly disagree with overall satisfaction with managed care. These variables are interpreted as follows for the five level model. If an individual's estimated location on the underlying scale is less than zero, the individual is very dissatisfied with their health care plan. Those with estimated locations between zero and .74 are dissatisfied. Those with estimated locations between .75 and 1.26 are neutral. Those with estimated locations between 1.27 and 3.21 are satisfied. And, individuals' whose estimated position falls above 3.22 are very satisfied. All the MU variables are significant. Based on the above discussion, the model utilizing the fullest information about the dependent variable (5 levels) was tested using the other half of the sample. These results are presented in the last column of Table 3. The final model estimated using the hold out sample performed very similarly to the model estimated on the first half of the sample. Three variables **negatively** affect satisfaction with managed care health benefits: being older, having a salient dissatisfactory

experience with the administrators of the plan, and believing the managed care plan limits access to care. Five variables **positively** affect satisfaction: being satisfied with the benefits office that oversees the benefits plan, believing that the physical health benefits coverage and primary care physicians are of high quality, and the three variables measuring changes in satisfaction in the underlying, yet unmeasurable interval scale. Three of the four components of the conceptual model presented as Figure 1 influence judgements of overall satisfaction with managed care. To some extent personal experience with managed care influences satisfaction, but it is limited to experience with administrators of the plan. Judgements consumers make about the components of managed care influence satisfaction most.

Discussion

Results indicate that, with the exception of the age of the enrollee, demographic variables **do not** influence whether or not an individual is satisfied with their health benefits plan. How consumers perceive the quality, access, and convenience of using various components of the plan **do** influence satisfaction. These results are similar to the findings of other researchers who have found that satisfaction is related to qualities describing components of health care provision, including access, availability of resources, competence, and continuity (Russell, 1990; Abramowitz et al., 1987; Higgins et al., 1991; Woodside et al., 1980). Specific to this study are the findings that consumers who find care accessible with regard to appointment scheduling and co-payments, who agree that physical health benefits are convenient to use and provide adequate coverage, who are satisfied with their chosen primary care physician, and who believe the office that oversees benefits is informed, solved problems, and acts in a professional manner are more likely to be satisfied with their overall managed care benefits plan. The following discussion details these results.

Enrollees who agree that emergency and specialty care are adequate are more likely to be satisfied in general with their benefits plan. These components of the plan changed with the move to managed care and are used to measure expectations consumers may have brought with them when the managed care health plan was introduced. Under the new plan, specialty care is available by referral only and the emergency room of hospitals is not to be used for routine care. If consumers expectations were met, their overall satisfaction was increased. Because access to these services could be

Table 3. Probit Results Using Different Measures of the Dependent Variable: Satisfaction

INDEPENDENT VARIABLES	5 Levels SD-D-N-A-SA	4 Levels SD--D--A--SA	2 levels D-----A	FINAL MODEL 5 LEVELS SD-D-N-A-SA
INTERCEPT	4.90 ^{***}	4.53 ^{***}	4.36	3.47 ^{***}
AGE	-.01*	-.00	-.93	-.88*
GENDER	-.07	-.17	.44*	-.14
OUTNET	.10	-.22	-.24	.09
LOWINC	.11	-.34	-.06	-.17
HIGHINC	.20	.31	.59*	-.11
OTHER	-.10	-.91	-.23	.15
NPRPCP	-.04	-.23	.11	-.05
DISPCP	-.18	-.19	-.16	-.04
NPRPROV	.02	-.09*	.02	.05
DISPROV	.04	-.11	.23	.33
NPRADM	-.02	-.07	-.01	-.04
DISADM	-2.14 ^{***}	-1.77 ^{***}	-2.97	-1.17*
BENQUAL	.21 ^{***}	.19 ^{***}	-.02	.21 ^{***}
ACCESS	-.26 ^{***}	-.28 ^{***}	-.20*	-.22 ^{***}
MENTQUAL	.05	.06	.63	.08
CHANGES	.08*	.15 ^{***}	.17*	.06*
DRUGQUAL	-.02	-.02	.07	.04
PHYSQUAL	.24 ^{***}	.39 ^{***}	.81 ^{***}	.16 ^{***}
PCPQUAL	.34 ^{***}	.40 ^{***}	.57 ^{***}	.33 ^{***}
STAFF	-.02	.12	.53 ^{***}	-.05
HERECHN	-.09	-.08	-.11	-.08
MU 1	.74 ^{***}	.80 ^{***}		.75 ^{***}
MU 2	1.26 ^{***}	3.23 ^{***}		1.20 ^{***}
MU 3	3.21 ^{***}			3.06*
Log Likelihood	.32E-13	.32E-13	.32E-13	.32E-13
N	531	480	531	589

perceived as being curtailed, administrators of benefits plans must, in a positive light, change consumer expectations about access to these services. For example, consumers may be shown how their primary care physician will be available for local emergencies, or how easily the plan covers "out of town" emergencies.

The specification of the model included the ability to discern whether overall satisfaction with a managed care health benefits plan is influenced by recent personal experiences with components of the health plan (the last encounter with an aspect of the plan). Results indicate that salient dissatisfactory experiences with physicians and mental health care providers do not impact on overall satisfaction, while dissatisfactory salient experiences with administrators of the plan (including managed care representatives and insurance handlers) have a negative influence on satisfaction. It appears that consumers are willing to "put up" with dissatisfaction with providers, but not with those who actually manage the plan. Because the plan studied in this research is relatively new, this results points to the need of administrators tied directly to the plan to provide

top quality service to consumers if managed care is to be seen as a satisfactory alternative to traditional insurance plans. Along the same lines, if the office associated with overseeing the plan is seen in a positive light by enrollees, satisfaction with the benefits plan is increased. This finding is extremely important as the administrators of the plan provide the information that sets the tone for consumer expectations. The bottom line is that since an additional layer of administration is added under managed care, consumers must be able to communicate effectively with this bureaucratic layer probably to the point of "not even knowing it is there." The administrative aspects of managed care must take a back seat and the medical services provided shine in the forefront.

Limitations of the study must be noted. First, this is a study of one managed care plan offered as an employee benefit. There is little opportunity for consumers to decline insurance benefits and disenroll from the plan. thus, the study is limited in its ability to be generalized to all managed care health plans. Despite this limitation, the results indicate that when full

information is used on the dependent variable (satisfaction) consumer judgements about various components of the plan are related to overall satisfaction with the plan. While consumers base their overall assessments of satisfaction on their general beliefs about components of the plan including accessibility, quality, and coverage, they also base their assessments on their satisfaction of the last encounter with administrators of the plan (personal experience). This finding has relevance for increasing satisfaction, and thus, acceptance of managed care health plans by consumers. The bottom line is not new for those familiar with the customer satisfaction literature: *get it right the first time and every time*. However, it appears that consumers are more forgiving of the actual providers of care than they are of the administrators directly associated with providing payment (insurance) and managing care (managed care representatives).

References

- Abramowitz, S., Cote, A. A., & Berry, E. (1987). Analyzing Patient Satisfaction: A Multianalytic Approach. Quality Review Bulletin, 13(4-April), 122-130.
- Aharony, L., & Strasser, S. (1993). Patient satisfaction: what we know about and what we still need to explore. [Review]. Medical Care Review, 50(1), 49-79.
- Buller, M. K., & Buller, D. B. (1987). Physicians' Communication Style and Patient Satisfaction. Journal of Health and Social Behavior, 28(December), 375-388.
- Cardozo, R. N. (1965). An Experimental Study of Consumer Effort, Expectation and Satisfaction. Journal of Marketing Research, 2(August), 244-249.
- Cleary, P. D., & McNeil, B. J. (1988). Patient Satisfaction as an Indicator of Quality Care. Inquiry, 25(Spring), 25-36.
- Doering, E. R. (1983). Factors Influencing Inpatient Satisfaction With Care. Quality Review Bulletin, 9(10), 291-299.
- Fielding, S. L. (1984). Organizational impact on medicine: the HMO concept. Social Science & Medicine, 18(8), 615-620.
- Hanushek, E. A., & Jackson, J. E. (1977). Statistical Methods for Social Scientists. New York: Academic Press.
- Higgins, L. F., Ferguson, J. M., & Winston, W. J. (1991). Understanding and assessing service quality in health maintenance organizations. Health Marketing Quarterly, 9(1-2), 5-21.
- Long, S. H., Settle, R. F., & Wrightson, C. W., Jr. (1988). Employee premiums, availability of alternative plans, and HMO disenrollment. Medical Care, 26(10), 927-938.
- Luft, H. S. (1981). Health Maintenance Organizations: Dimensions of Performance. New York: Wiley and Sons.
- McKelvey, R. D., & Zavoina, W. (1975). A statistical model for the analysis of ordinal level dependent variables. Journal of Mathematical Sociology, 4, 103-120.
- Miller, R. H., & Luft, H. S. (1994). Managed care plan performance since 1980. A literature analysis. JAMA, 271(19), 1512-1519.
- Oliver, R. L. (1989). Processing of the Satisfaction Response in Consumption: A Suggested Framework and Research Propositions. Journal of C/S & D Behavior, 2, 1-16.
- Parasuraman, A., Zeithaml, V., & Berry, L. (1988). Servqual: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality. Journal of Retailing, 64(1), 12-40.
- Pindyck, R. S., & Rubinfeld, D. L. (1981). Econometric Models and Economic Forecasts. (Second ed.). New York: McGraw-Hill Book Company.
- Russell, M. (1990). Consumer satisfaction: An investigation of contributing factors. Journal of Social Service Research, 13(4), 43-56.
- Solnick, S. J., & Hemenway, D. (1992). Complaints and Disenrollment at a Health Maintenance Organization. The Journal of Consumer Affairs, 26(1), 90-103.
- Steele, K. (1992). Patients as Experts: Consumer Appraisal of Health Services. Public Money & Management, (October-December), 31-37.
- Strasser, S., Aharony, L., & Greenberger, D. (1993). The patient satisfaction process: moving toward a comprehensive model. [Review]. Medical Care Review, 50(2), 219-248.
- Street, R. L., & Wiemann, J. M. (1995). Patients' satisfaction with physicians' interpersonal involvement, expressiveness, and dominance. In M. McLaughlin (Ed.), Communication Yearbook (pp. 591-612). Beverly Hills: Sage.
- Swan, J., & Trawick, F. (1980). Satisfaction related to predictive vs. desired expectations. In R. Day (Ed.), Refining concepts and measures in consumer satisfaction and complaining behavior (pp. 7-12). Bloomington, IN: Indiana University School of Business.

- Swan, J. E. (1992). Satisfaction Work: The Joint Production of Patient Satisfaction by Health Care Providers and Patients. Journal of Consumer S/D & C Behavior, 5, 69-80.
- Ward, R. A. (1990). Age and patterns of HMO satisfaction. Journal of Aging & Health, 2(2), 242-260.
- Ware, J. E., & Snyder, M. K. (1975). Dimensions of Patient Attitudes Regarding Doctors and Medical Care Services. Medical Care, 13, 669-682.
- Weiss, B. D., & Senf, J. H. (1990). Patient satisfaction survey instrument for use in health maintenance organizations. Medical Care, 28(5), 434-445.
- Winship, C., & Mare, R. D. (1984). Regression Models with Ordinal Variables. American Sociological Review, 49(August), 512-525.
- Woodruff, R. B., Cadotte, E. R., & Jenkins, R. L. (1983). Modeling Consumer Satisfaction Processes Using Experienced-Based Norms. Journal of Marketing Research, 20(August), 296-304.
- Woodside, A. G., Frey, L. L., & Daly, R. T. (1980). Linking Service Quality, Consumer Satisfaction, and Behavioral Intention. Journal of Health Care Marketing, 9(4), 5-17.
- Woolley, F. R., Kane, R. L., Hughes, C. C., & Wright, D. D. (1978). The Effects of Doctor-Patient Communication on Satisfaction and Outcome of Care. Social Science and Medicine, (12), 123-128.

Endnotes

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