

# Consumer Expenditure Survey Anthology, 2008



U.S. Department of Labor  
U.S. Bureau of Labor Statistics  
December 2008

Report 1009



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# Preface

This is the third in a series of reports presenting articles pertaining to the U.S. Bureau of Labor Statistics (BLS) Consumer Expenditure Survey (CE). The most recent report, *Consumer Expenditure Survey Anthology, 2005*, was published in April 2005. As in the previous anthologies, articles discussing ongoing research and methodological issues pertaining to the CE and analytical articles using this survey's data are included in this report. For the first time, articles discussing processing methods and improvements are also included here.

This report was prepared in the Office of Prices and Living Conditions, Division of Consumer Expenditure Surveys (DCES), under the general direction of Steve Henderson, Chief of the Branch of Information and Analysis, and was produced and edited by John M. Rogers, Section Chief. Articles on research and methodology were contributed by Lucilla Tan and Nhien To of the Branch of Research and Program Development; Sylvia Johnson-Herring, Susan King, and Sharon Krieger of the Division of Price Statistical Methods; and Nathan McDermott formerly of the Branch of Production and Control. Articles on processing improvements were contributed by Steven Bass, Brendan Livingston, and Nathan McDermott, all formerly of the Branch of Production and Control. Analytical articles were contributed by Brett Creech, Meaghan Duetsch, Geoffrey Paulin, and Mark Vendemia of the Branch of Information and Analysis.

This report was edited by Brian Baker, Edith Baker, and Monica Gabor of the Office of Publications and Special Studies; and Margaret Jones, of the same office provided layout services.

BLS makes CE data available in news releases, reports, and articles in the *Monthly Labor Review*, as well as on CD-ROMs and on the Internet. A biennial report includes standard tables of recent survey data, a discussion of expenditure changes, and a description of the survey and its methods. Current and historical CE tables classified by standard demographic variables are available at the BLS Internet site <http://www.bls.gov/cex>. This site also provides other survey information, including answers to frequently asked questions, a glossary of terms, order forms for survey products, articles from the *Monthly Labor Review*, and other research articles.

The material that follows is divided into three sections: Section 1 includes articles on survey research and methodology, section 2 includes articles on processing issues and improvements, and section 3 presents analysis of topics of interest based on CE data. An appendix includes a general description of the survey and its methods and a glossary of terms.

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# Contents

	<i>Page</i>
<b>Part 1. Survey Research and Methodology</b> .....	1
<b>Evaluation of the 2005 redesigned Consumer Expenditure Survey diary</b> .....	3
A redesigned diary questionnaire, designed to simplify the recording task without sacrificing data quality, was evaluated using data quality measures to see how well it compared to the old questionnaire.	
<i>Nhien To and Lucilla Tan</i>	
<b>Selecting a sample of households for the Consumer Expenditure Survey</b> .....	14
The sample design and the method for selecting households for participation in the survey are described.	
<i>Susan King and Sylvia Johnson-Herring</i>	
<b>Response rates in the Consumer Expenditure Survey</b> .....	20
How the outcome of visits to survey households is categorized in terms of response and nonresponse is described, as well as how response rates are calculated.	
<i>Sylvia Johnson-Herring and Sharon Krieger</i>	
<b>The effect of refusal conversion on data quality in the Consumer Expenditure Interview Survey</b> .....	23
Achieving and maintaining high response rates are important goals of the survey program, and guidelines have been established to persuade reluctant respondents to participate in the survey. The quality of data obtained from such respondents is compared to that of other respondents.	
<i>Nathan McDermott and Lucilla Tan</i>	
<b>Part II. Processing Improvements</b> .....	33
<b>Outlier detection by forecasting</b> .....	34
Three methods for improving the selection of data outliers for review were evaluated, and one was selected for implementation.	
<i>Nathan McDermott and Brendan Livingston</i>	
<b>Reclassifying low-expenditure consumer units in the Consumer Expenditure Interview Survey</b> .....	41
The survey program implemented an improved method for screening consumer units with unusually low expenditure totals to determine if their interviews should be reclassified as non-interviews.	
<i>Steven Bass</i>	
<b>Part III. Analyses Using Survey Data</b> .....	45
<b>Out-of-pocket health care spending patterns of older Americans, as measured by the Consumer Expenditure Survey</b> .....	46
Comparing health care spending by consumer units headed by 55-to-64 year olds with those headed by 65-to-74 year olds in 1985, 1995, and 2005 shows that they allocated their spending differently among healthcare components in each year, whereas the changes in shares allocated over the periods trended in the same direction for both groups, although the magnitude of the percent changes differed.	
<i>Meaghan Duetsch</i>	

## Contents—Continued

	<i>Page</i>
<b>Examining expenditure patterns of young, single adults in a historical context: two recent generations compared</b> .....	52
<p>An examination of expenditures and incomes of young adults in 2004-2005, compared to those of young adults 20 years earlier, does not reveal conclusively that they are either better off or worse off than in the earlier period, although the results indicate that their well-being may be improving after a period of decline.</p> <p><i>Geoffrey Paulin</i></p>	
<b>Spending on telephone service</b> .....	74
<p>The share of telephone services spent on cellular phone service increased rapidly over the past several years and by 2006 was nearly equal to the share allocated to residential phone service.</p> <p><i>Brett Creech</i></p>	
<b>Housing expenditures by race and Hispanic or Latino origin</b> .....	78
<p>Housing is the largest component of average annual expenditures, accounting for about a third of the total. The amount consumer units spent on housing varied by race and Hispanic origin, and minorities spent a larger share of total spending on housing than did Whites.</p> <p><i>Mark Vendemia</i></p>	
<b>Appendix: Description of the Consumer Expenditure Survey</b> .....	87

**Part I.**  
**Survey Research and Methodology**

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# Evaluation of the 2005 Redesigned Consumer Expenditure Survey Diary

Nhien To and Lucilla Tan

A diary is one of two data collection instruments for the Consumer Expenditure Survey (CE). Diary keepers are asked to record their consumer unit's expenses in a weekly diary, for 2 consecutive weeks. Since the Diary Survey requires extended participation by diary keepers, survey managers recognized that simplifying the diary keeper's recording task was critical to improving survey participation rates, which had declined from about 80 percent in 1998 to about 69 percent in 2004. However, data quality could not be compromised in the process of simplifying the recording task. Both these considerations, therefore, were taken into account in the recent efforts to redesign the CE diary to be more user friendly. After several years of research and testing, a new CE diary, the *Redesigned Diary*, was introduced as the new instrument for data collection beginning in January 2005. This article highlights findings from an evaluation of the Redesigned Diary against the old diary. The Redesigned Diary performed better than the old diary on most, but not all, quality measures used to compare the two diaries.

## Background

Beginning in 2000, the CE embarked on a research program to redesign the diary. Three prototypes were developed, cognitively tested, and refined using

feedback from survey diary keepers, field interviewers, and program staff.<sup>1</sup> Based on this feedback, a fourth diary design was developed, the Redesigned Diary, which CE management selected for field testing in 2002. The field test indicated no difference in response rates between the Redesigned Diary and the Production Diary (the data collection instrument in use), however, the Redesigned Diary performed better in collecting item attributes, item details, higher expenditure means, and more detailed item descriptions in 3 of the 4 major expenditure categories.<sup>2</sup> The Redesigned Diary that was field tested was further modified by the addition of cues at the top of the recording pages.<sup>3</sup> In January 2005, the Redesigned Diary became the new data collection instrument for the CE Diary Survey.

**The Redesigned Diary.** The Redesigned Diary was designed to be more user friendly to encourage diary keeper

<sup>1</sup> Stinson, L., et. al., *Creating a "User-Friendly" Expenditure Diary*, Consumer Expenditure Survey Anthology, U.S. Bureau of Labor Statistics Report 967, pp 3-17, April 2003.

<sup>2</sup> Figueroa, E., et. al., *Is a User-Friendly Diary More Effective? Findings from a Field Test*, Consumer Expenditure Survey Anthology, U.S. Bureau of Labor Statistics Report 981, pp 2-8, April 2005.

<sup>3</sup> Cues are examples of goods and/or services in each major expenditure category. To, N., et. al., *The Efficacy of Cues in an Expenditure Diary*, Consumer Expenditure Survey Anthology, U.S. Bureau of Labor Statistics Report 981, pp 9-17, April 2005.

Nhien To and Lucilla Tan are economists in the Branch of Research and Program Development, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.



participation and elicit better reporting of purchased items. The following is a summary of the new features of the Redesigned Diary:

1. Redesign of form layout. The Redesigned Diary has a simpler organization. It is smaller in size than the former diary (the diary used for data collection from 1993 through 2004) and is now in portrait, rather than landscape, format. Each diary day consists of four pages, with one page for each major expenditure category:
  - Food and Drinks Away from Home (MLS)
  - Food and Drinks for Home Consumption (FDB)
  - Clothing, Shoes, Jewelry, and Accessories (CLO)
  - All Other Products, Services, and Expenses (OTH)

If diary keepers have more than one page of entries for a major expenditure category, additional pages are available at the end of the diary.

2. Elimination of most sub-category entries within major expenditure categories. In FDB, CLO, and OTH, all subcategories were eliminated in the Redesigned Diary. In MLS, subcategories of vendor type were eliminated, but replaced with vendor-type checkboxes. Differences in expenditure categorization between the Redesigned Diary and the former diary are summarized in table 1.
3. Addition of more checkboxes to solicit detail about items purchased. Checkboxes were added to the MLS recording page for the attributes of meal type, vendor type, and alcohol type. On the CLO recording page, checkboxes for gender and age were added to the CLO recording

page. (Formerly, the diary keeper recorded the gender-age item attribute by selecting a value from a list of coded values for gender and age.)

4. Clarification of instructions to diary keepers. Instructions, rules, and definitions were clarified; a greater variety of examples was added with important recording instructions highlighted. Additionally, *Frequently Asked Questions* (FAQs) were introduced. The FAQs and examples are printed on flaps of the diary cover for easy access. These flaps can also serve as bookmarks, to help diary keepers mark their place.
5. Visual enhancement of the diary form. Photographs and additional color are used in the Redesigned Diary, to give the diary a contemporary and less-intimidating look.

### Evaluation of the 2005 Redesigned Diary

Data collected in January through December of 2005 in the Redesigned Diary were compared with data collected over the same months of 2004 in the former diary. Evaluation was based on approximately 14,000 completed diaries for each type of diary. Ideally, comparison would be based on data collected from the Redesigned Diary and the former diary fielded over the same time period so data collection conditions—such as economic climate and consumer confidence—would be the same for both instruments; and, therefore, any differences found could be more directly attributed to changes in the format. However, the former diary was retired when the Redesigned Diary was released for data collection.

Since the evaluation was based on comparing data from two time periods, time-sensitive measures, such as expenditures and the relative shares of each major expenditure category of total expenditures, are not reported here, since such data could be biased by changes in economic conditions

across the years. For that reason, the focus in the evaluation is on measures which reflect how entries are recorded, since these measures can be primarily associated with form design.

**Measures.** Form designers hoped that the smaller, more attractive questionnaire with its simplified layout would encourage more diary keepers to participate in the survey. It was decided that the Redesigned Diary would be an improvement over the former diary, if the Redesigned Diary improved response rates and collected higher quality data (that is, more complete and detailed recording of purchased items).<sup>4</sup> Variances for statistical tests to measure significant differences between estimates from the Redesigned Diary and the former diary were computed using the method of random groups. (See appendix A.)

### A. Participation Rates

Completion response rates and attrition rates are two measures of participation. Completion response rate measures the proportion of all diaries successfully placed with eligible households and completed.<sup>5</sup> Completed cases are cases where the household completed the weekly diary or where the household was temporarily absent for the week.<sup>6</sup>

<sup>4</sup> An underlying assumption of the Consumer Expenditure Surveys is that surveys are subject to significant recall error [Silberstein, A., *Recall Effects in the U.S. Consumer Expenditure Survey*, Journal of Official Statistics 5 (2) 1989, pp. 125-142.]. Therefore, a result at higher levels of reporting is “better” and closer to the true value.

<sup>5</sup> Eligible housing units are those in the designated sample, less housing vacancies, housing units under construction, housing units with temporary residents, destroyed or abandoned housing, and units converted to nonresidential use

<sup>6</sup> The U.S. Bureau of Labor Statistics counts cases that will be temporarily absent for the entire data collection period as completed cases for the Diary survey. The parallel Consumer Expenditure Quarterly Interview Survey (a second household expenditure survey conducted by the CE to obtain large and infrequent expenditure items) collects data for diary keepers who are away from home on trips. Since Diary and Interview data are later merged, this practice avoids double-counting the same set of expenditures.

Attrition rate measures the proportion of eligible diaries successfully placed and completed in the first week, but not in the second week. (That is, diary keepers dropped out of the survey after the first week.)

## B. Data Quality Measures

Data quality is measured by the extent to which purchased items are reported with the required amount of detail, and can be used, as reported, without further editing. Editing refers to the various processes of *cleaning* originally recorded diary data that were misclassified, recorded with inadequate detail, or the requested item attributes failed to be reported.

### 1. *Entry misclassification rate.*

Entry or item misclassification occurs when the diary keeper records an entry in the wrong major expenditure category of the diary. For example, the diary keeper recorded “disposable diapers” in the All Other Products, Services, and Expenses (OTH) section; and the correct major expenditure category for the entry is Clothing, Shoes, Jewelry, and Accessories (CLO). The entry disposable diapers has been misclassified in OTH, and will be moved to CLO during data processing. If the diary layout has been effectively simplified and the recording instructions improved, we should expect a lower item misclassification rate in the Redesigned Diary.

### 2. *Allocation rate.* If the description of an item is recorded with inadequate detail, the item’s reported expenditure will be allocated among related items.<sup>7</sup> The allocation rate of entries in a major expenditure category was measured as the proportion

<sup>7</sup> An example of a description with inadequate detail is “groceries.” Instead, the diary keeper should have recorded the items purchased that make up groceries.

of the number of entries needing allocation to the total number of entries in the major expenditure category. The recording task in the Redesigned Diary was simplified by eliminating expenditure subcategories that served as cues for the universe of products to be reported on the recording page, as well as lessening the level of detail to report. Additionally, with the Redesigned Diary, diary keepers write in entries on a more free-form page. The elimination of subcategories in the Redesigned Diary was expected to have the following effects:

- Increase the allocation rate in FDB in the Redesigned Diary. FDB was the major expenditure category with the highest number of subcategories (15), and the eliminated FDB subcategories were not replaced with checkboxes. Furthermore, the subcategories in FDB were also cues to the level of reporting detail requested from the diary keeper. (For example, *beef, pork, poultry, other meats* were four subcategories in FDB that tell the diary keeper it is not sufficient to record an entry as “meat.”) (See appendix B.)
- Decrease the allocation rate in MLS with the replacement of vendor type subcategories with checkboxes and the addition of new cues (checkboxes) for meal type.
- The loss of subcategories in CLO and OTH was expected to have a less-severe impact on reporting detail in CLO and OTH than in FDB. This is because—like MLS—the subcategories in CLO and OTH served as cues to the universe of products relevant for reporting, and not as cues to the level of reporting detail, as in FDB.

### 3. *Item attribute imputation rate.*

Imputation in the CE Diary is performed only on item attributes, not on expenditures. Item attributes collected by the CE Diary are:

- type of meal purchased, in MLS
- type of vendor from whom meal was purchased, in MLS
- type of alcohol purchased with meal (if any), in MLS
- type of item packaging, in FDB
- gender-age for whom item was purchased, in CLO

The imputation rate for each attribute is measured by the proportion of entries in each major category that are missing the attribute that should have been reported.<sup>8</sup> Item attributes collected in the diary are described below:

- *Meal attribute in MLS.* In the former diary, classification of the type of meal purchased (*breakfast, lunch, dinner, or snack/other*) was dependent on the diary keeper’s written description. If the diary keeper failed to specify the meal type in the entry, that detail was lost. In the Redesigned Diary, checkboxes for each meal type are provided as a cue to the diary keeper that we want that detail. (The imputation rate for meal type was expected to be lower in the Redesigned Diary.)
- *Vendor attribute in MLS.* Diary keepers are asked to specify the type of vendor from whom a meal was purchased. To simplify the diary keeper’s recording task in the Redesigned Diary, the vendor type subcategories of the former diary were eliminated and replaced with four vendor type checkboxes. (See appendix C.)

<sup>8</sup> The missing value is indicated by an ‘invalid blank’ flag.

In the former diary, if the diary keeper made an entry in the MLS section of the diary, the entry would have had to be written in one of the vendor subcategories, so the vendor type was always reported. In the Redesigned Diary, a diary keeper can make an MLS entry and omit marking off a vendor type checkbox, so the vendor attribute can be missing. Thus, the reporting of vendor attribute is not directly comparable between the former diary and the Redesigned Diary.

- *Alcohol attribute in MLS.* In the former diary, there was a *Yes/No* screener alcohol purchase question for whether alcohol was purchased with the meal, but there was no question asked for the type of alcohol purchased. (See technical note C.) In the Redesigned Diary, the screener alcohol purchase question has been eliminated; instead, diary keepers are asked to indicate the type of alcohol purchased with the meal, by marking one or more of the three types of alcohol (*wine, beer, or other*) checkboxes. Thus, reporting of the alcohol attribute is not directly comparable between the former diary and the Redesigned Diary.
- *Package type attribute in FDB.* Checkboxes indicating an item's package type (*fresh, frozen, bottled/canned; other*) in the *Food and Drinks for Home Consumption* section are identical in the Redesigned Diary and the former diary. Thus, we did not expect much difference in the imputation rate of an item's package type in the FDB expenditure category.
- *Gender-age attribute in CLO.* On the *Clothing, Shoes, Jewelry, and Accessories* recording page, the diary keeper is asked to indicate the gender and age group of the person for whom the item

was purchased. In the former diary, diary keepers were asked to assign a code to each reported item by selecting from a list of five gender-age combinations (*Male 16 or over, Female 16 or over, Male 2 through 15, Female 2 through 15, Under 2 years*). In the Redesigned Diary, the list of gender-age combinations was replaced by two sets of checkboxes, one checkbox to indicate gender, and another checkbox to indicate age (*Under 2, 2–15, 16 & Over*). (See technical note D.) Age and gender attributes are then combined during data processing to form the five gender-age categories from the former diary. We expected the use of the checkboxes in the Redesigned Diary to improve the recording of gender-age attributes, as checkboxes simplify the recording task.

In summary, only the imputation rates for the attributes of meal type, package type, and gender age are comparable between the Redesigned Diary and the former diary.

4. *Number of entries recorded.* If the Redesigned Diary were more effective in soliciting participation and reporting, we anticipated more entries in the Redesigned Diary (other factors being equal). However, since we are comparing data from the Redesigned Diary and the former diary using two time periods, we must be cautious in attributing differences in the number of recorded entries solely to differences in diary format.

## Findings

*Participation rates.* The diary completion response rate was statistically significantly higher in the Redesigned Diary (71.0 percent vs. 68.9 percent). The proportion of eligible diary keepers who completed diaries for both weeks was also higher in the Redesigned Diary (66.6 percent vs. 64.5 per-

cent). However, the refusal rate was not significantly different between the Redesigned Diary and the former diary (12.2 percent vs. 11.7 percent). (See table 2.)

*Entry misclassification rate.* Overall, the proportion of misclassified entries was higher for the Redesigned Diary (2.1 percent vs. 1.5 percent). By major expenditure category, the Redesigned Diary contained higher rates of misclassified entries in CLO (8.0 percent vs. 4.8 percent) and OTH (3.5 percent vs. 1.5 percent), but a lower misclassification rate in MLS (0.4 percent vs. 0.7 percent).

*Allocation rate.* Overall, the allocation rate in the Redesigned Diary was significantly lower (8.5 percent vs. 11.7 percent). However, the allocation rate was significantly higher in FDB (9.9 percent vs. 7.8 percent), and significantly lower in MLS (5.9 percent vs. 34.8 percent) and OTH (7.7 percent vs. 8.3 percent), as anticipated. The much lower allocation rate in MLS probably reflects the effectiveness of the additional checkboxes in the Redesigned Diary. The higher allocation rate in FDB in the Redesigned Diary probably reflects the loss of detailed cueing through subcategories that was eliminated in the Redesigned Diary.

*Item attribute imputation rate.* Among the three attributes where imputation rates could be compared, the imputation rates for *meal type* (4.7 percent vs. 33.1 percent) and *age-gender* (16.1 percent vs. 23.7 percent) were significantly lower in the Redesigned Diary. This is probably due to the effectiveness of the additional checkboxes introduced in the Redesigned Diary. The imputation rate for package type was significantly higher in the Redesigned Diary (6.6 percent vs. 5.7 percent). Since both diaries had identical package-type checkboxes, it is not possible to attribute the increase in imputation rate to changes in form design. One possible explanation may simply be that the comparison is between data collected in 2 different years.

*Number of entries.* Overall, there was no significant difference in the number of entries. The Redesigned Diary had a significantly higher number of entries in MLS, CLO and OTH, but a significantly lower number of entries in FDB. As with the worsening in the allocation rate of entries in FDB, the lower number of entries in FDB probably reflects the loss of detailed cueing through the elimination of subcategories in the Redesigned Diary.

### **Conclusion**

In summary, the Redesigned Diary appears effective in most areas. In soliciting respondent participation, the Redesigned Diary had higher completion rate, but was similar to the Former Diary in refusal and attrition rates. The Redesigned Diary also performed better in two of the three comparable imputation rates for missing attributes. However, results were mixed for comparisons of entry misclassifications, allocation rates, and entry misclassifications.

The improvement in completion rate should be qualified, as there was a targeted effort to encourage field interviewers to obtain better response rates for the CE Diary, in 2005. The completion rate, therefore, will be monitored to see if the improved rate for the Redesigned Diary will be sustained in the future. That no improvements were seen in the Redesigned Diary's refusal and attrition rates is probably a reflection of the unchanged nature of the underlying task of reporting all of a household's expenses for 2 weeks—even with a more user-friendly redesign.

The addition of checkboxes to elicit item attribute detail appears effective, as two of the three comparable imputation rates for missing attributes were significantly lower in the Redesigned Diary.

The diary form simplification and data quality tradeoff was most evident in FDB in the Redesigned Diary. The elimination of subcategories that served as cues to the product universe and for the level of reporting detail expected in

the Redesigned Diary probably largely accounts for the higher allocation rate and lower number of entries.

*Possible future research:* The data suggest that many respondents may not understand how to record *alcohol only* purchases in MLS. While the present layout provides the necessary prompts, it does so at a high burden on processing, as well as with the apparent potential for respondent confusion. To handle this situation, options for consideration are the use of an alcohol-only checkbox as an additional meal-type checkbox on the MLS recording page, or the addition of a separate instruction.

The reporting of gifts in CLO and OTH, and the purchase of alcohol with meals, fell in the Redesigned Diary; and these types of reporting coincide with the replacement of the *Yes/No* checkboxes with a *Yes* only checkbox in the Redesigned Diary. We may want to further investigate the effect of this aspect of form design. ■

Table 1. Comparison of main expenditure categories and subcategories

Former diary	Redesigned diary
<p><b>Part 1. Food Away From Home (MLS)</b></p> <p>Fast Food, Take-out, Delivery, Concession Stands, Buffet and Cafeteria</p> <p>Full-Service Meals, Snacks, Drinks</p> <p>Vending Machines and Mobile Vendors</p> <p>Employer and School Cafeteria</p> <p>Board or Meal Plan Food</p> <p>Catered Affairs</p>	<p><b>Part 1. Food and Drinks Away from Home (MLS)</b></p> <p><i>Vendor type subcategories changed to checkboxes</i></p> <p><i>Meal type checkboxes added</i></p>
<p><b>Part 2. Food for Home Consumption (FDB)</b></p> <p>Flour, Cereal, and Other Grain Products</p> <p>Bakery Products</p> <p>Beef</p> <p>Pork</p> <p>Poultry</p> <p>Other Meats</p> <p>Fish and Seafood</p> <p>Fats, Oils and Dressings</p> <p>Eggs and Dairy Products</p> <p>Fruits and Fruit Juices</p> <p>Sugar, Sugar Substitutes and Sweets</p> <p>Vegetables and Vegetable Juices</p> <p>Other Food Items</p> <p>Non-Alcoholic Beverages</p> <p>Alcoholic Beverages</p>	<p><b>Part 2. Food and Drinks for Home Consumption (FDB)</b></p> <p><i>Gift purchases subcategory changed to a checkbox</i></p> <p><i>All other subcategories eliminated</i></p>
<p><b>Part 3. Food and Beverages Purchased as Gifts (FDB)</b></p>	<p><b>Food and Beverages Purchased as Gifts (FDB)</b></p> <p><i>Eliminated as a category</i></p>
<p><b>Part 4. Clothing, Shoes and Jewelry (CLO)</b></p> <p>Casual, Sportswear, Formal</p> <p>Undergarments and Sleepclothes</p> <p>Outdoor, Work, School, Costumes</p> <p>Shoes</p> <p>Sports – Team Clothes and Sport Shoes</p> <p>Jewelry, Accessories, and Sewing Items</p> <p>Clothing Services</p>	<p><b>Part 3. Clothing, Shoes, Jewelry, and Accessories (CLO)</b></p> <p><i>All subcategories eliminated</i></p>
<p><b>Part 5. All Other Purchases and Expenses (OTH)</b></p> <p>Tobacco and Smoking Supplies</p> <p>Gasoline, Oil, and Additives</p> <p>Medicines, Medical Supplies and Services</p> <p>Personal Care Products and Services</p> <p>Housekeeping Supplies and Services</p> <p>Housewares and Small Household Appliances</p> <p>Home Furnishings, Decorative Items, Linens, and Major Appliances</p> <p>Home Maintenance, Hardware, Lawn Supplies and Services</p> <p>Housing Expenses</p> <p>Entertainment/Amusements and Sports/Recreation</p> <p>Transportation Expenses</p> <p>School Expenses</p> <p>All Other Expenses</p>	<p><b>Part 4. All Other Products, Services, and Expenses (OTH)</b></p> <p><i>All subcategories eliminated</i></p>

Table 2. Comparison of data from the 2004 former diary and the 2005 Redesigned Diary

	Former diary	Redesigned diary
<b>A. Participation</b>		
Eligible CUs	21,369	21,309
<i>Response rate</i>		
Percent completed diaries *	68.9	71.0
Percent eligible CUs who did not participate because:		
- Refused	11.7	12.2
- Not home	3.3	2.5
- Other	3.9	4.8
<i>Participation across both weeks:</i>		
Percent completed diaries in both weeks *	64.5	66.6
Percent completed diary in Week 1 but not in Week 2	2.5	2.6
<b>B. Data quality - Recording of entries</b>		
<b>Entry misclassification rate (percent)</b>		
Overall *	1.5	2.1
Clothing, Shoes, Jewelry, and Accessories (CLO) *	4.8	8
Food and Drinks for Home Consumption (FDB) *	1.4	1.4
Food and Drinks away from Home (MLS) *	0.7	0.4
All Other Products, Services, and Expenses (OTH)*	1.5	3.5
<b>Allocation rate - proportion of entries recorded with insufficient detail (percent)</b>		
Overall *	11.7	8.5
Clothing, Shoes, Jewelry, and Accessories (CLO)	8.8	9.4
Food and Drinks for Home Consumption (FDB) *	7.8	9.9
Food and Drinks away from Home (MLS) *	34.8	5.9
All Other Products, Services, and Expenses (OTH) *	8.3	7.7
<b>Missing attributes - proportion of entries requiring imputation (percent)</b>		
Type of packaging *	5.7	6.6
Type of vendor	na <sup>1</sup>	4.9
Type of meal *	33.1	4.7
Type of alcohol	na <sup>2</sup>	11.4
Age-gender *	23.7	16.1
<b>Number of entries</b>		
Overall	500,672	498,458
Clothing, Shoes, Jewelry, and Accessories *	17,270	20,333
Food and Drinks for Home Consumption *	261,961	243,570
Food and Drinks away from home *	69,551	81,168
All Other Products, Services, and Expenses *	151,890	153,387

\* Indicates statistically significant difference ( $p < 0.05$ ) was found between the two diaries.

<sup>1</sup> In the former diary, there was no imputation of the vendor attribute, because the diary keeper could only record an entry on the MLS page by writing it in one of the vendor subcategories. In the Redesigned Diary, a diary keeper can make an MLS entry and omit marking off a vendor-type checkbox. Thus, the imputation rate of the vendor attribute between the former diary and the Redesigned Diary are not comparable.

<sup>2</sup> In the former diary, there was no imputation of the alcohol type attribute, because there was not an explicit prompt for alcohol type. Instead, there was an alcohol purchase screener question (Yes/No checkbox). In 2004, there were 6.5 percent invalid blanks for the alcohol-purchase screener question.

# Technical note A: Variance computation

The Consumer Expenditure (CE) Survey has a complex sample design, and the Balanced Repeated Replication (BRR) method of variance estimation is used to calculate variances. However, as the 2005 Redesigned Diary evaluation is based on data gathered early in the data processing cycle, replicate weights were not yet available at the time the evaluation was conducted. Instead, variances were computed using the random groups method.<sup>9</sup> All CUs in the former diary sample and the Redesigned Diary sample were randomly assigned into one of 10 groups (called replicates), with each replicate containing approximately 10 percent of the universe. For each statistic of interest, the statistic was computed separately for each replicate, as well as for the full sample.

Then, the variance for the statistic was estimated by:

$$Var(\bar{x}) = \frac{\sum_{r=1}^{10} (\bar{x}_r - \bar{x})^2}{10(10-1)}$$

where  $\bar{x}$  = the full sample statistic of interest, and  $\bar{x}_r$  = the statistic for the  $r^{\text{th}}$  replicate.<sup>10</sup>

The standard error is estimated by

$$SE(\bar{x}) = \sqrt{Var(\bar{x})}$$

<sup>9</sup> See Sharon Lohr (1999), Chpt 9.2 in *Sampling: Design and Analysis, Sampling Techniques 3rd Edition*.

<sup>10</sup> When the full sample statistic of interest is a count, the following modification is made: First, divide the full sample count by 10, then take the square difference of replicate count and (full sample count/10).

To determine if the statistic of interest was significantly different between the former diary ( $\bar{x}_F$ ) and Redesigned Diary ( $\bar{x}_R$ ) samples, z-scores (Z) that allow a statement of statistical significance were calculated using the following formula:

$$Z = \frac{[\bar{x}_R - \bar{x}_F]}{\sqrt{Var(\bar{x}_F) + Var(\bar{x}_R)}}$$

where  $Var(\bar{x}_R)$  and  $Var(\bar{x}_F)$  are the variance of the Redesigned Diary sample and former diary sample statistics, respectively.

If the absolute value of the z-score is greater than 2, the statistic of interest is significantly different between the former diary sample and the Redesigned Diary sample at 5 percent.

# Technical note B: FDB layout

## Former Diary

FORM CE-801 (11-1-99) Page 12

### FIRST DAY - Continued

a Line number	PROCESSING USE	b Describe item purchased	c Is this item - Mark (X) one				d Total cost Do not include sales tax	
			Fresh	Frozen	Bottled or canned	Other	Dollars	Cents
<b>Part 2 - Food for Home Consumption</b>								
		<b>FLOUR, CEREAL and OTHER GRAIN PRODUCTS</b> (Flour, cake mixes, cereal, rice, cornmeal, spaghetti, and other pasta, etc.)						
201			1	2	3	4		
202			1	2	3	4		
203			1	2	3	4		
204			1	2	3	4		
205			1	2	3	4		
206			1	2	3	4		
207			1	2	3	4		
		<b>BAKERY PRODUCTS</b> (White bread, other bread, cakes, cookies, pies, frozen waffles, etc.)						
208			1	2	3	4		
209			1	2	3	4		
210			1	2	3	4		
211			1	2	3	4		
212			1	2	3	4		

a Line number	PROCESSING USE	b Describe item purchased	c Is this item - Mark (X) one				d Total cost Do not include sales tax	
			Fresh	Frozen	Bottled or canned	Other	Dollars	Cents
<b>Part 2 - Food for Home Consumption - Cont.</b>								
		<b>PORK</b> (Bacon, pork chops, ham, sausage, pork roasts, etc.)						
222			1	2	3	4		
223			1	2	3	4		
224			1	2	3	4		
225			1	2	3	4		
		<b>POULTRY</b> (Whole chicken, turkey parts, other poultry, etc.)						
226			1	2	3	4		
227			1	2	3	4		
228			1	2	3	4		
229			1	2	3	4		
		<b>OTHER MEATS</b> (Frankfurters, bologna, liverwurst, salami, lamb, game, organ meats, etc.)						
230			1	2	3	4		
231			1	2	3	4		
232			1	2	3	4		

## Redesigned Diary (2005)

<b>SUN</b>	<b>MON</b>	<b>TUE</b>	<b>WED</b>	<b>THU</b>	<b>FRI</b>	<b>SAT</b>	<b>Day 1</b>
------------	------------	------------	------------	------------	------------	------------	--------------

### 2. Food and Drinks for Home Consumption

**Examples:**    eggs    cereal    tea    beer    apple juice    ground beef    chicken parts    fish  
                   whole milk    white bread    cola    liquor    tomato juice    bacon    whole chicken    shellfish  
                   sugar    cooking oil    ground coffee    oranges    carbonated water    lettuce    baby food    pet food

**Please unfold the RIGHT FLAP to see Frequently Asked Questions**

	What did you buy or pay for? <i>(see examples above and on the flap)</i>				Is this item: Mark (X) one		Total Cost without tax	Mark (X) If purchased for someone not on your list
	fresh	frozen	bottled/ canned	other				
201	1	2	3	4				
202	1	2	3	4				
203	1	2	3	4				
204	1	2	3	4				
205	1	2	3	4				
	1	2	3	4				



# Technical note C: MLS layout

## Former Diary

FIRST DAY								
		1 <input type="checkbox"/> None	2 <input type="checkbox"/> TR	PROCESSING USE		3 <input type="checkbox"/> BD 4 <input type="checkbox"/> VC		
a	PROCESSING USE	b	c		d		e	
Line number		List all meals, snacks, and beverages purchased	Total cost Include tax and tip		Were alcoholic beverages included in total cost? Mark (X) one		If "YES" – How much?	
		<b>Part 1 – Food Away From Home</b>	Dollars	Cents	Yes	No	Dollars	Cents
		<b>FAST FOOD, TAKE-OUT, DELIVERY, CONCESSION STANDS, BUFFET and CAFETERIA – You pay BEFORE eating/drinking.</b>						
101					1	2		
102					1	2		
103					1	2		
104					1	2		

## Redesigned Diary (2005)

Day 1		SUN	MON	TUE	WED	THU	FRI	SAT							
<b>1. Food and Drinks Away from Home</b>															
<b>Examples:</b>		breakfast buffet carry-out lunch dinner & cocktails at restaurant	pizza delivery Chinese takeout child's school lunch	beer at happy hour pretzels at ballgame wine at tavern	croissant from café ice cream from truck wedding reception caterer	soda from vending machine hot dog from convenience store popcorn and soda at movies									
← Please unfold the LEFT FLAP to see Additional Examples															
Mark (X) one that best describes the type of meal	Description (see examples above and on the flap)				Mark (X) one that best describes where you made this purchase				Total Cost with tax & tip		If alcoholic beverages included, mark (X) all that apply			Enter the total cost of the alcohol	
											wine	beer	other		
breakfast lunch dinner snack/other	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	
101															
102															
103															

# Technical note D: CLO layout

## Former Diary

a	b	c		d		e	
Line number	PROCESSING USE	Describe item purchased	Total cost <i>Do not include sales tax</i>		Was this bought for someone outside your consumer unit? <i>Mark (X) one</i>		For whom was this item purchased? 1 - Male 16 or over 2 - Female 16 or over 3 - Male 2 through 15 4 - Female 2 through 15 5 - Under 2 years <i>Enter code</i>
			Dollars	Cents	Yes	No	
		<b>Part 4 - Clothing, Shoes, and Jewelry</b>					
401		CASUAL, SPORTSWEAR, FORMAL (Suit, shirt, dress, shorts, pants, sweater, etc.)			1	2	
402					1	2	
403					1	2	
404					1	2	
405					1	2	
406					1	2	
407					1	2	
408					1	2	
409		UNDERGARMENTS and SLEEP CLOTHES (Socks, pajamas, lingerie, hosiery, etc.)			1	2	
410					1	2	

## Redesigned Diary (2005)

Day 1	SUN	MON	TUE	WED	THU	FRI	SAT	
<b>3. Clothing, Shoes, Jewelry, and Accessories</b>								
<b>Examples:</b>	shirt sweater shorts	suit dress pants	sandals sneakers shoe repairs	soccer cleats team uniform ski boots	gloves slippers dance costume	watch necklace belt	pajamas lingerie socks	coat jacket windbreaker
← Please unfold the LEFT FLAP to see Additional Examples								
	What did you buy or pay for? <i>(see examples above and on the flap)</i>	Total Cost without tax	Was the item for:		Age			Mark (X) if purchased for someone not on your list
			male	female	Under 2	2-15	16 & Over	
301			1	2	1	2	3	
302			1	2	1	2	3	
303			1	2	1	2	3	

# Selecting a Sample of Households for the Consumer Expenditure Survey

Susan L. King and  
Sylvia A. Johnson-Herring

## Introduction

The Consumer Expenditure Survey (CE) is a nationwide household survey designed by the U.S. Bureau of Labor Statistics (BLS) to find out how Americans spend their money. The CE consists of two separate surveys, the Diary and Quarterly Interview surveys. Each quarter of the year, approximately 3,200 households are visited in the Diary survey and approximately 15,000 households are visited in the Interview survey to collect information on the expenditures of American households. A question frequently asked by the survey respondents is “How was my household selected to be in this survey?” This article answers that question by looking at the CE’s sample design and the selection process.

## Survey description

The CE is an important economic survey. One of the primary uses of its data is to provide expenditure weights for the Consumer Price Index (CPI). The CPI affects millions of Americans by its use in cost-of-living wage adjustments for many workers, cost-of-living adjustments to Social Security payments, and inflation adjustments to Federal income-tax brackets. CE data also are used to compare expenditure patterns of various segments of the

population, such as elderly versus non-elderly people. In addition, the data are being used by the Federal Government in a new experimental poverty index.

The purpose of the Diary survey is to obtain detailed expenditure data on small, frequently purchased items such as food and apparel. The purpose of the Interview survey is to obtain detailed expenditure data on large items such as property, automobiles, and major appliances; and on recurring expenses such as rent, utilities, and insurance premiums. Under contract with BLS, field representatives from the U.S. Census Bureau personally visit the households in the Diary and Interview surveys’ samples to collect the data.

Each household in the Diary survey is asked to record all of the expenditures it makes during a 2-week period. Field representatives visit each household in the sample three times. On the first visit, the field representatives introduce themselves, explain the survey, and leave a diary in which the household members are asked to record all their expenditures for a 1-week period. On the second visit, the field representatives pick up the first week’s diary, ask whether there are any questions, and leave another diary for the second week. On the third visit, the field representatives pick up the second week’s

Susan L. King is a mathematical statistician in the Division of Price Statistical Methods, Branch of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

Sylvia A. Johnson-Herring is a mathematical statistician in the Division of Price Statistical Methods, Branch of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

diary and thank the household for participating in the survey. After participating in the survey for 2 weeks, the household is dropped from the survey, and it is replaced by another household.

Each household in the Interview survey is interviewed every 3 months for 5 consecutive quarters. Trained field representatives ask household members about their expenditures over the previous 3 months. Responses are entered into a laptop computer. Each interview takes approximately 70 minutes to complete. Expenditure information obtained in the first interview is used only for “bounding” purposes, which address a common problem in which survey respondents tend to report expenditures to have been made more recently than they actually were made. Thus, expenditure information from the first interview is not used. Only expenditure information from the second through fifth interviews is used in the CE’s published estimates. The households in the Interview survey are on a rotating schedule, with approximately one-fifth of the households in the sample being new to the survey each quarter.

### Sample design

The selection of specific households to participate in the CE survey is carried out in multiple stages. The first stage of sampling is defining and selecting a random sample of geographic areas called “primary sampling units” (PSUs) from across the United States. In this stage, all of the counties in the United States are divided into small groups of counties (called PSUs), and a representative sample of them is selected to be in the survey. After the PSUs are defined and selected, the second stage of sampling involves determining the number of households to be visited in each PSU. The CE’s budget allows for a certain number of households to be visited each year nationwide, and, in this stage, that number is allocated to the individual PSUs selected for the survey. The final stage of sampling is selecting specific households to be vis-

ited within the PSUs. Households are selected using a systematic selection procedure to ensure that each category of households is well represented in the survey. This is a brief summary of the CE’s sample design. The rest of this article describes these steps in more detail.

### Defining and selecting the PSUs

In the first stage of sampling, PSUs are defined and selected for the survey. PSUs are counties or groups of counties grouped together into geographic entities called “core-based statistical areas” (CBSAs) by the U.S. Office of Management and Budget. CBSAs were defined for use by Federal statistical agencies in collecting data and tabulating statistics.

There are two types of CBSAs, metropolitan and micropolitan. Metropolitan CBSAs consist of one or more counties with at least one urban area of 50,000 or more people, while micropolitan CBSAs consist of one or more counties centered around an urban area with 10,000–50,000 people. Both include the adjacent counties that have a high degree of social and economic integration with the area’s core as measured by commuting ties. Areas outside CBSAs are called “non-CBSA” areas and are mostly rural.

After the PSUs are defined, they are categorized according to their population and region of the country. There are four regions of the country (Northeast, Midwest, South, and West), and four PSU “size classes”:

- “A” PSUs, which are metropolitan CBSAs with a population over 2 million people
- “X” PSUs, which are metropolitan CBSAs with a population between 50,000 and 2 million people
- “Y” PSUs, which are micropolitan CBSAs
- “Z” PSUs, which are non-CBSA areas and are often referred to as “rural” PSUs

By definition, the “A” PSUs are “self-representing” and, therefore, have a 100 percent probability of selection in the survey. The “X,” “Y,” and “Z” PSUs are “non-self-representing.” The non-self-representing PSUs are grouped together into groups of PSUs (called “strata”) according to a 5-variable geographic model whose variables are latitude, longitude, latitude squared, longitude squared, and percent of the population in the PSU who live in an urban area. A typical stratum has approximately 10 PSUs, and all of the PSUs are in the same “region-size class.” After the PSUs are grouped into strata, one PSU per stratum is randomly selected with probability proportional to its population. The PSU that is randomly selected represents the whole stratum.

For example, table 1 shows stratum X344, which is a group of eight “X”

Table 1. The PSUs in stratum X344

PSU	Population
Charlotte, NC-SC	1,114,808
Charleston-North Charleston, SC	549,033
✓ <b>Greenville, SC</b>	<b>379,616</b>
Fayetteville-Fort Bragg, NC	302,963
Columbus, GA-AL	274,624
Gastonia, NC	190,365
Wheeling, WV-OH	153,172
Warner Robbins, GA	134,433
<b>Total</b>	<b>3,099,014</b>

PSUs in the South. According to the 2000 Census, their populations ranged from 134,433 to 1,114,808, for a total stratum population of 3,099,014 people. One PSU was randomly selected to represent the entire stratum. The PSU was Greenville, South Carolina. It had 12.25 percent of the stratum's population (0.1225=379,616/3,099,014); hence, it had a 12.25 percent chance of being selected, and a random number generator selected it.

PSU definitions for the current CE sample are based on information from the 2000 Census. Prior to 2005 (1996–2004), PSUs were defined based on information from the 1990 Census. The two sample designs are called the “2000 Census-based sample design” and the “1990 Census-based sample design,” respectively. The original 2000 Census-based sample design consists of 102 PSUs, of which 86 urban PSUs are designated as “CPI areas.” The CE and CPI share the sample design, with the exception of the “Z” PSUs. The CE survey covers the entire Nation (“A,” “X,” “Y,” and “Z” PSUs), while the CPI survey covers only the urban portion of the Nation (“A,” “X,” “Y,” but not “Z” PSUs.) See table 2 for the number of PSUs by region and

size class in CE's original 2000 Census-based sample design.

Shortly after this sample design was implemented, newly imposed budget constraints forced the CE and CPI to eliminate 11 “X” PSUs from the sample, and to change the size class of 7 “A” PSUs to the “X” category. As a result, the sample of PSUs currently used by the CE has 91 PSUs, of which 75 urban PSUs also are used by the CPI. The CE began collecting data in the original 2000 Census-based sample design in 2005 and in the revised 2000 Census-based sample design in 2006. (See table 3 for a summary of the revised 2000 Census-based sample design.)

A map of the PSUs in the revised 2000 Census-based sample design is shown in figure 1.

### Allocating the national sample of households to individual PSUs

Once the PSUs are selected, the number of households to be visited in each PSU must be determined. In the original 2000 Census-based sample design, CE's budget allowed for 7,700 household interviews per year in the Diary survey and 7,700 household interviews per quarter in the Interview survey (interviews 2–5 only) at the national level.

In this stage of sampling, those 7,700 households are allocated (divided) among the 102 PSUs in the original 2000 Census-based sample design.

The first step in determining the number of households to visit in each PSU is to group the “X,” “Y,” and “Z” PSUs by region and size class. Cross-classifying the four regions of the country (Northeast, Midwest, South, and West) with the three non-self-representing PSU size classes (“X,” “Y,” and “Z”) yields 12 region-size classes, which are treated like the 28 self-representing (“A”) PSUs. This gives 40 self-representing geographic areas.

The objective of this stage of sampling is to allocate the 7,700 households to the 40 areas in a way that minimizes the standard error of CE's published expenditure estimates at the national level. This can be accomplished by allocating the households in a manner that is directly proportional to the population that each area represents; this allocation method is a standard statistical technique that comes very close to minimizing the standard error at the national level.

Without any modifications, proportional allocation would have given 7,034 households to the urban (“A,” “X,” and “Y”) areas and 666 households to the rural (“Z”) areas. However, research indicated that increasing the number of households in urban areas to 7,300 and decreasing the number of households in rural areas to 400 would have a significant impact on lowering CPI's standard error but would have only a minimal impact on CE's standard error. Since the CPI is the CE's primary customer, the allocation process was modified to allocate exactly 7,300 households to the 36 urban areas, and exactly 400 households to the four rural areas. Further, to guarantee that enough interviews are collected to satisfy CPI's publication requirements in each of the 36 urban areas, the sample of 7,300 households is allocated in a way that at least 80 interviews are obtained in each area. Operationally, the 7,700 households were allocated to the 40 areas by solving the following nonlinear programming problem:

Table 2. Original 2000 Census-based sample design (102 PSUs)

PSU size class	Region				Total
	Northeast	Midwest	South	West	
A	6	5	7	10	28
X	4	12	18	8	42
Y	2	4	6	4	16
Z	2	4	6	4	16
<b>Total</b>	<b>14</b>	<b>25</b>	<b>37</b>	<b>26</b>	<b>102</b>

Table 3. Revised 2000 Census-based sample design (91 PSUs)

PSU size class	Region				Total
	Northeast	Midwest	South	West	
A	5	4	6	6	21
X	4	10	16	8	38
Y	2	4	6	4	16
Z	2	4	6	4	16
<b>Total</b>	<b>13</b>	<b>22</b>	<b>34</b>	<b>22</b>	<b>91</b>

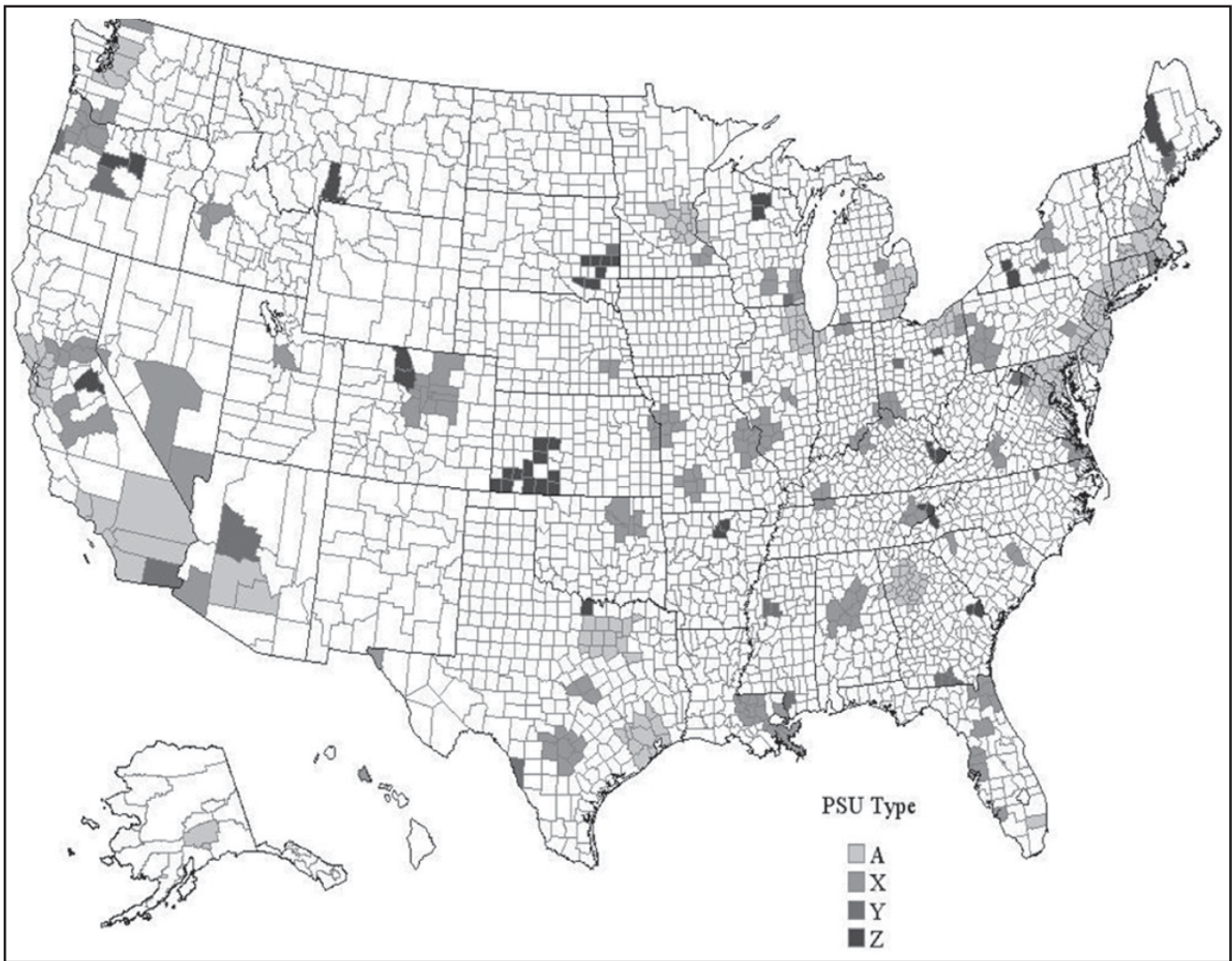


Figure 1. Spatial distribution of CE PSUs across the United States. The “A” PSUs correspond to the large population centers. The southern United States has a large number of “X” PSUs, and there are parts of the western United States without representation.

Given values of  $p_i$  and  $p$ , find values of  $x_i$  that...

$$\text{minimize } \sum_{i=1}^{40} \left( \frac{x_i}{7,700} - \frac{p_i}{p} \right)^2 \quad (0)$$

$$\text{subject to } \sum_{i=1}^{36} x_i = 7,300 \quad (1)$$

$$\sum_{i=37}^{40} x_i = 400 \quad (2)$$

$$x_i \geq 80 \quad i = 1, 2, \dots, 36 \quad (3)$$

$$x_i \geq 0 \quad i = 37, \dots, 40 \quad (4)$$

where  $x_i$  = the number of households allocated to geographic ‘area  $i$ ’  
 $p_i$  = the population represented by geographic ‘area  $i$ ’  
 $p = p_1 + p_2 + \dots + p_{40}$

The output from this nonlinear program is an allocation of the 7,700 households to the individual geographic areas. The objective function (0) minimizes the sum of squared differences between each area’s share of the national population and its share of the national sample of households. This allocates the sample of households as close to population proportionality as possible. Constraint (1) limits the sample of the 36 urban areas to 7,300 households. Constraint (2) limits the sample of the four rural areas to 400 households. Constraint (3) allocates at least 80 households to each urban area to ensure that the CPI’s survey estimates are accurate enough to pub-

lish. Constraint (4) makes sure that the remaining areas are assigned nonnegative numbers of households.

After the 7,700 households are allocated to the 40 geographic areas, the households allocated to the 12 “X,” “Y,” and “Z” areas are suballocated to individual PSUs according to their proportion of the area’s population.

Continuing the example from above, the nonlinear program allocated 1,342.32 out of 7,700 households to the “X” areas in the South. There are 18 “X” strata in the South, and stratum X344 has 6.20 percent of its population; hence, it was suballocated 6.20 percent of the sample. Thus, stratum X344 is given a target sample size of 83.22 interviewed households ( $83.22 = 1,342.32 \times 0.0620$ ).

### Adjusting the PSU’s target sample sizes for nonparticipation

Unfortunately, not all households selected for the survey participate in it. Some households cannot be contacted; some households are contacted but refuse to participate; and some households are ineligible for the survey. As a result of this “nonparticipation,” the actual number of households designated for the survey must be larger than the target number of interviewed households. The designated number of households to be visited in each PSU is determined by adjusting the target sample size that was identified by the expected survey participation rate.

For example, the participation rate in stratum X344 is estimated to be 60 percent based on data from 1999–2001. Approximately 20 percent of the households are “out of scope” (the housing units are unoccupied, demolished, converted to nonresidential use, located on a military base, etc.), and 20 percent of the households are “in scope” but do not participate, leaving 60 percent of the households participating in the survey. Thus, the sample size inflation factor for stratum X344 is 1.66 ( $= 1/0.60$ ), which means 166 households need to be selected for every 100 completed interviews that are wanted. Finally, the

inflated target sample size is multiplied by 2 to account for the two surveys, Diary and Interview. This yields a “designated sample size” for each PSU. In stratum X344, the designated sample size is 276.29 households:

$$\begin{aligned} \text{Designated} &= (\text{Target Sample Size}) \times \\ \text{Sample Size} &= (\text{Nonparticipation Inflation} \\ &\quad \text{Factor}) \times 2 \\ &= 83.22 \times 1.66 \times 2 \\ &= 276.29 \end{aligned}$$

This means that, each year, the U.S. Census Bureau selects 276.29 households in the Greenville, South Carolina, metropolitan area in order to collect data from 83.22 households per year in the Diary survey and 83.22 households per quarter in the Interview survey (interviews 2–5 only).

### The revised sample allocation

As mentioned, shortly after the original 2000 Census-based sample design was implemented, newly imposed budget constraints caused the CE and CPI to eliminate 11 “X” PSUs from the sample and to change the size class of 7 “A” PSUs to the “X” category. When this change was implemented, a decision was made to keep the target sample sizes for the PSUs in the 2000 Census-based sample design and to drop the 642 households that had been allocated to the 11 eliminated PSUs. This effectively reduced the national target sample size from 7,700 to 7,058. Computations to reallocate the national sample were not carried out. Instead, the CE’s original sample size was simply reduced by the sample sizes that were allocated to the 11 eliminated PSUs.

### Selecting the households to visit

After determining the number of households to visit in each PSU, the final stage of sampling is selecting specific households to visit. The U.S. Census Bureau has a list of households across the Nation (called the “sampling frame”), and the specific households to visit are selected from that list.

The sampling frame is divided into four “segments”: Unit, area, permit, and group quarters. The “unit” segment has about 80 percent of the households, and it consists of regular housing units with “city-style addresses” (street name, house number, apartment number, etc.). The “area” segment has about 10 percent of the households, and it consists of housing units that are physically located and listed by Census field personnel prior to sample selection. Most households in the “area” segment are in rural areas. The “permit” segment has about 9 percent of the households, and it consists of housing units that were constructed after April 1, 2000 (the date of the last census). Finally, the “group quarters” segment has about 1 percent of the households, and it consists of housing units in which the occupants share their living arrangements.

Within each PSU, a “systematic sample” of households is selected from each of the four segments. The households are sorted by variables that are correlated with their expenditures: Urban/rural; the market value of the home (for owners) or the rental value of the apartment (for renters); the number of people in the household; etc. This ensures that every kind of household is well represented in the survey. Although the specific variables used to sort the households differ slightly in each of the four segments, the procedures for selecting the sample are the same.

Once the list of households is sorted, a systematic sample of households is selected. The first household selected from the list is randomly selected using a random number generator to select one of the first  $k$  households on the list. Then, the remaining households are selected by taking every  $k^{\text{th}}$  household on the list after the first one. The number  $k$  is called the “sampling interval,” and it is computed independently for each PSU by dividing the total number of households in the PSU by the number of households in the PSU that will be visited.

For example, in stratum X344 (Greenville, South Carolina), the sam-

pling frame has 176,654 households, and the CE draws a sample of 276.29 households per year in that area; hence, the sampling interval is  $k = 639.38$ :

$$\begin{aligned} k &= \text{PSU sampling interval} \\ &= (\text{Number of Households in the} \\ &\quad \text{PSU}) / (\text{Designated sample} \\ &\quad \text{size}) \\ &= 176,654 / 276.29 \\ &= 639.38 \end{aligned}$$

This means that the first household selected for the sample is one of the first 639 households on the list. After the initial household is randomly selected, every 639<sup>th</sup> household on the

list is selected for the sample as well. Thus, if the  $r^{\text{th}}$  household on the list is randomly selected ( $1 \leq r \leq 639$ ), then the other households will be  $r + 639$ ,  $r + (2 \times 639)$ ,  $r + (3 \times 639)$ , etc. The selected households are assigned to the Diary and Interview surveys on an alternating basis.

### Conclusion

This article describes the CE's selection of a representative sample of American households to participate in a survey about their expenditures. The first stage of sampling is defining geographic areas called "PSUs," which are small groups of counties. The PSUs are grouped into

"strata," and one PSU is randomly selected from each stratum. Each randomly selected PSU represents itself plus the other nonselected PSUs. Then, the number of interviewed households targeted for the entire Nation is allocated to the individual PSUs, and those numbers are inflated to account for survey "nonparticipation." Finally, the specific households to be visited are selected from the complete list of households (called the "sampling frame") using a systematic selection procedure. The three-stage sampling process provides the CE with a well-balanced and representative sample of American households. ■



# Response Rates in the Consumer Expenditure Survey

Sylvia A. Johnson-Herring  
and Sharon Krieger

**R**esponse rates are one of the most important indicators of a survey's quality. It is important to monitor survey participation and to monitor response rates because non-response can introduce bias into any survey's published estimates. When a survey's responders and nonresponders differ in terms of the characteristic being measured, great care must be taken to produce accurate estimates for the population as a whole. Although most surveys have procedures to adjust for nonresponse, any imperfection in them is magnified when response rates decline. Therefore, it is important to monitor response rates and keep them as high as possible.

This article describes how the Consumer Expenditure Survey (CE) categorizes the outcomes of visits to survey households in terms of response and nonresponse, and explains how the U.S. Bureau of Labor Statistics (BLS) calculates the CE response rates.

## Selection of households

The CE selects a representative sample of households from across the Nation to find out how Americans spend their money. Specific households to visit are drawn from the decennial census 100-percent-detail file, which is a complete list of addresses of American households. Independent samples of households are selected for the Interview and Diary components of the CE.

Field representatives visit households in each survey's sample to collect data. For the Interview survey, people living at an address answer the survey questions five times, with the interviews conducted at 3-month intervals for 5 quarters. For the Diary Survey, people living at an address answer the survey questions two times, keeping a diary for two 1-week periods. Gaining cooperation at each household is important because each household in the sample represents many American households.

## Nonresponse types and outcome codes

Like any survey, the CE does not get responses from every household in its sample. At most addresses, a household member participates, giving a "completed interview." However, at some addresses, the survey's field representative finds an occupied housing unit but either is unable to contact an eligible household member or is unable to convince a reluctant household member to participate in the survey. At still other addresses, the housing unit is unoccupied, or the structure is nonresidential or otherwise not eligible to participate in the survey. Such cases are called "nonresponders."

Field representatives assign outcome codes to each address that they visit. Multiple visits to an address may be necessary before a final outcome code

Sylvia A. Johnson-Herring is a mathematical statistician in the Division of Price Statistical Methods, Branch of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

Sharon Krieger is a mathematical statistician in the Division of Price Statistical Methods, Branch of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

can be assigned. Sometimes, multiple visits are made in an attempt to convince reluctant households to respond to the survey; other times, it takes more than one visit before a field representative actually contacts an eligible household member. When field representatives make multiple visits and are still unable to find anyone home, they may obtain information from neighbors or people in the area to verify the status of the housing unit. Sample households are assigned a separate outcome code for each quarter in the Interview survey and for each week in the Diary survey. Although field representatives assign the outcome code, BLS may make some changes later based on criteria that measure the completeness of respondents' reporting of household income and expenditures.

Field representatives can select from more than 30 different outcome codes to describe the nonresponse situation that they find at an address. These outcome codes are categorized as Types A, B, and C nonresponses. Some common outcome codes for Type A nonresponses are as follows: Temporarily absent; No one home (unable to contact); Refused—hostile respondent; Refused—time-related excuses; and Refused—language problems. Some common outcome codes for Type B nonresponses are: Occupied by persons with usual residency elsewhere; Vacant for rent; Vacant for sale; and Unit under construction. Some common outcome codes for Type C nonresponses are: Dwelling demolished; House or trailer moved; Dwelling condemned; and Located on military base or post.

Two essential concepts when classifying sample addresses in terms of response and nonresponse are “eligible” and “in scope.” Completed interviews and Types A and B nonresponders are all “in scope,” while Type C nonresponders are “out of scope” for the CE. In scope refers to addresses that have residential housing units. Out-of-scope addresses are generally nonresidential.

An address is eligible to participate in the survey if the residential housing unit at the address is occupied by its

usual residents; otherwise, it is not eligible. Completed interviews and Type A nonresponders are eligible, but Types B and C nonresponders are not eligible. Only eligible addresses are used in the response rate calculations.

Type A nonresponders are both in scope and eligible, because their housing units are occupied by the usual residents. Type B nonresponders are in scope, but they are not eligible, because the housing units are not occupied or the housing units are occupied solely by persons whose usual place of residence is elsewhere. Interviews are not possible for Type C nonresponders, because these cases are out of scope and permanently not eligible to participate in the CE; empty lots or buildings used for nonresidential purposes fall into this category.

In summary, results of visits to the sample addresses are divided into four main categories:

- Completed Interviews (eligible cases that are interviewed—in scope)
- Type A nonresponses (eligible cases that are not interviewed—in scope)
- Type B nonresponses (cases that are not eligible for interview—in scope)
- Type C nonresponses (cases that are not eligible for interview—out of scope)

### Response rates

The CE program defines the response rate as the percent of eligible house-

holds that actually are interviewed for each survey. Types B and C nonresponders are not part of the response rate, because they are not eligible for the survey.

Response rates are reported separately for the Interview and Diary components of the CE. When calculating a response rate for the Interview survey, BLS generally uses outcome information only from the second through fifth interviews. Information from the first interview is used only for “bounding” purposes, which address a common problem in which survey respondents tend to report expenditures to have been made more recently than they were actually made. When calculating a response rate for the Diary survey, BLS uses outcome information from the two 1-week periods a household is in the sample.

The sample size and response status for housing units “designated” for the Interview survey in 2004 and 2005 are shown in table 1. The CE counts each of the four “nonbounding” interviews at a household (interviews 2–5) separately when reporting the number of housing units designated for the Interview survey; in other words, interviews 2–5 at one household generally represent four housing units designated for the survey. In 2005, there were 49,242 housing units designated for the Interview Survey. Field representatives occasionally find more than one housing unit at the addresses they visit, so the number of housing units designated is slightly more than the number of addresses selected for the sample. Those 49,242 housing units designated for the survey contained 39,988 eligible units and 9,254 ineligible units. The 39,988

Table 1. Analysis of response in the CE Interview Survey, 2004 and 2005

Sample unit	2004	2005
Housing units designated for the survey	50,509	49,242
Less: Type B or C nonresponses	9,626	9,254
Equals: Eligible units	40,883	39,988
Less: Type A nonresponses	9,798	10,184
Equals: Interview units	31,085	29,804
Percent of eligible units interviewed	76.0	74.5

eligible units produced 29,804 completed interviews, yielding a response rate of 74.5 percent ( $29,804/39,988=0.745$ ).

In 2005, the CE's sample design was changed. The list of addresses from which the sample is drawn was updated by replacing the 1990 decennial census 100-percent-detail file with the 2000 decennial census 100-percent-detail file. Under special procedures, all households selected from the 2000 Census-based sample in January 2005 were treated as first interviews during the transition. Hence, as shown in table 1, the number of Interview survey

housing units designated in 2005 is less than normally would be expected.

The sample size and response status for housing units "designated" for the Diary survey in 2004 and 2005 are shown in table 2. The CE counts each of the two 1-week diary periods at a household separately when reporting the number of housing units designated for the Diary survey. In 2005, there were 26,054 housing units designated for the Diary survey. (The two diaries are counted as separate interviews.) Field representatives occasionally find more than one housing unit at the addresses they visit, so the number of

housing units designated is slightly more than the number of addresses selected for the sample. Those 26,054 housing units designated for the survey contained 21,309 eligible units and 4,745 ineligible units. The 21,309 eligible units produced 15,126 completed interviews, yielding a response rate of 71.0 percent ( $15,126/21,309=0.710$ ).

For both the Interview and Diary surveys, the number of Types B and C nonresponses decreased from 2004 to 2005. This decrease can be attributed to the more up-to-date list of addresses used to select the sample in 2005.

### Conclusion

The CE collects expenditure data from a representative sample of American households. Like any survey, the CE does not get responses from every household in its sample. This article has described how the CE categorizes the outcomes of visits to survey households and how it calculates response rates. It is important to monitor response rates and to keep them as high as possible in order to minimize the amount of bias that can be introduced into the survey estimates. ■

Table 2. Analysis of response in the CE Diary Survey, 2004 and 2005

Sample unit	2004	2005
Housing units designated for the survey	27,385	26,054
Less: Type B or C nonresponses	5,746	4,745
Equals: Eligible units	21,639	21,309
Less: Type A nonresponses	6,722	6,183
Equals: Interview units	14,917	15,126
Percent of eligible units interviewed	68.9	71.0

# The Effect of Refusal Conversion on Data Quality in the Consumer Expenditure Interview Survey

Nathan McDermott  
Lucilla Tan

Achieving and maintaining high response rates are important goals of the Consumer Expenditure (CE) Survey program. However, as with other Federal Government surveys, response rates for the Interview Survey component of the CE have been declining in recent years. Between 1998 and 2002, the response rate for the Interview Survey was about 79 percent, and it fell to about 76 percent between 2003 and 2006.<sup>1</sup> In an attempt to stem the decline in response rates and minimize nonresponse bias, guidelines for refusal conversion were established. Refusal conversion is a process by which the interviewer makes additional efforts to persuade an initial refuser to become a survey participant. In order to offset the decline in response rates, interviewers have increased their efforts to encourage survey participation. This is evidenced by the proportion of completed interviews accounted for by converted refusals, which rose from 9 percent in 2003 to 12 percent in 2006.

The level of effort required to convert an initial refusal raises issues of higher-than-anticipated field costs, as well as concerns over the quality of data provided by such respondents, compared with respondents who were cooperative throughout the interview

experience. Converted refusers may exert less cognitive effort to respond, or interviewers may be more willing to accept ‘satisficing’ responses from reluctant respondents to obtain a completed interview (Triplett et al., 1996). Satisficing occurs when respondents exert minimal effort when answering survey questions in order to hurry through the interview.

Findings about the effect of converted refusers on data quality have been inconclusive. Burton et al. (2006) cited various studies that compared survey estimates with and without converted refusers. They reported that significant differences between these two groups were found in fewer than half of the survey measures, and some of these differences disappeared after controlling for demographics. While some of these studies found consistent differences in demographics between converted refusers and respondents, others did not.

In this study, we compare measures of data quality for the survey estimates between converted refusers and other respondents in the Interview Survey, describe their demographic characteristics, and summarize the nature of interviewer contact attempts. By treating the group of converted refusers as proxy nonrespondents, we estimate the nonresponse bias in major expenditure categories.

Nathan McDermott is an economist formerly working in the Branch of Production and Control, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

Lucilla Tan is an economist working in the Branch of Research and Program Development, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

<sup>1</sup> Response rate calculation is based on The American Association of Public Opinion Research (AAPOR) Response Rate 1 definition (2006).

## Methods

We began with all respondents to the survey and divided them into two groups, **converted refusers**, and other respondents (henceforth, referred to as **respondents**). We differentiated converted refusers from respondents on the basis of the interviewer's response to the question "Was this a converted refusal?" at the end of the interview. If the interviewer responded, "Yes," we classified the case as a **converted refuser**; if "No," the case was classified as a respondent. The identification of converted refusers in this analysis is not rigorous: For completed interviews, we rely only on the interviewer's response to the converted refusal question; for noninterviews, there is no question asking if the interviewer attempted to convert the refusal. Thus, the universe of cases subject to refusal conversion is unknown. Although there are prescribed criteria for identifying initial refusals for possible refusal conversion, there is anecdotal evidence that these criteria may not be uniformly applied in the field.

Since April 2005, interviewers have been able to maintain detailed information about contact attempts for each assigned case using the Contact History Instrument (CHI). The information includes day and time of the contact attempt, outcome of the attempt, strategies used to attempt contact, and perceived concerns of respondents.

During the interview, expenditure information is collected by describing a category of goods or services (for example, home furnishings, healthcare) and asking if anyone in the consumer unit (CU) either had expenditures in the general category or had expenditures for specific items that fall into that category. If they did, then the respondents are probed for details about their spending, such as a description of the product or service, cost, quantity, and month purchased. Most information about goods and services is collected using detailed lists of goods and services, rather than general categories.

Better data quality is expected from respondents who are more willing to

complete the interview and are thorough in their reporting. Poorer quality data are expected from reluctant respondents, as they are more likely to give "satisficing" responses. For the Interview Survey, the following measures taken together suggest poorer data quality:

- lower levels of reported expenditures
- fewer responses to expenditure questions
- more "don't know/refused" responses to the expenditure questions
- more expenditure and income reports requiring editing due to incomplete reporting

In addition, interview characteristics, such as the following, support the hypothesis of poorer data quality:

- the respondent took less time to answer the expenditure questions
- there was less use made of the information booklet and records of purchases to answer questions during the interview.

The **information booklet** is a document that lists examples of different categories of products and services. Interviewers are supposed to show it to respondents to help respondents understand and recall purchases in different expenditure categories. **Records** refer to receipts, bank statements, and other documentation of purchases. These aids to better reporting may not be used or may be used less in interviews where the interviewer perceives that the respondent is anxious to hurry through the interview.

The **category of total expenditures** is regarded as the most direct measure of data quality for the Interview Survey. For the data quality measures, we used 1-sided t-tests to test the alternative hy-

pothesis that converted refusers provide poorer quality data than respondents to the null hypothesis of no difference between converted refusers and respondents. The alternative hypothesis reflects the belief that converted refusers are more likely to exhibit satisficing behavior and provide poorer quality data. For comparisons on demographic characteristics, and characteristics of contact attempts and interviews, we tested the alternative hypothesis that there is a difference between converted refusers and respondents. We used 2-sided t-tests on the means of characteristics that are continuous variables and the Chi-square test of association between type of respondent and characteristics that are categorical variables. Following these bivariate comparisons, we fitted multiple regressions with controls for demographic characteristics and interview characteristics to assess the effect of converted refusers on reported total expenditures. All analyses were performed on unweighted data.

We used completed interviews with known converted refusal status in waves two through five from April 2005 through September 2006 in our analysis.<sup>2</sup> Since the Interview Survey is a panel survey, a household can be represented multiple times in the analysis data. However, we treated each completed interview as an independent case. There were 43,395 completed interviews in the sample for this study, of which 11.8 percent were converted refusers.

## Findings

### Data quality measures

Every measure supported the alternative hypothesis that converted refusers provide poorer quality data than respondents. (See table 1.) Converted refusers reported lower total expenditures (\$10,499 v. \$11,302); they answered fewer expenditure questions (37.3 v. 46.1 questions); they had a

<sup>2</sup> The Contact History Instrument was introduced for the Interview Survey in April 2005. The latest data available at the time of analysis was September 2006.

Table 1. Mean estimates of data quality measures for converted refusers and respondents, Consumer Expenditure Interview Survey, April 2005–September 2006

Data quality measure	Converted refusers (N = 5,314)	Respondents (N = 38,081)	Difference	95 percent confidence interval	t-stat	1-sided p-value <sup>1</sup>
Quarterly total expenditures after editing.....	\$10,449	\$11,302	-854	(-1,104,-604)	-5.62	<0.001
Number of expenditure questions answered .....	37.3	46.1	-8.8	(-9.3, -8.4)	-30.4	<0.001
Percent of expenditure questions answered "don't know/refused" <sup>2</sup> .....	6.0	2.7	3.3	(3.0, 3.6)	20.92	<0.001
Percent of complete expenditure reports <sup>2</sup> .....	80.6	85.8	-5.1	(-5.6, -4.7)	-23.2	<0.001
Percent of income reports not requiring imputation.....	39.7	55.2	-15.5	(-16.9, -14.1)	-21.2	<0.001

<sup>1</sup> The null hypothesis of no difference between converted refusers and respondents was tested against the alternative 1-sided hypothesis of poorer quality measures from converted refusers.

<sup>2</sup> Complete reports are reports that do not require editing. Standard t-test for ratio of variable means was used to test this difference.

<sup>3</sup> Standard t-test of proportions was used to test this difference.

Table 2. Characteristics of Contact Attempts and Interviews, Consumer Expenditure Interview Survey, April 2005–September 2006

Characteristic	Converted refusers (N = 5,314)	Respondents (N = 38,081)	Difference	95 percent confidence interval	t-stat	2-sided p-value <sup>1</sup>
Number of contact attempts .....	4.2	3.4	0.88	(0.79, 0.97)	15.9	<0.001
Percent of noncontacts.....	39.3	33.3	6.1	(4.8, 7.3)	9.3	<0.001
Mode of data collection: Percent by personal visit <sup>2</sup> .....	52.1	66.5	-14.3	(-15.7, -12.9)	-20.5	<0.001
Number of days between first and last attempt .....	10.7	8.1	2.57	(2.3, 2.8)	17.9	<0.001
Percent use of records <sup>3, 4</sup> .....	20.1	37.3	-17.2	(-18.5, -15.8)	-24.6	<0.001
Percent use of information booklet <sup>4</sup> .....	37.5	51.0	-13.5	(-14.9, -12.0)	-18.4	<0.001
Time to complete interview (minutes).....	57.1	64.0	-6.9	(-7.7, -6.1)	-14.7	<0.001
Time spent on expenditure questions (minutes)						
25th percentile .....	23.1	28.8	-5.8			
50th percentile .....	34.4	42.2	-7.9			
75th percentile .....	49.0	60.4	-11.3			

<sup>1</sup> The null hypothesis of no difference between converted refusers and respondents was tested against the alternative 2-sided hypothesis of a difference between the two groups.

<sup>2</sup> This was based on the interviewer's report of the mode, either in-person or by telephone, in which most of the data was collected.

<sup>3</sup> Use of records is originally a 6-level categorical variable; for this study, we indicated "record used" when the response was "mostly" through "always."

<sup>4</sup> Standard t-test of proportions was used to test this difference.

higher percentage of "don't know/refused" responses (6.0 v. 2.7 percent); and they were less likely to provide complete reports for expenditures (80.6 v. 85.8 percent) and income (39.7 v. 55.2 percent).

These bivariate comparisons together reflect satisficing by converted refusers and indicate poorer quality responses from them. However, there may be additional characteristics of converted refusers, when compared to respondents, which could account for these differences in the measures of data quality.

#### *Interview characteristics of converted refusers and respondents*

##### **Contact attempts and interview**

CHI data showed that more effort was

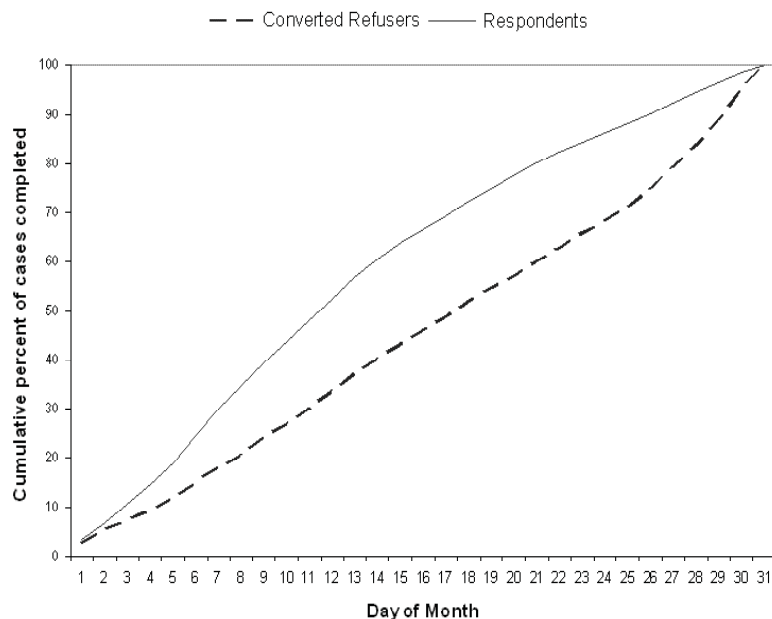
required to reach and complete an interview with converted refusers. It was more difficult to contact converted refusers than respondents: 39.3 percent of contact attempts resulted in noncontact for converted refusers compared with 33.3 percent for respondents. (See table 2.) A smaller percent of interviews was completed by personal visit, the preferred method, for converted refusers, compared with respondents (about half versus two-thirds). Converted refusal cases are active in the field for a longer time period (10.7 v. 8.1 days for respondents). By day 15 of the month, 63.9 percent of respondents have completed their interviews, compared with 43.2 percent of converted refusers. (See chart 1.) Interviews with

converted refusers involve less use of records (20.1 v. 37.3 percent), less use of the information booklet (37.7 v. 51.0 percent), and less time on the expenditure questions (34.4 v. 42.2 minutes at the median of the distributions).

##### **Respondent concerns**

In the CHI, interviewers can record their perceptions of respondent concerns for each contact made. For each case, we summed up the number of times a specific concern was cited, then computed the average number of times each concern was reported for respondents, converted refusers, and refusers (those eligible respondents who refused to participate in the survey). We compared the differences in

Chart 1. Rate of cases reaching final disposition



the reporting rates between converted refusers and respondents, and between converted refusers and refusers. (See charts 2a and 2b.)

Interviewers reported higher incidences of time-related concerns (too busy, interview too time-consuming, scheduling difficulty) for converted refusers, compared with respondents and refusers. In contrast, higher incidences of hostile behavior, lack of interest, and anti-Government concerns were reported for final refusers compared with converted refusers. Differences suggest that initial refusals are more likely to be converted if the perceived respondent concerns are of a temporary, circumstantial nature (such as time-related concerns), than if the concerns were attitudinal in nature. This finding is consistent with Burton et al.'s (2006, page 467) analysis of reasons for refusal and interview outcome in subsequent waves; they found that "...refusals are indeed more likely to be temporary if the reason for refusal is situational or due to a short-term circumstance."

### Demographics

We examined associations between categorical characteristics and the type of respondent (converted refuser v. respondent) using a Chi-squared test of independence. Income was divided into five categories: Negative income (less than zero) and the four quartiles for income greater than or equal to zero. Converted refusers differed from respondents in household composition, in addition to respondent characteristics of age, race, educational attainment, and income before tax. (See table 3.) Differences were significant statistically, but not substantively. For continuous characteristics, we used the t-test to compare the mean characteristic for converted refusers to respondents. We found that converted refusers were more likely to live in Metropolitan Statistical Areas, and were less likely to be homeowners. (See table 4.) Converted refusers were not significantly different from respondents in income, average number of members in the consumer unit (CU), average number of mem-

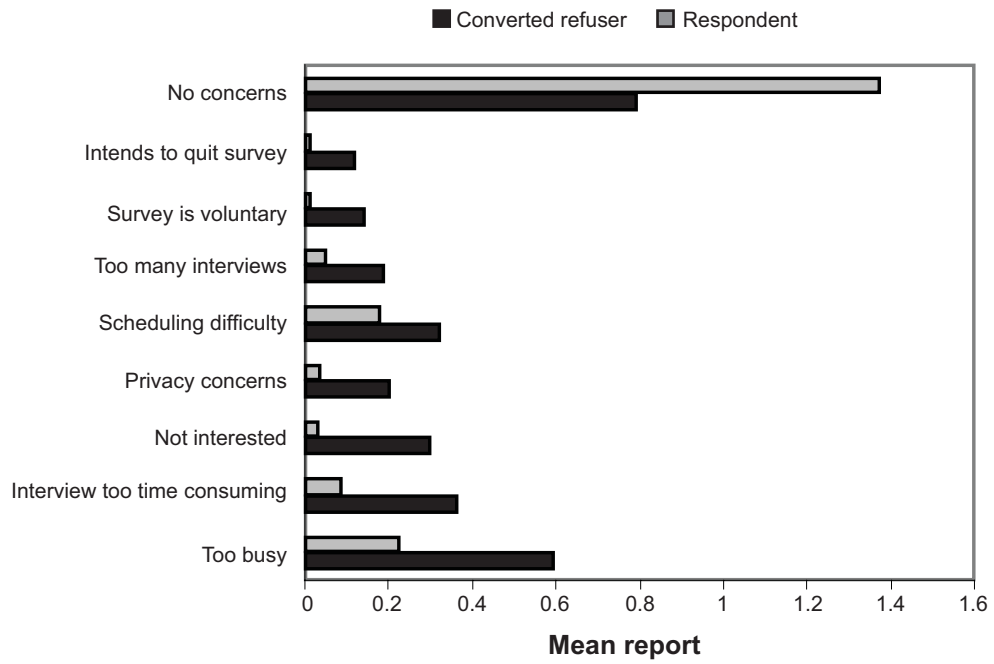
bers under age 18 and over age 64, and number of earners in the CU.

### Regression analysis

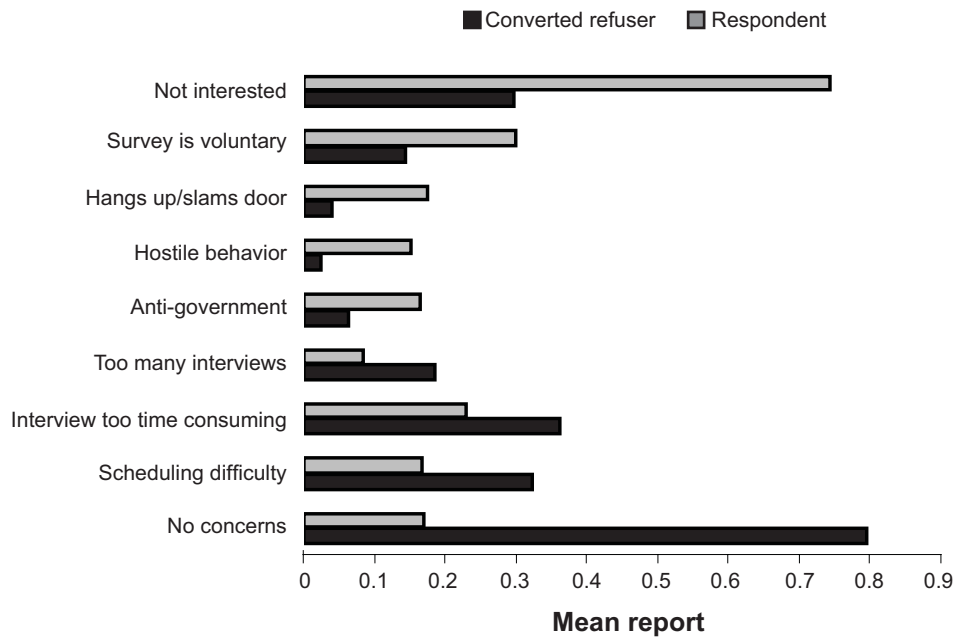
Since the bivariate comparisons showed that converted refusers differed from respondents in some demographic and interview characteristics, we used linear models to examine the effect of converted refusers on reported total expenditures, controlling for these characteristics. The first regression model includes only demographic characteristics for the respondent and household. The second regression model includes covariates for interview attributes in addition to the demographic covariates. Converted refusers spend less time answering expenditure questions, are less likely to use records, and are more likely to have telephone interviews. Using the distribution of time spent on answering expenditure questions, we created time categories of "shorter than average" (less than 25th percentile, 28 minutes), "average" (25th to 75th percentile), and "longer than average" (greater than 75th percentile, 59.1 minutes).

From the first model with only demographic covariates, the coefficient for converted refusals is negative as expected, and significant (-606.56,  $p < .001$ ). (See table 5.) While the coefficients for the positive income percentiles exhibited the expected "staircase" pattern (reported expenditures increased with higher income percentiles), the large positive coefficient for negative income was unexpected (6,135.78,  $p < 0.001$ ). This could be due to under-reporting of income, the reporting of large short-term losses, or reporting by those with low income but large savings (such as retirees). Besides the coefficients for income, most other demographic coefficients had the expected directions and most were found to be significant ( $p < 0.05$ ). This suggests there are characteristics about converted refusers—other than these demographic characteristics—that are associated with their reporting lower expenditures.

**Chart 2a. Perceived respondent concerns among converted refusers and respondents**



**Chart 2b. Perceived respondent concerns among converted refusers and final refusers**





**Table 3. Frequency distribution of demographic characteristics for converted refusers and respondents, Consumer Expenditure Interview Survey, April 2005–September 2006**

Characteristic	Converted refusers (N = 5,314)	Respondent N= 38,081	Chi-square	P-value
CU size .....			7.59	.0553
1.....	27.1	28.1		
2.....	31.0	31.4		
3-4 .....	31.5	29.7		
5+ .....	10.4	10.9		
CU composition .....			21.45	.0003
Husband-wife only.....	20.8	21.7		
Husband-wife families .....	30.3	30.5		
Single parent .....	7.4	5.9		
Singles.....	27.1	28.1		
Other.....	14.4	14.0		
CU tenure .....			18.31	.0001
Owner.....	66.1	67.9		
Renter.....	33.3	31.0		
Other.....	0.6	1.1		
CU area type .....			89.9	<.001
In MSA.....	91.7	87.1		
Outside MSA.....	8.3	12.9		
Respondent gender.....			.27	.6040
Male .....	39.5	39.8		
Female.....	60.5	60.2		
Respondent age .....			23.62	<.001
<21 .....	1.8	2.3		
21-34 .....	22.1	20.7		
35-49 .....	33.4	31.5		
50-64 .....	23.8	25.8		
65+ .....	18.9	19.7		
Respondent race .....			31.84	<.001
White .....	79.3	82.3		
Black.....	13.6	11.5		
Native American .....	.6	.5		
Asian.....	4.8	4.0		
Pacific Islander .....	0.3	0.4		
Multi-race.....	1.3	1.4		
Respondent's education level .....			32.71	<.001
Less than high school.....	16.6	14.9		
High school graduate.....	27.6	25.6		
Some college.....	29.6	31.3		
College graduate .....	26.2	28.2		
Income before tax distribution after imputation.....			15.16	.0044
Negative income.....	23	.14		
Less than 25th percentile .....	24.9	25.0		
25th-50th percentile .....	26.2	24.8		
50th-75th percentile.....	25.5	24.9		
Greater than 75th percentile .....	23.1	25.2		

The second regression model includes interview characteristics as additional covariates. Coefficients of the demographic covariates remain significant and with expected signs, as in the first regression model. The coefficients for the interview characteristics are significant, but the coefficient for converted refusers is no longer significant. On the length of time spent answering expenditure questions, the coefficient for “greater than 59 minutes spent answering expenditure questions” was signifi-

cantly large and positive (3,124.71,  $p = <.001$ ), while the coefficient for “shorter than 28 minutes” was significantly negative (-1,634.61,  $p = <.001$ ). This is consistent with expectations that more expenditures are reported when more time is spent on answering expenditure questions. The coefficient for “no records used” is negative and significant (-444.80,  $p = <.001$ ). The coefficient for “interview by telephone” is positive (273.06,  $p = .002$ ); this is consistent with other research which found phone

respondents to report higher expenditures and income (McGrath 2005).

The regression results suggest that differences in interview characteristics—not differences in demographics—explain converted refusers’ lower reporting of expenditures compared to respondents.

### Effect of converted refusers on expenditure estimates

The quarterly mean of overall expenditures is lower for converted refusers than it is for respondents. One way to estimate the effect that data collected from converted refusers have on the mean expenditure estimates is to treat converted refusers as proxy nonrespondents, and compute the bias of nonresponse in the respondent mean as shown in Groves (2006):

$$\text{Bias}(\hat{Z}_{jR}) = \frac{n_N}{n_T} (\hat{Z}_{jR} - \hat{Z}_{jN})$$

Here

$\hat{Z}_{jR}$  = mean expenditure estimate for expenditure category  $j$  from respondent  $R$ ,

$\hat{Z}_{jN}$  = mean expenditure estimate for expenditure category  $j$  from converted refusers, who are proxy nonrespondents,

$n_N$  = number of converted refusers, who are proxy nonresponders, and

$n_T$  = total sample (converted refusers plus respondents).

The relative nonresponse bias estimate for expenditure category  $j$  is computed as

$$\hat{\theta}_j = \frac{\text{Bias}(\hat{Z}_{jR})}{\hat{Z}_{jT}} = \frac{\hat{Z}_{jR} - \hat{Z}_{jN}}{\hat{Z}_{jT}}$$

where

$\hat{Z}_{jT}$  = mean expenditure estimate for expenditure category  $j$  from the total sample.

Table 4. Means of demographic characteristics for converted refusers and respondents, Consumer Expenditure Interview Survey, April 2005–September 2006

Characteristic of the CU	Converted refusers (N = 5,314)	Respondent (N = 38,081)	Difference	95 percent confidence interval	t-stat	2-tailed p-value
Number of members.....	2.59	2.55	0.03	(0.00, 0.07)	1.51	.1321
Number of earners.....	1.37	1.35	.02	(.00, .04)	1.39	.1632
Number of members under age 18.....	.70	.67	.03	(.00, .05)	1.57	.1164
Number of members over age 64.....	.31	.32	-.01	(-.02, .01)	-1.07	.2824

The variance for relative nonresponse bias does not have a closed-form solution. An estimate of the variance for the relative nonresponse bias for each expenditure category was calculated using random groups (Wolter 1985). With the number of random groups equal to 10, the variance formula is as follows:<sup>3</sup>

$$\text{var}_{\text{rg}}(\tilde{\theta}_j) = \frac{\sum_{k=1}^{10} (\hat{\theta}_{k,j} - \tilde{\theta}_j)^2}{10(10-1)},$$

where

$\hat{Z}_{R,k,j}$  is the respondent sample mean on expenditure category *j* for random group *k*,

$\hat{Z}_{T,k,j}$  is the total sample mean on expenditure category *j* for random group *k*

$\hat{\theta}_{k,j} = \frac{\hat{Z}_{R,k,j} - \hat{Z}_{T,k,j}}{\hat{Z}_{T,k,j}}$  is the relative bias on expenditure category *j* for random group *k*, and

$\tilde{\theta}_j = \frac{1}{10} \sum_{k=1}^{10} \hat{\theta}_{k,j}$  is the average of the relative bias on expenditure category *j* over all 10 random groups.

We used the variance formula provided above to calculate 95 percent confidence intervals for the relative nonresponse bias for each expenditure

<sup>3</sup>This random group's variance for the relative bias was first implemented in a nonresponse bias study for the Interview Survey, CE Nonresponse Bias Team (2007a). Nonresponse Bias: Using Harder-to-Contact Respondents as Proxies for Nonrespondents.

category. The general formula for the 95 percent confidence interval is

$$\hat{\theta}_j \pm t_{9,0.975} * \sqrt{\text{var}_{\text{rg}}(\tilde{\theta}_j)},$$

where

$\tilde{\theta}_j = \frac{1}{10} \sum_{k=1}^{10} \hat{\theta}_{k,j}$  is the full sample estimate of the relative nonresponse bias on expenditure category *j*.

The sign of the relative bias measure indicates if converted refusers lowered (positive relative bias) or raised (negative relative bias) the expenditure estimate for a category, while the magnitude of the relative bias indicates the extent to which the expenditure estimate is changed by including the expenditures of converted refusers in computing the mean expenditure estimate. Where the 95 percent confidence interval of the relative bias includes zero, it indicates that the relative bias reflects sampling variability and that the expenditure estimate is not subject to nonresponse bias. The underlying assumption behind these computations is that nonresponse is the only source of bias.

The estimated relative bias for average quarterly total expenditures is 0.86 (.64, 1.08) percent. (See table 6.) The survey estimate of expenditures on reading materials has the largest relative bias (3.6 percent), followed by personal insurance and pensions (3.5 percent), tobacco (2.7 percent), alcoholic beverages (2.5 percent), cash contributions (2.0 percent), entertainment (1.9 percent), apparel (1.3 percent), health

care (1.2 percent), and personal care (1.2 percent). The 95 percent confidence interval for the estimated relative bias for quarterly expenditure estimates of transportation, housing, education, and food include zero, indicating that nonresponse bias is not affecting these expenditure estimates.

Other recent studies of potential nonresponse bias in the Interview Survey used other definitions of proxy nonrespondents, and their estimates of relative bias of quarterly total expenditures ranged from -0.14 (-1.4, 1.1) percent to 5.8 (2.0, 9.6) percent (CE Nonresponse Team, 2007a, 2007b, Reyes-Morales 2007). These estimates of potential nonresponse bias are limited by how closely these various proxy nonrespondents represent nonrespondents.

A pattern emerges when the expenditure categories are listed in decreasing magnitude of the relative bias. Categories with large relative bias are reading materials, personal insurance and pensions, tobacco, alcoholic beverages, cash contributions, entertainment, apparel, health care, and personal care. Expenditure categories with small nonresponse bias (and not statistically different from 0 at the 5 percent level) are transportation, educational expenses, and housing. The categories with large relative bias represent more discretionary types of expenditures, while the categories with smaller relative bias are more likely to be "necessities." This difference in relative bias between expenditure categories may partly be explained by recognizing that "necessity" goods and services are less dependent on personal characteristics and preferences, and these regular expenditures require less respondent effort to

Table 5. Multiple regressions with quarterly total expenditures as the dependent variable, Consumer Expenditure Interview Survey, April 2005–September 2006

Explanatory variable <sup>1</sup>	Model with only demographic characteristics			Model with demographic and interview characteristics		
	Parameter estimate	Standard error (SE)	P-value	Parameter estimate	Standard error (SE)	P-value
Intercept.....	8,500.68	268.50	<.001	8,278.29	273.87	<.001
Converted refuser <sup>2</sup> .....	-606.56	122.72	<.001	-85.62	121.90	.4825
<b>Respondent characteristic</b>						
Male <sup>2</sup> .....	94.68	84.24	.261	328.21	83.10	<.001
<b>Age</b>						
Less than 21 years old.....	-731.06	287.19	.0109	-489.09	281.97	.0828
21-34 years old.....	-712.18	117.72	<.001	-593.11	115.63	<.001
50-64 years old.....	3.80	117.23	.9741	-225.42	115.18	.0503
Greater than 65 years old.....	-34.10	233.21	.8838	-371.45	229.08	.1049
<b>Race</b>						
Black.....	-1,275.38	129.94	<.001	-1,032.57	127.77	<.001
Asian.....	-1,032.14	206.93	<.001	-604.39	203.35	.003
Other race.....	-137.19	273.80	.6163	-338.24	268.68	.2081
<b>Education level</b>						
College graduate.....	1,840.05	109.20	<.001	1,648.74	107.35	<.001
High school graduate.....	-876.37	108.25	<.001	-618.15	106.39	<.001
Less than high school.....	-1,773.17	132.75	<.001	-1,257.12	131.00	<.001
<b>Household characteristic</b>						
<b>Age composition--number of members</b>						
Under 18 years.....	587.80	52.35	<.001	511.54	51.42	<.001
18-64 years.....	165.83	89.61	.0642	209.24	87.96	.0174
Over 64 years.....	-383.78	148.01	.0095	-365.10	145.20	.0119
<b>Family composition</b>						
Husband and wife only.....	-428.66	155.68	.0059	-422.84	152.81	.0057
Single parent.....	-1,465.51	213.50	<.001	-1,276.94	209.55	<.001
Single.....	-2,443.97	195.04	<.001	-2,123.56	191.53	<.001
Other family type.....	-1,522.71	146.45	<.001	-1,278.00	143.87	<.001
<b>Income before tax distribution<sup>3</sup></b>						
Negative income.....	6,135.78	1,052.52	<.001	5,729.98	1,032.66	<.001
25th-50th percentile.....	1,755.38	123.78	<.001	1,429.96	121.98	<.001
50th-75th percentile.....	4,184.24	142.15	<.001	3,642.01	140.52	<.001
Greater than 75th percentile.....	11,619.00	165.14	<.001	10,740.00	163.82	<.001
Number of earners.....	-192.75	71.24	.0068	-206.51	69.91	.0031
Renter.....	-1,012.39	102.76	<.001	-584.86	101.71	<.001
Outside of MSA <sup>2</sup> .....	-1,475.64	124.54	<.001	-1,431.44	122.45	<.001
<b>Interview characteristic</b>						
Interviewed by telephone <sup>2</sup> .....			273.06	85.81	.0015	
No use of records <sup>2</sup> .....			-444.80	88.27	<.001	
<b>Time spent on answering expenditure questions</b>						
Less than 28 minutes.....			-1,634.61	100.65	<.001	
Greater than 59 minutes.....			3,124.71	101.50	<.001	
R-square.....	.3453			.3700		

<sup>1</sup> The reference group is female, 35–49 years old, White, with some college education, family composition of husband and wife with children, income in the positive first quartile, and an interview time between 28 and 59 minutes.

<sup>2</sup> Following are indicator (0, 1) variables: Converted refuser, male,

renter, outside of MSA, interviewed by telephone, and no use of records.

<sup>3</sup> Income distribution was broken out into five categories: Negative income and positive (greater than or equal to zero) income divided into quartiles.

recall and report. Thus, the differences between respondents and converted refusers, who are proxies for nonrespondents, are less likely to affect spending on necessities.

### Conclusion

In summary, we found that converted

refusers answered fewer expenditure questions with valid values, more frequently responded with “don’t know” or “refused” answers, reported lower overall expenditures, provided less complete reporting of expenditures and income, and spent less time answering expenditure questions than respondents.

These behaviors are consistent with satisficing, and suggest that, when converted refusers agree to do the survey, they are more likely to rush through it and, thus, to provide poorer quality responses. There was mixed evidence for differences in demographics between converted refusers and respondents.

Table 6. Effect of converted refusers on expenditure estimates measured by relative bias, Consumer Expenditure Interview Survey, April 2005–September 2006

Expenditure category	Base-weighted mean expenditures (\$)			Relative bias	
	Converted refusers (N = 5,314)	Respondents (N = 38,081)	All respondents	Percent	95 percent confidence interval
Quarterly total expenditures .....	10,336.64	11,128.31	11,033.11	0.86	(0.64, 1.08)
Reading materials.....	22.48	31.70	30.59	3.62	(3.03, 4.27)
Personal insurance and pensions .....	842.97	1,169.02	1,129.82	3.47	(3.27, 3.67)
Tobacco .....	64.78	82.68	80.53	2.67	(1.98, 3.42)
Alcoholic beverages .....	73.05	91.30	89.10	2.46	(1.96, 2.97)
Cash contributions.....	369.16	439.80	431.30	1.97	(0.47, 3.64)
Entertainment .....	481.62	571.86	561.01	1.93	(0.97, 2.79)
Apparel .....	282.41	315.45	311.48	1.28	(0.54, 2.03)
Health care .....	601.68	668.91	660.83	1.22	(0.67, 1.75)
Personal care .....	63.85	70.49	69.69	1.15	(0.60, 1.69)
Transportation .....	2,014.91	2,141.52	2,126.30	0.72	(-0.06, 1.48)
Housing .....	3,633.79	3,670.39	3,665.99	0.12	(-0.27, 0.52)
Education.....	207.31	203.63	204.07	-0.22	(-2.10, 1.82)
Food .....	1,520.59	1,472.14	1,477.97	-0.39	(-0.59, -0.21)

Interviewers also perceived converted refusers as having more time-related concerns than respondents and as being less likely to express hostile behavior than final refusers. Regression analysis provided some evidence that differences in interview characteristics—not demographics—account for the disparity in the quality of reporting. This finding suggests that interview characteristics should be considered when evaluating whether the interview is providing good data.

When treating converted refusers as proxy nonrespondents, we found a small positive nonresponse bias for quarterly total expenditures. That is, including the expenditure reports of

converted refusers lowers overall expenditure estimates. Our estimate is within the range of estimates of relative bias from recent studies which used other definitions of proxy nonrespondents. This result raises the broader question of whether the cost and effort of converting refusal cases is justified.

One possible limitation of this research is the use of the converted refusal question in the questionnaire to identify converted refusal cases because of possible inconsistencies in how interviewers respond to the question. Another possible limitation derives from the measures used to evaluate data quality. Since there is no single measure of quality, we considered a variety of in-

dicators. We were not able to quantify the trade-off between these measures to come up with a single “weighted” measure of overall quality.

Further research is needed to examine the impact of converted refusers on published expenditure estimates by treating them as nonrespondents and reweighting the data. Another relevant research project would be using the panel feature of the Interview Survey to study the behavior of converted refusers in later waves; the study could measure whether they are more likely to become **dropouts** or intermittent respondents, or to exhibit reluctance compared to fully cooperative respondents. ■

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**Part II.**  
**Processing Improvements**

# Outlier Detection by Forecasting

Nathan McDermott and  
Brendan Livingston

The Consumer Expenditure Quarterly Interview Survey collects data from consumer units (CUs) about their expenses during the previous 3 months. The purpose of the survey is to gather information about large purchases, such as those of vehicles and appliances, and expenditures that are made on a regular basis, such as rent and utility payments. These data are collected by the U.S. Census Bureau and then transferred to the U.S. Bureau of Labor Statistics (BLS), Division of Consumer Expenditure Surveys (CE). The branch of Production and Control (P&C) screens and processes the raw data for their eventual use in publications and in the weighting of the BLS Consumer Price Index.

P&C's final data-editing procedure for the Interview Survey is the Monthly Tabulation of Expenditures (MTAB), which maps or assigns expenditures to a specific month and a Universal Classification Code (UCC).<sup>1</sup> The MTAB Review procedure then evaluates the created data for suspicious values. To improve the existing review procedure, P&C initiated a research project in August 2005. The goals of this project were to make the MTAB Review more efficient, focus analysts' attention on outliers, create more informative re-

ports, and provide more accurate data to end users.

Three techniques for improving the process of selecting outliers were investigated during the modernization of the MTAB Review. The method that was chosen, which compared forecasted with reported values, was implemented in February 2006. With this technique, the analyst detects outliers by using forecasted prediction intervals created by SAS and comparing them with current means.<sup>2</sup> This article summarizes the forecasting technique adopted for the MTAB Review.

## Background

After all quarterly data have been reviewed and deemed complete, the MTAB edit program produces a data set containing the monthly expenditure values. This data set contains approximately 450,000 observations per quarter, categorized into one of 600 UCC codes. A timing variable indicates whether the collected expenditure constitutes a continuous expense, with the same amount every month, or whether it represents a single monthly value. For continuous expenses, the MTAB edit creates three expenditure records, one for each month in the quarter. For all records, the amounts are assigned

Nathan McDermott is an economist formerly working in the Branch of Production and Control, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

Brendan Livingston is an economist formerly working in the Branch of Production and Control, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

<sup>1</sup> The Universal Classification Code, or UCC, is the lowest level of aggregation for consumer expenditures. For example, camping equipment, admission to sporting events, and men's shirts are categorized into different UCCs.

<sup>2</sup> Created by the SAS Institute, SAS, a statistical analysis software package, is widely used throughout the Bureau of Labor Statistics. More information about SAS can be found on the Internet at [www.sas.com](http://www.sas.com).

to a month of purchase and to the UCC for the appropriate category. After categorizing all of the expenditure variables, analysts review the MTAB data set for suspicious values.

Expenditure data typically have a skewed distribution, with a few extreme observations.<sup>3</sup> Only large expenditure values qualify for review. Extremely small values are usually considered legitimate. They are also too numerous and do not have a substantial enough effect on the mean to warrant investigation; therefore, they are not reviewed. Outliers can arise from unusually high reported expenditures, from incorrectly entered values or codes, or from other data-editing processes that estimate missing values. The MTAB Review procedure attempts to find, document, and manually fix these outliers.

The Interview Survey has several data-editing procedures, used throughout the production cycle, for identifying suspicious data. Screening at different classification levels ensures clean data. Current outlier detection techniques, besides those used for MTAB Review, consist of gap tests, *z*-scores, and mean comparisons. A gap test takes all values above the mean and sorts them in descending order. Then the difference between the expenditure and the value immediately below it is calculated. The largest gap is determined, and every value above the largest gap is flagged for further review. The Priority Index (PINDX), one kind of gap test, scores the difference between each value against the point immediately below it for all observations above the largest gap.<sup>4</sup> Any observation with a PINDX greater than 2.0, where the suspect value is 3 times larger than the value below it, is selected for manual review.

*Z*-scores use distributional statistics, such as the standard deviation or

the interquartile range, to compare individual points against the population mean in relative terms. The standardized *z*-score is equal to the observation, minus the mean, divided by the standard deviation. For a two-tailed test, a *z*-score of 3 is in the 99th percentile. The CE uses a modified, more robust version of this test, in which the observation is divided by the interquartile range.<sup>5</sup> A “robust” *z*-score of 25 is considered large enough for the observation to be an outlier and is equal to approximately the 99.9th percentile.<sup>6</sup>

Unlike *z*-scores, mean comparisons consist of *t*-tests and other descriptive statistics that compare means between groups. Mean comparisons are useful because the mean is sensitive to extremely large values. Although *t*-tests, which use the standard deviation, are the most common type of mean comparison, a simple percent change also can be used. However, without any normalization, percent changes between means have no scale for comparison. Therefore, each record must be manually examined to determine whether it contains an outlier.

These different techniques continue to be used in statistical investigations. However, analysts believed that improvements could be made to the method used in the MTAB Review. A description of the old procedure and the new procedure that was adopted follows, along with a discussion of other methods that were considered.

### Previous MTAB Review Procedure

The old MTAB Review procedure was based on comparing changes in mean values. Analysts received two worksheets to be used in detecting outliers. One worksheet compared the percent change from the current quarter with the percent changes from each of the previous three quarters; the second

worksheet compared the percent change from the current quarter with that from the same quarter for the previous 3 years. (See example 1.) The comparison with the previous three quarters facilitated the detection of large single-quarter shifts, while the comparison with the same quarter for the previous 3 years looked for spikes in the yearly trends. Analysts then searched for particularly large percent changes in UCCs, where the percent changes were based on the categorical type of UCC.

### MTAB Review worksheet

The old review procedure was particularly cumbersome for several reasons:

- The review consisted of manually comparing percentages for a very large number of groups.
- Each UCC appeared in both worksheets, together with the changes for the three respective quarters.
- Analysts reviewed every UCC, because there was no standardized method for identifying suspicious UCCs for further outlier review.

### Methods Investigated

A number of outlier detection techniques were considered in the investigation of a new methodology for the MTAB Review procedure. One method compared histograms in order to identify distributional differences. Tests of the distribution of the current quarter against the previous quarter’s distribution produced no reliable results, because outliers do not necessarily change the underlying distribution and single values are too hard to detect on a large scale.

A second method used *t*-tests to determine whether there was a statistical difference in the means. Because the skewed distributional pattern of the CE data did not meet all of the requirements of a regular *t*-test, the Wilcoxon rank-sum test, a nonparametric *t*-test,

<sup>3</sup> Expenditures are recorded as positive real numbers. Reimbursements can be recorded as negative values. The distribution is generally skewed to the right.

<sup>4</sup> For example, if the top values for a UCC were 150, 50, 45, 40, and 35, then the PINDX for the top observation would be  $(150 - 50)/50 = 2.0$ .

<sup>5</sup> See Appendix A.

<sup>6</sup> The exact distribution of the “robust” *z*-score is unknown. The percentile approximation for a *z*-score of 25 is equal to 99.88. This is calculated by using income and expenditure data from 2004 through 2006.



Example 1. Previous MTAB Review worksheet

UCC	RTYPE	EXPNAME	PC_Q041	PC_Q042
220612	CRB	QADEQPX5	27400.00	27400.00
320522	CRB	QADEQPX1	520.69	27229.22
600210	FRA	FURNPURX	99.77	1610.33
790600	CRB	QADPSPLX	.	1522.02
220615	CRB	QADLAB3X	741.76	1408.59
240321	CRB	QADPSP3X	114.29	1400.00
790600	CRB	QADLAB1X	.	1319.10
600121	OVB	QTRADEX	381.01	1285.41
870401	OVB	QTRADEX	381.01	1285.41
300322	CRB	QADEQPX2	66.67	1007.26
450312	LSD	TRADEEXP	400.00	829.13
240311	CRB	QADPSPLX	9556.98	777.91
220615	CRB	QADLAB2X	4560.39	616.02
240213	CRB	QADPSP2X	-79.74	606.58
230150	CRB	QADLAB1X	784.32	600.35
UCC		SC_Q034	SC_Q041	SC_Q042
220612		27400.00	.	14411.05
320522		27229.22	41.91	272.84
600210		1610.33	83.76	83.91
790600		1522.02	.	.
220615		1408.59	918.70	420.13
240321		1400.00	.	59.83
790600		1319.10	.	.
600121		1285.41	512.94	269.26
870401		1285.41	512.94	269.26
300322		1007.26	22.21	37.01
450312		829.13	421.16	208.21
240311		777.91	765.55	5062.77
220615		616.02	2165.42	2513.58
240213		606.58	8.84	258.94
230150		600.35	751.57	612.17

was used. This test examines the distributional differences between two samples. A disadvantage of the test is that extremely large values do not have a significant impact on the ordinal ranking of observations and thus cannot be identified. Another disadvantage is that the test can compare the current quarter only with a single previous quarter; it cannot identify trends or seasonality sometimes found in CE data.

The final method investigated to detect outliers used a forecasting model to predict UCC means for the current quarter. The forecasting procedure, accounting for trend and seasonality, creates a prediction interval that is then compared against the actual mean. This method was determined to be the most effective, and it replaced the previous method beginning with the second quarter of 2005.

**Adopted MTAB Review procedure**

The new procedure uses forecasting to create a prediction for the current quarter of data and then compares the predicted value against the mean of actual data value collected in the current quarter. Let  $\mu_t$  denote the collected mean of the current quarter. The input time-series data consist of quarterly means taken from the previous 10 years of data (from  $\mu_{t-41}$  through the preceding quarter,  $\mu_{t-1}$ ). The procedure then forecasts a mean  $\hat{\mu}_t$  and compares this predicted mean against the collected  $\mu_t$ . The width of the confidence interval is calculated on the basis of the average number of observations from each quarter, and any collected  $\mu_t$  that is greater than the upper bound of the confidence interval for the predicted  $\mu_t$  will be output for the analyst to review.

Before forecasting, a check is run to ensure that there are enough observations for an accurate prediction. Any UCC that does not have at least 10 quarters of historical means, either because it was recently added or it was rarely collected, cannot be accurately forecasted and is output for manual review. This minimum requirement is satisfied for the majority of UCCs, including those collected annually, by using 10 previous years of data as the starting date for the collection. After making certain that the UCC has a sufficient number of observations, analysts test whether a logarithmic transformation is appropriate.

The LOGTEST macro applies a logarithmic test to each UCC that has 10 or more observations.<sup>7</sup> If the log-trans-

<sup>7</sup> The LOGTEST macro is included in the SAS/ETS software package. Details of the macro can be found on the Internet at [v8doc.sas.com/sashtml/ets/chap4/sect17.htm](http://v8doc.sas.com/sashtml/ets/chap4/sect17.htm).

formed model has a larger log likelihood than that of the untransformed model, then the log transformation is run on the UCC.<sup>8</sup> This transformation smoothes the data, thereby correcting for exponential growth (exhibited, for example, by expenditures on cellular phones) and exponential decline (demonstrated, for instance by spending on pagers).

After testing whether a log transformation is appropriate, the width of the confidence interval is determined. This calculation is based on the mean number of observations in the historical quarters. For UCCs for which there are a large number of observations, the mean is less vulnerable to a single large value; thus, it becomes more difficult to find outliers. In order to offset the reduced effect of the outlier, the width of the confidence interval is decreased. For example, UCCs with an average of 1,000 or more observations each quarter are assigned a confidence interval of 85 percent, while less common UCCs are tested at a wider confidence interval of 97 percent.

After an appropriate width has been established, the Proc Forecast procedure in SAS is used to predict the current quarter's mean. This procedure employs a user-specified method—the Holts-Winter exponentially smoothed trend-seasonal method—to decompose the data into trend, seasonal, and irregular components. Exponential smoothing weights previous data points according to how important they are in predicting future quarters' values. The Proc Forecast procedure allows the user to specify the weights given to previous quarters, from zero to unity. A weight closer to zero makes the forecast less sensitive to recent trends. A weight near zero is used with time-series data that are not volatile. A weight closer to unity makes the forecast **more** responsive to recent trends. A weight of 0.3 was chosen for the project because CE data, while volatile, still follow long-term trends. This weight is on the upper end of a reasonable bound and compensates for the lack of stability in some of the

UCC predictions.<sup>9</sup> The Holts-Winter method was chosen for the project because of its ability to adjust for seasonal fluctuations in the series. The forecast provides mean and interval predictions for four quarters into the future. These predictions are then used to test for outliers.

Proc Forecast creates an output data set containing the actual and predicted points, along with the upper and lower bounds of the confidence interval. This data set is then used by Proc Gplot to create a graphical representation of the UCC's life cycle.<sup>10</sup> For documentation purposes, a graph is created for every UCC. The resulting graphs allow the analyst to visually compare the current quarter's mean with previous means and predicted means. For example, the plot of UCC 270102, **Cellular phone service** (see chart 1), shows that the mean has been relatively steady and increasing gradually over time. The mean for the first quarter of 2006 is within the confidence interval and very close to the predicted mean; therefore, this UCC would not require any further investigation.

The plot of UCC 310220, **Video cassettes, tapes, and discs** (see chart 2), shows an increasing trend over time, with strong seasonal spikes in the first quarter of each year. The previous methodology for the MTAB Review, which involved the percent change between quarters, could not identify seasonality. Once again, the actual mean is within the prediction intervals, so this UCC would not be reviewed by the analyst.

Finally, the plot of UCC 450310, **Car lease payments** (see chart 3), reveals a break in the trend, with the mean starting to decrease in the third quarter of 2003. The prediction model quickly adapts and corrects itself, showing a downward trend. From the graph, an analyst can see that the current quarter's mean not only is above the upper bound of the

confidence interval, but also is equal to the maximum of the past means. This UCC would be considered an outlier and would thus be investigated.

A report is generated for a UCC when its current-quarter mean,  $\mu_t$ , is greater than the upper bound of the prediction interval. The report consists of summary statistics, the forecasted model's graph, a plot of the number of observations by quarter, and the highest 20 expenditures for the UCC. For the highest 3 expenditures, the report also includes CU characteristics and income—additional information that aids the analyst in deciding whether the outlying expenditure is valid.

### Implementation of the Forecasting Technique

The use of a forecasting model to detect outliers offers several advantages over the previous review procedure:

- Forty quarters of data are used to forecast trends and seasonality. In contrast, in the previous review procedure, analysts could compare only 7 quarters of data.
- Reviewer burden is reduced. The number of UCCs reviewed per quarter has decreased from more than 600 to approximately 35, which are selected by the forecasting model.
- Reviewers have visual summaries of the data they are reviewing. The new program creates graphs that plot the actual and forecasted means and the number of observations per quarter. In contrast, in the old review procedure, reviewers had access only to a tabular presentation of the data.
- The nonnormal distribution of the expenditure data does not invalidate statistical results.

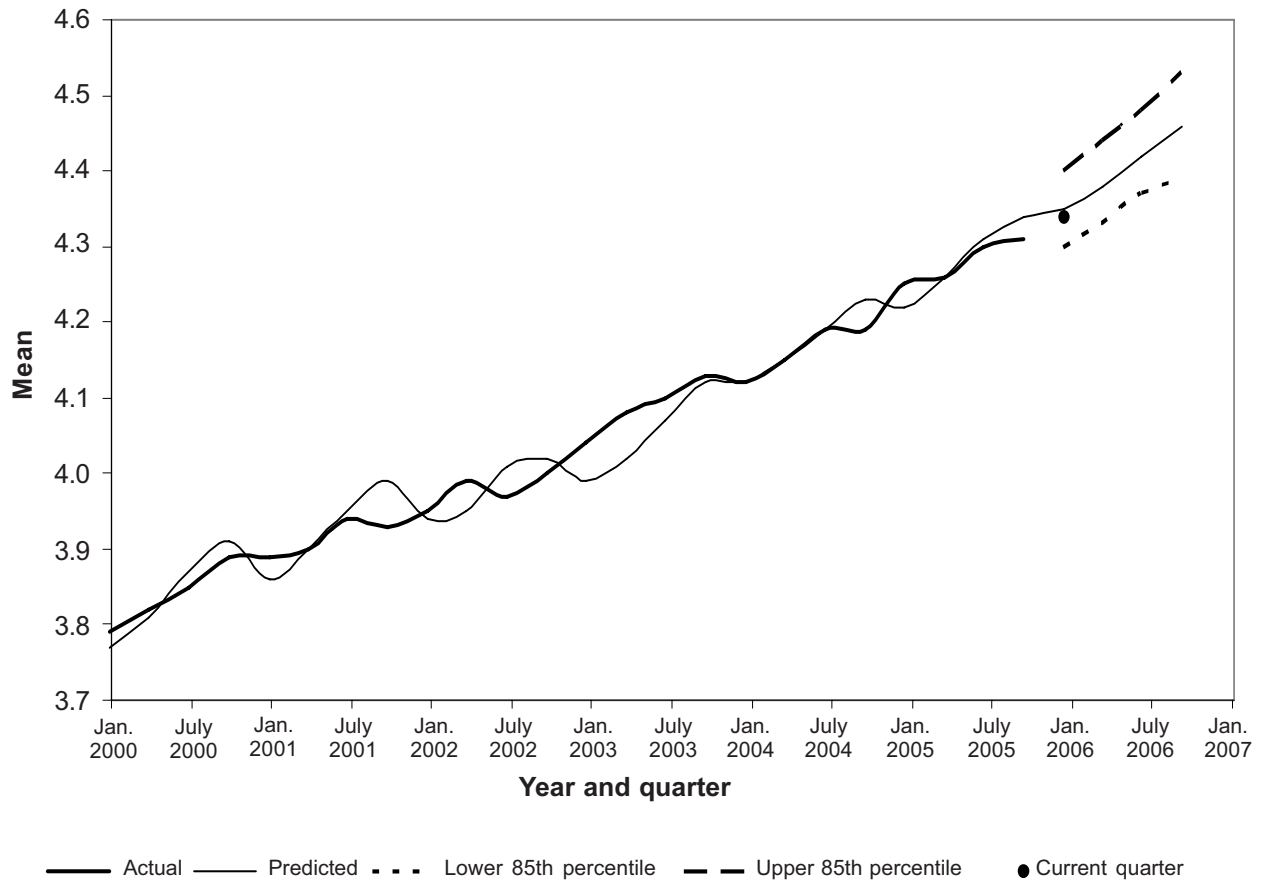
Forecasting as a means of detecting outliers yields better results than the previous method or any of the other methods investigated. The updated MTAB Review process now uses 40

<sup>9</sup> **Forecasting Methods**, on the Internet at [v8doc.sas.com/sashtml/ets/chap12/sect13.htm](http://v8doc.sas.com/sashtml/ets/chap12/sect13.htm).

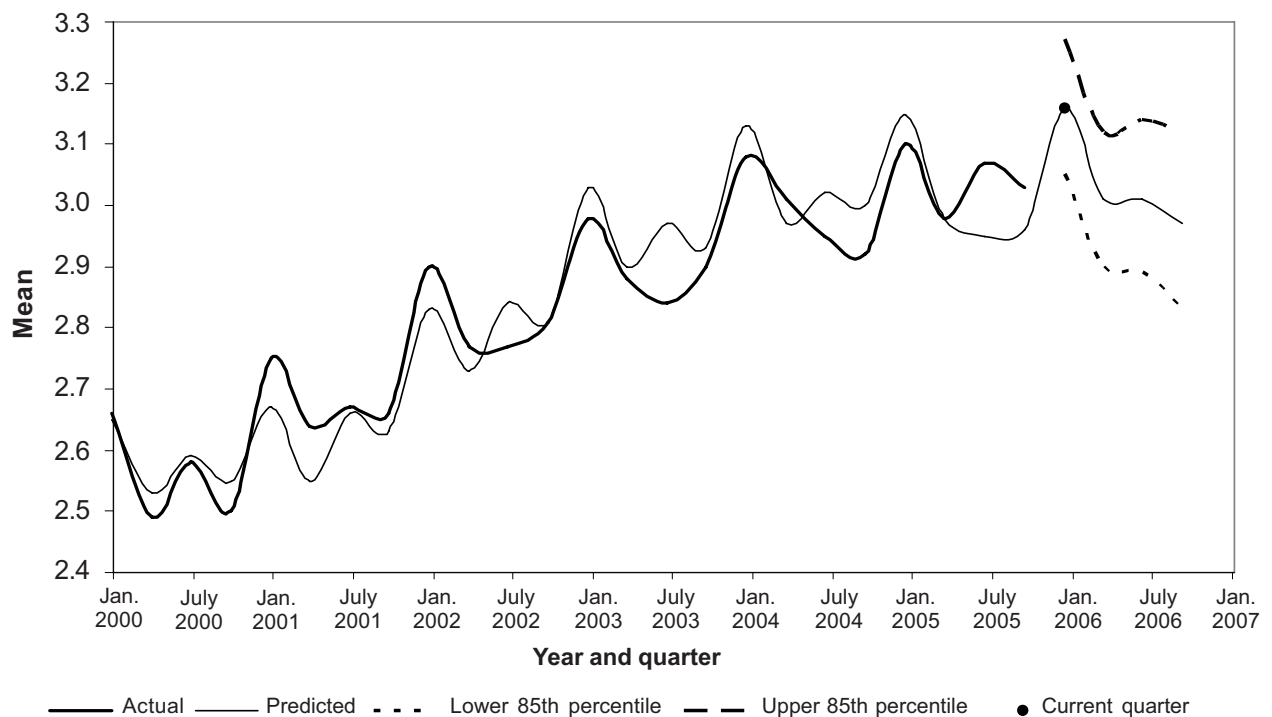
<sup>10</sup> **The GPLOT Procedure**, on the Internet at [v8doc.sas.com/sashtml/gref/zlotchap.htm](http://v8doc.sas.com/sashtml/gref/zlotchap.htm).

<sup>8</sup> See Appendix B.

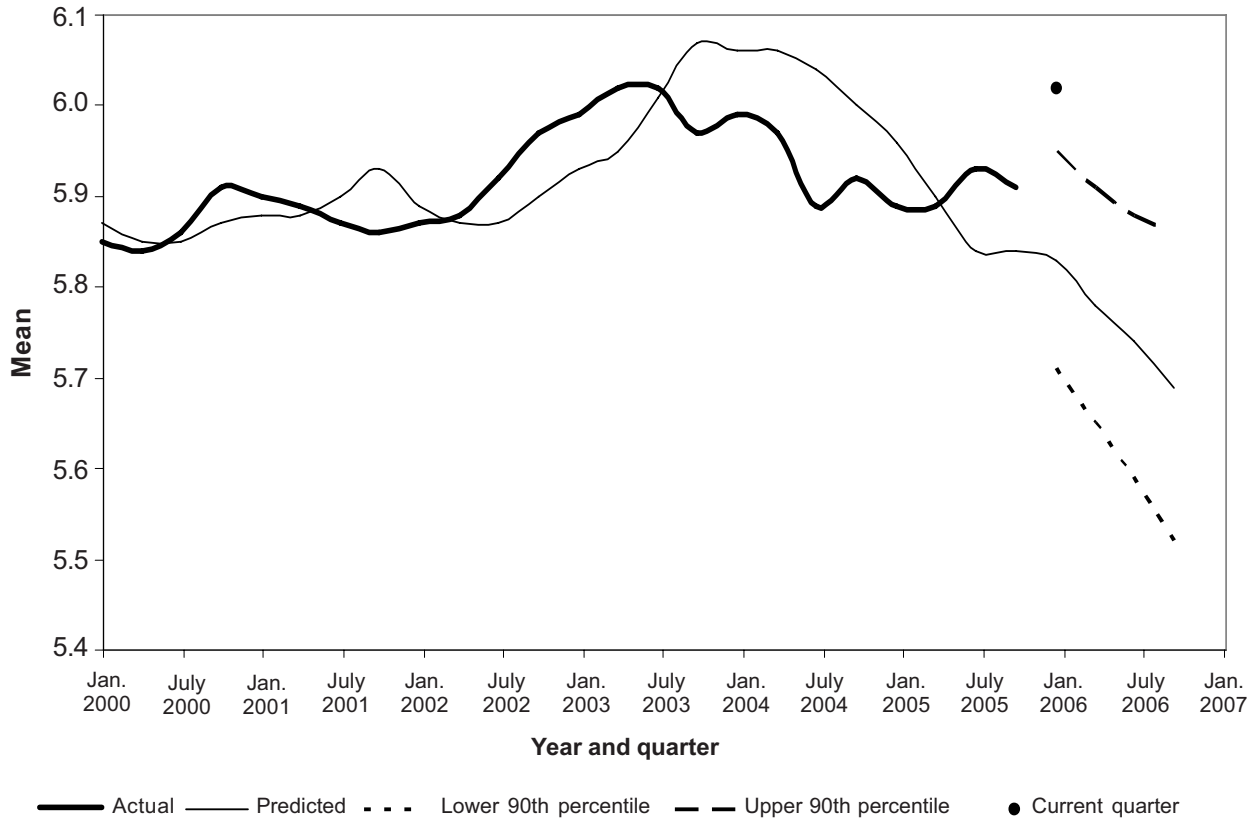
**Chart 1. Forecast of UCC 270102 cellular phone service**



**Chart 2. Forecast of UCC 310220 video cassettes, tapes, and discs**



**Chart 3. Forecast of UCC 450310 car lease payments**



quarters of data and produces output in the form of tables and graphs. Mean comparisons, by contrast, can display only a limited number of historical means and percent changes in the form of a spreadsheet. Graphs displaying the last 40 quarters are easier to understand than numbers on spreadsheets. With the new method, the number of UCCs to investigate has increased from roughly 20 to approximately 35, but the effort of deciding which UCCs are selected is determined by the prediction interval. Using prediction intervals, analysts save time in the detection phase of a review and concentrate on

the investigative stage. This method allows analysts more time to determine why the UCC was outside of the confidence interval.

### Conclusion

A comparison of the forecasted mean with the reported mean as a technique for detecting outliers is superior to the previous method used for the MTAB Review. The new method accounts for levels, trends, and seasonality and successfully identifies outlying means, whereas traditional techniques do not. The use of a prediction interval to detect outliers reduces reviewer burden

by eliminating the need to review every UCC individually, enabling analysts to focus on suspicious expenditure values.

An issue for further investigation is the examination of instances in which insufficient reports on a UCC render the forecasting technique ineffective. These UCCs include rarely collected expenditures, as well as added categories created to capture new technologies and changes in consumer spending. A statistical method for detecting outliers within these UCCs is needed and would save analysts the task of reviewing such UCCs manually. ■

# Technical note A

The z-score is defined as

$$Z = \frac{(X_i - \mu)}{\sigma},$$

where  $X_i$  = the expenditure value of the individual observation,  $\mu$  = the mean of the UCC, and  $\sigma$  = the standard deviation of the UCC.

The robust z-score is defined as

$$Z = \frac{X_i}{\theta},$$

where  $\theta$  = the interquartile range.

# Technical note B

The log test macro runs “an autoregressive model to a series and fits the same model to the log of the series. Both models are estimated by

the maximum likelihood method, and the maximum log likelihood values for both autoregressive models are computed. These log likelihood values are

then expressed in terms of the original data and compared.”<sup>11</sup>

<sup>11</sup> Overview, on the Internet at [v8doc.sas.com/sashtml/ets/chap4/sect18.htm](http://v8doc.sas.com/sashtml/ets/chap4/sect18.htm).

# Reclassifying Low-Expenditure Consumer Units in the Consumer Expenditure Interview Survey

Steven Bass

One of the primary uses of data from the Consumer Expenditure Survey (CE) is the computation of weights representing the purchases of goods and services in the construction of the Consumer Price Index (CPI), a principal Federal economic indicator. Accurate representation of actual expenditures is thus critically important beyond usual data quality standards. The CE processing system has several screening processes in place to ensure data quality. One such process is the *minimal expenditure edit*, which screens out consumer units (CUs)<sup>1</sup> with unusually low reported total expenditures for further investigation, to determine whether they should be reclassified as noninterviews—that is, whether they should be treated as if they had refused to take part in the survey. Data from noninterviews are not used in the computation of official expenditure estimates from the CE. A minimal expenditure edit has been implemented for the CE Diary Survey since 2002. In April 2006, a minimal expenditure edit was implemented for the CE Interview Survey, to investigate cases with very low expenditures. This article describes the methodology of the minimal expenditure edit for the Interview Survey, as well as the results attained from its first year of implementation.

## Background

Both Interview and Diary Survey data go through a series of edits before publication. Among these edits are consistency checks, outlier review, imputation, and weighting. Minimal expenditure edits for both surveys take place early in the production process, prior to CU weighting and any expenditure or income imputation. Although the minimal expenditure edit process for each survey is essentially the same, a number of differences exist because the Diary Survey is self-administered while the Interview Survey is administered by a field interviewer. For the Diary Survey, respondents record all their expenditures in a diary for two consecutive 1-week periods. It is difficult to ensure that a respondent has completed the Diary form accurately, including all of his or her expenditures, because no one is observing the process. For this reason, the minimal expenditure edit process for the Diary Survey is much more structured than that for the Interview Survey.

The Diary minimal expenditure edit process uses the number of expenditures recorded, the total amount recorded, and CU characteristics (such as the size of the CU) to determine whether a low report for total expenditures by a CU is legitimate. As part of the reclassification algorithm, urban CUs have to meet a higher expenditure threshold than rural CUs, because rural CUs are more likely to do their shop-

Steven Bass is an economist formerly working in the Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

<sup>1</sup> See the glossary in Appendix: Description of the Consumer Expenditure Survey for the definition of a *consumer unit*.

ping less often. Students and small CUs also are treated differently because of their lower expected expenditure levels. In 2006, more than 800 of the nearly 20,000 eligible diaries were from CUs that were reclassified as noninterviews. The process is entirely automated, and none of the individual CU reclassifications are manually reviewed.

In contrast to the Diary Survey, which is a self-administered paper survey, the Interview Survey is a computer-assisted personal interview (CAPI). Using a laptop computer, the field interviewer asks the respondent a series of questions about his or her expenditures and records the responses.<sup>2</sup> To reduce respondent burden, most sets of related questions (such as those having to do with telephone expenses) are preceded by a screener question (for example, “Have you received any bills for telephone services?”). If the respondent has not received any telephone bills, the entire section can be skipped by answering “No” to the question. However, although a “No” answer can help avoid unnecessary followup questions, respondents may respond “No” to screener questions (even though they have applicable expenditures) in order to skip over questions and minimize the time it takes to complete the interview. The minimal expenditure edit is meant to screen out such invalid cases of low total expenditures.

The Interview minimal expenditure edit process was intended to screen for three separate potential problems:

- CUs effectively refusing to participate in the survey by answering “No” to all or most of the screener questions or refusing to answer individual questions.
- Field interviewers fraudulently completing the survey without interviewing the CU.

<sup>2</sup> The Interview Survey moved from a paper form to the CAPI format in April 2003. For more information, see L. Groves, “Computer-Assisted Personal Interviewing for the Consumer Expenditure Interview Survey,” *Consumer Expenditure Survey Anthology* (Bureau of Labor Statistics, 2003), p. 18.

- Field interviewers not asking all of the questions to certain groups of people (for example, skipping questions to students about owned properties).

### Methodology

In the minimal expenditure edit process for the Interview Survey, CUs are selected by an automated procedure and are manually reviewed on an individual basis. Two factors—the length of the interview and the total sum of expenditures reported—are used to determine whether a CU should be investigated. In the computation of total expenditures reported by a CU, “Don’t know” or “Refused” responses are treated as zeroes. Although some questions ask for quarterly values while others ask for monthly values, these different reference periods are not standardized to the same period for the purposes of the minimal expenditure edit.

A CU’s records are manually reviewed in greater detail if

- The total sum of expenditures is less than \$100 or
- The total sum of expenditures is between \$100 and \$300, and the interview time is less than 15 minutes.

In the manual review of the CUs screened out by the automated process, other variables in addition to total expenditures and interview time are used to evaluate a case. These additional variables are related to expenditure reporting characteristics (such as the number of expenditures recorded and the number of “Don’t know” or “Refused” responses), respondent characteristics (such as the respondent’s age, the size of the CU, whether the CU is in an urban or a rural location, and whether the CU resides in public housing or student housing), and data collection characteristics (such as whether the interview is a telephone or personal interview and the number of visits to the CU by the field interviewer). A detailed record of all the CU’s expenditures and any field inter-

viewer notes are taken into consideration, as is information provided by the CU in previous interviews.

CUs that are manually reviewed in the minimal expenditure edit process are presumptively treated as noninterviews. The review process consists of a search for mitigating factors that would explain the low level of expenditures for the quarter. Elderly respondents, college students, recipients of food stamps, and occupants of public housing are almost always treated as valid low expenditure cases, because they tend to have lower expenditure levels than the general population has. If the respondent has a high number of “Don’t know” or “Refused” responses, that is also taken as evidence of a proper interview, because such respondents still provide information on the specific items purchased by a CU. Expenditure amounts for “Don’t know” and “Refused” responses are imputed later. Often, field interviewer notes also will provide valuable information, such as expenses that have been paid for by parents or other relatives. If no persuasive reason can be found to explain the low level of expenses for the 3-month recall period, the CU is reclassified as a noninterview and is excluded from the computation of official estimates from the CE.

### Results

The Interview Survey minimal expenditure edit was implemented in 2006. For that year, 49 CUs were reclassified as noninterviews, out of a total of 257 flagged by the edit process. These reclassified CUs differed significantly from the general population of CUs. (See table 1.) Specifically, reclassified cases have much lower expenditure totals, interview time, and reported income than the general population has. Although data can be collected either in person or over the phone, in-person interviews generally elicit higher quality data. Reclassified interviews are more likely to have taken place over the phone. Also, respondents are more likely to have been converted refusals, a term used for CUs that initially refuse to participate in the survey. In addition,

the complete absence of any record usage (for example, credit card statements or receipts) shows a low level of diligence on the part of respondents in these CUs.

The differences between the reclassified interviews and those flagged by the process but not reclassified are enlightening. (See table 1.) Although the income level is still low, cases that are flagged but not reclassified have a much higher income level than the reclassified cases. They also have a higher rate of personal interviews and a lower rate of converted refusals. Students and residents of public housing are also among those who are less likely to be reclassified.

Although low annual income would seem to be a reasonable explanation for low expenditure totals, it is likely to be unrepresentative of true income in many cases. The income questions in the Interview Survey are asked at the end of the interview and are part of the Work Experience and Income section. Many respondents choose not to answer these questions fully. In the Interview Survey minimal expenditure edit process, annual income is used mostly as a proxy for respondent diligence. Beginning with 2004 data, the CE implemented an income imputation process to correct for the low response rate of income questions. The Interview Survey minimal expenditure edit is performed at an earlier stage of process-

ing, and only the reported income data are used in the edit.

In addition to reclassifying CUs to noninterview status, the April 2006 minimal expenditure edit revealed that a field interviewer had been systematically falsifying data, and those falsified cases were removed from the database. These cases accounted for 5 of the 49 reclassified CUs. The expenditure data compiled for that edit also have been useful as data quality measures in other analyses. The number of expenditure questions answered, the number of “Don’t know” or “Refused” responses to expenditure questions, and the total reported expenditures before processing are variables that were created specifically for the Interview Survey minimal expenditure edit. However, these variables also serve as indicators of data quality and have been used in other recent research on the Interview Survey (such as comparing the quality of reporting between converted refusers and other respondents and comparing the quality of responses among different treatment groups in an incentive experiment). The data compiled by the edit process can be used to examine other issues as well. CUs with high expenditure totals and short interview times could be interpreted as evidence of inaccurate information provided by the respondent or of fraudulent data entered by the field interviewer. In addition, the data can be used to

investigate the correlations between expenditures and other variables, such as participation in public housing or in food stamps programs.

### **Conclusion**

Analysis of the effectiveness of the minimal expenditure edit process in the Interview Survey is still ongoing. So far, the low number of reclassified cases has had a negligible effect on the computation of official expenditure estimates from the CE. Further analysis is necessary to determine whether the thresholds used in the edit should be revised to increase the number of cases evaluated.

One consideration for future implementations of the Interview minimal expenditure edit is automation. Currently, cases are selected for manual review on the basis of a fixed set of criteria, but the ultimate decision to reclassify is left to the reviewer. A rule-based approach would increase the consistency of the edit by removing human error, in addition to saving the reviewer time, thereby allowing him or her to consider a larger number of cases. However, this change would come at the expense of flexibility. Experimentation with a more extensive set of criteria, as well as an analysis of the tradeoff between false positives and false negatives, is needed to determine whether the process should be modified to achieve the appropriate balance. ■



**Table 1. Comparison of average expenditures, income, and characteristics, by type of interview, Consumer Expenditure Survey, second quarter 2006 to first quarter 2007**

Item	Good interviews (n = 32,554)	Reclassified cases (n = 49)	Flagged but not reclassified (n = 208)
Expenditure total .....	\$8,542	\$44	\$42
Necessities total <sup>1</sup> .....	\$2,325	\$18	\$19
Total time <sup>2</sup> .....	60 minutes	29 minutes	32 minutes
Annual income <sup>3</sup> .....	\$30,405	\$45	\$440
CU size .....	2.4 persons	1.7 persons	1.5 persons
Age of respondent .....	49	53	53
Other statistics (percent):			
Personal interviews <sup>4</sup> .....	67.2	55.1	72.6
Converted refusal <sup>5</sup> .....	11.7	38.8	20.7
Usage of records <sup>6</sup> .....	47.4	0	3.4
Food stamps .....	4.7	4.1	4.3
Student housing .....	1.1	12.2	16.8
Public housing .....	2.7	4.1	18.8

<sup>1</sup> The necessities *total* statistic is the sum of the amounts spent on groceries, utilities, and housing payments—items for which almost all CUs should report expenditures.

<sup>2</sup> *Total time* is the amount of time spent in the interview process.

<sup>3</sup> Annual income reported here is lower than published income for two reasons. First, respondents who are unwilling to reveal their income levels have the option of selecting an income bracket instead. An income equal to the median of reported incomes inside the bracket selected is then imputed. Second, data are imputed for incomplete income reporters. Income data reported in this table are compiled prior to both bracket and income imputation.

<sup>4</sup> The Interview Survey is conducted either in person or over the phone. In-person interviews are the preferred method, because they generally elicit higher quality data.

<sup>5</sup> The designation *converted refusal* is selected at the discretion of the field representative if the respondent initially refused the survey, but was eventually convinced to participate.

<sup>6</sup> In the survey assessment section, the field interviewer is asked whether the respondent “Always, almost always, mostly, occasionally, almost never, or never” used records (such as receipts or credit card statements) to answer the questions. The entry “usage of records” is the percentage of CUs classified in a category other than “never.”

**Part III.**  
**Analyses Using Survey Data**

# Out-of-Pocket Health Care Spending Patterns of Older Americans, as Measured by the Consumer Expenditure Survey

Meaghan Duetsch

The United States has experienced many changes over the past two decades in the way health care is managed, such as the shift from primarily fee-for-service type health insurance coverage to coverage through health maintenance organizations (HMOs) and preferred provider organizations (PPOs). Health care expenditures, as a proportion of all expenditures, have increased over the last 20 years. This article examines the health care expenditures of older families in the age ranges just before and just after the Medicare eligibility age of 65 and analyzes how health care expenditures for these two groups have changed. The analysis includes an examination of health care expenditure changes over the past two decades between consumer units with reference person in the 55-64 year-old range, and so not eligible for Medicare, and consumer units with reference person in the 65-74 year-old range, whose reference person is eligible for Medicare.

In the Consumer Expenditure Survey (CE), health care expenditures include health insurance, medical services, drugs, and medical supplies. Only out-of-pocket, non-reimbursed expenditures on these items are included; for example, the portion of a health insurance premium that the consumer unit pays, as opposed to the portion paid by an employer; any copayments paid by the consumer unit;

and any insurance deductibles. Thus, the CE captures data on how much consumer units pay for their health care expenditures, not necessarily the total cost of the health care provided to that consumer unit. The CE also captures data on the health insurance status of the consumer unit—although this article does not include health insurance status of the consumer unit in its analysis—as well as the type of health insurance, such as PPO or HMO.

## Data and methods

Data from the Consumer Expenditure Survey for 1985, 1995, and 2005, are used in this analysis. Note that while the age of the reference person classifies the consumer unit into an age group, other members of the consumer unit could be different ages. Therefore, someone in a consumer unit in the 55-64 year-old age group other than the reference person could be eligible for Medicare. In the 65-74 year-old age group, the reference person is eligible for Medicare, because the reference person is at least 65 years old.

Some key demographic characteristics associated with expenditures do not change, or vary only slightly, across this 20-year period. In the 55-64 year-old group, the average number of persons<sup>1</sup> in the consumer unit is 2.4 in 1985, 2.2 in 1995, and 2.1 in 2005. In the 65-74 year-old group, the average number of persons in the consumer unit is approximately 2 in all 3 years.

Meaghan Duetsch is an economist with the Branch of Production and Control, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

Another similarity in all 3 years is the average number of earners in the consumer unit: For the 55-64 year-old group, the average number of earners in the consumer unit is about 1.4, while in the 65-74 year-old group it is slightly more than 0.5.

### Expenditures

Over the 20-year period, there was a greater percent increase in expenditures on health care than in total expenditures. As a share of average total annual expenditures, health care expenditures rose for both age groups over the two decades. Total average annual expenditures, in nominal terms, increased for both groups from 1985 to 1995 to 2005. The nominal percent change in average annual expenditures was different from 1985 to 1995 for the two groups, with a 32-percent increase in expenditures for the 55-64 year-old group and a 41-percent increase in expenditures for the 65-74 year-old group. The nominal percent change in expenditures from 1995 to 2005 was similar for both groups at about 52 percent. In real terms, using constant dollars with 2005 as the base year, the percent change in average annual expenditures was also different between the two groups from 1985 to 1995 – a 7-percent decrease for the 55-64 year-old group and 0.5-percent decrease for the 65-74 year-old group; it was similar from 1995 to 2005 with an increase of approximately 19 percent for both groups. (See table 1.)

In the 55-64 year-old group, health care expenditures were 5.5 percent of total average annual expenditures in 1985. (See table 1 for values.) In 1995, the proportion rose slightly to 5.9 percent, but by 2005 the share allocated to health care had increased by another percentage point to 6.9 percent. In contrast, the larger increase in share allocation for those 65-74 years old occurred from 1985 to 1995. In 1985, the share allocated to health care was 9.2 percent, and by 1995 that share had increased to 10.4 percent. From 1995 to 2005, the share increased to 10.8 percent of total annual expenditures. When comparing the two age groups,

the share of expenditures allocated to health care by the 65-74 year-old group is slightly more than 1.5 times the share allocated by the 55-64 year-old group in all 3 years.

The rate of increase in health care expenditures differed between the two groups. The 55-64 year-old group showed a different rate of increase from 1985 to 1995 than from 1995 to 2005. Expenditures on health care by the 55-64 year-old group rose 41 percent, in nominal terms, from \$1,355 in 1985 to \$1,911 in 1995; they rose another 78 percent to \$3,410 in 2005. In real terms, expenditures on health care by the 55-64 year-old group declined by 27 percent from 1985 to 1995 and rose by 22 percent from 1995 to 2005. In contrast, the rate of increase in health care expenditures, in nominal terms, by the 65-74 year-old group was the same from 1985 to 1995 and from 1995 to 2005. For this group, health care expenditures rose 59 percent, from \$1,649 in 1985 to \$2,618 in 1995, followed by a 60-percent increase to \$4,176 in 2005. In real terms, health care expenditures by the 65-74 year-old group declined by 18 percent from 1985 to 1995 and rose by 9 percent from 1995 to 2005.

The Consumer Price Index<sup>2</sup> (CPI-U) for medical care shows that the price of medical care rose from 1985 to 2005. The CPI for medical care rose 94 percent from 1985 to 1995, and then rose 47 percent from 1995 to 2005. The medical care price index rose faster than the All Items price index measured by the CPI. There was a 42-percent increase in the All Items CPI-U from 1985 to 1995, and another 28 percent increase to 2005.

There is a distinction between the level of out-of-pocket expenditures, as measured by the CE, and the rate of price inflation as measured by the CPI for medical care. The CE measures a consumer unit's expenditures, (price times quantity) while the CPI measures quality-adjusted (where possible) price change for a fixed quantity of goods and services. Therefore, the CE expenditure value alone cannot be used to determine whether price or quantity

consumed, or both, are rising or falling. Thus, it is useful to examine the CPI to determine whether prices for a particular good or service were rising or falling over the period examined.

**Health insurance.** Expenditures on health insurance by the 55-64 year-old group, in constant dollars, with 2005 as the base year, increased in all three periods, rising from \$1,284 in 1985 to \$1,314 in 1995, and to \$1,585 in 2005. Among the 65-74 year-old group, health insurance expenditures also rose in real terms in all three periods, from \$1,917 in 1985 to \$2,239 in 1995, and to \$2,352 in 2005. Medicare payments are a component of the health insurance category, along with the more traditional types of insurance. Expenditures on Medicare payments by both age groups rose in both nominal and real terms over the three periods.

While the 65-74 year-old group spent more of their health care dollar on health insurance than did the 55-64 year-old group in all 3 years, both groups showed the largest increase in the shares allocated to health insurance from 1985 to 1995, as compared to 1995 to 2005. In 1985, the 55-64 year-old group allocated about 33 percent of their health care spending to health insurance; by 1995, that share increased to 47 percent. (See table 1 for dollar amounts.) In 2005, the share allocated to health insurance was relatively unchanged from 1995 at 46 percent of all health care spending. The older group, those 65-74 years old, spent 41 percent in 1985, compared to 58 percent in 1995 and 56 percent in 2005.

Charts 1 and 2 show the four components of health care and the allocation of health care expenditures among those components in 1985, 1995, and 2005. Chart 1 shows these data for the 55-64 year-old group; chart 2 shows these data for the 65-74 year-old group.

The magnitude of the share increase for health insurance was about the same

<sup>1</sup> This analysis does not adjust for changes in consumer unit size over time.

<sup>2</sup> All urban consumers, U.S. all-city average; <http://www.bls.gov/cpi/home.htm>

Table 1. Selected average annual expenditures and characteristics of consumer units, by selected age of reference person, Consumer Expenditure Survey, selected years, nominal dollars

Item	55 - 64 years			65 - 74 years		
	1985	1995	2005	1985	1995	2005
Number of CUs (in thousands).....	13,056	12,624	18,104	11,302	11,933	11,505
Income before taxes.....	\$27,055	\$38,326	\$64,156	\$18,191	\$25,553	\$45,202
Average age of reference person.....	59.5	59.4	59.3	69.3	69.3	69.1
Average number of persons in CU.....	2.4	2.2	2.1	2.0	1.9	1.9
Average number of earners.....	1.4	1.4	1.3	.6	.6	.7
All item CPI, all urban consumers (1982-84=100).....	107.6	152.4	195.3	107.6	152.4	195.3
Medical care CPI, all urban consumers (1982-84=100).....	113.5	220.5	323.2	113.5	220.5	323.2
Prescription drugs CPI, all urban consumers (1982-84=100).....	120.1	235	349	120.1	235	349
Average annual expenditures.....	\$24,765.52	\$32,626.42	\$49,592.08	\$17,937.87	\$25,277.23	\$38,573.50
Percent change in nominal terms.....		31.74	52.00		40.92	52.60
Expenditures in real dollars (2005 as base year) <sup>1</sup> .....	\$44,950.80	\$41,810.63	\$49,592.08	\$32,558.23	\$32,392.67	\$38,573.50
Percent change in real terms.....		-6.99	18.61		-.51	19.08
Health care.....	\$1,355.27	\$1,911.27	\$3,410.39	\$1,648.78	\$2,618.00	\$4,175.77
Percent change in nominal terms.....		41.03	78.44		58.78	59.50
Expenditures in real dollars (2005 as base year) <sup>2</sup> .....	\$3,859.24	\$2,801.46	\$3,410.39	\$4,695.03	\$3,837.36	\$4,175.77
Percent change in real terms.....		-27.41	21.74		-18.27	8.82
Share of average annual expenditures.....	5.47	5.86	6.88	9.19	10.36	10.83
Percent reporting <sup>5</sup> .....	83.09	84.31	84.00	95.42	97.47	94.56
Health insurance.....	\$451.02	\$896.76	\$1,584.75	\$673.36	\$1,527.32	\$2,352.13
Expenditures in real dollars (2005 as base year) <sup>2</sup> .....	\$1,284.31	\$1,314.43	\$1,584.75	\$1,917.44	\$2,238.68	\$2,352.13
Percent reporting.....	56.77	61.34	65.03	89.70	95.56	88.71
Medicare payments.....	\$26.49	\$87.84	\$184.22	\$208.93	\$687.69	\$1,085.71
Expenditures in real dollars <sup>2</sup> .....	\$75.43	\$128.75	\$184.22	\$594.94	\$1,007.99	\$1,085.71
Percent reporting.....	13.08	14.08	17.30	81.84	90.95	80.78
Medical services.....	\$627.59	\$587.22	\$979.06	\$576.26	\$473.29	\$733.39
Expenditures in real dollars <sup>2</sup> .....	\$1,787.11	\$860.72	\$979.06	\$1,640.94	\$693.73	\$733.39
Percent reporting.....	56.72	50.26	49.03	59.90	49.13	37.08
Drugs.....	\$221.04	\$343.83	\$712.73	\$308.79	\$535.65	\$956.26
Expenditures in real dollars <sup>3</sup> .....	\$642.32	\$510.62	\$712.73	\$897.32	\$795.50	\$956.26
Prescription drugs.....	\$168.39	\$247.22	\$560.73	\$241.92	\$428.07	\$812.34
Expenditures in real dollars <sup>3</sup> .....	\$489.33	\$367.15	\$560.73	\$703.00	\$635.73	\$812.34
Percent reporting.....	50.81	51.66	52.74	62.83	60.81	62.11
Medical supplies.....	<sup>4</sup>	\$83.47	\$133.86	<sup>4</sup>	\$81.74	\$133.98
Expenditures in real dollars <sup>2</sup> .....		\$122.35	\$133.86		\$119.81	\$133.98
Percent reporting.....		10.43	9.31		11.84	8.75
Share of health care:						
Health insurance.....	33.28	46.92	46.47	40.84	58.34	56.33
Medicare payments.....	1.95	4.60	5.40	12.67	26.27	26.00
Medical services.....	46.31	30.72	28.71	34.95	18.08	17.56
Drugs.....	16.31	17.99	20.90	18.73	20.46	22.90
Prescription drugs.....	12.42	12.93	16.44	14.67	16.35	19.45
Medical supplies.....	4.10	4.37	3.93	5.48	3.12	3.21

<sup>1</sup> Average annual expenditure values are deflated by the All item CPI.

<sup>2</sup> Health care, health insurance, Medicare payments, medical services, and medical supplies expenditure values are deflated by the medical care CPI.

<sup>3</sup> Drugs and prescription drugs expenditure values are deflated

by the prescription drugs CPI.

<sup>4</sup> Medical supplies in 1985 were not strictly comparable to 1995 and 2005 due to collection differences.

<sup>5</sup> Percent reporting information is from Interview survey data, whereas integrated data are used in the rest of the table.

Chart 1. Shares of health care, 55-64 year olds, 1985, 1995, 2005

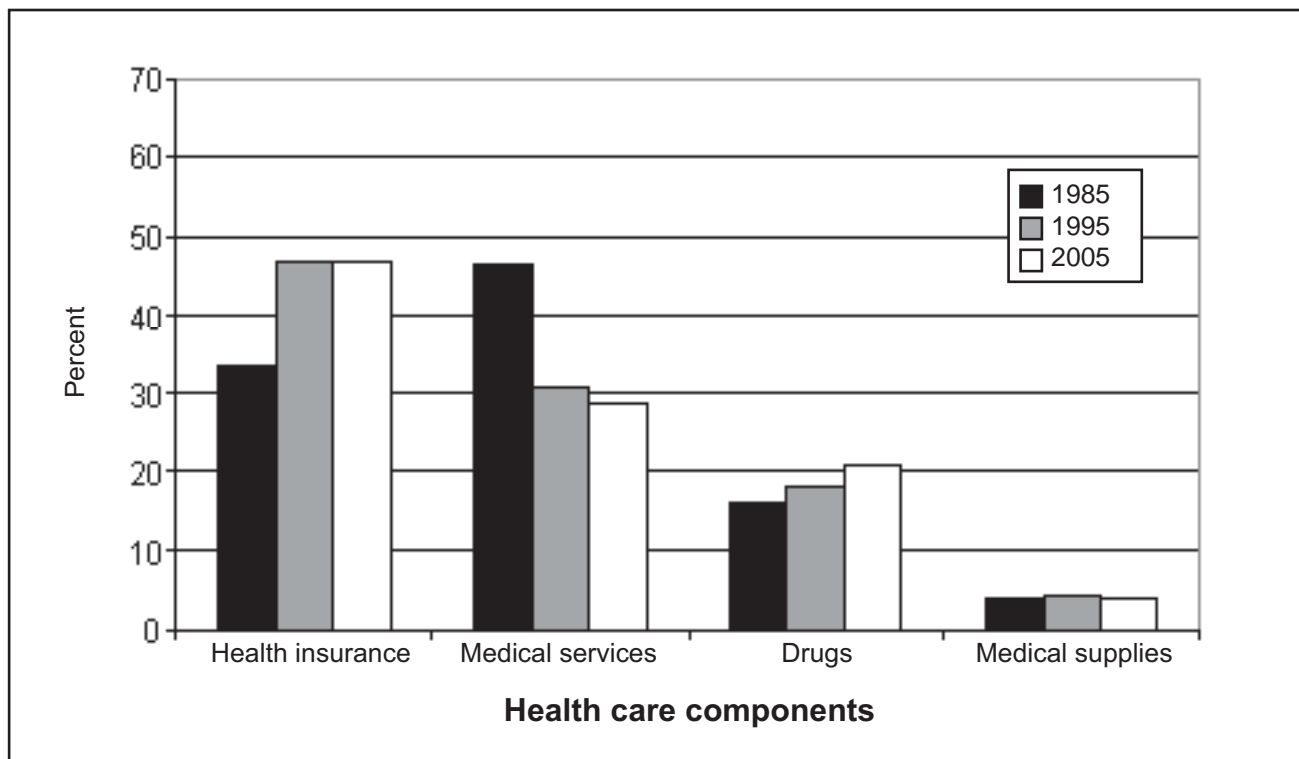
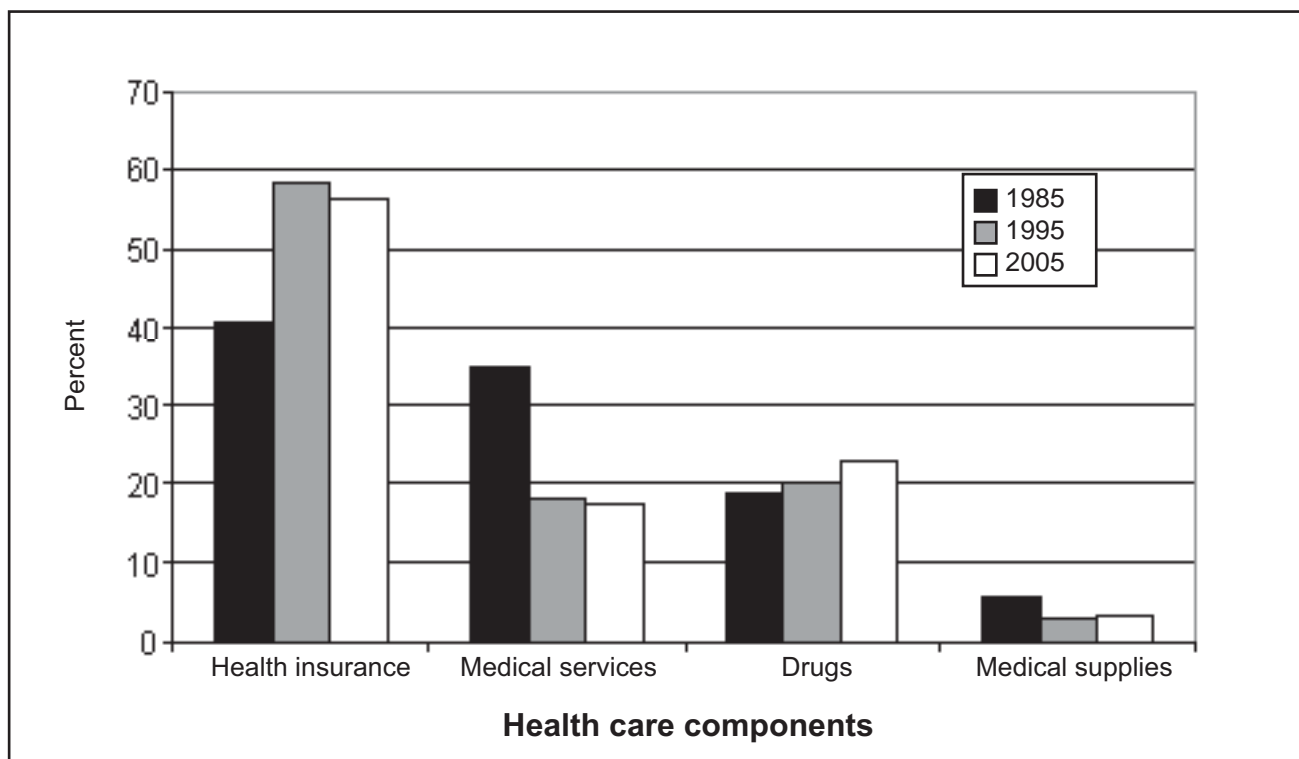


Chart 2. Shares of health care, 65-74 year olds, 1985, 1995, 2005



for both groups from 1985 to 1995, just over 40 percent. This suggests that the increase in health insurance spending accounted for a greater portion of the total cost of health care. Similarly, both age groups showed a slight decrease in the share of expenditures allocated to health insurance from 1995 to 2005, also suggesting stability in that trend and nothing explicitly related to age group. Medicare premium payments by both groups, as a share of health care expenditures, also jumped quite a bit from 1985 to 1995, and then showed only a slight increase from 1995 to 2005, mirroring the share allocations for health insurance overall.

**Medical care services.** The share of health care expenditures allocated to medical services declined from 1985 to 2005 for both age groups. The largest decline for both age groups occurred from 1985 to 1995 and was followed by a further slight decline from 1995 to 2005. In fact, actual expenditures showed a drop for both groups between 1985 and 1995. In the 55-64 year-old group, the share allocated to medical services declined from 46 percent in 1985 to 31 percent in 1995. By 2005, the share had declined further to 29 percent of health care expenditures. Among the 65-74 year-old group, the share of health care expenditures allocated to medical services followed a similar pattern, though the share allocated to medical services by this group was smaller than the share allocated by the younger group in all 3 years. For the 65-74 year-old group, the share declined from 35 percent of health care expenditures allocated to medical services in 1985, to 18 percent in 1995. The share allocated to this category declined slightly from 1995 to 2005 to 17.6 percent. Note that the decline in shares of health care expenditures allocated to medical services mirrors the increase in the share of health care expenditures allocated to health insurance. This perhaps suggests that since 1985 a larger portion of those expenditures previously spent directly on medical services were shifted to expenditures on health insurance.

Perhaps medical services are now being covered through health insurance, rather than paid for directly by the consumer unit.

**Drugs.** Expenditures on drugs in the CE include both prescription drugs and non-prescription drugs. The share of health care expenditures allocated to drug expenditures increased for both groups over the two decades, although the 55-64 year-old group experienced somewhat larger percentage increases in share allocation than did the older group. The share of health care expenditures allocated to drug expenditures by the 55-64 year-old group rose 10 percent from 1985, when 16 percent of health care expenditures were allocated to drugs, to 1995, when 18 percent of health care expenditures were allocated to drugs. A larger share increase occurred from 1995 to 2005, when it rose 16 percent with the result that 21 percent of health care expenditures were allocated to drugs. The 65-74 year-old group had a smaller magnitude of percentage share increases. From 1985 to 1995, the share allocated to drug expenditures grew by 9 percent, to 20.5 percent in 1995 from just under 19 percent in 1985; the share increased by another 12 percent from 1995 to 2005, when 23 percent of health care expenditures were allocated to drugs.

The CE and CPI drug categories are not completely comparable due to some definitional differences—the CPI includes some medical supplies in its non-prescription drug category that the CE does not. However, they can be compared at the subset level of prescription drugs. The share of health care expenditures allocated to prescription drugs by the 55-64 year-old group increased by 4 percent from 1985 to 1995, and then increased by 27 percent from 1995 to 2005. In the 65-74 year-old group, the share allocated to prescription drugs increased by 11 percent from 1985 to 1995, and then increased by 19 percent from 1995 to 2005.

Drug expenditures by the 55-64 year-old group rose, in nominal terms, from \$221 in 1985 to \$344 in 1995, an increase of 56 percent. From 1995 to

2005, they increased by 107 percent, to \$713. In contrast, the percentage increases among the older group showed more similarity over the two periods: 73 percent from 1985 to 1995 (\$309 to \$536), and 79 percent from 1995 to 2005 (\$536 to \$956). In constant dollars, with 2005 as the base year, expenditures on drugs by both groups declined from 1985 to 1995 and then rose from 1995 to 2005. For the younger group, they declined from \$642 in 1985 to \$511 in 1995, a decrease of 21 percent, but then rose to \$713 in 2005, an increase of 40 percent. Expenditures on prescription drugs by this group, in constant dollars, followed a similar trend: they declined from \$489 in 1985 to \$367 in 1995, and then rose to \$561 in 2005. Expenditures on drugs by the 65-74 year-old group, in constant dollars, declined from 1985 to 1995 (\$897 to \$796), a decrease of 11 percent, and then rose to \$956 in 2005, an increase of 20 percent. Expenditures on prescription drugs, in constant dollars, by this group, followed a similar pattern.

Examining these same years for the CPI for prescription drugs, prices almost doubled from 1985 to 1995, rising 96 percent. In 2005, prescription drug prices had increased another 49 percent over 1995. Again, as with health care expenditures, it is impossible to determine from CE data how much of the nominal expenditure increase resulted from the increase in prices and how much was caused by an increase in quantity of prescription drugs consumed. In fact, the quantity consumed could have decreased, with prices rising enough to more than offset the consumption decrease and, thus, show an increase in expenditure for that item.

Expenditures on medical supplies by the 55-64 year-old group rose, in nominal dollars, over the two decades as it did for the 65-74 year-old group. However, as a share of health care, spending on medical supplies by both groups declined over the two decades. The share allocated to medical supplies by the 55-64 year-old group showed a slight decline, from 4.1 percent in 1985 to 3.9 percent in 2005, while the

share allocated by the 65-74 year-old group showed a more marked decline in spending allocated to medical supplies—from 5.5 percent in 1985 to 3.2 percent in 2005.

### Conclusion

Examining shares of expenditures allows an analysis of how consumer units are allocating their various types of expenditures. For both age groups, the share of average annual expenditures allocated to health care expenditures rose over both decades. The increase in the share of health care expenditures allocated to health insurance from 1985

to 2005 mirrors a decrease in health care expenditures allocated to medical services over the period for both groups. Consumption of health care increases with age. The 65-74 year-olds spent more overall on total health care in both decades. They also spent more on health insurance and drugs than did the 55-64 year-old group in each of the survey years, while spending less overall on medical services and about the same on medical supplies. Thus, the shares of the components of health care are different between the two groups. However, the percentage changes from 1985 to 1995 and from 1995 to

2005 in the shares allocated among the components of health care trended in the same direction for both age groups, although the magnitudes of the percent changes were different. Examining CE data, Medicare eligibility at the age of 65 has little effect on the allocation of health care expenditures, since the share allocations among the health care components moved in similar directions for the two age groups over the 3 years examined. The new Medicare prescription drug benefit will impact the drug expenditure data after 2005, and that change will warrant further analysis. ■



# Examining Expenditure Patterns of Young Single Adults in a Historical Context: Two Recent Generations Compared

Geoffrey Paulin

For many Americans, the age of 21 is a major point of demarcation in one's life cycle. This age marks the start of full legal adulthood—that is, the age at which the young person is no longer considered a minor and can freely engage in all legal activities, such as renting or purchasing a home. By age 21, many Americans have completed their formal education, and many more will do so during their twenties.<sup>1</sup> In addition, numerous individuals in this age group are starting on their first jobs leading

to a career, and consequently, they face many new challenges. Achieving and maintaining financial independence can be difficult and has long-term ramifications for young adults and others in society. After all, income and spending patterns established in youth will affect one's ability not only to save for the purchase of a home, provide for a family—including future children's education—and live well in retirement, but also to contribute toward programs such as Social Security for current retirees. Clearly, then, understanding the economic status of young single adults is important for society as a whole, especially when substantial structural changes in the economy occur, as they have during the last generation.

Indeed, the changes that have taken place may lead to outcomes that differ from what has happened in the past. On the one hand, there has been a persistent belief, based on experience, that the current generation of Americans will be better off economically than

<sup>1</sup> According to data from the 1998 Current Population Survey (CPS), 36 percent of 21-year-olds reported graduating from high school as the highest level of education attained, while 7 percent reported completing an associate's degree or higher. Eight years later, in 2006, the CPS indicated that 28 percent of 29-year-olds reported graduating from high school as the highest level of education attained, while 41 percent reported completing an associate's degree or higher level of education. In comparison, that same year, 31 percent of 21-year-olds reported graduating from high school as the highest level of education attained, while 9 percent reported completing an associate's degree or higher level of education. (See "Table 2. Educational Attainment of the Population 15 Years and Over, by Single Years of Age, Sex, Race, and Hispanic Origin: 2006," on the Internet at [www.census.gov/population/socdemo/education/cps2006/tab02-01.xls](http://www.census.gov/population/socdemo/education/cps2006/tab02-01.xls); and "Table 2. Educational Attainment of Persons 15 Years Old and Over, by Single Year of Age, Sex, Race, and Hispanic Origin: March 1998," from "Educational Attainment in the United States: March 1988 (Update)" (U.S. Census Bureau, report P20-513, issued October 1998), on the Internet at [www.census.gov/prod/3/98pubs/p20-512u.pdf](http://www.census.gov/prod/3/98pubs/p20-512u.pdf) (visited May 20, 2008). Note that 2006 is the last year for which tables showing educational attainment by exact age were produced.)

<sup>2</sup> For an example of these changing beliefs, see Melinda Crowley, "Generation X Speaks Out on Civic Engagement and the Decennial Census: An Ethnographic Approach," *Census 2000 Ethnographic Study*, June 17, 2003, especially page 2, on the Internet at [www.census.gov/pred/www/rpts/Generation%20X%20Final%20Report.pdf](http://www.census.gov/pred/www/rpts/Generation%20X%20Final%20Report.pdf) (visited Sept. 26, 2007). For an example of the changing economic status of young single adults, see Geoffrey Paulin and Brian Riordon, "Making it on their own: the baby boom meets Generation X," *Monthly Labor Review*, February 1998, pp. 10–21; on the Internet at [www.bls.gov/opub/mlr/1998/02/art2full.pdf](http://www.bls.gov/opub/mlr/1998/02/art2full.pdf).

Geoffrey Paulin is a senior economist in the Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics. This article is abridged. The complete version appears in the December 2008 issue of the *Monthly Labor Review*.

the previous generation. On the other hand, since the 1990s, much literature has suggested that that belief may not be true anymore.<sup>2</sup> This article examines expenditure and income patterns for single, never-married young adults (persons aged 21 to 29 years) who were interviewed in 2004–05 and compares the patterns with those exhibited by single young adults 20 years earlier. The aim of the comparison is to assess the economic status of the two groups of singles in each period.

Before starting the analysis, it is important to keep in mind that many factors describe one's economic status and none by itself can provide a complete answer to the question "Who was better off when?" Each measure has its own inherent strengths and limitations that must be considered before attempting to draw conclusions.

### The data

The main source of data used in this article is the Interview Survey, a component of the Consumer Expenditure Survey (CE). The CE is the most detailed source of expenditure information collected directly from households by the Federal Government. In addition, data on income and other demographics are collected. Collected periodically throughout most of the 20th century, consistent data from the Interview Survey are available for analysis on a quarterly basis from 1984 onward.

### Terms and definitions

**Expenditures and outlays.** Technically, this article examines **outlays**, which are similar, but not identical, to **expenditures**. Both expenditures and outlays consist of the transaction costs, including taxes, of goods and services. They also include spending for gifts for persons outside the consumer unit, but exclude business purchases. However, expenditures include the full cost of each purchase, even though full payment may not have been made at the date of purchase.<sup>3</sup> Outlays include periodic

<sup>3</sup> See "BLS Information: Glossary," on the Internet at [www.bls.gov/bls/glossary.htm#E](http://www.bls.gov/bls/glossary.htm#E), or "Consumer Expenditure Survey: Glossary," on the Internet at [www.bls.gov/cex/csxgloss.htm#expn](http://www.bls.gov/cex/csxgloss.htm#expn), both visited Jan. 30, 2007.

credit or installment payments for major items already acquired, such as automobiles.<sup>4</sup> For example, if a consumer purchases a new automobile during the 3 months prior to the interview (that is, the "reference period"), the full cost of which is \$30,000, then, under the definition of "expenditure," the consumer is taken to have spent \$30,000 during the reference period. However, if the consumer financed the purchase with a loan and made payments of \$500 each month of the reference period, then, under the definition of "outlays," the consumer is taken to have spent \$1,500 during the reference period, plus any additional amount spent on a down-payment or a similar fee.<sup>5</sup> In addition, for homeowners, mortgage principal payments, if any, are excluded from the expenditure computation; for outlays, principal payments are included.<sup>6</sup>

Although expenditures are useful to analyze in many contexts, outlays are used in the analysis that follows because they provide a better view of monetary flows for young consumers, who presumably have less in savings or investments on which to rely for purchases and who therefore may depend

<sup>4</sup> *Ibid.* See also "2004 Consumer Expenditure Interview Survey Public Use Microdata Documentation," Oct. 18, 2006, p. 103, on the Internet at [www.bls.gov/cex/2004/cex/csxintvw.pdf](http://www.bls.gov/cex/2004/cex/csxintvw.pdf) (visited Sept. 8, 2008).

<sup>5</sup> In addition to automobiles, major items include other vehicles used primarily for transportation (for example, trucks, vans, and motorcycles) or entertainment and recreation (such as boats and campers). For other items (for instance, apparel) that have been financed by other means (say, by credit card), the expenditures approach applies. That is, the full purchase price is recorded in the reference period during which the purchase was made, even if the balance is not paid immediately. Payments for interest accruing to the balance also are collected during each interview, but the proportion of the total interest accruing to any particular purchase (apparel in the present example) that is included in the total balance, which may also include amounts from other purchases in addition to the amount for the particular purchase, is neither collected nor estimated.

<sup>6</sup> This criterion applies to all mortgage principal payments, whether for the home of residence, a vacation home, or some other property. However, regardless of the kind of computation—of expenditures or outlays—mortgage interest, but not the full purchase price, paid for the owned home is included. Nevertheless, information on "purchase price of property (owned home)" is collected, and is included as a component of "net change in total assets" in published tables.

on loans for financing more than do older consumers.<sup>7</sup>

**Adjustment for expenditures for food at home.** Prior to 1988, respondents to the Interview Survey were asked to report usual monthly expenditures for food at home during the reference period. Starting in 1988, respondents were asked to report usual weekly expenditures instead. Due to this change in the questionnaire, expenditures for food at home are not directly comparable over time. This incomparability is evidenced by a large increase in the average for these expenditures for young single adults from 1987 to 1988 (almost 45 percent), which is inconsistent with all other year-to-year changes in these expenditures from 1984 to 2005. Therefore, prior to any analysis, 1984–85 data on food at home are adjusted to account for this change to the extent possible. Outlays that include food at home as a component, either directly (for example, total food outlays) or indirectly (for example, outlays for all other items, which are computed by subtracting several expenditures from total outlays), are recomputed with the use of the adjusted expenditures for food at home. (Details concerning the change in the questionnaire and the computation of the adjustment factor are given in "Statistical procedures" in the technical notes.)

**Group of interest: young single adults.** In this article, the main analysis is performed using data from young, single, never-married adults aged 21 to 29 years who constitute their own consumer units.<sup>8</sup>

<sup>7</sup> However, actual values for assets and liabilities are not examined here. See section titled "Limitations of the Data" for more information.

<sup>8</sup> Excluded from the analysis are cases in which two or more single, never-married adults who share living quarters are either financially interdependent or sharing responsibility for major expenses (or both). By definition, these consumer units consist of at least two members, who may be described either as "unrelated persons" (1984–85 and 2004–05) or "unmarried partners" (2004–05), unless they are related by blood or some legal arrangement. Such consumer units are in contrast to single, never-married persons who share living quarters, but who are financially independent, and who do not share responsibility for more than one major expense. These consumer units constitute single-member consumer units within the same housing unit. (For more information, see the definition of "consumer unit" in the glossary.)

The group is limited to single-member consumer units in order to facilitate comparisons across time. For example, if all consumer units that include at least one 21- to 29-year-old are compared, changes in patterns may be due solely to changes in the composition of these units: If there are more (or fewer) married couples, single parents, or other non-single-member units in the later period, expenditure patterns for the group as a whole will appear to differ, even if there has been no change when only married couples, single parents, or other non-single-member units are compared. In addition, the sample is limited to never-married singles because singles who were previously married may have very different expenditure or other patterns based on differences in their life experiences or differences in income resulting from their unions. These patterns may even include expenditures for a child who lives in a consumer unit different from that of the previously married parent. Therefore, to remove the potential influence of these factors on the analysis, only never-married singles are included, wherever possible.

**Quarterly outlays or annualized outlays?** In the Interview Survey, data for expenditures and outlays are collected quarterly in most cases. That is, respondents are usually asked to report values for expenditures or outlays that occurred during the 3 months prior to the interview. For convenience, the data for expenditures and outlays presented in this article are annualized prior to analysis. That is, quarterly values are multiplied by 4. However, the annualized values do not represent calendar-year spending. For example, respondents interviewed in January 1984 reported outlays that occurred between October and December 1983. Similarly, respondents interviewed in February 1984 reported outlays that occurred between November 1983 and January 1984, thus crossing years. Also, multiplying an individual's quarterly outlays by 4 may not accurately represent what that individual actually spent during the 12-month period

of interest. However, on average, this approach provides a reasonable estimate of outlays for a 12-month period.

**Real dollars or nominal dollars?** In performing economic comparisons across time, it is essential to control for changes in prices, because changing prices affect purchasing power. That is, if a person spent \$1 for apples yesterday, but \$2 today, then the person did not buy more apples today if the price of apples doubled since yesterday. Price indexes are often used to convert **nominal** (that is, reported) dollars into **real** (that is, price-adjusted) dollars, either by converting yesterday's expenditures into today's dollars or by converting today's expenditures into yesterday's dollars. (For more information on this topic, see "Real or nominal expenditures?" in the technical notes.)

**Sample or population?** In conducting the CE, it is impossible to interview every consumer unit in the United States (the **population**). Therefore, a representative group is interviewed. The members of this group constitute the **sample**. To obtain population estimates, each consumer unit in the sample is weighted by the number of consumer units it represents. In 1984–85, there were 2,359 consumer units of interest sampled; as shown in table 1, together they are estimated to represent nearly 4.9 million consumer units in the population. In 2004–05, there were 2,158 consumer units of interest sampled, representing about 4.6 million consumer units in the population.<sup>9</sup>

**Statistical significance.** Because data compared across groups come from samples of each group, rather than entire populations, it is important to consider the probability that differences in outcomes are the result of actual differences in the population and not due to chance. Depending on the type of sampling performed, different formulas are available to compute the *statistical significance* of the outcome—that is, the probability that the difference was due to chance alone, rather than to a real difference in outcomes. In the analysis that follows, when results are described as "statistical-

ly significant," the outcome is not likely to have been due to chance alone. (Tests used to measure statistical significance are described in "Measuring statistical significance: types and computations of t-statistics" in the technical notes.)

### Limitations of the data

A complete description of economic well-being includes measures that are not available in the data analyzed. For example, the CE does not collect information about expectations of the future. Presumably, the anticipation of a particular event or outcome in the future influences expenditure patterns in the present. For example, if one expects to make a major purchase (for instance, a home or a car) soon, one may save more in the present than someone who does not expect to do so for some time; or, as discussed subsequently, the more one expects to earn in the future as the result of obtaining a college degree, the more one is willing to pay for it. As another example, rapid changes in technology, such as those which occurred during the period under study, presumably have ramifications for economic well-being that are impossible

<sup>9</sup> Publications of the 2005 CE data use information from consumer units that were selected for interview under a sample design different from that of those selected for interview in 2004. For technical reasons, only consumer units participating from February through December 2005 were eligible to be selected for interview under the new sample design. Therefore, only information from these consumer units is used in this article when results from 2005 are described. To ensure a proper computation of population counts, the weight of each consumer unit interviewed in 2005 is multiplied by 12/11 before any additional computation is performed. The reason is that 11 months of sample are used to represent 12 months of population. This adjustment does not affect the means or variances of outlays or other characteristics that would have been obtained from the sample of interviews occurring in 2005 and that are used in this study had the adjustment not been made. However, it corrects the population counts, thereby changing the weight of the 2005 interviews in the total sample (that is, interviews occurring in 2004 and 2005) when the means and variances for the 2-year period are computed. For interviews occurring in 2004, no additional adjustment is necessary. Although the sample design used to select consumer units for interview in 2004 is different from the one used in 2005, the same design is used consistently from January through December 2004. Therefore, no adjustment to weights is necessary for consumer units interviewed anytime during that period.

Table 1. Demographic characteristics of never-married young adults (aged 21 to 29 years), 1984–85 and 2004–05

Characteristic	1984–85	2004–05
Estimated population (rounded) .....	4,854,000	4,610,000
Percent distribution:		
Educational status:		
Highest level attained:		
High school diploma or less.....	26.2	17.8
College experience.....	73.8	82.2
Attended college.....	<sup>1</sup> 40.1	<sup>2</sup> 45.3
Graduated college.....	<sup>3</sup> 33.7	<sup>4</sup> 36.9
Currently enrolled in college:		
Full time.....	25.6	35.7
Part time.....	7.0	7.4
Not at all.....	64.7	53.4
Not eligible.....	2.7	3.5
Housing tenure:		
Homeowner.....	8.0	15.8
Renter.....	92.0	84.2
Race and ethnic origin		
Hispanic.....	3.5	7.1
Non-Hispanic.....	96.5	92.9
Black.....	8.3	10.1
White and other.....	88.2	82.8
Men.....	57.6	59.3
Women.....	42.4	40.7
Size of dwelling:		
Homeowners.....		
Rooms, other than bathrooms.....	5.0	5.3
Bedrooms.....	2.4	2.5
Bathrooms.....	1.2	1.5
Half baths.....	.2	.2
Renters.....		
Rooms, other than bathrooms.....	4.1	4.2
Bedrooms.....	1.8	2.1
Bathrooms.....	1.2	1.3
Half baths.....	.1	.1

<sup>1</sup> Includes those who report attending or completing 1 to 3 years of college and those who report attending, but not completing, 4 years of college.

<sup>2</sup> Includes those who report some college, but no degree, and those who report receiving an associate's degree (occupational/vocational

or academic).

<sup>3</sup> Includes those who report completing 4 years of college or attending graduate school.

<sup>4</sup> Includes those who report receiving a bachelor's degree, master's degree, professional school degree, or doctoral degree.

to measure by examining expenditures alone.<sup>10</sup>

In addition, a consideration of assets and liabilities is excluded from this analysis. Although the CE collects information on assets and liabilities, the information is not detailed enough for purposes of analysis. For example, some information about levels of debt and to whom it is owed is collected; however, information about many sources of debt, including school

loans, is not collected separately from information about other debt.<sup>11</sup> Furthermore, the CE data on assets and liabilities are not considered as reliable as expenditure data, due to nonresponse.<sup>12</sup> Finally, unlike expenditure data, which are collected during each interview, data on assets and liabilities are collected only during the fifth interview. Therefore, not all consumer units that are interviewed have an opportunity to provide information about assets and

liabilities.<sup>13</sup> Despite these data limitations, young singles presumably make expenditure decisions with the preceding factors in mind. Consequently, those factors are implicitly included in the analysis that follows.

### Demographic analysis

Before comparing groups, it is important to understand their basic demographic characteristics. Changes in demographics, such as educational attainment, may explain differences in economic attainment. For example, a higher percentage attending college may indicate a better trained workforce whose members are more able to enter professional or skilled careers. At the same time, changes in demographics may be associated with changes in tastes and preferences that would change expenditure patterns.

<sup>10</sup> Paulin and Riordon, "Making it on their own," pp. 16, 18.

<sup>11</sup> In 2004, school loans began to be cited as an example when the respondent is asked to report the amount owed for "other credit, such as school loans, personal loans or loans from retirement plans." (See "Consumer Expenditure Survey: Section 21, Part A—Credit Liability—Credit Balances—Second Quarter Only" (U.S. Bureau of Labor Statistics, Nov. 20, 2005), on the Internet at [www.bls.gov/cex/capi/2004/csxsection21a1.htm](http://www.bls.gov/cex/capi/2004/csxsection21a1.htm) (visited Apr. 9, 2008).) Nevertheless, the proportion of the total amount owed for any of these types of credit separately is neither collected nor estimated.

<sup>12</sup> See "Consumer Expenditure Survey: Frequently Asked Questions (FAQ's)" (U.S. Bureau of Labor Statistics, Mar. 4, 2008), on the Internet at [www.bls.gov/cex/csxfaq.htm#q8](http://www.bls.gov/cex/csxfaq.htm#q8) (visited Mar. 25, 2008).

<sup>13</sup> Like asset and liability data, income data are collected less frequently than expenditure data. However, in contrast to asset and liability data, income data are collected not only during the fifth interview, but also during the second interview (or during the earliest interview, in the event that either no respondent was available in time to complete the second interview or the consumer unit originally at the address visited has been replaced by a new consumer unit). Income information from the second (or the earliest) interview is then carried forward to subsequent interviews until it is replaced with information collected during the fifth interview. However, values for assets and liabilities are considered validly blank for records pertaining to all but the fifth interview; that is, no attempt is made to carry the information backward to records pertaining to earlier interviews. Therefore, although information on income is at least potentially available for each consumer unit in the sample, regardless of which particular interview is under consideration (even for those who participate only once), information on assets and liabilities is available only for consumer units participating in the fifth interview, thus limiting its contribution to the analyses conducted herein.

**Population share.** The data indicate that, despite growth in the U.S. civilian noninstitutional population, the number of young adults (of any marital status, living alone or with others) in that population has decreased over time. For example, the number of consumer units in the U.S. population increased from more than 90.5 million in 1984–85 to more than 116.6 million in 2004–05. At the same time, the approximate number of 21- to 29-year-olds who lived in consumer units of any size decreased from 37.5 million in 1984–85 to 34.3 million in 2004–05. As a result, the number of consumer units reporting at least one member between the ages of 21 and 29 fell from nearly 27.7 million (almost 31 percent) to 25.7 million (22 percent).

Nevertheless, despite the overall decrease in the number of young adults over this time span, the estimated number of young **single** (never-married) adults increased from about 17.2 million to 20.3 million. In addition, the number of consumer units that included at least one young single increased from 14.5 million to 16.7 million, and, the values increased dramatically for consumer units with at least one young adult of **any** marital status. For example, in 1984–85, more than half (53 percent) of these consumer units included at least one young **single** adult, with an average of 0.6 per consumer unit. In 2004–05, nearly two-thirds (65 percent) included at least one young single adult, with an average of nearly 0.8 per consumer unit.

Presumably, these findings indicate that although, due to demographic shifts, there were fewer young adults in the population, they were marrying later in life in 2004–05 than they were in 1984–85.<sup>14</sup> If so, whether this trend indicates an improvement or a deterioration in that age group’s economic status is not clear. On the one hand, the decision to wait may reflect the desire to complete a degree or establish a career before undertaking such an important commitment as marriage. On the other hand, it may be that young persons still want to marry early, but find it too difficult financially. At any rate, as

evidenced by this discussion, the trend toward later marriage again underscores the importance of narrowing the subject of study to young singles. Attempting to include marriage, and even children, into the analysis introduces comparisons that are too complex to complete meaningfully.

**Education.** According to table 1, in 2004–05 young singles reported higher levels of educational attainment than they did in 1984–85.<sup>15</sup> From the earlier survey period to the later one, the percentage reporting a high school diploma or less dropped substantially (from 26 percent to 18 percent), while the percentage reporting at least some college experience increased notably

<sup>14</sup> Indeed, the following tabulation from the U.S. Census Bureau shows that the median age at first marriage has risen by about 2 years from 1984–85 to 2004–05 for both men (25 to 27 years) and women (23 to 25 years):

Year	Men	Women
1984.....	25.4	23.0
1985.....	25.5	23.3
2004.....	27.4	25.3
2005.....	27.1	25.3

Source: Table MS-2, “Estimated Median Age at First Marriage, by Sex: 1890 to the Present” (U.S. Census Bureau, Mar. 27, 2007), on the Internet at [www.census.gov/population/socdemo/hh-fam/ms2.xls](http://www.census.gov/population/socdemo/hh-fam/ms2.xls) (visited May 21, 2008.)

<sup>15</sup> In the 1984–85 data, educational attainment is described by the highest grade attended and whether or not that grade was completed. For the data from this period, college graduates are defined as those who reported completing the fourth year of college or its equivalent and those who reported attending at least 1 year of graduate school. Those who reported attending, but not completing, 4 years of college are defined as having attended college, as are those who reported attending for 1 to 3 years, even if they reported completing the final year they attended. In the 2004–05 data, educational attainment is described by degree received, including associate’s degree (occupational/vocational or academic), bachelor’s degree, master’s degree, professional school degree, and doctoral degree. For consistency with the 1984–85 data, those who reported receiving a bachelor’s degree or higher are defined as college graduates in the 2004–05 data. In addition, those who reported receiving an associate’s degree or attending college, but not receiving any degree, are defined in the 2004–05 data as having attended college.

(from 74 percent to 82 percent).<sup>16</sup> In addition, those enrolled in college full time increased their share from a little more than 1 in 4 (26 percent) to well over 1 in 3 (36 percent).<sup>17</sup>

Higher education is usually considered to be a benefit, leading to higher pay for professional or skilled workers. This is especially true as changes in technology and communications dur-

<sup>16</sup> Data from the CPS also show increased levels of educational attainment for young adults. In 1985, 41.4 percent of those aged 20 to 24 years had completed at least 1 year of college. In 2005, 55.3 percent of those aged 20 to 24 years and 56.8 percent of those aged 25 to 29 years had completed at least some college. Note that CPS data underwent a change in the definition of educational attainment similar to the change undergone by CE data. In 1985, data are shown by highest level of grade or year of school completed. In 2005, for those who attended college, data are shown for some college, but no degree, and for degree received: Associate’s degree, occupational/vocational or academic degree; bachelor’s degree; master’s degree; professional school degree; and doctoral degree. Sources of data are as follows: “Educational Attainment in the United States: March 1982 to 1985 (P20-415) Issued November 1987: Table 2, Years of School Completed by Persons 15 Years Old and Over, by Single Years of Age, Sex, Race, and Spanish Origin: March 1985” (U.S. Census Bureau, November 1987), on the Internet at [www.census.gov/population/socdemo/education/p20-415/tab-02.pdf](http://www.census.gov/population/socdemo/education/p20-415/tab-02.pdf) (visited May 20, 2008); Table 1, “Educational Attainment of the Population 15 Years and Over, by Age, Sex, Race, and Hispanic Origin: 2005” (U.S. Census Bureau, Oct. 26, 2006), on the Internet at [www.census.gov/population/socdemo/education/cps2005/tab01-01.xls](http://www.census.gov/population/socdemo/education/cps2005/tab01-01.xls) (visited May 20, 2008).

<sup>17</sup> Although not measuring an identical sample, data from the National Center for Education Statistics show that college enrollment has increased over time for students graduating from high school. In 1984, 55.2 percent of high school completers were enrolled in college in the October immediately following high school completion. By 2005, the figure had increased to 68.6 percent. Note that these data do not separate enrollment rates for full- and part-time students, nor do they take age into account—presumably, most high school completers in this group are younger than 21, and some are older than 29. Nevertheless, these data are consistent with the findings presented in table 1, namely, that college enrollment has increased for young adults over time. Source of data is “Student Effort and Educational Progress, Table 25-1, Percentage of high school completers who were enrolled in college the October immediately following high school completion, by family income and race/ethnicity: 1972–2005” (National Center for Education Statistics, 2006), on the Internet at [nces.ed.gov/programs/coe/2007/section3/table.asp?tableID=702](http://nces.ed.gov/programs/coe/2007/section3/table.asp?tableID=702) (visited May 21, 2008.)

ing the intervening years have created jobs, such as computer technicians and administrators, that may require at least some college education for a jobseeker to qualify for employment. However, at the same time, the Consumer Price Index (CPI), which measures changes in prices for goods and services that urban U.S. consumers purchase, shows that the cost of college tuition and fees more than quadrupled—rising 365.3 percent—from January 1984 to December 2005.<sup>18</sup> This increase is in contrast to one of 93.1 percent—less than double—for all goods and services over the same period. Thus, young singles in the later period may have been receiving education in larger numbers, but they were facing considerably higher prices than their historical counterparts. In order to benefit from their education, at least in a purely financial way, expected wages and salaries or other income would have to rise substantially to compensate for the increased cost of education.

**Housing status.** In recent years, there has been much discussion regarding students moving back into their parents' homes after college, rather than into their own dwellings. Many reasons for this development have been posited, and some would suggest that it is due to a decrease in economic well-being—for example, because nowadays students are unable to afford housing on their own. However, others suggest that moving back with parents is a benefit to young adults, as it allows them to forego rent and spend savings therefrom on consumer goods.<sup>19</sup> It could also be that young adults who choose to live with parents do so in order to save for a downpayment on a nicer

<sup>18</sup> Data are from tables that were created with online tools ("Create Customized Tables"), on the Internet at [www.bls.gov/cpi/home.htm](http://www.bls.gov/cpi/home.htm) (visited Dec. 5, 2000). Data are for "All Urban Consumers (Current Series)" and are not seasonally adjusted.

<sup>19</sup> See "Echoboomerang—number of adult children moving back home—Statistical Data Included," *American Demographics*, June 1, 2001, on the Internet at [www.findarticles.com/p/articles/mi\\_m4021/is\\_2001\\_June\\_1/ai\\_76579415](http://www.findarticles.com/p/articles/mi_m4021/is_2001_June_1/ai_76579415) (visited July 17, 2007).

home than they could have afforded if they had to pay housing expenses while saving.

Whatever the case, the CE data do not support this conclusion. To demonstrate, the sample is expanded to include all consumer units consisting of at least one never-married adult aged 21 to 29 years. Expanding the sample to take these individuals into account ensures that young singles who live with their parents, as well as those who live with others but who do not pay rent or are otherwise not financially independent, are included in the analysis. In this new sample, 35 percent of young singles were reported to be the child of the reference person<sup>20</sup> in 2004–05, compared with 48 percent in 1984–85. In addition, the percent reporting that they were the reference person increased from 39 percent in 1984–85 to 43 percent in 2004–05.<sup>21</sup>

Another key factor in considering well-being is that, despite a sharp increase in home prices in many U.S. cities in recent years, young single adults in 2004–05 were more likely to own their homes than they were in 1984–85. The percentage of homeowners doubled from 8 percent to 16 percent during that time. Usually, homeownership is considered to indicate higher economic status than renting. Owning a home provides the purchaser with not

<sup>20</sup> See glossary for definition.

<sup>21</sup> Data from the U.S. Census Bureau are consistent with these findings. Specifically, one Census Bureau table shows separately the percentages of men and women 18 to 24 years old, presumably of any marital status, who are classified as "child of householder" in various years. For women aged 18 to 24 years, there is not much change between 1984 (47 percent) and 2005 (46 percent). However, men in that age group exhibit a decline from 62 percent to 53 percent. The reason for this decline is not clear. One possibility is that young men used to live at home during their college years and then moved out after graduation, whereas now they move to campus for their college years and return home after graduation. Whatever the cause, a thorough investigation is beyond the scope of this article. (Source: Table CH-1, "Young Adults Living At Home: 1960 to Present" (U.S. Census Bureau, Mar. 27, 2007), on the Internet at [www.census.gov/population/socdemo/hh-fam/ad1.xls](http://www.census.gov/population/socdemo/hh-fam/ad1.xls) (visited May 21, 2008).

only living quarters, but a valuable asset against which to borrow in case of emergency. Of course, if young adults in the later period were buying homes with riskier, more exotic mortgages that were not available in the earlier period, that could have led to worse outcomes than renting. However, the answer to that question is beyond the scope of the CE data.

## Economic analysis

**Macroeconomic factors.** One indicator of economic conditions is the real value of **gross domestic product (GDP)**. GDP measures the value of all goods and services produced in an economy.<sup>22</sup> According to this measure, both groups look like they were about equally well off. Each group lived and worked during a period of economic growth. Real GDP expanded both from 1983 to 1985 (by 11.6 percent) and from 2003 to 2005 (by 6.8 percent).<sup>23</sup> Interestingly, the two groups also grew up in similar historical contexts as far as economic growth is concerned. In this regard, real GDP grew at an average annual rate of about 3.3 percent from 1964–65 to 1984–85 and 3.0 percent from 1984–85 to 2004–05,<sup>24</sup> while the population grew at an average annual rate of about 1 percent over each of the two periods.<sup>25</sup> Therefore, each group experienced periods in which real GDP grew faster than population growth, indicating that there were more goods and services per person available to be consumed or otherwise used in the economy.

Though important, the GDP values reflect changes for the economy as a

<sup>22</sup> See the Bureau of Economic Analysis (BEA) glossary at [bea.gov/bea/glossary/glossary.cfm?keyword=GDP&letter=C#GDP](http://bea.gov/bea/glossary/glossary.cfm?keyword=GDP&letter=C#GDP) (visited Jan. 30, 2007).

<sup>23</sup> Growth rates for real GDP were derived from data listed in the Excel file titled "Current-dollar and 'real' GDP" (Bureau of Economic Analysis, Oct. 31, 2007), on the Internet at [bea.gov/national/index.htm#gdp](http://bea.gov/national/index.htm#gdp) (visited Nov. 8, 2007).

<sup>24</sup> *Ibid.*

<sup>25</sup> Percentages are derived from *Statistical Abstract of the United States: 2007*, 126th ed. (U.S. Census Bureau, 2006), table 2, "Population: 1960 to 2005."

whole—not necessarily for the group of interest. Therefore, other macroeconomic indicators are also useful to examine. One of these is the **unemployment rate**. This measure describes the ratio of persons actively seeking work, but unable to find it, to all persons in the labor force, which includes the former group as well as those who currently hold jobs.<sup>26</sup> Although the available measures are not precise or specific to the group in question, there are historical data readily available to describe outcomes.<sup>27</sup> Using such data enables rates for young (never-married) singles to be computed for those aged 20 to 24 years. Data also are available for adults aged 25 to 29 years, but no data are available for never-married persons in this age group.

Both sets of data show a decline of nearly 2 percentage points in unemployment rates for young adults in each age group. Although they experienced higher rates of unemployment than the general population (all adults aged 20 years and older) did in each period (about 6.5 percent in 1984–85 and 4.7 percent in 2004–05), the decline in rates for young adults indicates that they were better off in the later period than the earlier one.<sup>28</sup> The following tabulation shows unemployment rates

for young singles and for all young adults for 1984–85 and 2004–05:

Category	Young singles only (20 to 24 years)		All young adults aged 25 to 29 years	
	1984–85	2004–05	1984–85	2004–05
Total	11.7	9.6	7.8	6.0
Men	12.8	10.6	7.6	5.8
Women	10.2	8.3	8.0	6.2

In addition to these unemployment figures, certain related macroeconomic factors may have affected economic well-being differently for young adults in the two periods. If so, these factors also support the hypothesis that young adults were better off in the second period. For example, the first group experienced several serious economic recessions from the mid-1970s to the early 1980s that were marked by historically high levels of unemployment. By contrast, there were only two recessions from 1984–85 to 2004–05 (in 1990–91 and 2001), each with peak unemployment rates lower than in the earlier downturns.<sup>29</sup> Although 1984–85 and 2004–05 were each periods of growth in real GDP, the differences in economic outcomes in the preceding years may have affected the abilities of the young adults to secure jobs or savings prior to the years of study or may have affected the finances of those on whom they would normally rely for support, such as parents or other family members.<sup>30</sup> These experiences also may have affected the group’s expectations about the future and therefore affected its members’ planning.

### Microeconomic factors: measures using outlays.

<sup>29</sup> In 1975, the annual unemployment rate for the entire civilian noninstitutional population (that is, a population not limited to young single adults) peaked at 8.5 percent, the highest annual unemployment rate between 1970 and 1979. In 1982, the annual unemployment rate reached 9.7 percent. By contrast, in 1990–91, annual unemployment rose to only 6.8 percent (in 1991) and was 4.7 percent in 2001. These figures were obtained with online tools (“Create Customized Tables”), on the Internet at [www.bls.gov/cps/home.htm](http://www.bls.gov/cps/home.htm) (visited July 17, 2007).

status of a particular group, many persons would probably immediately think of income as the appropriate measure. However, outlays are used in this article, for both theoretical and practical reasons.

From a theoretical viewpoint, total outlays reflect not only income received today (that is, current income), but expectations of future income. For

<sup>30</sup> This is especially true for the group in the earlier period. Many of those aged 21 to 29 years in 1984 would have been members of the labor force in 1981. In July 1981, the seasonally adjusted civilian unemployment rate fell to its lowest point for that year: 7.2 percent. One year later, it reached 9.8 percent. In November and December 1982, it peaked at 10.8 percent. The rate did not return to its 1981 minimum until almost 3 years later, in June 1984. (See “Most Requested Statistics: Labor Force Statistics from the Current Population Survey: Unemployment Rate—Civilian Labor Force—LNS14000000,” on the Internet at [data.bls.gov/cgi-bin/surveymost?ln](http://data.bls.gov/cgi-bin/surveymost?ln) (U.S. Bureau of Labor Statistics, no date) (visited Nov. 29, 2007).) Although the actual rates are different for 20- to 24-year-olds and 25- to 29-year-olds during these periods, the patterns they follow are similar to those for the labor force as a whole. (See “Labor Force Statistics from the Current Population Survey” (U.S. Bureau of Labor Statistics, no date), on the Internet at [data.bls.gov/PDQ/outside.jsp?survey=ln](http://data.bls.gov/PDQ/outside.jsp?survey=ln) (visited Nov. 29, 2007), accessible by using “One-screen data search” for the database named “Labor Force Statistics including the National Unemployment Rate (Current Population Survey—CPS)” at [www.bls.gov/cps/home.htm#data](http://www.bls.gov/cps/home.htm#data) (visited Sept. 18, 2008). Seasonally adjusted rates for the 25- to 29-year-old group are not available at this link, but unadjusted rates are.) For many of the younger members of this group (that is, the 20- to 24-year-olds), who, as shown in the tabulation on this page, have higher unemployment rates than the older members of the group (that is, the 25- to 29-year-olds), finding a first job was presumably quite difficult; even for those older members who held jobs prior to 1981, the situation was likely precarious. Undoubtedly, many of them lost jobs due to the recession or had difficulty changing jobs if they desired to. Those who were unemployed not only lacked the ability to add to their savings from the wages or salaries they earned, but also may have had to use their savings to pay for basic goods and services, such as food and housing. By contrast, during the analogous timeframe for the second group, the unemployment rate for the entire civilian labor force was lowest in January and February 2001 (4.2 percent) and eventually peaked in June 2003 (at 6.3 percent). Although never matching the 2001 minimum during the second period, the rate declined from March 2004 (5.8 percent) through December 2005 (4.8 percent). Again, these figures support the hypothesis that young adults in the later period were economically better off than those in the earlier period both during and immediately prior to the years under study.

<sup>26</sup> For definitions of the unemployment rate and the labor force, visit [www.bls.gov/bls/glossary.htm](http://www.bls.gov/bls/glossary.htm) (visited Jan. 30, 2007).

<sup>27</sup> These data are from computations that were made with annual data obtained with the use of online tools (“Create Customized Tables”) that were found on the Internet at [www.bls.gov/cps/home.htm](http://www.bls.gov/cps/home.htm) (visited Jan. 30, 2007).

<sup>28</sup> These statistics exclude marginally attached workers—those who are available and willing to work and who have sought employment in the past 12 months, but not during the past 4 weeks. (For a precise definition of marginally attached workers, visit the Web site [www.bls.gov/bls/glossary.htm#M](http://www.bls.gov/bls/glossary.htm#M) (visited Nov. 6, 2007).) The statistics also exclude discouraged workers, a subset of marginally attached workers, namely, those who have looked for work in the past 12 months, but are not currently looking because they believe that there are no jobs available for which they qualify. (For a precise definition of discouraged workers, visit the Web site [www.bls.gov/bls/glossary.htm#D](http://www.bls.gov/bls/glossary.htm#D) (visited Nov. 6, 2007).) However, no data on either marginally attached or discouraged workers were found for any age group prior to 1994 when the BLS Web site ([www.bls.gov/cps/home.htm](http://www.bls.gov/cps/home.htm)) was last visited (Nov. 6, 2007).

example, an applicant seeking a student loan almost certainly knows that his or her current savings and income are inadequate to cover tuition, but has the expectation that future earnings (enhanced by the degree sought) will more than repay the loan. The sum of current income and expected future income is known as **permanent income**; the idea that consumers spend money on the basis of their permanent income levels is known as the “permanent-income hypothesis.”<sup>31</sup> Because outlays are hypothesized to be based on permanent income, they are used as a proxy thereof in this analysis.

Among the practical reasons for using outlays rather than (current) income with CE data is that, prior to 2004, income before taxes was published only for “complete income reporters.” In general, complete reporters were those for whom at least one member of the consumer unit (usually, the reference person) reported a value for a major source of income, such as wages and salaries. However, even complete income reporters did not necessarily provide a full accounting of income from all sources. For example, the respondent might have provided a value for wage and salary income, but not known or refused to provide the value for interest income. Relying on complete reporters only, then, reduced available information in two ways: Not all respondents were complete reporters, and not all complete reporters provided full income information for analysis. Using total outlays as a proxy for permanent income solves both problems, because values for outlays are either reported or, where appropriate, estimated by various methods.<sup>32</sup>

**Using outlays to assess economic status.** Perhaps the first answer to come to

<sup>31</sup> Milton Friedman, *A Theory of the Consumption Function* (Princeton, NJ, Princeton University Press for National Bureau of Economic Research, 1957); on the Internet at [www.nber.org/books/frie/57-1](http://www.nber.org/books/frie/57-1) (visited Aug. 6, 2008).

<sup>32</sup> Starting with the publication of data collected in 2004, multiple imputation began to be used to fill in blanks for income. It will be interesting to use the data obtained therefrom for future cross-generational analyses.

mind to the question, “Which group is economically better off?” is the answer to another question: “Which group has more income?” As has already been demonstrated, even answering this question is not as straightforward as it might seem. A simple comparison of permanent incomes would make it seem as if the young adults in 2004–05 were better off than those in 1984–85: Total annualized outlays for the average young single adult studied rose from \$13,145 to \$22,744 over the period between the two surveys, an increase of 73 percent! However, in the United States, total annualized outlays would probably be observed to increase during **any 20-year period** since World War II, simply because of inflation, which is defined as a rise in prices for goods and services when other factors (such as size and quality) remain essentially constant. Given this situation, it is more accurate to compare **real** outlays (those adjusted for price change with the use of the CPI for all goods and services) than **nominal** outlays (unadjusted figures, as cited earlier). The 2-year average of the annual CPI for all goods and services rose nearly 82 percent from its base in 1984–85 (105.8) to its value in 2004–05 (192.1). That means that the \$13,145 spent in 1984–85 would purchase about the same amount of goods and services as would \$23,867 in 2004–05. By this measure, young adults in 2004–05 were **worse** off than their earlier counterparts, experiencing a decrease of almost 5 percent (\$23,867, compared with \$22,744) in their real outlays. However, caution must be used in interpreting this finding, because the difference in means is not statistically significant.

Of course, the preceding finding relies on certain assumptions, namely, that the same goods and services are purchased in each year by each group, that qualities remain unchanged, and so forth. Even so, by this measure, young adults in the later period appear to be worse off than they were in the earlier period. But perhaps the same is true of all other consumers. If so, is the decrease in purchasing power experi-

enced by young singles larger, smaller, or about the same as that experienced by others? In other words, how are young adults faring compared with the rest of the population?

Comparing the changes in real total outlays from 1984–85 to 2004–05 for young singles with those of other single, never-married adults who also were surveyed during those periods is one way to attempt to answer this question. Before proceeding, it is useful to remove outlays for food at home from both groups, because of the change in questionnaire occurring in 1988. As noted earlier, young, single, never-married adults exhibit a large change (almost 45 percent) in food at home expenditures from 1987 to 1988 that is inconsistent with annual changes in these expenditures for this group in other years. Other single, never-married adults exhibit a similarly large (more than 38 percent) and inconsistent change in these expenditures. However, the factors required to adjust their expenditures are almost certainly different from those required for young single adults. Performing this adjustment would therefore add one more element of uncertainty to the comparison: If differences are found in the rates of change of total outlays for these groups, how much will be due to actual differences in expenditure patterns and how much to qualitative differences in the estimated factor for adjustment of food-at-home expenditures for each group? Therefore, for simplicity, outlays less food at home are compared.

For young singles, real total outlays less food at home fell 3.8 percent over time, from \$21,613 in 1984–85 to \$20,795 in 2004–05. For other singles, real total outlays less food at home increased 6.1 percent over the same period, from \$24,415 to \$25,906. Although this finding appears to indicate that young singles are falling behind in permanent income while others are gaining, it is not conclusive. First, neither change is statistically significant, indicating that the differences in means observed for each group across time may be due to chance alone. Second,



the increase in outlays for other singles may be due to changing demographics within this group. For example, the proportion of singles aged 35 to 54 years increased from 39 percent in 1984–85 to 56 percent in 2004–05. In each year during the period examined, never-married adults in both age groups had the highest levels of average total outlays. Therefore, even if average real total outlays for singles aged 35 to 54 years have not changed over time, the fact that there are more members of that group in the sample will increase the mean for the entire sample of other singles.

### Using shares to measure outcomes

Another useful tool for comparing the economic well-being of different groups is derived from a finding known as **Engel's proposition**. In 1857, Prussian economist Ernst Engel reported that, as income increases, the share of total expenditures allocated to food decreases.<sup>33</sup> The assumption in the analysis presented in this article is that the smaller the share of total expenditures a consumer allocates to expenditures for basic needs like food, the larger is the share available to allocate to other items. Therefore, understanding the allocation of shares of total outlays provides insight into the economic well-being of the groups studied. (For more information on analyzing shares, including caveats associated with this type of analysis, see "Analyzing shares" in the technical notes.) Table 2 shows shares of total outlays that young adults allocated to selected goods and services in 1984–85 and 2004–05.

Several findings are of note. First, the share of outlays allocated to food has declined over time—by more than 2 percentage points, in fact. Taken alone, this may indicate an increase in economic well-being. However, food outlays can be decomposed into two parts:

<sup>33</sup> Louis Philips, *Applied Consumption Analysis* (Amsterdam, Elsevier Science Publishers B.V., rev. ed. 1983; distributed in the U.S. and Canada by Elsevier Science Publishing Company, Inc., of New York, NY), p. 103.

outlays for food at home (for example, food purchased at grocery stores) and outlays for food away from home (for instance, food purchased at restaurants). Analyzing these components separately is useful, because they represent two different types of spending. Because of the convenience, change in ambience, and typically higher cost associated with meals at restaurants, these meals are considered to be a treat for many consumers; therefore, it is reasonable to suppose that an increased share for food away from home indicates an increase in well-being, while an increased share for food at home indicates a decrease in well-being. Over the period examined, the shares for food at home **and** for food away from home both decreased. Each of these changes is statistically significant, as are many of the other changes in share shown in the table. However, the directions of the changes in the components of food spending are contradictory, one indicating an increase, and the other a decrease, in economic well-being. Resolving this apparently paradoxical outcome is the topic of the next section. (See also "Analyzing shares" in the technical notes.)

### Other measures using outlays

Although analyzing shares of outlays provides an easy, intuitive way to compare economic statuses, it has its limitations. In historical comparisons, one major limitation is, once again, price change. When outlays within a certain period are compared, it is usually assumed that all groups face roughly the same prices. However, across different periods, prices for some goods and services may have risen, perhaps rapidly, while others stayed the same or even dropped. When prices are not changing at a uniform rate, the shares can be affected in ways that do not accurately reflect the underlying idea of analysis using a framework based on Engel's proposition. (See "Analyzing shares" in the technical notes.) Therefore, comparing real (price-adjusted), rather than nominal (contemporaneous), outlays for specific items is a useful way of

seeing whether a decrease in share is due to less consumption or a change in prices.

The CPI for food at home rose more than 81 percent from 1984–85 (103.6) to 2004–05 (188.0). Therefore, the real-dollar expenditure for food at home in 1984–85 was about \$2,252, which is more than the \$1,950 spent in 2004–05. Similarly, the CPI for food away from home rose about 79 percent from 1984–85 (106.3) to 2004–05 (190.5). Therefore, the real-dollar expenditure for food away from home in 1984–85 was about \$1,437, which is more than the \$1,073 spent in 2004–05. In each case, the real-dollar expenditure in 1984–85 is statistically significantly different from the value observed in 2004–05. Consequently, these findings are consistent with the Engel analysis, which indicates a higher economic well-being in the second period than in the first due to a decrease in expenditures for food at home, but a lower economic well-being in the second period due to a decrease in expenditures for food away from home.

Further analysis reveals another interesting finding: Although the percentage of respondents reporting expenditures for food at home remained unchanged (almost 97 percent in each period), the percentage reporting expenditures for food away from home fell nearly 5 percentage points (from 90.8 percent to 86.3 percent). This finding supports a diminution in economic well-being, given the smaller percentage of young singles who report expenditures for food away from home.

However supportive, by themselves these numbers do not conclusively indicate that the second group was worse off than the first. For example, an increased variety of frozen and prepared foods in the second period may mean that consumers can enjoy, at home, the convenience of food away from home at lower, grocery store prices. In addition, the consumer can make one trip to the grocery store each week and purchase all meals at once, rather than visiting a fast-food establishment every day, thus saving time. If all this is true,

Table 2. Average annualized outlays and shares, young single adults, 1984–85 and 2004–05

Outlay category	Average annualized outlay			Share (percent)		t-statistic
	1984–85		2004–05 nominal (real) dollars	1984–85	2004–05	
	Nominal dollars	Real 2004–05 dollars				
Total outlays <sup>1</sup> .....	\$13,145	\$23,866	\$22,744	100.0	100.0	...
Food, total less trips <sup>1</sup> .....	2,043	3,710	3,022	15.5	13.3	<sup>2</sup> -4.49
Food at home, less trips <sup>1</sup> .....	1,241	2,254	1,950	9.4	8.6	<sup>2</sup> -2.55
Food away from home, less trips.....	802	1,456	1,073	6.1	4.7	<sup>2</sup> -4.75
Shelter and utilities.....	3,113	5,652	7,249	23.7	31.9	<sup>2</sup> 9.88
Owned dwellings.....	353	641	1,326	2.7	5.8	<sup>2</sup> 4.53
Rented dwellings .....	2,039	3,702	4,602	15.5	20.2	<sup>2</sup> 5.99
Utilities .....	722	1,312	1,322	5.5	5.8	1.21
Apparel and services.....	821	1,490	757	6.2	3.3	<sup>2</sup> -8.84
Transportation.....	2,320	4,213	3,494	17.7	15.4	<sup>2</sup> -2.44
Cars and trucks (new).....	606	1,100	457	4.6	2.0	<sup>2</sup> -4.74
Cars and trucks (used) .....	462	840	853	3.5	3.7	.32
Other vehicles.....	31	57	33	.2	.1	-1.10
Gasoline and motor oil.....	583	280	969	4.4	4.3	-.86
Maintenance and repair.....	304	1,058	398	2.3	1.7	<sup>2</sup> -2.37
Vehicle insurance.....	211	552	487	1.6	2.1	<sup>2</sup> 3.40
Public transportation .....	49	383	76	.4	.3	-.62
Vehicle rental .....	74	89	223	.6	1.0	<sup>2</sup> 3.10
Health care.....	256	466	478	2.0	2.1	.55
Entertainment.....	703	1,277	1,129	5.4	5.0	-.79
Travel and trips .....	631	1,146	668	4.8	2.9	<sup>2</sup> -5.47
Education .....	558	1,012	1,760	4.2	7.7	<sup>2</sup> 2.55
All other outlays <sup>1</sup> .....	2,699	4,900	4,186	20.5	18.4	<sup>2</sup> -2.45

<sup>1</sup> Item or subcomponent computed with the use of adjusted values for food at home in 1984–85; see “Adjusting expenditures for food at home” and “Computing adjustment factors for food at home,” in the technical notes, for details.

<sup>2</sup> Indicates statistically significant difference in shares when

periods are compared.

NOTE: To convert to real 2004–05 dollars, nominal 1984–85 dollars are multiplied by 192.1 (the average CPI for 2004–05) and divided by 105.8 (the average CPI for 1984–85). Components may not add to aggregate values due to rounding.

then the decreased share for food away from home may indicate an **increase** in well-being. Yet, if it is true, it is inconsistent with the fact that real expenditures for food at home fell between the two periods; that is, given that the price index for food at home rose between the two periods, purchasing more food at home and less food away from home should lead to **higher**, not lower, real-dollar expenditures for food at home in the second period. Still, this outcome is not implausible. The price index for food at home is based on what **all** consumers purchase, and not solely on what young singles purchase. If young singles are purchasing more food at home, and the prices of the foods they tend to purchase have increased less than the prices of other types of food at home,

then the preceding findings are consistent with the hypothesis described here (that is, that young singles are substituting lower priced foods from grocery or other stores for food from restaurants). In fact, the CPI for frozen and freeze-dried prepared foods increased less than 48 percent (from 103.8 to 153.2) from January 1984 to December 2005, substantially less than the 81-percent increase in prices already reported for food at home in general.<sup>34</sup> However, to investigate this hypothesis fully requires both further investigation into price increases for specific foods and an examination of data from the CE’s Diary component, or Diary Survey, which, unlike the Interview Survey, is designed to collect detailed information on food expenditures. Such an investigation, while

<sup>34</sup> To better understand this chain of reasoning, suppose that young singles purchase only frozen and freeze-dried prepared foods in both periods, while other consumers purchase different foods. Then adjusting food-at-home expenditures for young singles will overestimate their real expenditures for food at home purchased in 1984–85. If the overestimate is large enough, it will make it appear that young singles have lower expenditures for food at home in 2004–05 than they did in 1984–85. Now, as seen from the values presented in table 2, real expenditures for food at home decrease for young singles when the CPI for all food at home is used to adjust these expenditures. But if young single consumers really did purchase only frozen and freeze-dried prepared foods in each period, then the \$1,241 nominal expenditure shown in that table should be adjusted to \$1,832 [ $1,241 \times (153.2/103.8)$ ]. Then, because \$1,832 is less than the value reported in 2004–05 (\$1,950), it follows that young singles actually purchased more food at home in the second period than the first, and they may have done so because they purchased less food away from home, just as the hypothesis purports.

Table 3. Housing attributes of young singles, households including at least one young single person, 1984–85 and 2004–05

Characteristic	Household includes only young single person			Household includes at least one other person		
	1984–85	2004–05	t-statistic <sup>1</sup>	1984–85	2004–05	t-statistic <sup>1</sup>
Sample size .....	1,252	1,401	...	701	410	...
Percent of households with at least one young single person.....	64.1	77.4	8.91	35.9	22.6	-8.91
Percent owners.....	10.5	21.1	7.42	( <sup>2</sup> )	( <sup>2</sup> )	...
Per-capita number of: <sup>3</sup>						
Rooms, other than bedrooms .....	3.7	3.9	4.62	2.0	2.0	1.68
Bedrooms .....	1.4	1.7	8.31	.9	1.1	5.99
Bathrooms .....	1.1	1.2	10.96	.5	.6	4.64
Half baths .....	.1	.1	3.44	( <sup>4</sup> )	.1	1.60

<sup>1</sup> Based on test of proportions when percentages are compared and difference in means when number of rooms are compared. (See "Measuring statistical significance: types and computations of t-statistics," in the technical notes, for details.)

<sup>2</sup> Results are not computed for multiple-member households. The problem is that, within the household, there can be a mix of owners and renters. For example, the homeowner may rent a room or part of the house to at least one young single person. In addition, in this case the consumer unit that owns the home may be of any composition. That is, the owner may be a young, single person, as defined throughout this study, or may be of a different age or marital status.

<sup>3</sup> These households include at least one young single person, as defined in this study, who constitutes a unique consumer unit within

the household. However, the remaining members may constitute any number of consumer units from one to the total number of other members of the household. For example, if a husband and wife with two children rent a room to a young single, the household size is five, but the number of consumer units is two. In this case, the per-capita number of rooms is still computed to be the total number of rooms in the household divided by the household size, whether or not the renter has full use of other rooms in the house.

<sup>4</sup> Less than .05.

NOTE: Values presented are for the sample and are not weighted to reflect the population. Weights computed in the survey are designed for use with consumer units, not households.

interesting for future work, is beyond the scope of this study.

Regardless, expenditures on other goods and services are also useful to examine. First, consider the case of shelter and utilities.<sup>35</sup> The share allocated to these outlays has increased substantially, from less than one-fourth to nearly one-third of total outlays. Again, it is possible that housing attributes account for this change. Now, if outlays for shelter and utilities have risen because young singles are purchasing or renting larger homes, the change in share may be due to an increase in their well-being. However, evidence to suggest such purchases is limited. For example, only the increase in number of bathrooms (see table 1) is statistically significant for both owners and renters. The changes in the numbers of bedrooms and half baths for renters, while statistically significant, are not necessarily economically significant. (For example, the number of bedrooms for those who rent increased from less than 1.8 to less than 2.1.) Neither homeowners nor renters experienced a sta-

<sup>35</sup> Because rent includes utilities in some cases, comparing only expenditures for rent with outlays for a mortgage does not provide an accurate comparison of basic housing costs.

tistically significant change in "rooms, other than bathrooms." Although other factors, not measured in the CE, also affect these outlays—for example, the quality of the neighborhood in which the housing exists—the substantial change in these shares, coupled with the considerable increase in housing prices noted in recent years, may be evidence of a diminution of well-being for this group, or at least that the increase in well-being from slightly larger dwellings is more than offset by the increase in outlays. However, these data do not tell the full story. The numbers of rooms, bedrooms, bathrooms, and half baths are all described for the **consumer unit**. However, many of the consumer units sampled actually reside in the same **household**. It is quite possible that numbers of rooms per consumer unit have not changed, but that the number of households in which these consumer units reside has changed; if the number has increased, it could indicate an increase in well-being. To illustrate, consider two young singles sharing a one-bedroom apartment (that is, two separate consumer units sharing one household). Suppose that each roommate is interviewed and

reports that the apartment has one bedroom. Then the data would show two separate consumer units, each with one bedroom. Now suppose that one roommate moves into a new apartment, also containing one bedroom. Then, assuming that each of the former roommates still lives alone, the data still show two separate consumer units with one bedroom. Yet, if they prefer to live alone, the constant number of rooms per consumer unit would not reflect the hypothetical increase in their well-being. Fortunately, the data provide information that allows the analyst to distinguish these two cases. That is, it is possible to count the number of consumer units per household to see whether two roommates are sharing one household with one bedroom or two young singles live alone in separate households, each of which contains one bedroom. Analyzed in this way, the results tell a different story: First, in 1984–85, more than one-third (nearly 36 percent) of the

<sup>36</sup> The other person or persons could be roommates, the landlord, or anyone else not related by blood, marriage, or some other legal arrangement and from whom the young single is financially independent. If any of these conditions is violated, the young single would no longer constitute a single-member consumer unit.

young singles studied lived in a household with at least one other person;<sup>36</sup> then, in 2004–05, less than one-fourth (under 23 percent) did. (See table 3.)

Of course, some caution must be used in interpreting these numbers. The data are not edited for consistency, for example. Therefore, it is possible that, due to differences in the way respondents interpret their situations (for instance, one housemate reports the second bedroom, which is being used as a den, as a room other than a bedroom, while the other reports it as a second bedroom), data entry error, or another reason, different numbers of rooms or bedrooms are reported for the same household within or across interviews. Also, some of the information is missing due to nonresponse or some other reason. But assuming that these factors are random each year, the data obtained provide useful information to help measure changes in numbers of rooms available to young single adults. Analyzed in this way, the data show that, regardless of household composition—at least, whether one or more than one person lives in the household—the number of rooms per capita has increased over time. Although the increases are small, they are statistically significant in most cases. Especially because more young singles are the sole occupants of their households, it is more difficult to argue that the increased expenditures for housing noted at the consumer-unit level clearly indicate a diminution of well-being. Those who are the sole occupants of their households may value privacy enough to pay the extra dollars, and if they can afford to do so in larger numbers in the later period than in the earlier period, then they are arguably better off in the later period, or at least any diminution in well-being due to higher housing prices is offset at least partially by an increase in privacy or in the number of bedrooms and bathrooms per capita.

In contrast to housing expenditures, which are necessary for at least a minimal level of economic well-being, travel expenditures are purely discretionary for most consumers. Therefore, an

increase in the frequency of purchasing goods or services related to travel or in dollars allocated toward trips presumably indicates an increase in economic well-being. However, for young singles, the share of total outlays allocated to travel has fallen substantially, from 5 percent to 3 percent. At the same time, the percentage of respondents reporting travel expenditures has decreased sharply, from more than half (53 percent) to more than one-third (35 percent). The percentage reporting many of the components of travel expenditures (such as food, lodging, transportation, and entertainment on trips) also has declined. Therefore, the drop in share is not the result of decreased prices, nor is it likely that members of this group are making different lodging arrangements than before (for example, staying with friends or relatives instead of in hotels). Young singles simply appear to be traveling less. However, they are not unique in this regard: The percentage reporting travel expenditures (including the components previously described) has decreased for all other consumer units as well during the period examined. (See chart 1.) Accordingly, rather than decreased prices, **increased** prices may play a role.<sup>37</sup> In addition, these changes in travel expenditures may be explicable by changes in technology. For example, the percentage

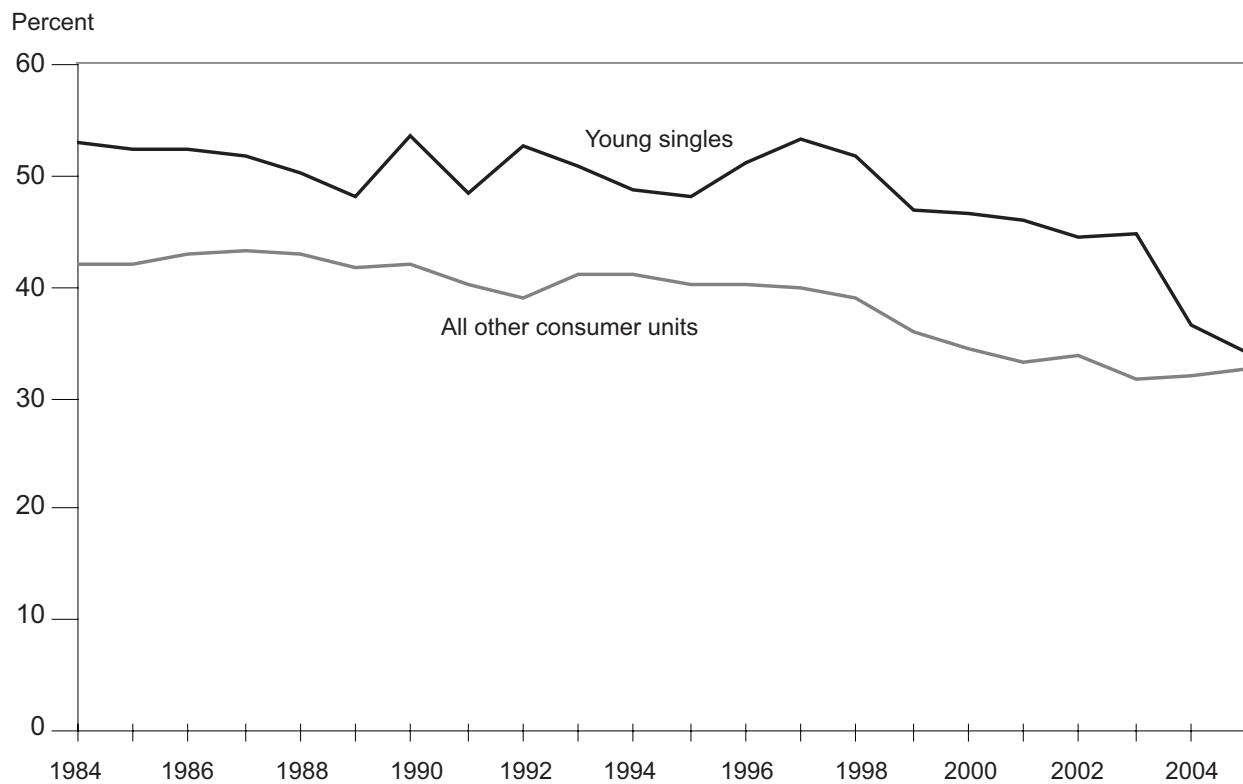
<sup>37</sup> The CPIs for at least three categories of goods and services directly related to travel are readily available on the Internet ([data.bls.gov/PDQ/outside.jsp?survey=cu](http://data.bls.gov/PDQ/outside.jsp?survey=cu) (visited Dec. 5, 2007), accessible by using “One-screen data search” for the database named “All Urban Consumers (Current Series) (Consumer Price Index—CPI)” at [www.bls.gov/cpi/home.htm#data](http://www.bls.gov/cpi/home.htm#data) (visited Sept. 18, 2008)). In each case, the increase in the CPI for these categories is higher than the increase in the CPI for all goods and services from 1984 to 2005 (88 percent). The categories are “other lodging away from home, including hotels and motels” (157 percent); “gasoline (all types)” (99 percent); and “airline fare” (243 percent). Changes in annual indexes are compared in this case, instead of changes from January 1984 to December 2005, in order to reduce the effects of in-year volatility. Prices for each of these travel expenditure categories presumably vary by season if not by month, so comparing values for different months across years, rather than comparing average annual values, may either mitigate or exacerbate differences in price changes computed. In addition, seasonally adjusted indexes are not available for airline fares in years prior to 1989.

reporting travel expenditures decreased as e-mail, cellular telephones, and instant messaging became more available. Therefore, consumers in general (and young singles specifically) may be substituting new forms of communication for travel, which would indicate an increase in their economic well-being. That is, young singles in the later period enjoy choices not available to those in the earlier period.<sup>38</sup> However, there is still no perfect substitute for the personal visit. From this perspective, the availability of new technology mitigates the decrease in well-being resulting from less frequent travel, whatever its cause (for example, increased prices), but does not necessarily negate (or outweigh) the decrease entirely.

Of particular interest is the change in shares for educational expenses, which nearly doubled over the period examined. This change is challenging to interpret. The proportion of young single adults enrolled in college full time rose sharply—from just above one-fourth (26 percent) to more than one-third (36 percent); the proportion of part-time students remained unchanged at about 7 percent, while the proportion not enrolled (including those not eligible) declined almost 11 percentage points. (See table 1.) However, those reporting educational expenditures actually dropped slightly—from 26 percent to 24 percent. Of course, not all of the

<sup>38</sup> Evidence supporting the hypothesis that consumers substitute new forms of communication for travel is seen in the CE results. The trend line for the percentage of those reporting total travel expenditures is much steeper downward from 1997 to 2005 than it is from 1984 to 1996, a pivotal year that coincides with a period of rapid increase in usage of these technologies. For example, the U.S. Census Bureau reports that in 1997 less than three-eighths (36.6 percent) of all households owned a computer and that about half of these households (18.0 percent of all households) had Internet access. By 2003, nearly five-eighths (61.8 percent) of all households owned a computer and nearly eight-ninths of these households (54.7 percent of all households) had Internet access. See Jennifer Cheeseman Day, Alex Janus, and Jessica Davis, “Computer and Internet Use in the United States: 2003,” *Current Population Reports*, P23-208, October 2005, pp. 1–14, especially Figure 1, p. 1, on the Internet at [www.census.gov/population/www/socdemo/computer.html](http://www.census.gov/population/www/socdemo/computer.html), item 1, CPS, October 2003, “Report” (visited Dec. 5, 2007).

Chart 1. Percent reporting expenditures for travel, 1984–2005



expenditures included in the CE definition of educational expenditures are for college tuition; however, the tuition expenditure accounts for a substantial portion.<sup>39</sup> Although many of these students may be receiving scholarships, participating in deferred payment plans, or working for payment of tuition instead of working for other pay, or may be children of parents who pay their tuition directly to the school, it is likely that those who do make payments were paying much more for their education in 2004–05 than those who did in 1984–85, even after adjustment for general price changes. In support of this claim, recall the increase in college tuition and fees described earlier. The fact that more young adults are attending college either because of a greater opportunity to do so or because of the changing nature of the general economy probably reflects an improvement

<sup>39</sup> For all consumer units, college tuition accounted for 58 percent of educational expenditures in 1984–85 and 64 percent in 2004–05.

in economic well-being. However, the fact that the price of going to college has escalated so much means that the expected gains from a college education would have to rise substantially for current students to “break even” with their older counterparts.<sup>40</sup>

#### Demographic differences among young singles

So far, the analyses presented have focused on young single adults as a group. However, as noted earlier, there are demographic differences within this segment of the population that either may account for changes in the group overall or may be obscured when

<sup>40</sup> The increase in education expenditures presumably also affects the allocation of shares for those who pay them. That is, given the same amount of funds available for spending, the person who allocates more to education has less to allocate to food, housing, and all other goods and services. However, separating out those who make these expenditures from those who do not and comparing the differences in their share allocations, both within and across various periods, is beyond the scope of this discussion.

the group is examined as a whole. For example, an increase in total outlays may be observed because one group has “caught up” to another or because both subgroups have experienced an increase in total outlays but one group has experienced a larger increase than the other. To examine these outcomes, total outlays for selected demographic groups within the young singles sample are compared.

Table 4 shows that, consistent with the larger population of young single adults, no subgroup tested experienced a statistically significant change (increase or decrease) in real total outlays. However, within each subgroup, substantial differences appear in each period observed. For example, total outlays for single men substantially exceed total outlays for single women in each period. Although the gap is larger in 1984–85 (18.5 percent) than in 2004–05 (12.6 percent), the decrease is due to a decrease in total outlays for men, rather than an increase in outlays

Table 4. Real total outlays, by demographic group, 1984–85 and 2004–05

Demographic characteristic	Real total outlays, 1984–85	Standard error	Real total outlays, 2004–05	Standard error	Percent change in real total outlays	t-statistic (change in mean of real total outlays)
All young single adults.....	\$23,866	663.03	\$22,744	531.85	-4.7	-1.32
Men.....	25,585	844.92	23,838	722.68	-6.8	-1.57
Women.....	21,536	717.51	21,151	637.39	-1.8	-4.0
Non-Hispanic:						
White.....	24,122	557.19	22,977	638.19	-4.7	-1.35
Black.....	23,416	1,975.59	21,644	1,456.91	-7.6	-.72
Hispanic.....	18,508	4,047.05	21,585	1,400.21	16.6	.72
High school or less.....	21,617	1,126.33	19,316	877.42	-10.6	-1.61
Some college.....	21,283	808.08	19,846	765.83	-6.8	-1.29
College graduate.....	28,685	1,209.18	27,962	848.94	-2.5	-.49

for women. Nevertheless, the decrease is not statistically significant and therefore reveals nothing about the change in relative well-being between young single men and women in this study.

Similarly, Hispanics appear to have the smallest total outlays, on average, in each period, but regardless of the interval studied, the difference in average total outlays is not statistically significant when Hispanics are compared with either group of non-Hispanics. The results—both within 1984–85 and across the time span examined—are more difficult to interpret, though, because of the relatively large variance of total outlays for Hispanics in the earlier period. At the same time, for non-Hispanics, the gap in real total outlays between Whites and Blacks nearly doubled from 1984–85 (\$706) to 2004–05 (\$1,333). In this case, both groups experienced decreases in average real total outlays, but the decrease for young Black singles (\$1,772) was larger than the decrease for young White singles (\$1,145). Nonetheless, neither the difference within, nor the difference across, periods was statistically significant for either of these groups.

By contrast, there are clear differences by education level: Those with a college degree have significantly—in both economic and statistical terms—higher total outlays in each period than those who have not earned a college degree. However, there are no statistically

significant differences between the two groups of non-college graduates (that is, those with a high school diploma or less and those who attended, but did not graduate from, college).

### Conclusion

Both demographic and spending patterns changed for young, never-married adults from 1984–85 to 2004–05. Whether these changes indicate an increase or decrease in economic status is unclear. By some measures, such as the rate of economic growth and unemployment rates, the more recent group is at least as well off—if not better off—than the earlier group. The more recent group also enjoys higher educational attainment and higher rates of homeownership, both of which are generally considered positive attributes.

However, other results indicate that there has been little discernible change over time. When average real total outlays for subgroups of young single adults, such as men and women, are compared, differences across groups within each period are apparent, but changes within groups across time are not generally observed.<sup>41</sup> Although it may be interesting to perform Engel or

<sup>41</sup> These findings are confirmed by regression analysis, which estimates changes in real total outlays over time when demographic differences are held constant. An explanation of the technique, together with some results obtained, is included in the complete version of this article in the December 2008 issue of the *Monthly Labor Review*.

some other, similar analysis on the demographic subgroups, this task is left for future work.

Finally, the evidence that young singles are worse off today is inconclusive. For example, young singles experienced a decrease in real total outlays from 1984–85 to 2004–05, while other singles experienced an increase during that time. However, neither change was statistically significant. In addition, young singles today allocate smaller shares of total outlays to food away from home and to travel, and larger shares to food at home and to housing. Each of these changes would appear to indicate a diminution in economic well-being, yet they are consistent with increased economic well-being as described earlier: The increased share for food at home may be due to the greater availability of convenience foods, allowing young singles to save time and money by “stocking up” rather than frequenting restaurants; and the housing share may have increased because more young singles are living alone, presumably by choice, and also because they are more likely to be homeowners.

Taken together, the results described in this study do not indicate that young singles were clearly better off in the second period than the first, a finding that is consistent with the belief among young adults that it is harder for them to gain economically than it was for

their parents.<sup>42</sup> Still, the results do not provide strong evidence that young singles are **worse** off than their predecessors, as has been found in previous

<sup>42</sup> Crowley, "Generation X Speaks Out," p. 2; based on interviews conducted in 2000–01 of young adults born from 1968 to 1979.

<sup>43</sup> Paulin and Riordon, "Making it on their own," especially p. 18.

work.<sup>43</sup> Given that previous work compared young adults in the mid-1990s with those in the mid-1980s and found a decrease in economic well-being, the current results may indicate that the fortunes of young adults are improving after a period of decline. This finding suggests that future work examining trends in outlays and other measures of

well-being for young adults would be useful in order to provide a fuller perspective on what changes have occurred and when they did so. In the meantime, it is valuable to continue to monitor expenditure patterns for young singles to better understand the challenges they face and how such challenges may affect them and others in the future. ■

# Technical notes

## Analyzing shares

In analyzing shares, the allocations of total outlays for two different groups are compared to find out which group is better off. To understand this idea, consider two single persons, each of whom purchases the same amount of food each week for \$20. Suppose the first person has the lower income and spends \$100 per week on all purchases; the second person spends \$200 per week. The share of expenditures allocated to food is 20 percent for the first person, but only 10 percent for the second, even though the same amount of food is purchased. Even if the second person buys more, or higher quality, food for \$30, the share increases only to 15 percent. In each case, the second person has a larger portion of spendable dollars left over to purchase goods and services other than food than does the first person; therefore, the second person is considered to be better off.

Although analyzing shares is particularly useful for comparing groups within the same period, there are some caveats to consider in analyzing changes in shares over time. For example, important information can be masked by price changes. To see this effect, consider a person who enjoys apples as an occasional snack and budgets \$10 per month for their purchase. If the price of apples is \$1 per pound, this person can afford 10 pounds per month. If the price rises to \$2 per pound, the person can afford only 5 pounds per month. If no other prices change, and the person's expenditure pattern remains the same in all other respects, then the share of total outlays allocated to apple purchases remains the same each period, yet the person is enjoying fewer pounds of apples.

If, then, the change in the price of apples is known, expenditures can be adjusted, and it becomes clear that the person is purchasing fewer pounds of apples. In the current example, the price of apples has doubled. Therefore, if the person bought the apples in the first period at the price of the second period, then the expenditure in the first period would be double the value observed. (That is, 10 pounds of apples purchased at the price of the second period would cost \$20, not \$10.) Because the price-adjusted outlay for the first period (\$20) is larger than the observed outlay for the second one (\$10), it is clear that the number of pounds of apples purchased has declined in the second period. This relationship (higher price-adjusted expenditures mean a larger quantity purchased) holds even when the actual number of pounds of apples (or quantity of other goods and services) purchased is unknown, as it is for the values shown in table 2 in the text.<sup>1</sup>

In addition, the allocation of total outlays changes with tastes and preferences, which in turn can change over time for individuals or groups. In cases such as these, in which both kinds of change occur, changes in shares are not so easy to interpret. For example, as discussed in the text, the share for food away from home has been decreasing over time, while the share allocated to food at home has been increasing.

<sup>1</sup> In general, the Consumer Expenditure Survey (CE) collects information on expenditures made, but not on amounts or quantities purchased. For example, a person may report having spent \$20 for movie tickets in the past 3 months, but data on whether that person went to the movies twice and spent \$10 each time or went 10 times to a discount movie theater are not collected.



Assuming that food away from home is preferred to food at home, this outcome reflects a decrease in well-being. However, if young adults in the second period have a higher preference for education than they did in the first period, they may forego some of the expenditures for food away from home in order to purchase education, even if the costs of education remain stable. In that case, if the increase in well-being due to purchasing more education is larger than the decrease due to purchasing less food away from home, then young adults in the second period are better off than they would be if they did not make such a tradeoff.

Finally, changes in technology and in the availability of products can influence the allocation of total outlays. As noted in the text, the availability of new types of food at home may lead to changes in purchases such that the increased share for food at home and decreased share for food away from home reflect an increase in well-being. Similarly, changes in technology or in the availability of products may lead less directly to changes in certain shares. For example, young adults in the first period may have purchased food away from home in conjunction with entertainment away from home (as when they go out for dinner and a movie). Although they still may do so in the second period, new products or services may have been developed that allow young adults to enjoy similar forms of entertainment at home (for instance, joining a movie-by-mail rental club or viewing movies over the Internet). In this case, the share for food away from home could decrease while both the share for food at home and well-being increase, because young adults in the second period could still choose to purchase the same amount of food and entertainment away from home as those in the first period did, but they are also able to choose an allocation that was not available in the first period.

Because no data on tastes, preferences, technological change, or the availability of products are collected directly in the Consumer Expenditure

Survey, it is impossible to identify precisely how these factors change and how expenditure patterns change as a result. Nevertheless, despite these caveats, analyzing shares in a historical context is useful as long as the assumptions underlying the analysis are reasonable and explicitly stated as needed.

**Real or nominal expenditures?** In performing economic comparisons across time, it is essential to control for changes in prices. To demonstrate, consider a person who spends \$10 for apples in the first period and \$20 in the second. It may be that the person purchased twice as many pounds of apples in the second period. But it also may be that the price changed (rose or fell) and the person purchased a different amount each period. For example, if the price of apples is \$1 per pound in the first period, but \$4 per pound in the second, it is clear that the person bought a greater amount of apples (10 pounds) in the first period than in the second (5 pounds). Usually, expenditures can be adjusted to reflect these changes by converting nominal expenditures to real expenditures through the mechanism of a price index. After adjustment, real expenditures can be compared to provide a better idea of whether changes in expenditures are due to changes in quantities purchased or changes in prices.

Price indexes are computed by comparing changes in price for a standard market basket of goods. In this case, the basket consists only of apples. Once the basket is defined, the index is computed by dividing the price of the basket in the period of interest by the price of the basket in the base period and multiplying the result by 100.0. In the base period, the period of interest and the base period are the same. Therefore, the index in the base period is always 100.0. However, if prices are different in the period of interest, the index will take on a higher or lower value, depending on the direction of the price change. For example, if the first period is selected as the base period and the basket is defined as con-

sisting of 1 pound of apples, then the base-period index is computed to be  $(\$1/\$1) \times 100.0 = 100.0$ . The index for the second period is  $(\$4/\$1) \times 100$ , or 400.0.

Once the indexes are computed, they can be used to convert nominal expenditures to real expenditures. In the current case, suppose the analyst wants to convert the nominal value of expenditures reported in the first period to real-dollar values for comparison with expenditures occurring in the second period. In other words, the analyst wants to know how much the market basket purchased in the first period would have cost if it had been purchased in the second period. The result is obtained by dividing the price index for the second period by the price index for the first period and multiplying the result by the expenditures reported in the first period. In this example, then, the equation is  $(400.0/100.0) \times \$10 = \$40$ . In other words, in the second period it costs \$40 to purchase the same amount of apples that was purchased in the first period. Even if the quantity of apples purchased is unknown to the analyst, it is clear that the purchaser must have purchased fewer pounds of apples in the second period than in the first period, because the value of real expenditures reported in the first period (that is, \$40) exceeds the value of real expenditures reported in the second period (that is, \$20).<sup>2</sup>

Note that this adjustment works because expenditures are defined as

<sup>2</sup> Note that similar comparisons can be made even when neither period of interest is the base year for the index. For example, suppose that the analyst wants to compare expenditures that took place before the base year with those in the second period. Suppose also that the price index for the pre-base-year period in question is 80.0 and the expenditures for that period are \$3. To convert these expenditures to second-period values, the analyst once again multiplies the expenditures from the pre-base-year period by the ratio of the second-period index to the index for the pre-base-year period (that is,  $[400.0/80.0] \times \$3 = \$15$ ). In other words, real expenditures in the pre-base-year period are less than the value of expenditures reported in the second period. Therefore, the purchaser must have purchased more pounds of apples in the second period than in the pre-base-year period, even though the price of apples has increased.

price ( $P$ ) times quantity purchased ( $Q$ ). Therefore, if  $P_1Q_1$  (that is, the expenditure in the first period) differs from  $P_2Q_2$ , it is not clear whether the difference is a result of changes in  $P$  or in  $Q$ . However, adjusting first-period expenditures in the manner just described has the effect of comparing  $P_2Q_1$  with  $P_2Q_2$ . Therefore, any difference in expenditure is due to a change in quantity.

However, the comparison is not always so precise. In this case, the analyst is literally comparing apples with apples. Suppose, however, the consumer purchases both apples and oranges. This purchase leads to a potential comparison of two different baskets of fruit. That is, suppose that the initial basket consists of 1 pound of apples and 1 pound of oranges. Suppose also that the price of apples remains unchanged, but the price of oranges rises. Then the price index for fruit will rise, because it reflects the change in the total price of a basket of fruit consisting of 1 pound of apples and 1 pound of oranges. However, in response to the price change, the consumer may choose to purchase fewer pounds of oranges and continue to purchase 1 pound of apples. Alternatively, the consumer may substitute apples for oranges (that is, purchase more than 1 pound of apples and less than 1 pound of oranges) or may indeed purchase less than 1 pound of each fruit. Only if the consumer continues to purchase 1 pound of apples and 1 pound of oranges after the price change will the index perfectly adjust nominal expenditures in the first period to values that are to be compared with those observed in the second period.<sup>3</sup>

Nevertheless, using the price index to convert nominal expenditures to real expenditures is important. Although the results may not provide a perfect

<sup>3</sup> These comments pertain to the Laspeyres index, upon which the Consumer Price Index (CPI) is based. [See *BLS Handbook of Methods* (U.S. Bureau of Labor Statistics, June 2007), Chapter 17, "The Consumer Price Index," especially p. 3, on the Internet at [www.bls.gov/opub/hom/pdf/homch17.pdf](http://www.bls.gov/opub/hom/pdf/homch17.pdf) (visited Mar. 25, 2008).] Although other price indexes exist that attempt to adjust for these kinds of substitutions, a complete discussion is beyond the scope of this article.

adjustment to the first-period expenditures for comparison over time, they still provide better information for analysis than a comparison of unadjusted values. Like any tool, a price index has to be used cautiously and correctly, and the analyst has to be aware of both its uses and its limitations before drawing analytical conclusions.

### Statistical procedures

**Adjusting expenditures for food at home.** In the Interview component, or Interview Survey, of the CE, data on expenditures for food at home are collected by means of two questions. Prior to 1988, the first question asked about monthly expenditures for food at grocery stores and the second asked about monthly expenditures for food at other stores, such as convenience stores. In 1988, each question was changed to ask about weekly expenditures for these items. From 1987 to 1988, average expenditures for food at home for young single adults rose 44.8 percent. By contrast, from 1984 to 1987 the average annual increase (2.5 percent) was similar to the average annual increase from 1988 to 2005 (1.9 percent).<sup>4</sup> Because the change in these expenditures in any single year other than from 1987 to 1988 ranged between -9.8 percent (from 1992 to 1993) and 8.6 percent (from 2003 to 2004), the large change from 1987 to 1988 is presumably due to the change in the two questions.

Some of the change may be due to the way in which respondents think about the questions, as well as the way in which the processing of the data changed starting in 1988. When asked to report monthly expenditures, respondents may have thought about weekly expenditures, which they then multiplied by 4 before reporting. For example, a respondent with \$50 in usual weekly expenditures would have reported \$200 per month. During proc-

<sup>4</sup> The food-at-home figure is computed by comparing the value in the final year of interest with the value in the first year of interest and computing the percentage by which expenditures would have to increase each year to reach the value in the final year. The formula is described subsequently in this section of the appendix.

essing, these monthly reported expenditures were multiplied by 3 to produce quarterly estimates, because there are 3 months per quarter. In this example, \$600 would be the resulting quarterly expenditure estimate. However, when weekly expenditures are collected directly, they are multiplied by 13 to obtain quarterly estimates, because there are 13 weeks per quarter. Thus, the quarterly estimate would be \$650, not \$600. However, if the hypothesis presented here is correct, then quarterly expenditures are expected to rise about 8 percent due to the change in the questionnaire, because, essentially, reported expenditures are being increased by about one-twelfth. (That is, when monthly expenditures are multiplied by 3, only 12 weeks of expenditures compose the quarterly estimate, whereas, since 1988, an extra week is included in the composition of the quarterly estimate). Of course, even if this hypothesis is correct, expenditures for 1988 could increase by more or less than 8 percent, due to changes in prices or other exogenous factors that contribute to the natural variation in expenditures for food at home from year to year. Still, the increase of nearly 45 percent strongly reduces the credibility of the aforementioned hypothesis, especially because data on expenditures for food at home (excluding food prepared by the consumer unit on out-of-town trips) published in standard tables, which are derived from the Diary component, or Diary Survey, of the CE, do not show such a change from 1987 to 1988.<sup>5</sup>

Therefore, to account for the change—whatever its cause—requires an adjustment more complicated than adding 8 percent to reported expenditures in order to make expenditures in 1984–85 more comparable to those reported in 2004–05.

To start, it is important to note that in the Interview Survey, as mentioned,

<sup>5</sup> For all consumer units, average annual expenditures reported in the Diary Survey for food at home excluding food prepared by the consumer unit on out-of-town trips increased by 1.8 percent from 1987 to 1988; at the same time, these expenditures increased by 16.2 percent according to results from the Interview Survey.

information on expenditures for food at home excluding food prepared on trips consists of data collected from two questions: one on food purchased from grocery stores, the other on food purchased from other stores, such as convenience stores. Both questions changed in 1988 to request usual weekly, rather than monthly, expenditures. Each question was affected by the change in the magnitude of the response to it: For those reporting expenditures at grocery stores, the expenditure increased more than one-third (37 percent); however, for those reporting expenditures at other stores, the expenditure more than doubled (rising almost 104 percent). Nevertheless, the change in the questions does not appear to have affected the rate of response to them: From 1986 to 1989 (that is, the last 2 years of the monthly question and the first 2 years of the weekly question), the percentage of respondents reporting purchases at grocery stores ranged from 95.9 percent (1986) to 96.8 percent (1989), while the percentage reporting purchases at other stores ranged from 40.4 percent (1988) to 42.0 percent (1987).

The next step is to estimate the values that would have been reported in 1984 and 1985 had the questions asked about usual weekly, rather than monthly, expenditures. One method is simply to adjust the 1984 and 1985 expenditures by the percent change reported from 1987 to 1988. Consider, for example, expenditures at grocery stores. As mentioned earlier, the change in the mean for young singles who report these expenditures was 37 percent. Therefore, multiplying these expenditures, as reported in 1984 and 1985, by 1.37 would increase them by the appropriate amount. However, this method is too simplistic, for when the 1987–88 change is excluded, the percent change in expenditures at grocery stores ranges from –9.8 percent (from 1992 to 1993) to 9.1 percent (from 1991 to 1992). Even excluding this period of volatility (from 1991 to 1993), the percent change ranges from –2.8 percent (from 1988 to 1989) to 7.5 per-

cent (from 1999 to 2000). Therefore, it is difficult to say how much of the 37-percent change is due to the change in the questionnaire and how much is due to natural variation in reported expenditures. Simply multiplying expenditures reported in 1984 and 1985 by 1.37 may substantially over- or underestimate the values that would have been reported if usual weekly expenditures had been collected then.

Instead, regression is used to estimate the adjustment factor. In each regression (run separately for grocery store expenditures and other store expenditures), for those reporting expenditures in each year, the natural logarithm of the mean value of their expenditures is regressed on certain variables (described subsequently), the values of which depend on the period. The purpose of this logarithmic model is to use a formula that is well known in finance, namely,  $A_t = A_0 e^{rt}$ , where  $A_0$  is the initial amount invested in an account,  $r$  is the rate of growth (for example, the interest rate) of the investment,  $t$  is the number of periods,  $e$  is a transcendental number equivalent to approximately 2.718, and  $A_t$  is the amount in the account in the final period. In the study of expenditures,  $r$  is the average annual rate of change of expenditures and can be calculated when other variables in the equation have known values. In the present case, the mean value for young singles who reported grocery store expenditures in 1984 was  $A_0 \approx \$216$ . In 1987, the value was  $A_t \approx \$229$ . Accordingly, by what rate would expenditures have to have increased each year to meet these conditions? To find out, the natural logarithm of both sides of the earlier equation is taken, or  $\ln(A_t) = \ln(A_0) + rt$ . From this point forward,  $r$  can be found with standard algebra, given that  $t$  is 3 (because the initial \$216 grew for 3 years after 1984—that is, from 1984 to 1985, from 1985 to 1986, and from 1986 to 1987).

Although this method describes the average annual growth rate necessary to move from the values observed in 1984 to those observed in 1987,

the rate obtained may be affected by random variation in the data. That is, suppose that a drought or some other event caused prices, and therefore expenditures, to be higher than usual in 1984, but that they returned to their expected level in 1987. Then the average annual growth rate computed in this way would underestimate the actual underlying long-term growth rate, because expenditures in 1984 would have started at a higher level than expected and therefore would need to increase less swiftly each year to reach the expected 1987 level than they would have had observed values equaled expected values in both years. To estimate both the initial expected starting value and the underlying long-term growth rate, then, regression is used. Note that when the natural logarithm of expenditures is regressed on time values, the intercept of the equation estimates  $\ln(A_0)$ —the logarithm of the expected value of expenditures when  $t$  equals zero—and the coefficient of  $t$  is the estimated average annual growth rate for the long-term trend.

Before performing the regression, it is important to note that the change in question may have affected not only the intercept of the equation, but also the rate at which reported expenditures change over time. To find out, a single regression is run so that the coefficients of the intercept and slope for the 1984–87 equation can be compared with those for the 1988–2005 equation. The equation for the regression is

$$\ln(A_t) = c_1 B_1 + c_2 B_2 + r_1 B_1 t + r_2 B_2 t + u.$$

In this regression, binary variables are used for convenience in place of the traditional intercept. The first binary variable ( $B_1$ ) equals unity for the years 1984 through 1987 and zero for 1988 through 2005. The second binary variable ( $B_2$ ) equals zero for the initial years (1984 through 1987) and unity for the later years (1988 through 2005). Next, each year is assigned a value  $t$  for the period it represents. For 1984,  $t$  equals zero; for 2005,  $t$  equals 21. This time variable is not included separately

in the model; however, it is multiplied by each of the binary variables just described, and these interaction terms are included in the model. The coefficients  $c_1$  and  $c_2$  of the binary variables provide the estimated intercept for each of the periods, while the coefficients  $r_1$  and  $r_2$  of the interaction terms provide the estimated long-term growth rates for each model. (The final term,  $u$ , is the error term.) As expected, the difference of the coefficients of the binary variables is statistically significant, indicating that there was a change in reported values when the new question was introduced. However, the difference of the coefficients of the interaction terms is not statistically significant, as shown by an F test.<sup>6</sup> Therefore, the hypothesis that the question had no effect on the underlying trend is reasonable on the basis of the evidence.

With the regression results computed, the coefficients of the binary variables are used to calculate the adjustment factor. Note that the coefficient of the second binary variable provides an estimate of what the natural logarithm of reported expenditures would have been in 1984 had the weekly, rather than monthly, question been asked then. To find out the estimated actual value that would have been reported, this coefficient is exponentiated, yielding \$212.42. Similarly, the coefficient of the first binary variable is exponentiated, yielding the estimated value (\$282.01) for expenditures in 1984 in the absence of random variation that removed reported values from their underlying trend line. The ratio of these two values is about 1.3276; that is, the change in the question is estimated to have raised expenditures by about 32.8 percent. Therefore, this ratio is used as the adjustment factor for food purchased at grocery stores in 1984 and 1985. A similar analysis shows that the estimated factor for food purchased at other stores is about 1.6825.

Once found, expenditures for each type of purchase are multiplied by their adjustment factor, and food-at-home expenditures in 1984–85 are computed

<sup>6</sup> F statistic = 0.16; p-value = 0.6977.

from these adjusted values. To test the adjustment, the unadjusted change in average expenditures for food at home from 1987 to 1988 is compared with the adjusted value. As noted in the text, prior to adjustment, expenditures for food at home excluding food prepared on trips rise nearly 45 percent from 1987 to 1988. However, after the adjustment, the percent change is 5.9 percent, a value that is within the range (from -2.8 percent to 7.5 percent) for changes in observed (that is, pre-adjusted) values, even when observations from the most volatile period (1991 to 1993) are excluded. Perhaps more important, after adjustment, the components also demonstrate reasonable changes in the mean for those reporting from 1987 to 1988.<sup>7</sup> Given that this finding is reasonable, the adjustment factors are accepted. Finally, as noted in the text, other values, such as total food expenditures, total outlays, and “all other outlays” (that is, total outlays less food, shelter and utilities, and other items listed in table 2), are then computed from these adjusted values.

An alternative method to that just described is to exponentiate the intercepts as described, subtract the 1984–87 value from the 1988–2005 value, and add the resulting difference to each of the observations in the data set before computing results for food at home. Either method would result in the same mean for expenditures for food at home excluding food prepared on trips. However, in the alternative method, the variance of each component that would be computed prior to the adjustment would be unchanged after the adjustment. The result would be a larger mean with the same standard error of the mean for each component, thus increasing the likelihood that differences over time for the aggregate expenditure (that is, food at home less trips) would be statistically significant.

<sup>7</sup> The adjusted mean for grocery store expenditures rises a modest 3.4 percent during this period. The mean for expenditures at other stores rises 21.1 percent from 1987 to 1988 after adjustment, but this percent change is not out of line with figures for other years. The largest percent change, from 1995 to 1996, is 28.0 percent.

In contrast, using the percentage adjustment factor allows the variance of each component to increase in proportion to the increase in the mean of each component. That is, if the mean for food purchased at grocery stores rises by 37 percent, so will the standard error of the mean for that component. Similarly, adjusting separately each of the components of expenditures for food at home excluding food prepared on trips allows for a larger variance in the recomputed aggregate expenditure than performing the regression directly on mean expenditures for food at home excluding food prepared on trips. The reason is that some respondents report expenditures only for food at grocery stores, some report expenditures only for food at other stores, and some report both. Because the adjustment factors differ for each of the components, the percent increase in total expenditures for food at home excluding food prepared on trips will differ for each type of respondent, which will in turn increase the variance among respondents. As noted, the larger variance makes the analysis of change more conservative. That is, the threshold for finding a statistically significant difference is higher when the variance is higher, and therefore the analyst can be more confident in accepting the results. This conservative approach is especially important given that the data have undergone adjustments which are themselves based on estimates rather than reported values.

**Computing adjustment factors for food at home.** Tables A-1 and A-2 present regression results for computing adjustment factors for, respectively, expenditures for food purchased at grocery stores and expenditures for food purchased at other stores.

*Measuring statistical significance: types and computations of t-statistics.* As noted in the text, a difference in two parameters, such as means, is considered to be statistically significant if it is not likely to be due to chance alone. A common statistic used to measure the probability that a difference is due to

Table A-1. Regression results for computing adjustment factors for expenditures for food purchased at grocery stores<sup>1</sup>

Variable	DF	Parameter estimate	Standard error	t value	Pr >  t
Year 1984–87 ( $B_1$ )	1	5.35857	.02370	226.06	<.0001
Time 1984–87 ( $B_1t$ )	1	.01858	.01267	1.47	.1599
Year 1988–2005 ( $B_2$ )	1	5.64193	.01742	323.87	<.0001
Time 1988–2005 ( $B_2t$ )	1	.02360	.00129	18.34	<.0001

Computation of factor:  $(\exp(5.64193))/(\exp(5.35857)) = 1.327583$ .

<sup>1</sup> Dependent variable: Natural logarithm of mean expenditures for food purchased at grocery stores.

Table A-2. Regression results for computing adjustment factors for expenditures for food purchased at other stores<sup>1</sup>

Variable	DF	Parameter estimate	Standard error	t value	Pr >  t
Year 1984–87 ( $B_1$ )	1	4.19795	.06290	66.74	<.0001
Time 1984–87 ( $B_1t$ )	1	-.01903	.03362	-.57	.5784
Year 1988–2005 ( $B_2$ )	1	4.71821	.04622	102.07	<.0001
Time 1988–2005 ( $B_2t$ )	1	.02188	.00342	6.41	<.0001

Computation of factor:  $(\exp(4.71821))/(\exp(4.19795)) = 1.682465$ .

<sup>1</sup> Dependent variable: Natural logarithm of mean expenditures for food purchased at other stores.

chance alone (and thus is, or is not, statistically significant) is the t-statistic. When samples are large, a t-statistic greater than 1.96 in absolute value indicates that the probability that a difference in parameters is due to chance alone is less than 5 percent.

The formula for computing the t-statistic depends on what type of comparison is being performed. Perhaps the most common use of the t-statistic is for comparing means. In the text, for example, average annualized real total outlays are compared for young singles in two different periods. The samples are therefore independent and are assumed to have different variances. In this case, the formula for computing the t-statistic is

$$\frac{x_2 - x_1}{\sqrt{SE_2^2 + SE_1^2}}$$

where  $x_i$  is average annualized real total outlays in period  $i$  (1984–85 or 2004–05) and  $SE_i$  is the standard error of the mean in period  $i$ .

In table 4 in the text, average annualized real total outlays for all young singles is shown to be \$23,866 in 1984–85 and \$22,744 in 2004–05. The standard errors associated with these means are 663.03 and 531.85, respectively. Therefore, the t-statistic is computed to be

$$\frac{22,744 - 23,866}{\sqrt{531.85^2 + 663.03^2}} = -1.32.$$

Because the absolute value of the t-statistic (1.32) is less than the critical value (1.96), the probability that the difference in means (a decrease of \$1,122) is due to sampling error or other random events is greater than 5 percent; therefore, the difference is not statistically significant at the 95-percent confidence level.

However, testing differences in means is not the only use for t-statistics: They also can be used to detect statistically significant differences in **proportions**. For example, table 3 in

the text shows that, in 1984–85, 64 percent of all households with at least one young single person were households with **only** that one young single person. (That is, 36 percent of these households included at least one other person, regardless of age or marital status.) In 2004–05, that proportion increased to 77 percent. The critical value to test whether these proportions reflect a change in the composition of households is still 1.96; however, the formula for computing the t-statistic changes to

$$\frac{p_1 - p_2}{\sqrt{p_3(1 - p_3)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where  $p_1$  is the proportion of households with exactly one young single person in 1984–85 (that is, 1,252/1,953);  $p_2$  is the proportion of households with exactly one young single person in 2004–05 (that is, 1,401/1,811);  $p_3$  is the “pooled” proportion (that is, [1,252 + 1,401]/[1,953 + 1,811]);  $n_1$  is the sample size in 1984–85 (that is, 1,953); and  $n_2$  is the sample size in 2004–05 (that is, 1,811). The outcome of this test is similar to that of a chi-square test; in fact, the t-statistic equals the square root of the chi-square statistic computed by means of a chi-square test.

In addition, there is a special formula for comparing differences in **shares** across groups. A special formula is needed for this type of comparison because the value being measured is a ratio of two other variables that not only have their own means and standard errors, but also are not independent of each other. For example, because food at home is a component of total outlays, the covariance of mean expenditures for food at home and total outlays is expected to be positive. That is, as expenditures for food at home rise, so do total outlays, assuming that all other outlays are held constant. Accordingly, in this case, before computing the t-statistic, it is necessary to compute the variance of the share for each year. The

formula for the variance of the share in a particular year is<sup>8</sup>

$$V(S) = \left(\frac{1}{n}\right) \left[ \frac{F^2}{T^4} V(T) - 2 \left(\frac{F}{T^3}\right) \text{cov}_{F,T} + \left(\frac{1}{T^2}\right) V(F) \right],$$

where  $n$  is the sample size (2,359 for 1984–85 and 2,158 for 2004–05);  $F$  is the average expenditure for food at home;  $T$  is the average of total outlays (including food at home);  $V(i)$  is the sample variance of the expenditure or

<sup>8</sup> Adapted from SAS online manual, Chapter 10, “The MIANALYZE Procedure,” p. 216, on the Internet at [support.sas.com/rnd/app/papers/mianalyzev802.pdf](http://support.sas.com/rnd/app/papers/mianalyzev802.pdf) (visited Nov. 6, 2007); and J. L. Schafer, *Analysis of Incomplete Multivariate Data* (London, Chapman & Hall, 1997), p. 196.

outlay; and  $\text{cov}_{F,T}$  is the covariance of food at home and total outlays.

Note that  $V(i)$  is the variance of the observations in the sample, not the variance of the mean obtained from the sample. That is,  $V(i)$  measures how the observations vary around the mean of the sample, rather than estimating how means of similarly sized samples drawn from the same population would vary around the population mean. In other words,  $V(i)$  is the square of the sample standard deviation, and  $V(i)/n$  is equal to  $(SE_i)^2$ . Therefore, the preceding formula can be rewritten as

$$V(S) = \left[ \frac{F^2}{T^4} (SE_T)^2 - 2 \left(\frac{F}{T^3}\right) \text{cov}_{F,T} + \left(\frac{1}{T^2}\right) (SE_F)^2 \right].$$

For convenience, this equation simplifies to

$$V(S) = \left(\frac{1}{T^2}\right) \left[ \left(\frac{F}{T}\right) SE_T^2 - 2 \left(\frac{1}{n}\right) \left(\frac{F}{T}\right) \text{cov}_{F,T} + (SE_F)^2 \right],$$

where  $F/T$  is the value of the share (that is, the ratio of the averages) undergoing testing.

Because  $V(S)$  equals the squared standard error of the share (and not the squared standard deviation of the share), the formula for the t-statistic is now

$$\frac{S_2 - S_1}{\sqrt{V(S_2) + V(S_1)}},$$

where  $S_i = F_i/T_i$ . Once again, the critical value in this case is 1.96.

# Spending on Telephone Service

Brett Creech

In recent years, the use of cellular phones has increased compared with that of residential landline telephones. This trend can be attributed to the wider availability and greater flexibility that cellular phones offer. Indeed, spending on cell phones has risen to the point that it nearly matches spending on traditional landline phones. Monthly cellular phone rate packages are now quite comparable to residential telephone rates and can include many features, such as free long-distance calling and text messaging, which are not included in most residential phone packages. Because of the flexibility and mobility of cellular phones, more households are using them as their main telephone source, thereby eliminating the need for residential landline telephone services. Data from the Bureau of Labor Statistics (BLS) Consumer Expenditure Survey (CE) show that cellular phone expenditures increased rapidly from 2001 through 2006. In comparison, average expenditures on residential telephones decreased during the same period.

In the CE, telephone service expenditures are divided into four major categories: residential telephone/pay phone, cellular phone service, pager services, and phone cards. This report focuses on comparing total expenditures on residential telephone and cellular phone services overall and by age

group. The residential telephone and cellular phone service data presented are from unpublished CE estimates that show more detail than the published annual tables provided on the BLS public Web site.

In 1991, the CE began data collection on mobile car phones. The CE questionnaire asked respondents about their expenditures on telephone services in their home city (excluding mobile car phones) and their expenditures on telephone services for mobile car phones. In 2001, as these devices became more portable, the CE broadened the question about mobile phones to generally include all cellular phone services. Also in 2001, the survey began to include questions aimed at capturing data on expenditures for phone cards and pager services.

## Average Annual Telephone Expenditures

From 2001 to 2006, increases in telephone expenditures kept pace with the increase in total annual expenditures, so that the share of telephone expenditures out of total annual expenditures remained fairly constant over that period; interestingly, the increase in expenditures on telephone services is due almost exclusively to higher expenditures on cellular phone service. Table 1 shows that average annual telephone service expenditures for all consumer

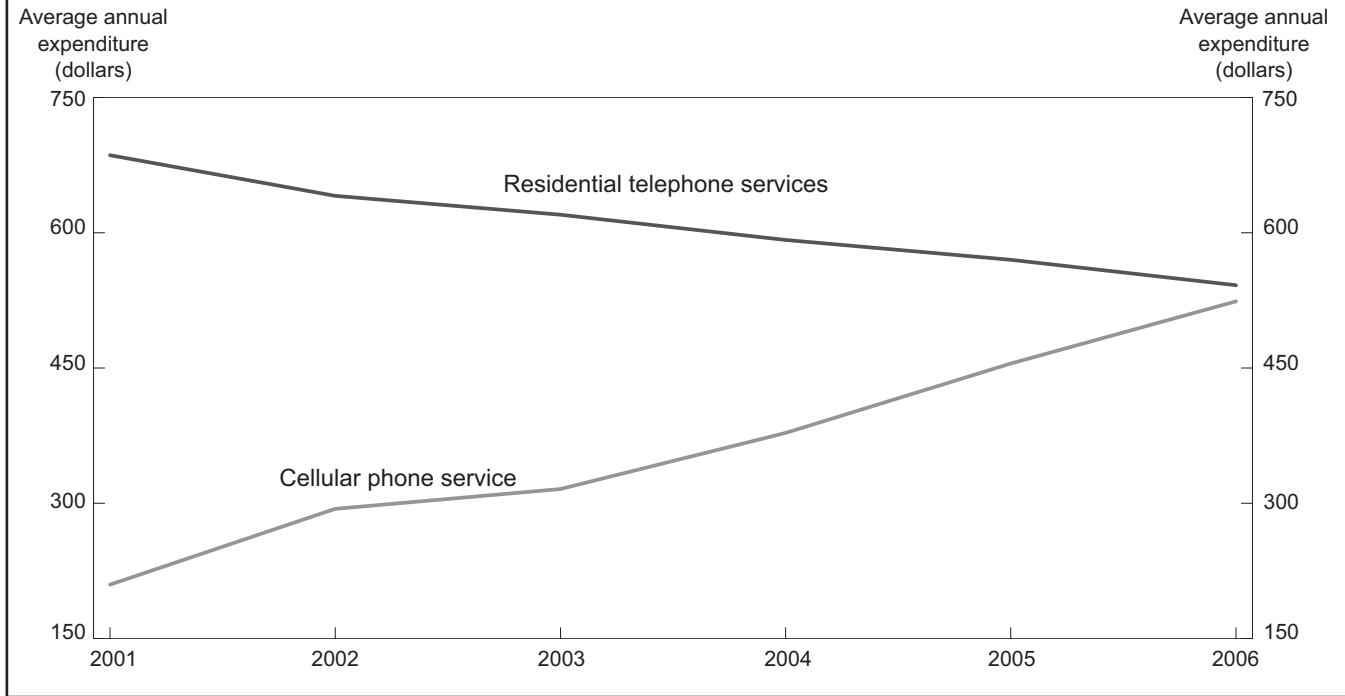
Brett Creech is an economist with the Branch of Information and Analysis, Division of Consumer Expenditure Surveys, U. S. Bureau of Labor Statistics

Table 1. Average annual expenditures (AAE) and percent distribution of telephone service expenditures for all consumer units, by age group, consumer expenditure survey, 2001–06

	2001	2001	2002	2002	2003	2003	2004	2004	2005	2005	2006	2006
	AAE	Per- cent distrib- ution	AAE	Per- cent distrib- ution	AAE	Per- cent distrib- ution	AAE	Per- cent distrib- ution	AAE	Per- cent distrib- ution	AAE	Per- cent distrib- ution
All consumer units .....	\$39,518		\$40,677		\$40,817		\$43,395		\$46,409		\$48,398	
Telephone services.....	914	100.0	957	100.0	956	100.0	990	100.0	1,048	100.0	1,087	100.0
Residential telephone/ pay phone .....	686	75.0	641	67.0	620	64.8	592	59.8	570	54.4	542	49.9
Cellular phone service.....	210	23.0	294	30.7	316	33.1	378	38.2	455	43.4	524	48.2
Other services.....	19	2.0	22	2.3	20	2.1	20	2.0	23	2.2	21	2.0
Age												
Under 25 years .....	23,526		24,229		22,396		24,535		27,776		28,181	
Telephone services.....	629	100.0	641	100.0	616	100.0	642	100.0	744	100.0	722	100.0
Residential telephone/ pay phone .....	423	67.2	346	54.0	278	45.1	245	38.2	247	33.2	195	27.0
Cellular phone service.....	165	26.3	259	40.4	313	50.9	371	57.8	472	63.4	502	69.5
Other services.....	41	6.5	36	5.7	25	4.0	26	4.0	25	3.4	26	3.6
25–34 years.....	39,451		40,318		40,525		42,701		45,068		47,582	
Telephone services.....	1,001	100.0	1,032	100.0	1,001	100.0	1,028	100.0	1,099	100.0	1,129	100.0
Residential telephone/ pay phone .....	712	71.1	642	62.2	592	59.1	537	52.2	495	45.0	434	38.4
Cellular phone service.....	263	26.3	360	34.9	377	37.6	465	45.2	572	52.0	658	58.3
Other services.....	26	2.6	31	3.0	33	3.3	26	2.6	32	3.0	38	3.3
35–44 years.....	46,908		48,330		47,175		50,402		55,190		57,546	
Telephone services.....	1,035	100.0	1,096	100.0	1,097	100.0	1,145	100.0	1,208	100.0	1,271	100.0
Residential telephone/ pay phone .....	761	73.5	713	65.0	696	63.4	665	58.0	633	52.4	599	47.2
Cellular phone service.....	254	24.6	358	32.7	379	34.6	451	39.4	545	45.1	649	51.1
Other services.....	20	1.9	25	2.3	22	2.0	29	2.5	30	2.5	22	1.8
45–54 years.....	47,930		48,748		50,101		52,764		55,854		57,563	
Telephone services.....	1,072	100.0	1,109	100.0	1,156	100.0	1,178	100.0	1,229	100.0	1,269	100.0
Residential telephone/ pay phone .....	786	73.3	723	65.2	724	62.7	682	57.9	660	53.7	621	48.9
Cellular phone service.....	268	25.0	365	32.9	413	35.7	479	40.7	548	44.6	627	49.4
Other services.....	18	1.6	21	1.9	19	1.6	17	1.4	21	1.7	21	1.7
55–64 years.....	41,462		44,330		44,191		47,299		49,592		50,789	
Telephone services.....	926	100.0	981	100.0	981	100.0	1,040	100.0	1,077	100.0	1,115	100.0
Residential telephone/ pay phone .....	718	77.5	697	71.0	680	69.3	673	64.7	638	59.2	623	55.9
Cellular phone service.....	194	21.0	266	27.1	285	29.0	353	34.0	422	39.2	476	42.7
Other services.....	14	1.5	19	1.9	16	1.6	13	1.3	17	1.6	16	1.4
65 Years and Older.....	27,714		28,105		29,376		31,104		32,866		35,058	
Telephone services.....	652	100.0	689	100.0	673	100.0	695	100.0	733	100.0	770	100.0
Residential telephone/ pay phone .....	560	85.9	555	80.6	541	80.4	542	78.0	541	73.8	548	71.2
Cellular phone service.....	85	13.1	125	18.2	122	18.2	144	20.8	180	24.6	213	27.7
Other services.....	7	1.0	9	1.2	10	1.5	9	1.2	12	1.6	9	1.2



**Chart 1. Residential and Cellular Phone Expenditures, 2001–06**



units<sup>1</sup> increased by 18.9 percent from 2001 through 2006, compared with an increase of 22.5 percent for total annual expenditures during the same period. In 2006, total annual expenditures averaged \$48,398 per consumer unit, of which 2.2 percent (\$1,087) was allocated to telephone expenditures. In comparison, total expenditures in 2001 averaged \$39,518 per consumer unit, of which 2.3 percent (\$914) went to telephone expenditures.

Chart 1 displays the change in average annual residential telephone/pay phone expenditures and cellular phone service expenditures from 2001 through 2006. Expenditures for cellular phone services per consumer unit grew from \$210 in 2001 to \$524 in 2006, an increase of 149.2 percent. Expenditures for residential telephones/pay phones per consumer unit decreased from \$686

in 2001 to \$542 in 2006, a decline of 21 percent.

Put another way, table 1 shows that the expenditure share of cellular phone services out of total telephone expenditures has increased. In 2001, the ratio of spending on residential telephone/pay phone expenditures to spending on cellular phone expenditures was greater than 3 to 1. In 2006, the shares of these two components were almost equal, with residential telephone/pay phone expenditures accounting for 49.9 percent of total telephone expenditures and cellular phone expenditures<sup>2</sup> constituting 48.2 percent. In addition, the percentage of households reporting cellular phone expenditures, increased from 34.1 percent in 2001 to 52.8 percent in 2006.<sup>3</sup> Also, the percentage of

<sup>2</sup> Expenditures on phone cards and pager services accounted for 2.0 percent of total telephone expenditures in 2006. Due to the small size of these expenditures, this report focuses on the comparison of cellular phone services with residential telephone services. Table 1 refers to expenditures on phone cards and pager services as “other services.”

<sup>3</sup> All percentages cited in this report were derived from average quarterly percent reporting totals for 2001 and 2006.

people who reported having cellular phone expenditures but no residential telephone expenditures increased: In 2006, 12.3 percent of respondents reported having cellular phone expenditures, but no residential telephone expenditures, compared with only 1.5 percent in 2001.

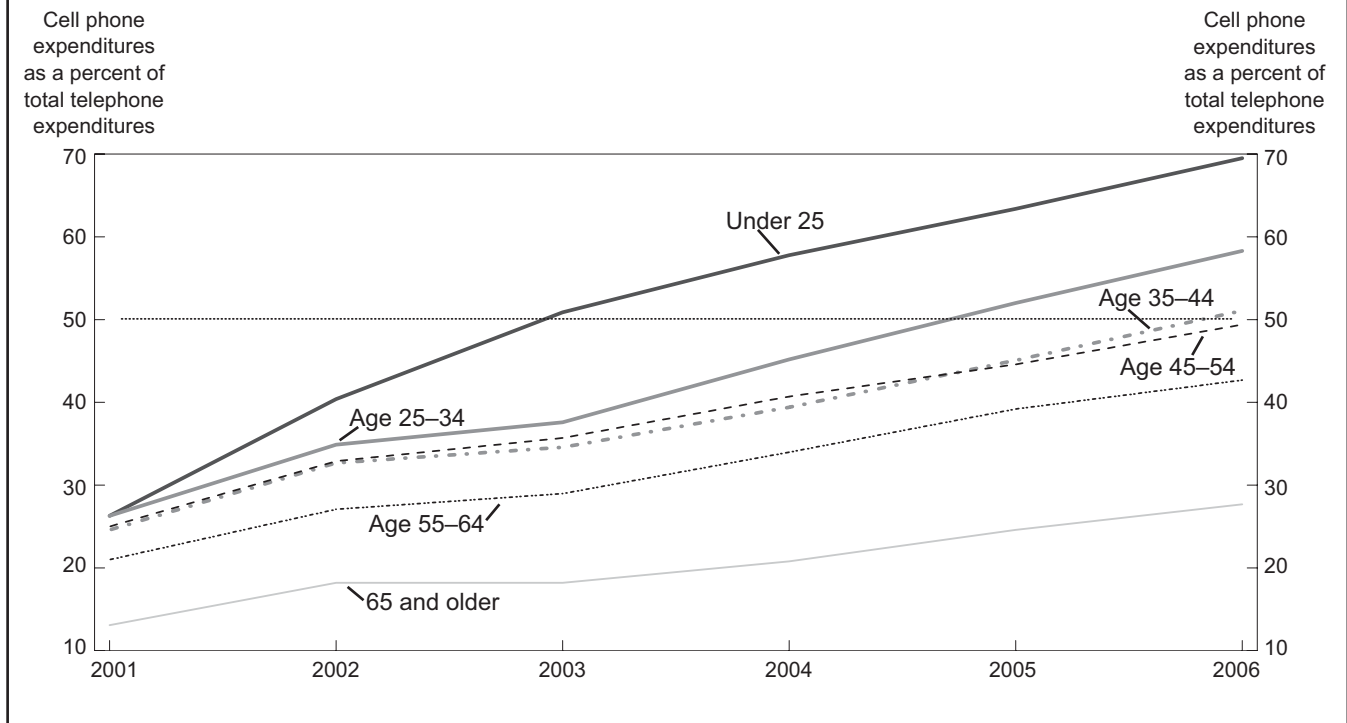
### Age

One interesting way to analyze the shift of expenditures from residential telephones to cellular phones is by age group. Table 1 shows expenditures on telephone services and its components by six age<sup>4</sup> groups. From 2001 through 2006, consumer units whose reference person was 25 through 64 years spent about the same amount annually for telephone services. In 2006, that amount was about \$1,200. Similarly, consumer units whose reference per-

<sup>4</sup> Age groups are determined by the age of the reference person—the first person mentioned by the respondent when asked to “start with the name of the person or one of the persons who owns or rents the home.” It is with respect to this person that the relationship of the other CU members is determined.

<sup>1</sup> A consumer unit is defined as all the members of a household related by blood, marriage, adoption, or other legal arrangement; a single person living alone or sharing a household with others, but who is financially independent; or two or more persons living together who share responsibility for at least 2 out of 3 major types of expenses—food, housing, and other expenses.

**Chart 2. Distribution of cell phone expenditures, by age group, 2001–06**



son was under 25 years or 65 years and older reported comparable levels of telephone service expenditures (\$722 for those under 25 years, and \$770 for those 65 years and older, in 2006).

However, since 2001, the distribution of telephone service expenditures between residential telephone/pay phone services and cellular phone services changed significantly in all age groups. For example, in 2001, the share of cellular phone services out of total telephone services for consumer units whose reference person was under 25 years was 26.3 percent. By 2006, the share had risen sharply, to 69.5 percent. Similar, but less dramatic, shifts occurred in all age groups from 25 through 64 years. This change in the distribution of expenditures has been so widespread that the majority of consumer units are now spending more on cellular phone service than on residential telephone/pay phone services. Although the shift in expenditures

was not as great for consumer units with reference person aged 65 years or older, even that age group saw a significant increase in its cellular phone service expenditures. In 2001, cellular phone expenditures accounted for 13.1 percent of total telephone expenditures for those consumer units. By 2006, the group's cellular phone expenditures had increased to 27.7 percent of its total telephone service expenditures.

Chart 2 demonstrates how the shift in expenditures toward cellular phones has occurred. In 2006, for all age groups under age 45, cellular phone expenditures constituted the majority of total telephone expenditures. The situation differed from that of 2001, when the majority of total telephone expenditures for all age groups were residential telephone/pay phone service expenditures. The under-25 age group was the first age group for whom spending on cellular phones accounted for the majority of total telephone expenditures,

in 2003. Those aged 25 to 34 years followed suit in 2005, while those aged 35 to 44 years shifted in 2006.

### Summary

This article has presented cellular phone service and residential telephone service spending patterns for all consumer units and by age group from 2001 through 2006. The CE data show that cellular phone expenditures increased, while residential telephone service expenditures decreased, over that period. Wider availability and price packages that are comparable to residential telephone packages have been the main sources of this increase. Also, cellular phone expenditures are now the majority of total telephone expenditures in three of the six age groups researched in this article. The CE will continue to analyze the data to see if cellular phone expenditures eventually become the majority of total telephone service expenditures for all age groups. ■

# Housing Expenditure by Race and Hispanic or Latino Origin

Mark Vendemia

## Introduction

The Nation's minority population is rapidly growing, with approximately 1 in 3 U.S. residents a member of a minority group<sup>1</sup> in 2007. Hispanics account for almost half the recent population growth and are now the largest minority group, slightly larger than Black or African-Americans. Asians comprise the third largest minority group.

Owning one's own home has always been a dream for most Americans, regardless of race or Hispanic origin. This dream, however, does not come easily or cheaply for many Americans, as spending on housing is the largest expense for most households. Data from the U.S. Bureau of Labor Statistics (BLS), Consumer Expenditure Survey (CE), show that in 2005, housing expenditures accounted for about a third of total spending for all consumer units.<sup>2</sup> This article will examine housing expenditures for homeowners and renters classified by race and Hispanic or Latino origin.

## Methodology

This article contains the following major sections:

- The first section looks at demographic characteristic differences, which may contribute to differences in spending on housing.
- The second section examines housing expenditures by all consumer units and also units classified by race

and Hispanic origin. This section establishes the importance of housing expenditures relative to overall expenditures and how shares of housing vary by race and Hispanic origin. To accomplish this, CE data are organized according to the standard definition of housing used in published data tables. This approach to owned housing in the CE includes mortgage interest and charges; property taxes; and maintenance, repairs, insurance, and other expenses, but not mortgage principal paid on owned property. Mortgage principal payments are considered to be reductions in liabilities and not expenditures. CE-published data include average characteristics and expenditure means for all consumer units and by race and Hispanic origin among other various demographic groups. Average expenditures on an item represent averages across all consumer units, both those that purchased the item, as well as those that had no expenditures. The average for those consumer units that actually purchased the item will be larger than the mean for all consumer units. For example, in the housing component, spending on owned dwell-

Mark Vendemia is an economist with the Branch of Information and Analysis, Division of Consumer Expenditure Surveys, U.S. Bureau of Labor Statistics.

<sup>1</sup> U.S. Census Bureau, "Minority Population Tops 100 Million" news release, May 17, 2007, available on the Internet at <http://www.census.gov/Press-Release/www/releases/archives/population/010048.html>

<sup>2</sup> See the glossary in the appendix for the definition of a consumer unit.

ing by homeowners will be higher than that shown in standard CE tables, because the mean in the published table is averaged over all consumer units, which includes both homeowners and renters.

- The third section looks at housing costs associated with only homeowner consumer units using a modified approach to owned housing. In this section, housing costs are conditional on being a homeowner and include mortgage principal paid on own property, in addition to the costs included in the standard approach. This corresponds more to what homeowners typically think of as their housing cost—principal, interest, property taxes, and insurance—and gives an idea of the regular outlays of homeowners.

- The final section includes housing expenditures for renter consumer units classified by race and Hispanic origin. These expenditures are conditional on renter tenure, using the standard CE approach to renters' costs as shown in published CE housing tenure data tables, which include shelter costs consisting primarily of contract rent.

Comparisons in this article are based on the standard race categories used in the CE race of reference person data table; White and all other races,<sup>3</sup> Asian, and Black or African-American. In addition, the article includes Hispanic households derived from the CE Hispanic or Latino origin of reference person table. The race and Hispanic or Latino origin of the consumer unit is determined by the reference person.<sup>4</sup> In the CE, if the reference person identifies origin as “Spanish,” “Hispanic,” or “Latino,” the consumer unit is classified as Hispanic or Latino. Those who identify their origin as “Spanish,” “Hispanic,” or “Latino” may be of any race and must also choose between one of the CE race categories. In the CE, race and Hispanic or Latino origin are two separate and distinct classifica-

tions.<sup>5</sup> Also, in this article, the terms “Black” and “African-American” are used interchangeably, as are “Hispanic or Latino origin” and “Hispanic,” and “White and All Other Races” and “White.”

#### Demographic characteristics of consumer units

Demographic characteristics, such as income, age, family size, and number of earners, are contributing factors in explaining differences in housing expenditures among households in the study groups. The average annual income across all consumer units was \$58,712 in 2005. (See table 1.) Asian households reported the highest income of all household groups, with an income of \$73,995—22 percent higher than White households, who reported the second highest income of \$60,791. Hispanic households reported an average annual income of \$47,509, and Black consumer units reported the lowest income of \$39,385 per year. The average age of the reference person in White households was 49.2, the highest of all groups, while Hispanic households reported the lowest average age of 41.7 years. The average age of Black households' reference person averaged 46.3 years, while Asian households reported the average age of reference person as 43.4 years. Asian and Hispanic households had the highest number of earners with 1.6 earners per household. White and Black households reported fewer numbers of earners per household, with 1.3 and 1.2 earners per household, respectively. Hispanic and Asian households also had the highest number of persons per household with Hispanic households reporting 3.4 persons and Asian households 2.9 persons per household, whereas Black and White households reported 2.6 and 2.5 persons per household, respectively. The average number of adults per household (18 years of age and older), however, were similar with 2.2 persons for Hispanic

households, 2.1 persons for Asian consumer units, and 1.8 persons for both Black and White households.

#### Section I: Housing expenditures for all consumer units by race and Hispanic origin

Published CE data show that housing expenditures in 2005 averaged \$15,167 out of a total of \$46,409, accounting for approximately one third of annual expenditures. Table 1 shows that the share of total expenditures spent on housing was similar among minority households, and higher than White households, despite large differences in all groups' household incomes. Asian households, who earned 26 percent more than the average household, allocated 36.5 percent of total expenditures to housing, Hispanic households, who earned 19 percent less than the average household, reported a housing share of 35.7 percent, and Black consumer units, who earned 33 percent less than the average consumer unit, allocated 35.5 percent of average annual expenditures towards housing. White households, with a share of 32.2 percent, allocated a significantly lower share of average annual expenditures towards housing expenditures than did minority groups.

In the CE, the housing component is divided into five major categories: Shelter; utilities, fuels, and public services; household operations; housekeeping supplies; and household furnishings and equipment. In 2005, the average consumer unit allocated 58.1 percent (\$8,805) of average annual housing expenditures for shelter, 21.0 percent (\$3,183) for utilities, fuels, and public services, 5.3 percent (\$801) for household operations, 4.0 percent (\$611) for housekeeping supplies, and 11.7 percent (\$1,767) for household furnishings and equipment. Asian households spent significantly more on shelter than did White households, \$12,659 per year compared to \$8,961 by White households. Asian households also allocated a significantly larger share, 66.6 percent, of average annual housing expenditures to shelter than did all other groups. White

<sup>3</sup> All other races includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and approximately 1.3 percent reporting more than one race.

<sup>4</sup> See the glossary in the appendix for the definition of reference person.

<sup>5</sup> To see the wording of the race and origin questions in the CE Interview Survey, go to the 2005 CE CAPI at: <http://www.bls.gov/cex/capi/2005/csxcontrol.htm>.

households allocated 57.8 percent to shelter.

Black households spent \$3,253 annually on utilities, highest of all groups, and allocated the largest share of average annual housing expenditures—27.9 percent—to utilities, fuels, and public services. White households, on the other hand, allocated 20.5 percent on utilities, fuels, and public services. Expenditures and shares for household operations and housekeeping supplies were relatively low and consistent among household groups. White households, and to a lesser degree Asian households, allocated more towards household furnishings and equipment than did Black and Hispanic consumer units. This could be attributed to the higher income and higher homeownership rates for both White (70 percent) and Asian households (62 percent), compared with approximately 50 percent for Black and Hispanic households.

## Section II: Housing expenditures for homeowner consumer units

This section looks at housing expenditures for homeowners only. In 2005, 67 percent of all consumer units were homeowners. As mentioned earlier, Black households had the lowest homeownership rate at 49 percent, followed closely by Hispanic households at 50 percent. Asian consumer units had a homeownership rate of 62 percent, and White households had a significantly higher homeownership rate of 70 percent. Table 2 shows that on average, approximately 63 percent of all homeowners reported paying a mortgage. The percent of homeowners with a mortgage varied among racial groups, as 73 percent of Asian households and 72 percent of Hispanic households reported paying a mortgage, while 65 percent of Black households, and 63 percent of White households, paid a mortgage. This affected the amount and allocation of housing expenditures, since mortgage interest and charges and mortgage principal paid on owned property are two of the largest housing expenditures for homeown-

ers. Although a similar proportion of Hispanic and Black households were homeowners, Hispanic homeowners were less likely to own their homes outright than were Black homeowners (28 percent versus 35 percent). Approximately 27 percent of Asian households who reported owning their own home did not pay a mortgage. This was the lowest of all groups and significantly less than the 37 percent of White households. Age is a factor in determining if a household owns their home outright, as older consumers are more likely to have paid off their mortgage. Both White and Black homeowner households had a higher average age of reference person—52.6 and 51.5 years, respectively, than the others.

The estimated market value of owned home, which is based on the respondent's answer to the question "About how much do you think this property would sell for in today's market," averaged \$243,517 for all homeowner consumer units in 2005. White households estimated the average market value of their homes was \$244,970, Blacks reported the lowest average estimated market value at \$156,345, Hispanics estimated an average value of \$233,217, and Asian consumer units reported the highest average value at \$428,087. There are many factors that may contribute to this difference in market value of owned home among the groups such as income, location of homes, type of area (urban/rural), number of earners within the household, family size, and age. Also, the value is an estimate given by the homeowners themselves.

In 2005, homeowners spent on average \$20,359 on housing expenditures, accounting for 35.6 percent of annual expenditures. Within the housing category, the largest sub-category expenditures were for shelter and for utilities, fuels, and public services, with average expenditures of \$12,632 and \$3,751, respectively. The shelter category is defined somewhat differently here than in table 1, as shelter category includes mortgage principal paid on owned property, as well as

mortgage interest and charges, property taxes, and maintenance, repairs, insurance, and other expenses. Shelter expenditures represented 62 percent on average of total housing expenditures for homeowner consumer units. The other three housing sub-categories: Household operations, housekeeping supplies, and household furnishings and equipment accounted for average annual expenditures of \$996, \$746, and \$2,234, respectively.

Asian households allocated a greater share of housing expenditures towards shelter than did the other homeowner groups, with 71 percent of all housing expenditures going towards shelter, followed by Hispanic households who allocated 64.2 percent, 61.9 percent for White households, and 57.3 percent for Black households.

The average amount for mortgage principal paid on own property for homeowner consumer units was \$3,062, or 15 percent of housing. It also showed wide variation among the studied groups. Not surprisingly, Asian households, who reported a significantly higher market value of owned home than the average household and also had the highest percentage of homeowners with a mortgage, also spent considerably more on mortgage principal, which accounted for a higher share of total housing than for the other groups. Asians spent \$5,857 annually repaying mortgage principal, or 20.4 percent of housing expenditures. White households spent \$3,054 a year, 14.9 percent of housing expenditures, on mortgage principal, followed by Hispanic households at \$2,549 (12.8 percent), and Black households at \$2,052 (13.1 percent).

Mortgage interest and charges, with average annual expenditures of \$4,935, or 24.2 percent of housing outlays, is the largest item under shelter. Asian households spent on average \$8,475 on mortgage interest and charges (29.6 percent of housing expenditures), more than double Black households' average annual expenditures of \$4,124. Although Black households spent much less on mortgage interest than did Asian households, Black house-

hold outlays represented 26.4 percent of their housing budget. Hispanic households allocated proportionately more towards mortgage interest and charges than the other groups, spending 32.2 percent of their total housing expenditures (\$6,402). White households allocated the smallest share to mortgage interest, spending 23.8 percent (\$4,879) of their housing expenditures on this component.

On average, White households outlays on mortgage interest and charges were approximately 1.6 times the amount they paid for mortgage principal, similar to Asian households' ratio of 1.5 times. However, Black and Hispanic households had a higher ratio of interest to principal, as Black households had a ratio of approximately 2.0 and Hispanic households a ratio of 2.5.

Overall, households usually pay mortgage principal and mortgage interest together as one payment. When combining mortgage principal and interest, White households had the lowest share to housing expenditures at 38.7 percent (\$7,933), followed closely by Black households, which spent 39.5 percent (\$6,176) of their housing outlays on mortgage principal and interest. Hispanic consumer units spent 45 percent (\$8,951) of their housing budget towards these combined

items, and Asian households, spending \$14,332 per year, allocated 50 percent of all housing expenditures towards mortgage expenditures.

The average homeowner spent a little more than 11 percent of their average annual housing expenditures, or \$2,275, on property taxes. The share of property taxes to housing expenditures ranged from a high of 12.1 percent for Asian households to a low of 9.6 percent for Black households.

Utilities, fuels, and public services was the second largest housing category for homeowners with average annual expenditures of \$3,751, accounting for 18.4 percent of total housing expenditures. (See table A below.) Black homeowners spent \$4,111 annually on utilities, the highest of all groups, and allocated a significantly higher share of average annual housing expenditures to that component with a 26.3 percent share. Hispanic consumer units reported spending \$3,825 a year, the second highest share at 19.2 percent, and White households spent \$3,713 annually, with a share of 18.2 percent. Asian consumer units spent \$3,818 and had a significantly lower share at 13.3 percent of housing expenditures.

As table A shows, electricity and telephone services were the largest utility expenditures for homeowners, and

Black households spent proportionately more for both than did all other groups, allocating 9.7 percent of their housing budget towards electricity and 8.3 percent towards telephone services. Asian households spent proportionately less than the other groups, allocating 4.2 percent of housing budget to electricity and 4.6 percent to telephone services. The higher electricity expenditure share for Black households may be attributed to the higher concentration of Black households residing in the South region and the associated costs with air conditioning a home. On the other hand, Asian households tend to be concentrated in temperate areas in the West region which may help explain their lower electricity costs. Looking at telephone expenditures, Black households had the highest share of housing expenditures for both residential telephone/pay phones and cellular phone expenditures with their residential telephone expenditures significantly higher than all the other groups. Asian households had the lowest share of both residential telephone/pay phones and cellular phone expenditures to total housing outlays.

The average homeowner consumer unit allocated 4.9 percent of average annual housing expenditures to household operations (\$996), showing less variation among the groups than

**Table A. Average annual utilities expenditures and expenditure shares of homeowners by race and by Hispanic or Latino origin, Consumer Expenditure Survey, 2005**

Items	All consumer units	White and All Other Races, and Asian			Black or African-American	Hispanic or Latino
		Total	White and all other races	Asian		
Housing expenditures.....	\$20,359	\$20,803	\$20,502	\$28,662	\$15,646	\$19,890
Utilities, fuels, and public services.....	3,751	3,717	3,713	3,818	4,111	3,825
Natural gas.....	586	571	569	624	743	497
Electricity.....	1,353	1,338	1,344	1,197	1,514	1,364
Fuel oil and other fuels.....	192	203	207	91	72	78
Telephone services.....	1,145	1,130	1,123	1,324	1,296	1,274
Residential telephone/pay phones.....	642	626	625	658	807	676
Cellular phone services.....	486	487	482	619	471	559
Water and other public services.....	475	475	470	583	485	612
Share of housing expenditures (percent distribution)						
Utilities, fuels, and public services.....	18.4	17.9	18.1	13.3	26.3	19.2
Natural gas.....	2.9	2.7	2.8	2.2	4.7	2.5
Electricity.....	6.6	6.4	6.6	4.2	9.7	6.9
Fuel oil and other fuels.....	0.9	1.0	1.0	0.3	0.5	0.4
Telephone services.....	5.6	5.4	5.5	4.6	8.3	6.4
Residential telephone/pay phones.....	3.2	3.0	3.0	2.3	5.2	3.4
Cellular phone services.....	2.4	2.3	2.4	2.2	3.0	2.8
Water and other public services.....	2.3	2.3	2.3	2.0	3.1	3.1

Table B. Average annual electricity expenditures and percent of electricity included in rent of renters by race and by Hispanic or Latino origin, Consumer Expenditure Interview Survey, 2005

Items	All consumer units	White and all other races	Asian	Black or African-American	Hispanic or Latino
Electricity expenditures.....	\$962	\$925	\$728	\$1,128	\$986
Percent of electricity expenditures included in rent (percent distribution).....	14.7	14.8	19.5	13.3	13.2

any other housing category, especially among minority households. White households had the highest expenditure share at 5.0 percent, Asian and Black households both had expenditure shares of 4.4 percent, and Hispanic consumer units had the lowest share at 4.2 percent.

The average annual expenditures for housekeeping supplies, which include laundry and cleaning supplies, was \$746, the lowest of all housing categories. The share of housekeeping supplies to housing expenditures was 3.7 percent for all homeowner consumer units, with minority households spending the smallest share, compared to White households who had the highest share at 3.8 percent. Hispanic households had a share of 3.2 percent, followed by Black households at 3 percent, and the Asian households with the lowest share at 1.9 percent.

Homeowner households' spending on household furnishings and equipment, which include some big ticket items, such as furniture and appliances, averaged \$2,234 in 2005, and showed relatively similar spending shares among households; however, minority households once again had smaller shares compared with White households. White households allocated 11.2 percent of average housing expenditures towards household furnishings and equipment, followed by Asian households with a 9.4 percent share, Hispanic households at 9.2 percent, and Black homeowners at 9 percent.

Section III: Housing expenditures for renter consumer units  
This section looks at housing expenditures based on renter consumer units

only. Average annual expenditures for renter consumer units as seen in table 3, was \$30,462. Housing expenditures, at \$10,838, accounted for 35.6 percent of average annual expenditures for all renters, the same as the homeowners' housing share (using the modified housing definition described in the homeowners section of the paper).

Thirty-three percent of all consumer units reported being a renter, with Black households having the highest renter rate of 51 percent, followed closely by Hispanic households at 50 percent, 38 percent for Asian consumers, and 30 percent for White households.

The average renter consumer unit spent \$7,296, or 67.3 percent, of total housing expenditures on shelter.<sup>6</sup> Within the shelter category, about 96 percent of expenditures were for rent, which includes rent as pay, with an annual average of \$6,981. Asian households spent \$9,161 annually on rent, considerably more than the other groups. Hispanic consumer units spent \$7,547, White households spent \$7,090, and Black households spent significantly less than the other groups at \$6,051 annually. Despite their lower income, Hispanic households spent more than the average renter household on rent, probably due to the larger number of persons per household in Hispanic consumer units, which averaged 3.1 persons per household, compared to the 2.2 average persons for all renter households. Asian households' share of rent to total housing expenditures was higher than

<sup>6</sup> Shelter category includes the sub-categories owned dwellings, rented dwellings, and other lodging.

all other households at 69.9 percent, followed by Hispanic households at 66.1 percent, White households at 64.7 percent, and lastly, Black households, which allocated 61.6 percent of their housing expenditures towards rent, the lowest share of all groups.

Renter consumer units spent \$2,011 on average for utilities, fuels, and public services, which accounted for 18.6 percent of all housing costs. The average renter household spends proportionately about the same for utilities as the average homeowner consumer unit. Black renter households, spending 24.8 percent (\$2,441) of their housing budget on utilities, allocated a significantly larger proportion of their housing expenditures towards utilities, fuels, and public services than any other group. As noted in the previous section, Black homeowner households also spent proportionately more for utilities than did any other group. Hispanic renter households spent 19 percent (\$2,163) of their housing on utilities, compared with a share of 17.6 percent (\$1,924) spent by White households, and 12.9 percent (\$1,688) by Asian households.

Renters often have utility costs included in their rental payments. If a smaller percentage of Blacks had their utility costs included in their rent, that may help explain why their utility expenditures were higher in the CE. To ascertain how often utilities were included in rental payments, the 2005 interview component of the CE was examined. (See table B.) The CE consists of two survey components, the Interview Survey and the Diary Survey, each designed to collect different types of expenditures. (See the appendix at the end of this anthology

for more information on the Interview Survey.) Results show that the percentage of households that reported renting their unit and also reported electricity cost included in the rental payment of the unit<sup>7</sup> were 19.5 percent of Asian households, 14.8 percent of White consumer units, 13.3 percent of Black consumer units and 13.2 percent of Hispanic households. When looking at all renter households that reported paying for electricity (electricity was not included in the rental payments), the average annual electricity expenditure for all renter consumer units was \$962. The Black renter households spent significantly more than the average renter household, spending \$1,128 annually on electricity, or 17 percent more than the average renter household. The Asian renter households spent only \$728 per year on electricity, while the Hispanic and White households spent close to the average annual expenditure, at \$986 and \$925, respectively. These results show that Black and Hispanic households are less likely to have electricity included in their rental payments, and also that Black households, and to a lesser degree, Hispanic households, that pay for utilities, pay proportionately more than Asian and White renter households. As described in the homeowner section, another reason for higher spending on utilities by Blacks may be attributed to their higher concentration in the South region (20 percent of households versus 12 percent nationally) and the electricity costs associated with air conditioning a home.

Black renters also spent more proportionately for telephone services, which includes both residential and cellular phone service, than the other groups, allocating 9.8 percent of their housing expenditures to this item, compared with 7.8 percent for the average renter. This is due to larger expen-

ditures by Black households on residential phone service, as Black renter households spent 33 percent more for residential phone service than the average renter consumer unit and 56 percent more than Asian renters—the group with the lowest residential phone expenditures. The share of cellular phone service expenditures, however, was approximately the same among the groups, averaging 3.6 percent of total housing expenditures.

The average renter consumer unit spent \$397 annually, or 3.7 percent of average annual expenditures on household operations. Household operations showed less variation among groups than any other housing component, with an expenditure share of 3.9 percent for Black households, 3.6 percent for White households, and 3.3 percent for both Hispanic and Asian households.

The average annual expenditure for housekeeping supplies for renters was \$331—the lowest of all the housing categories. The share of housing expenditures allocated to housekeeping supplies averaged 3.1 percent overall, varied from a high of 3.4 percent for Hispanic households, to a low of 2.4 percent for Black renter consumer units.

Consumer spending on household furnishings and equipment was \$803 for all renter consumer units, with Asian households (\$970) and White households (\$844) spending substantially more than Black households at \$592. White households had an expenditure share of 7.7 percent, Asian households 7.4 percent, Hispanic households had a share of 6.8 percent, and Black households apportioned significantly less at 6 percent. It appears that the more a consumer group allocated to housing expenditures overall, the greater the proportion that the group spent on furnishings and equipment.

### Summary

In conclusion, consumer units allocated about a third of annual expenditures for housing, significantly more than any other component. The amount

households spent on housing varied depending on race or Hispanic origin. However, minorities spent a larger share of total expenditures on housing than did White households.

When looking at consumer units that are homeowners only, the estimated market value of owned home varied significantly, with factors such as income, location of homes, family size, and age of reference person as possible major contributors to these differences. Expenditures for mortgage principal paid on owned property and mortgage interest and charges varied significantly among the groups, especially between Asian and Black groups. Data show that Black households spent more, on average, for utilities, fuels, and public services than did the other groups. This may be due to a higher percentage of Black households residing in the South, a region marked by higher-than-average utility expenditures. Data also show that, on average, Asian homeowners' expenditures and expenditure shares of housing are significantly higher (except for utilities) than those of Black homeowners—and to a lesser degree—than those of Hispanic and White homeowners. There are significant differences in income, region, family size, and number of earners per household between Black and Asian groups.

Renter households apportion the same share of total expenditures to housing that homeowners do. Renters spent, on average, about two thirds of their total housing expenditures on rent. Proportionately more Black and Hispanic households are renters, compared with Asian and White consumer units. Data for renter consumer units show that Black households, and to a lesser degree, Hispanic households, spend a larger share on utilities, fuels, and public services, than do White and Asian households. Overall, data show that Black and Asian renters seem to have different spending patterns for housing, whereas shares spent by Hispanic and White consumer units among housing subcomponents are similar. ■

<sup>7</sup> Electricity cost was selected as the proxy utility variable to examine, because it represents 64 percent of utilities, fuels, and public services expenditures (not including telephone services).



Table 1. Average annual expenditures and characteristics and shares of average annual expenditures by race and by Hispanic or Latino origin, Consumer Expenditure Survey, 2005

Items	All consumer units	White and all other races, and Asian			Black or African-American	Hispanic or Latino <sup>2</sup>
		Total	White and all other races <sup>1</sup>	Asian		
Number of consumer units (in thousands).....	117,356	103,314	99,031	4,283	14,042	12,462
Income before taxes .....	\$58,712	\$61,339	\$60,791	\$73,995	\$39,385	\$47,509
Age of reference person.....	48.6	48.9	49.2	43.4	46.3	41.7
Number of persons.....	2.5	2.5	2.5	2.9	2.6	3.4
Earners.....	1.3	1.4	1.3	1.6	1.2	1.6
Housing tenure:						
Homeowner.....	67	70	70	62	49	50
With mortgage.....	43	44	44	46	32	35
Without mortgage.....	25	26	26	17	17	14
Renter.....	33	30	30	38	51	50
Average annual expenditures.....	\$46,409	\$48,241	\$48,077	\$52,054	\$32,849	\$40,123
Housing.....	15,167	15,643	15,496	19,017	11,650	14,338
Shelter.....	8,805	9,115	8,961	12,659	6,524	8,937
Owned dwellings.....	5,958	6,335	6,236	8,623	3,188	4,886
Mortgage interest and charges.....	3,317	3,496	3,416	5,354	1,998	3,166
Property taxes.....	1,541	1,650	1,626	2,203	734	1,058
Maintenance, repairs, insurance, other expenses.....	1,101	1,188	1,194	1,066	456	662
Rented dwellings.....	2,345	2,236	2,182	3,479	3,148	3,876
Other lodging.....	502	544	544	556	189	175
Utilities, fuels, and public services.....	3,183	3,174	3,181	3,018	3,253	2,986
Household operations.....	801	837	833	948	530	605
Housekeeping supplies.....	611	645	653	439	352	508
Household furnishings and equipment.....	1,767	1,871	1,868	1,954	991	1,303
Estimated market value of owned home.....	\$164,800	\$176,814	\$172,808	\$269,443	\$76,405	\$116,024
Share of average annual expenditures (percent distribution)						
Housing.....	32.7	32.4	32.2	36.5	35.5	35.7
Share of housing expenditures						
Shelter.....	58.1	58.3	57.8	66.6	56.0	62.3
Owned dwellings.....	39.3	40.5	40.2	45.3	27.4	34.1
Mortgage interest and charges.....	21.9	22.3	22.0	28.2	17.2	22.1
Property taxes.....	10.2	10.5	10.5	11.6	6.3	7.4
Maintenance, repairs, insurance, other expenses.....	7.3	7.6	7.7	5.6	3.9	4.6
Rented dwellings.....	15.5	14.3	14.1	18.3	27.0	27.0
Other lodging.....	3.3	3.5	3.5	2.9	1.6	1.2
Utilities, fuels, and public services.....	21.0	20.3	20.5	15.9	27.9	20.8
Household operations.....	5.3	5.4	5.4	5.0	4.5	4.2
Housekeeping supplies.....	4.0	4.1	4.2	2.3	3.0	3.5
Household furnishings and equipment.....	11.7	12.0	12.1	10.3	8.5	9.1

<sup>1</sup> All other races includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and approximately 1.3 percent reporting more than one race.

<sup>2</sup> Race and Hispanic or Latino origin are two separate and distinct

categories. Hispanic consumer units may be of any race and are categorized into one of the following racial groups: White and all other races, Asian, and Black or African-American.

**Table 2. Average annual expenditures and characteristics and shares of average annual expenditures of homeowners by race and by Hispanic or Latino origin, Consumer Expenditure Survey, 2005**

Items	All consumer units	White and all other races, and Asian			Black or African-American	Hispanic or Latino <sup>2</sup>
		Total	White and all other races <sup>1</sup>	Asian		
Number of consumer units (in thousands).....	79,072	72,243	69,573	2,675	6,823	6,172
Income before taxes.....	\$70,791	\$72,596	\$71,801	\$93,280	\$39,385	\$62,588
Age of reference person.....	52.3	52.4	52.6	46.5	51.5	45.6
Number of persons.....	2.6	2.6	2.6	3.3	2.7	3.7
Earners.....	1.4	1.4	1.4	1.8	1.3	1.8
Housing tenure:						
Homeowner.....	100	100	100	100	100	100
With mortgage.....	63	63	63	73	65	72
Without mortgage.....	37	37	37	27	35	28
Renter.....	0	0	0	0	0	0
Average annual expenditures.....	\$57,223	\$58,644	\$58,242	\$69,490	\$42,131	\$51,913
Housing.....	20,359	20,803	20,502	28,662	15,646	19,890
Shelter.....	12,632	12,978	12,694	20,357	8,971	12,760
Owned dwellings.....	11,896	12,206	11,926	19,495	8,616	12,409
Mortgage principal paid on owned property.....	3,062	3,158	3,054	5,857	2,052	2,549
Mortgage interest and charges.....	4,935	5,012	4,879	8,475	4,124	6,402
Property taxes.....	2,275	2,348	2,305	3,465	1,504	2,124
Maintenance, repairs, insurance, other expenses.....	1,624	1,689	1,688	1,699	936	1,334
Rented dwellings.....	60	63	63	56	27	66
Other lodging.....	677	709	706	805	328	285
Utilities, fuels, and public services.....	3,751	3,717	3,713	3,818	4,111	3,825
Household operations.....	996	1,025	1,017	1,255	686	841
Housekeeping supplies.....	746	772	778	533	470	627
Household furnishings and equipment.....	2,234	2,311	2,300	2,699	1,409	1,838
Estimated market value of owned home.....	\$243,517	\$251,750	\$244,970	\$428,087	\$156,345	\$233,217
Share of average annual expenditures (percent distribution)						
Housing.....	35.6	35.5	35.2	41.2	37.1	38.3
Share of housing expenditures						
Shelter.....	62.0	62.4	61.9	71.0	57.3	64.2
Owned dwellings.....	58.4	58.7	58.2	68.0	55.1	62.4
Mortgage principal paid on owned property.....	15.0	15.2	14.9	20.4	13.1	12.8
Mortgage interest and charges.....	24.2	24.1	23.8	29.6	26.4	32.2
Property taxes.....	11.2	11.3	11.2	12.1	9.6	10.7
Maintenance, repairs, insurance, other expenses.....	8.0	8.1	8.2	5.9	6.0	6.7
Rented dwellings.....	0.3	0.3	0.3	0.2	0.2	0.3
Other lodging.....	3.3	3.4	3.4	2.8	2.1	1.4
Utilities, fuels, and public services.....	18.4	17.9	18.1	13.3	26.3	19.2
Household operations.....	4.9	4.9	5.0	4.4	4.4	4.2
Housekeeping supplies.....	3.7	3.7	3.8	1.9	3.0	3.2
Household furnishings and equipment.....	11.0	11.1	11.2	9.4	9.0	9.2

<sup>1</sup> All other races includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and approximately 1.3 percent reporting more than one race.

<sup>2</sup> Race and Hispanic or Latino origin are two separate and distinct

categories. Hispanic consumer units may be of any race and are categorized into one of the following racial groups: White and all other races, Asian, and Black or African-American.

Table 3. Average annual expenditures and characteristics and shares of average annual expenditures of renters by race and by Hispanic or Latino origin, Consumer Expenditure Survey, 2005

Items	All consumer units	White and all other races, and Asian			Black or African-American	Hispanic or Latino <sup>2</sup>
		Total	White and all other races <sup>1</sup>	Asian		
Number of consumer units (in thousands).....	38,284	31,066	29,458	1,608	7,218	6,290
Income before taxes .....	\$33,765	\$35,157	\$34,789	\$41,911	\$27,770	\$32,714
Age of reference person.....	40.9	40.8	40.9	38.4	41.3	38.0
Number of persons.....	2.2	2.2	2.2	2.3	2.5	3.1
Earners.....	1.2	1.2	1.2	1.2	1.1	1.5
Housing tenure:						
Homeowner .....	0	0	0	0	0	0
With mortgage.....	0	0	0	0	0	0
Without mortgage.....	0	0	0	0	0	0
Renter.....	100	100	100	100	100	100
Average annual expenditures.....	\$30,462	\$31,486	\$31,329	\$34,321	\$26,009	\$31,045
Housing .....	10,838	11,071	10,960	13,099	9,825	11,412
Shelter .....	7,296	7,557	7,442	9,664	6,170	7,718
Owned dwellings .....	89	106	93	348	16	35
Rented dwellings .....	7,065	7,290	7,187	9,173	6,097	7,615
Rent (incl. rent as pay) .....	6,981	7,197	7,090	9,161	6,051	7,547
Other expenses .....	84	93	97	12	46	68
Other lodging .....	142	161	162	142	57	68
Utilities, fuels, and public services.....	2,011	1,912	1,924	1,688	2,441	2,163
Household operations.....	397	400	398	438	382	373
Housekeeping supplies .....	331	352	352	339	240	385
Household furnishings and equipment .....	803	850	844	970	592	773
Share of average annual expenditures (percent distribution)						
Housing .....	35.6	35.2	35.0	38.2	37.8	36.8
Share of housing expenditures						
Shelter .....	67.3	68.3	67.9	73.8	62.8	67.6
Owned dwellings .....	0.8	1.0	0.8	2.7	0.2	0.3
Rented dwellings .....	65.2	65.8	65.6	70.0	62.1	66.7
Rent (incl. rent as pay) .....	64.4	65.0	64.7	69.9	61.6	66.1
Other expenses .....	0.8	0.8	0.9	0.1	0.5	0.6
Other lodging .....	1.3	1.5	1.5	1.1	0.6	0.6
Utilities, fuels, and public services.....	18.6	17.3	17.6	12.9	24.8	19.0
Household operations.....	3.7	3.6	3.6	3.3	3.9	3.3
Housekeeping supplies .....	3.1	3.2	3.2	2.6	2.4	3.4
Household furnishings and equipment .....	7.4	7.7	7.7	7.4	6.0	6.8

<sup>1</sup> All other races includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and approximately 1.3 percent reporting more than one race.

<sup>2</sup> Race and Hispanic or Latino origin are two separate and distinct

categories. Hispanic consumer units may be of any race and are categorized into one of the following racial groups: White and all other races, Asian, and Black or African-American.

# Appendix: Description of the Consumer Expenditure Survey

**T**he current Consumer Expenditure Survey (CE) program began in 1980. Its principal objective is to collect information on the buying habits of American consumers. Consumer expenditure data are used in various types of research by government, business, labor, and academic analysts. Also, the data are required for periodic revision of the Consumer Price Index (CPI).

The survey, which is conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics, consists of two components: A diary or record-keeping survey completed by participating consumer units for two consecutive 1-week periods; and an interview survey in which expenditures of consumer units are obtained in five interviews conducted at 3-month intervals.

Survey participants record dollar amounts for goods and services purchased during the reporting period, regardless of whether payment is made at the time of purchase. Expenditure amounts include all sales and excise taxes for items purchased by the consumer unit for itself or for others. Excluded from both surveys are all business-related expenditures and expenditures for which the consumer unit is reimbursed.

Each component of the survey queries an independent sample of consumer units that is representative of the

U.S. population. In the Diary Survey, about 7,000 consumer units are sampled each year. Each consumer unit keeps a diary for two 1-week periods, yielding approximately 14,000 diaries a year. In the Interview Survey, the sample is selected on a rotating panel basis, surveying about 7,000 consumer units each quarter. Each consumer unit is interviewed once per quarter, for five consecutive quarters. Data are collected on an ongoing basis in 91 areas of the United States.

The Interview Survey is designed to capture expenditure data that respondents can reasonably recall for a period of 3 months or longer. In general, data captured include relatively large expenditures, such as spending on real property, automobiles, and major appliances, and expenditures that occur on a regular basis, such as spending on rent, utilities, and insurance premiums. Also included are expenditures incurred on leisure trips. Expenditures on nonprescription drugs, household supplies, and personal care items are excluded. The Interview Survey collects detailed data on an estimated 60 to 70 percent of total household expenditures. Global estimates, that is, expenditures for a 3-month period, are obtained for food and other related items, accounting for an additional 20 to 25 percent of total expenditures.

The Diary Survey is designed to capture expenditures on small, fre-

quently purchased items that are normally difficult for respondents to recall. Detailed records of expenses are kept for food and beverages—both at home and in eating places—tobacco, house-keeping supplies, nonprescription drugs, and personal care products and services. Expenditures incurred away from home overnight or longer are excluded from the Diary Survey. Although the diary was designed to collect information on expenditures that could not be recalled easily over a period of time, respondents are asked to report *all* expenses (except overnight travel expenses) that the consumer unit incurs during the survey week.

Integrated data from the BLS Diary and Interview Surveys provide a complete accounting of consumer expenditures and income, which neither survey component alone is designed to do. Data on some expenditure items are collected in only one of the components. For example, the Diary Survey does not collect data on expenditures for overnight travel or information on third-party reimbursements of consumer expenditures, as the Interview Survey does. Examples of expenditures for which reimbursements are excluded are medical care; automobile repair; and construction, repairs, alterations, and maintenance of property.

For items unique to one or the other survey, the choice of which survey to use as the source of data is obvious. However, there is considerable overlap in coverage between the surveys. Because of this overlap, integrating the data presents the problem of determining the appropriate survey component from which to select expenditure items. When data are available from both survey sources, the more reliable of the two (as determined by statistical methods) is selected. As a result, some items are selected from the Interview Survey and others from the Diary Survey.

Population coverage and the definition of components of the CE differ

from those of the CPI. Consumer expenditure data cover the total population, whereas the CPI covers only the urban population. In addition, home ownership is treated differently in these two surveys. Actual expenditures of homeowners are reported in the CE, whereas the CPI uses a rental equivalence approach that attempts to measure the change in the cost of obtaining, in the rental marketplace, services equivalent to those provided by owner-occupied homes.

### Interpreting the data

Expenditures are averages for consumer units with specified characteristics, regardless of whether a particular unit incurred an expense for a specific item during the recordkeeping period. The average expenditure for an item may be considerably lower than the expenditure by those consumer units that actually purchased the item. The less frequently an item is purchased, the greater the difference between the average for all consumer units and the average for those purchasing the item. Also, an individual consumer unit may spend more or less than the average, depending on its particular characteristics. Factors such as income, ages of family members, geographic location, taste, and personal preference influence expenditures. Furthermore, even within groups with similar characteristics, the distribution of expenditures varies substantially. These points should be considered when relating reported averages to individual circumstances.

In addition, sample surveys are subject to two types of errors: Sampling and nonsampling. Sampling errors occur because the data are collected from a representative sample rather than the entire population. Nonsampling errors result from the inability or unwillingness of respondents to provide correct information, differences in interviewers' abilities, mistakes in recording or coding, or other processing errors.

## Glossary

**Consumer unit.** Members of a household related by blood, marriage, adoption, or some other legal arrangement; a single person living alone or sharing a household with others, but who is financially independent; or two or more persons living together who share responsibility for at least two out of three major types of expenses: Food, housing, and other expenses. Students living in university-sponsored housing are also included in the sample as separate consumer units.

**Reference person.** The first member mentioned by the respondent when asked to "Start with the name of the person or one of the persons who owns or rents the home." It is with respect to this person that the relationship of other members of the consumer unit is determined.

**Total expenditures.** The transaction costs, including excise and sales taxes, of goods and services acquired during the interview period. Estimates include expenditures for gifts and contributions and payments for pensions and personal insurance.

**Income.** The combined income earned by all consumer unit members 14 years or older during the 12 months preceding the interview. The components of income are wages and salaries; self-employment income; Social Security and private and government retirement income; interest, dividends, and rental and other property income; unemployment and workers' compensation and veterans' benefits; public assistance, Supplemental Security Income, and Food Stamps; rent or meals or both as pay; and regular contributions for support, such as alimony and child support.

**Quintiles of income before taxes.** Consumer units are ranked in ascending order of income value and divided into five equal groups. ■