

## **SUPPORTING STATEMENT**

### **Consumer Price Index Housing**

#### **B. COLLECTION OF INFORMATION EMPLOYING STATISTICAL METHODS**

The current CPI Housing Survey sample used eighty-seven geographic areas or Primary Sampling Units (PSUs) nationwide to be the boundaries from which rental housing units were selected based on 2000 Census data. Technical details of the sample design and estimation procedures of the Consumer Price Index are provided in Chapter 17 of the *BLS Handbook of Methods*, as well as "Redesigning the Consumer Price Index Area Sample" by Johnson, Shoemaker and Rhee, from the *2002 ASA Proceedings*.

The CPI Housing Survey is starting to replace samples based on the 2000 Census with samples based on the 2010 Census. The first use of housing samples based on the 2010 Census in CPI estimation in current PSUs will be for January 2017 data.

The CPI also is updating its area sample, and will begin using a 75-PSU geographic area sample design based on the 2010 Census with data for January 2018.

#### **1. Universe and Sample Size**

The universe for the CPI Housing Survey consists of all urban rental-housing units used as primary residences. The number of year-round rental-housing units in the universe is approximately 44 million units.\* These units are distributed:

Renters	41,034,000
Vacant	3,405,000

\* Source: Table 7. Estimates of the Total Housing Inventory for the United States: 2014, Housing Vacancies and Homeownership (CPS/HVS), U. S. Census Bureau.

The Rent index measures changes in rents paid by tenants and received by landlords adjusted for changes in quality. The Owners' Equivalent Rent index (OER) measures the change in the implicit rent for owner-occupied housing. The implicit rent is the amount the homeowner would pay to rent, or earn from renting his/her home in a competitive market. It is for the construction of these indexes that a sample is selected and information gathered. The current sample design uses a sample size of approximately 10,000 segments with five units per segment, or, 50,000 rental units in 87 PSUs. The sample based on the 2010 Census will use approximately 8,600 segments with five units per segment, or, 43,000 rental units in 75 PSUs.

#### **2. Collection Procedures**

The collection instruments for prescreening and computer-assisted data collection (CADC) are found in Attachments II and III, respectively.

## 2. a. Description of Sampling Methodology

A multi-stage sampling process is used in the CPI. For Housing the main steps are:

- (1) the sampling of geographic areas (segments);
- (2) configuration and weighting of selected segments;
- (3) the purchase of coded addresses for selected segments;
- (4) the elimination of addresses with a very high probability of being owners and addresses that can be identified as commercial and post office boxes;
- (5) the sampling of specific addresses in the segments;
- (6) the mail prescreening of selected addresses by renter tenure; and
- (7) the telephone/personal visit screening and initiation of eligible addresses from which rent prices will be followed over time.

## 2. b. Description of Estimation Methodology

The CPI-U and CPI-W are defined as fixed quantity price indexes, and are the ratio of the cost of purchasing a set of items of constant quality and constant quantity in two different time periods. The published CPI for the Rent and Owners' Equivalent Rent (OER) strata uses a Laspeyres estimator.

The Laspeyres index,  $I_{t,0}^L$ , where "t" is the comparison period for which a new index will be calculated and "0" the reference period, can be denoted by:

$$I_{t,0}^L = \frac{\sum_i P_{i,t} Q_{i,0}}{\sum_i P_{i,0} Q_{i,0}} * 100.0$$

where:

$P_{i,t}$  is the price for the  $i$ th item in comparison period  $t$ ,

$P_{i,0}$  is the price for the  $i$ th item in reference period 0,

$Q_{i,0}$  is the quantity of the  $i$ th item consumed in the reference period 0.

The indexes for the Rent and OER strata are specifically calculated as follows:

Let  $S_6$  be the set of rental units interviewed in the Housing survey in time  $t$  in a market basket with valid comparable rents in both time  $t$  and in time  $t-6$ . Vacant units that were previously renter occupied are also included in  $S_6$  and have current ( $t$ ) and previous ( $t-6$ ) month's rents assigned using a vacancy imputation process. Non-interviewed units that were previously renter occupied are also included in  $S_6$  and have current ( $t$ ) and previous ( $t-6$ ) month's rents assigned using a non-interview imputation process. Let the rent for rental unit  $i$  in time  $t$  be  $r_{i,t}$  and let  $a_{i,t}$  be a factor that adjusts for the estimated small loss in quality due to the aging it experienced between  $t-1$  and  $t$ . The 6-month estimate of rent change is calculated by:

$$R_{t,t-6}^L = \frac{\sum_{i \in S_6} r_{i,t} * W_{i6}}{\sum_{i \in S_6} r_{i,t-6} * e^{(-6a_{i,t})} * W_{i6}}$$

where:

$W_{i6}$  is the inverse probability of selection adjusted for non-response for renter unit  $i$ .

Using  $R_{t,t-6}^L$  and the index for the previous month,  $I_{t-1}$ , the BLS computes the current month's rent index,  $I_t$ , as follows:

$$I_t = I_{t-1} * (R_{t,t-6}^L)^{1/6}$$

The final Rent and OER indexes for month  $t$  for each market basket are last month's index times the sixth root of the six-month relative.

The rents for renters are obtained directly. The basic weights for Rent and OER were computed with the initiation of the sample design.

## 2. c. Degree of Accuracy Required

The statute mandating the CPI does not specify a required precision or accuracy for the index. However, the BLS does provide measures of the standard error for the All U. S. CPI (CPI-U) and for the Northeast, Midwest, South and West Regions CPI (CPI-U). The most recent standard error data can be viewed at <http://www.bls.gov/cpi/cpivar1402.pdf>. The BLS also requires that the precision of the CPI be maximized given the total cost. The allocation of the Rent sample was optimized given a fixed cost constraint with the stipulation that the variances of the Rent Index and the Owners' Equivalent Rent index be approximately equal.

For example, the estimate of the CPI-U median standard error for 12-month intervals from January 2013 through December 2013 was 0.17 for Rent of Primary Residence; and 0.17 for Owners' Equivalent Rent of Residences.

## 2.d. Special Sampling Procedures

Due to the difficulty in contacting some respondents, data on the rental units are collected through most of the index month.

## 2.e. Use of Periodic Data Collection Cycles

The rental units in the CPI survey are divided into 6 subsamples, called panels. Each month one panel (one-sixth of the renter units) is collected. For example, panel 1 is collected each January and July, and panel 2 is collected each February and August. Collecting each panel twice a year reduces the burden on each respondent.

### **3. Methods to Maximize Response Rates**

The Bureau of Labor Statistics has constantly engaged in research to improve the quality of the data collected and used in the CPI Housing indexes. The CPI collects data in a sample of 87 metropolitan areas called Primary Sampling Units (PSUs). The majority of the current sample, 50,000 rental units, were selected based on 2000 Census data. It is of paramount importance to the BLS to replace these units with units selected on the basis of 2010 Census data.

The survey design for the new sample of rented units has two important features: First, commercially available address lists are being used in place of a manual listing process, resulting in significant cost savings. Second, a mail prescreening survey is being employed to identify and screen out owner-occupied housing units in advance of in-person data collection.

The prescreening mail survey processes are described as follows: Initially, a vendor supplies addresses for each newly-created segment with codes that indicate the probability that the address is an owner. Since owners are out of scope for the Housing Survey, addresses that are most certainly owners are removed. Addresses that can be identified as commercial and post office boxes are also removed. The remaining addresses are sampled for a prescreening of prospective renters. Another vendor distributes and collects the mailed prescreening forms. Additionally, telephone numbers may be collected through the prescreening process.

The BLS utilizes several techniques to insure that adequate sample sizes and response rates are maintained for estimating the CPI. Initial sample sizes are larger than the desired sample sizes to cover non-responses, e.g., out-of-business, refusal, unable to locate, and housing units that convert to owner occupied, among other reasons.

Response rates are tracked and EAs who collect the data are trained to obtain complete address and telephone information for all possible eligible respondents--tenants, managers or authorized respondents--in order to complete the survey. Any potential respondent may be contacted by telephone or in person at any time during the index collection month time period. In 2014 a rent was collected for 73.4% of attempted units, 7.1% of units were reported as vacant, and the non-response rate was 19.5%.

In the CPI Housing survey, two types of imputations are employed. For non-responding units, a current price is imputed based on the movements of other units within the PSU. Units that are reported as vacant have rents imputed for them as well. Rents for newly vacant units, that have become vacant within the previous six months, are imputed using rent changes for responding units that have been occupied by the current tenant for six months or less. Rents for longer term vacant units are imputed using responding changes for units that have been occupied by the current tenant for longer than six months. For both types of imputations, group-mean imputation is used.

#### **4. Testing Plans/Procedures**

Periodically, the CPI may test a new procedure or method to determine its validity. Prior to testing of any new questions CPI will submit a nonsubstantive change to OMB for approval.

#### **5. Statistical Contacts**

W. John Layng, Assistant Commissioner for Consumer Prices and Price Indexes (telephone 202-691-6955) and Robert G. Poole, Division of Price Statistical Methods in the Office of Prices and Living Conditions of the BLS (telephone: 202-691-6910) have reviewed and approved the statistical methodology for the survey design. Other than the mail prescreened data, the Office of Field Operations of the BLS will collect all data. The data will be processed by the Division of Consumer Price Computer Systems of the Directorate of Survey Processing of the Office of Technology and Survey Processing of BLS. David M. Friedman, Associate Commissioner, Office of Prices and Living Conditions of BLS has overall responsibility for the CPI.

OMB Supporting Statement Attachments:

- I. Code of Laws—Title 29
- II. Consolidated Prescreening Forms (Provided to Strategic Research Group)
- III. Screen Shots—Collection Instrument for Housing
- IV. Housing Survey Brochure
- V. Housing Introductory Letter
- VI. Chapter 17. The Consumer Price Index (Updated 06/2015)  
<http://www.bls.gov/opub/hom/pdf/homch17.pdf>
- VII. Final Materials for the 2010 Decennial Area Sample Design Memo