Measurement of Owner Occupied Housing in the U.S. Consumer Price Index

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BEA Advisory Committee Meeting
Suitland, MD
November 15, 2019
Treatment of owner-occupied housing (OOH) in consumer price indexes is... the most difficult issue faced by CPI compilers.

The dual use of CPIs as both (1) a macroeconomic indicator and (2) an indexation tool can lead to clear tensions in designing an appropriate treatment for (OOH).

- Consumer Price Index Manual: Theory and Practice
  ILO, IMF, OECD, Eurostat, UN, World Bank, © 2004
  §§10.4-10.5, page 179.
Conceptual approaches to OOH

1. Acquisition

Objective: Change in the cost of acquiring a housing unit

Weight: Net purchase price + maintenance\repair + property taxes + insurance

Price change: Change in replacement cost of dwellings (sample of home sales)

Challenges:
- Separating investment element from consumption element
- Quality adjustment of homes sold month by month

2. Payment

3. Use
Conceptual approaches to OOH

1. Acquisition  2. Payment  3. Use

**Payment**

- **Objective:** Change in outlay required to gain access to shelter service
- **Weight:** Mortgage interest + maintenance/repair + property taxes + insurance
- **Price change:** Aggregate of price change of weight components
- **Challenges:**
  - Measurement of price change for mortgage interest cost is problematic
  - Classification of mortgage principal as investment or consumption
Conceptual approaches to OOH

1. Acquisition  2. Payment  3. Use

**Use**

- **Objective:** Change in the value of the flow of shelter service
- **Weight:** User cost or rental equivalence
  - **User Cost** = recurring costs + opportunity cost of holding the asset
  - **Rental equivalence** = estimated amount owner would pay to rent home
- **Price change:** Imputed from the change in rent of like-kind rental dwellings
- **Challenges:**
  - Full user cost difficult to measure
    - Are owner estimates of rental value reliable (for weighting)?*
    - Is rental housing stock homogeneous\representative of owned housing stock (for pricing)?
History of OOH treatment in CPI-U

Weight

- **Payment**
  - Purchase + 50% contracted mortgage interest cost + taxes + insurance + maintenance

- **Rental equivalence**

Price Change

- **1978**
  - **Owner sample**
    - Source: FHA; matrix of 600 stratified cells for quality adjustment

- **1983**
  - **Renter sample**
    - Reweighted rent change

- **1987**
  - **Owner sample matched to renter sample**
    - Implicit rent collected from owners, moved by like-kind renters (match model function of housing characteristics and location)

- **1998**
  - **Renter sample**
    - Reweighted rent change

- **2008**

- **2018**
  - **Renter sample, improved sampling**
Model to estimate segment OOH rental value

\[
\ln(\text{Rental equivalence}) - \ln(\text{Owner Rent}) = \text{Intercept} + \text{Average number of bedrooms} + \ln(\text{Average property value}) + \ln(\text{Median owner income}) + \% \text{ mobile home units} + \% \text{ other structure units} + \% \text{ apartment building} + \% \text{ high rise}
\]

- Source: CE Interview Survey data; units mapped into Census blocks (segments)
- 1998: Systematic segment sampling, controlling for inner city and suburb location
- 2008: Systematic segment sampling, controlling for segment housing stock value
12-month percent change, 1983 to 2019
## CPI Housing Survey example unit data

<table>
<thead>
<tr>
<th></th>
<th>Month T-6</th>
<th>Month T</th>
<th>Change in month T</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collected rent</strong></td>
<td>$ 500</td>
<td>$ 600</td>
<td>Landlord increased biweekly payment by $100</td>
</tr>
<tr>
<td><strong>Payment frequency</strong></td>
<td>biweekly</td>
<td>biweekly</td>
<td></td>
</tr>
<tr>
<td><strong>Normalized monthly rent</strong></td>
<td>$ 1,000</td>
<td>$1,200</td>
<td></td>
</tr>
<tr>
<td><strong>Utility adjustment</strong></td>
<td>$ 50</td>
<td></td>
<td>Electricity no longer included in rent</td>
</tr>
<tr>
<td><strong>Facility adjustment</strong></td>
<td>$ (75)</td>
<td></td>
<td>Garage parking space now included</td>
</tr>
<tr>
<td><strong>Structural change adjustment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analyst adjustment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age-bias adjustment</strong></td>
<td>$ (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Economic rent (HA01)</strong></td>
<td>$ 995</td>
<td>$1,175</td>
<td>18.1% 6-month change, 2.8% one month change</td>
</tr>
<tr>
<td><strong>Normalized monthly rent</strong></td>
<td>$ 1,000</td>
<td>$1,200</td>
<td></td>
</tr>
<tr>
<td><strong>Utility removal</strong></td>
<td>$ (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Facility adjustment</strong></td>
<td>$ (75)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Structural change adjustment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analyst adjustment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age-bias adjustment</strong></td>
<td>$ (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pure rent (HC01)</strong></td>
<td>$ 945</td>
<td>$1,125</td>
<td>19.0% 6-month change, 2.9% one month change</td>
</tr>
</tbody>
</table>

Units used for RENT but not OOH include rent-controlled units and units in 100% renter occupied segments.
Relative importance of Housing in CPI-U, December 2018

Housing = 42%

- Owners equivalent rent, 24.1
- Rent, 7.9
- Fuels and household utilities, 4.7
- Other shelter, 1.3
- Household goods and operations, 4.3
Average monthly rental equivalence, 1999 to 2017

- Nominal Rental equivalence
- Real Rental equivalence (OER deflator)
- Real Rental equivalence (All-items deflator)
- Nominal rent
- Real rent (All-items deflator)
Reliability of owner estimates of rental value

Distribution of Q1 to Q4 rent value change, 4-quarter households, CE-Interview Survey, 2018
# Rented dwellings vs. owned dwellings

**Unique addresses sampled, CE-Interview Survey, 2017 and 2018**

<table>
<thead>
<tr>
<th>Structure type</th>
<th>Owners</th>
<th>Renters</th>
</tr>
</thead>
<tbody>
<tr>
<td>single family units</td>
<td>92.0%</td>
<td>47.6%</td>
</tr>
<tr>
<td>single family detached</td>
<td>85.6%</td>
<td>31.3%</td>
</tr>
<tr>
<td>single family attached</td>
<td>6.4%</td>
<td>16.3%</td>
</tr>
<tr>
<td>multi-family units</td>
<td>2.9%</td>
<td>46.9%</td>
</tr>
<tr>
<td>garden-style</td>
<td>0.4%</td>
<td>2.4%</td>
</tr>
<tr>
<td>high-rise</td>
<td>0.7%</td>
<td>4.3%</td>
</tr>
<tr>
<td>type not specified</td>
<td>1.8%</td>
<td>40.3%</td>
</tr>
<tr>
<td>mobile homes and other units</td>
<td>5.1%</td>
<td>4.1%</td>
</tr>
<tr>
<td>college dorms</td>
<td>0.0%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

**CPI Housing Survey**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>41.5%</td>
<td>26.0%</td>
</tr>
<tr>
<td></td>
<td>15.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>56.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4%</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Single family attached units include townhomes, rowhomes, and duplexes.
2. Mobile homes and other units include houseboats, campers, and recreational vehicles garaged on owned or leased land with an address.
3. CE-Interview sample size per PSU (CBSA) in 2018: @ 250 total, 160 owner, 90 renter (64% owner, 36% renter)
5. CPI Housing Survey sample size per PSU (CBSA), roughly 100 per panel, 20 segments per PSU, 5 units per segment.
Concluding remarks

- Reliability of owner estimate of rental equivalence in CE-Interview has improved over time
- CPI Housing Survey rent sample under-represents single family detached houses for use in OOH estimator
- Future BLS research:
  - Evaluate stratification of renter sample by housing type (2004 ILO CPI Manual recommendation)
  - Evaluate use of Payment approach for OOH in subpopulation indexes such as CPI-W and CPI-E (2002 CNSTAT At What Price? recommendation)
Comments on Aten\Rassier proposal

- Should owner premium $\beta$ be calculated at the core-based-statistical area (CBSA) level instead of STATE level?
- Does the lag in ACS availability present practical challenges to implementing this methodology?
- Should 100% of vacant owned dwellings be treated as occupied (re: owners ‘rent’ to themselves)?
Contact Information

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Reference Slides
## Conceptual approaches to OOH

<table>
<thead>
<tr>
<th>Measurement Objective</th>
<th>Weight</th>
<th>Price Change</th>
<th>Practical Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use</td>
<td>Change over time in the value of the flow of shelter service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User cost</td>
<td>Change in the cost of using the dwelling</td>
<td>$rM + iE + D + RC - K$ where $M$=mortgage debt, $E$=equity in the home, $r$= mortgage interest rates, $i$= rate of return available on alternative assets, $D$=depreciation, $RC$= recurring costs, and $K$=capital gains.</td>
<td>Derive from rent sample, excluding rent-controlled and rent subsidized units</td>
</tr>
<tr>
<td>Rental equivalence</td>
<td>Change in the price of the housing service consumed</td>
<td>1. Estimate of rental value by owner; or 2. Match owner dwelling to rental dwelling, and use rented dwelling rental value</td>
<td></td>
</tr>
</tbody>
</table>

| **2. Payment**        |        |              |                 |
| Payment               | Change in actual outlay required to gain access to shelter service | Downpayments on new purchases + purchase transaction costs + repayments of mortgage principal + mortgage interest + alterations and additions + insurance + maintenance and repair + property taxes | Aggregate of separate component indexes for mortgage interest, maintenance and repair, and property taxes | Measurement of mortgage interest cost change difficult |

| **3. Acquisition**    |        |              |                 |
| Acquisition           | Change in the cost of acquiring the dwelling | Net purchases of used dwelling + purchases of new dwellings + alterations and additions + purchase transaction costs + maintenance and repair + insurance + property taxes minus portion considered investment (e.g. cost of land=investment element and cost of structure=consumption element). | Change in replacement cost of existing dwellings and newly constructed dwellings (owner sample) | Separating investment element from consumption element |

**NOTES:**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CONCEPT</th>
<th>WEIGHT</th>
<th>PRICE CHANGE</th>
</tr>
</thead>
</table>
| 1978 | Payment                  | Net purchase price (1968-1973) + mortgage interest cost (first half of amortization term) + property tax + maintenance and repairs + insurance | Quality adjusted average price of a monthly, lagged rotating sample of homes purchased.  
SOURCE: house sales from Federal Housing Administration  
+ Indexes for mortgage interest cost change  
+ Indexes for maintenance & repairs, insurance, and property taxes (standard CPI goods\services approach) |
| 1983 |                          |                                                                        | Renter sample; reweighted to represent owner units                                                                                                                                                           |
| 1987 |                          |                                                                        | Owner sample; implicit rent moved forward by matched rented dwelling unit                                                                                                                                 |
| 1998 | Use (Rental equivalence) | Rental value of owned dwelling, unfurnished and without utilities; Directly estimated in CE-Interview Survey | Renter sample; reweighted to represent owner units; sample stratified by geography to control for inner city and suburb representation                                                                          |
| 2018 |                          |                                                                        | Renter sample; reweighted to represent owner units; CBSA's partitioned into segments (Census block groups); systematic sampling of segments, controlling for total housing stock value                                      |