Homeownership Costs

The Bureau of Labor Statistics has announced a plan to change the way the Consumer Price Index measures homeownership costs. Here are some questions and answers about the change.

1. Why is the change in the homeownership component being made?

The change is being made to improve the CPI. The cost of owning a home is a large part of a family's expenses. People buy houses to live in and because houses are important investments. The CPI should include the price of the shelter provided by the home but should exclude the change in the value of the house as an asset. The new approach will do that.

2. Will the change result in lower inflation figures?

There is no way of knowing whether the new measure will produce higher or lower inflation figures. In the past, an experimental measure similar to the one to be adopted rose more slowly than the CPI.

3. Was politics involved in the decision to change the CPI?

The decision to change the homeownership component was made entirely on technical grounds by the Commissioner of Labor Statistics. The CPI is widely used to adjust benefits under government programs and payments under private contracts. Any change in the index naturally is of concern to those who have a stake in these payments, both as payers and recipients. Because of these concerns, decisions about CPI measurement are carefully insulated from politics.

4. How does the present CPI measure homeownership?

The present CPI reflects the cost of the purchase of a house as an asset. The index includes the net price of the house purchased, the total amount of mortgage interest contracted for over the entire life of the mortgage, property taxes, insurance, and home maintenance and repairs. The current CPI represents the expenditures of only those who purchased houses in the base period, roughly 6 percent of all consumers covered by the index. All other consumers living in their own homes are assumed to have no home purchase and mortgage interest cost at all.

5. What is wrong with the current approach?

From a practical point of view, accurate data needed to support the current approach are becoming increasingly difficult to obtain. The scarcity of long-term mortgage financing, the growth of seller financing, and the advent of variable rate mortgages have combined to make the current approach unrepresentative of the marketplace.

Furthermore, the current approach is based upon the purchase of an asset rather than the price of the shelter consumed. The index reflects shelter costs incurred only by those who purchased homes in the base period and does not cover shelter costs incurred by others who lived in homes purchased in earlier years.

6. How will the new homeownership measure differ?

A new measure of rental equivalence will be used to represent the cost of the shelter consumed by the homeowner. BLS agents will collect information on rents for housing units that are similar to those that are owned. The change in these rents will represent the change in the amount that a homeowner would have to pay each month to live in a home like the one he owns.

7. How will the change to rental equivalence affect the weight of homeownership in the CPI?

Homeownership costs make up about 25 percent of the present CPI. In an experimental rental equivalence measure produced by BLS, homeownership accounted for about 14 percent.

8. How will the rental equivalence measure differ from the CPI rent measure?

The rental equivalence measure will consist of rents for a sample of homes for which sample weights represent owned units. Thus, in each sampling area, the

housing units will represent the proportion of owner-occupied houses rather than the proportion of rental units.

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The CPI is an important statistical series which affects the incomes of a large number of people. It must have public credibility and it must be understood. The BLS raised the measurement issue publicly more than 10 years ago, published papers on the subject, calculated alternative measures, and encouraged public discussion of the issues involved. It took time for people to understand the issue.

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2. Families covered:	For house price and mortgage interest, only those families who in base period purchased house	All families who lived in owned homes during base period; covers the entire stock of owned homes
3. Method of weight derivation:	a. For property taxes, property insurance, home maintenance and repairs: Expenditures of all homeowners in base period	Estimate of rental value of all owner-occupied houses in base period; based on specific question asked in Consumer Expenditure Survey
	b. For house price: Net expenditures (purchases minus sales) for houses during base period	
	c. For mortgage interest: Total amount of interest expected to be paid over half the stated life of the mortgage only for those who purchased house in base period	
4. Prices used:	Current monthly prices for each element, including current price of house and current mortgage interest rate (conventional, Federal Housing Administration, and Veterans Administration)	Current rent paid for homes like those that are owned

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The Bureau of Labor Statistics has announced a plan to change the way the Consumer Price Index measures homeownership costs. Here are some questions and answers about the change.

1. Why is the change in the homeownership component being made?

The change is being made to improve the CPI. The cost of owning a home is a large part of a family's expenses. People buy houses to live in and because houses are important investments. The CPI should include the price of the shelter provided by the home but should exclude the change in the value of the house as an asset. The new approach will do that.

2. Will the change result in lower inflation figures?

There is no way of knowing whether the new measure will produce higher or lower inflation figures. In the past an experimental measure similar to the one to be adopted rose more slowly than the CPI.

3. Was politics involved in the decision to change the CPI?

The decision to change the homeownership component was made entirely on technical grounds by the Commissioner of Labor Statistics. The CPI is widely used to adjust benefits under government programs and payments under private contracts. Any change in the index naturally is of concern to those who have a stake in these payments, both as payers and recipients. Because of these concerns, decisions about CPI measurement are carefully insulated from politics.

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There is no way of knowing whether the new measure will produce higher or lower inflation figures. In the past an experimental measure similar to the one to be adopted rose more slowly than the CPI.

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5. What is wrong with the current approach?

From a practical point of view, accurate data needed to support the current approach are becoming increasingly difficult to obtain. The scarcity of long-term mortgage financing, the growth of seller financing, and the advent of variable rate mortgages have combined to make the current approach unrepresentative of the marketplace.

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7. How will the change to rental equivalence affect the weight of homeownership in the CPI?

Homeownership costs make up about 25 percent of the present CPI. In an experimental rental equivalence measure produced by BLS, homeownership accounted for about 14 percent.

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Changing the Homeownership Component of the Consumer Price Index to Rental Equivalence

The Bureau of Labor Statistics introduced an important improvement in the Consumer Price Index for All Urban Consumers (CPI-U) with release of January 1983 data on February 25, 1983. The Bureau changed the homeownership component of the CPI to a "flow-of-services" approach. The change, first announced by Commissioner of Labor Statistics Janet L. Norwood in October of 1981,[1] was implemented by means of the rental equivalency technique.

The Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) will continue to use the old homeownership method until January 1985, when it also will be changed to incorporate a rental equivalence measure of homeownership costs. In both cases, BLS will publish indexes using the old method for a 6-month overlap period following the switch to the new method.

In essence, the change converted the homeownership component from a method that included investment as well as consumption elements, to a flow-of-services approach that measures only the cost of shelter services consumed by homeowners. The flow-of-services approach was implemented using the rental equivalence technique, which estimates the change in the cost of renting housing services equivalent to those provided by owner-occupied homes.

This article presents some background on the nature and purpose of the change and the steps involved in the conversion to the rental equivalence measure. The specific changes, discussed in detail below, are summarized in tabular form in table D.

Background

The change in the index followed many years of recommendations and research by BLS staff and by other government, academic, business, and labor economists and statisticians.

The Bureau conducted extensive research on measuring shelter cost for homeowners as part of the program that led to the comprehensive revision of the CPI in 1978. From these efforts came a BLS staff proposal to change the treatment of shelter costs in the CPI to a flow-of-services approach. This proposal was widely reviewed and discussed. However, difficulties in developing a workable flow-of-services measure and the diversity of views held by various advisory groups led to the decision not to change the component's concept at that time.

After the completion of the revision program, BLS continued its research on the measurement of homeownership costs. In 1980, the Bureau introduced five experimental measures (known as the CPI-U-X1 through the CPI-U-X5) to demonstrate the effect different homeownership concepts and techniques could have on the All Items CPI. The measure known as CPI-U-X1, which used a rent substitution technique, is the direct (although approximate) antecedent of the method the Bureau now has adopted. The development of the CPI-U-X1 increased confidence in the workability and credibility of a rental equivalence measure. The extraordinary changes that have occurred in real estate and mortgage markets in recent years, changes which called greater attention to the limitations of the old method, also influenced the timing of the Bureau's decision to change the homeownership component.

The asset approach to homeownership formerly used in the CPI-U was based in part on house prices and mortgage interest rates. In recent years, the Bureau has had serious difficulties in obtaining reliable data for both.

Important changes had occurred in financial markets which were not reflected in the CPI. Funds available for long-term mortgage commitments had declined sharply. New types of mortgage instruments, involving variable rates, shorter financing terms, and other special arrangements, had developed, making the standard, long-term, fixed-rate mortgage used in the CPI increasingly unrepresentative of the mortgage market. In fact, some of the new instruments had characteristics, such as variable rates and principal amounts, which made them impossible to use in computing the CPI, because the CPI assumed long-term mortgages at fixed interest rates. Furthermore, because of high interest rates and difficulties faced by home buyers in securing bank mort-

[1] Janet L. Norwood, "Statement Regarding Changes in the Consumer Price Index," News release 81-506, U.S. Department of Labor, Bureau of Labor Statistics, October 27, 1981.

gages, many owners were offering to sell their home by providing financing at below bank rates. These financing arrangements were not reflected in the CPI.

The house prices used in the CPI-U were obtained from the Federal Housing Administration (FHA) and pertained only to purchases financed with FHA-insured mortgages. This data base represented a very small, specialized, and declining segment of the housing market; the data were becoming less representative of the market and were causing serious estimation problems.

In addition to problems of data adequacy, the Economic Recovery Tax Act of 1981 (Public Law 97-34), which requires use of the CPI-U for escalation of income tax brackets and the personal exemption amount, made it even more important to improve the index. The law requires announcement of the new tax brackets in December 1984, based on CPI-U data for the prior 2 years. This major new use of the index will have a broad effect on total Federal Government revenues. This new use was among the factors which underscored the importance of action to ensure that the CPI reflects the consumption cost experience of consumers in the most accurate way possible.

Conceptual framework for homeownership

The appropriateness of a given homeownership method for use in the CPI is best judged in terms of its underlying conceptual framework. The old method of measuring homeownership costs—the so-called asset approach—is based on procedures that are largely definitional. The flow-of-services approach and the rental equivalence methods were developed directly from the economic theory of consumer price indexes.

In the overall conceptual framework for the Consumer Price Index,[2] it is assumed that the consumer's welfare is determined by the flow of consumption services received, where the services can be (1) directly provided, (2) obtained coincidentally with the consumption of a nondurable good (in which case, the distinction between a good and a service is unnecessary), or (3) obtained from the use of a durable good owned by the consumer. In each case, satisfaction is derived from the act of consumption. Ownership of a source of consumption service—a durable good—is an "investment," designed to provide consumption services over a future timespan.

Within this framework, the CPI should measure the change over time in the cost of the market basket of services consumed in the base period. For the services provided by directly purchased services and nondurable goods, this implies observing market prices and transaction levels in the base period, as well as the subsequent time path of market prices. However, for the services provided by durable goods owned by consumers, the implicit price of the services must be estimated, because market transactions do not take place each time the service is consumed. Consequently, the problem is basically one of estimation. This problem is not serious for many durable goods because aggregate service flows and aggregate purchase flows are closely related, and asset price movements are closely related to service price movements. For example, an automobile normally will depreciate fully over a period of years. New automobile purchases during a period can be viewed as replacing the depreciated stock, thus equaling the value of automobile services for all consumers. In these cases, standard techniques can be used. For housing, however, this pattern does not typically hold, and more complex procedures are required to capture its consumption cost.

The rental equivalence approach as incorporated into the CPI attempts to answer the following question: How much rental income do the owners of housing units forego when they choose to occupy the units themselves instead of renting them out? In what follows, this is called the "implicit rent." It is useful to stress that, although homeowners' rent is implicit, it is not hypothetical. It is a cost all homeowners actually incur. This cost includes both indirect and direct homeowner expense items. Indirect items include the cost of keeping wealth tied up as equity in one's home and the house's physical depreciation. Price appreciation can be an implicit negative cost, that is, a cost offset, when rising real estate prices give homeowners a gain in the value of their homes. Property taxes and insurance are examples of direct homeowners' expenditures which affect the level of homeowners' implicit rent.

Implementation of rental equivalence

Even before the October 1981 decision to adopt the rental equivalence method, work was underway to improve the experimental rental equivalence measure, CPI-U-X1, and to conduct further research on rental equivalence techniques. Funds were obtained to augment the CPI rent survey, adding more renters in heavily owner-occupied areas, and to begin observing a sample of owner-occupied housing units. With the decision to convert homeownership costs in the CPI-U to a rental equivalence measure, these activities were organized into three separate phases of work.

Phase 1 addressed the limitations of the experimental measure CPI-U-X1 and was completed with the publication of the January 1983 CPI. Phase 2 augmented the rent sample so as to improve both the homeowners' rent-

[2] For a fuller discussion, see Robert Gillingham, "A Conceptual Framework for the Revised Consumer Price Index," *Proceedings*, Business and Economics Statistics Section, American Statistical Association, 1974, pp. 246-52. See also Robert Gillingham and Walter Lane, "Changing the Treatment of Homeownership in the CPI," *Monthly Labor Review*, June 1982, pp. 9-14; and Robert Gillingham, "Estimating the User Cost of Owner-Occupied Housing," *Monthly Labor Review*, February 1980, pp. 31-35.

al equivalence and the regular rent components of the CPI. Although not originally announced for completion at this time, phase 2 also was completed with the publication of the January 1983 CPI. Phase 3, which is currently in progress, consists of research activities to identify improved rental equivalence estimating techniques.

Limitations of CPI-U-X1

Because the CPI-U-X1 was computed outside the CPI production system by restructuring indexes at the U.S. major group level, it lacked the precision and detail and, more importantly, the proper local area weighting of the official CPI. Further, the five homeownership items of the old method—home purchase, contracted mortgage interest cost, property taxes, property insurance, and maintenance and repairs—were simply replaced in the CPI-U-X1 by a single, new homeownership item. The weight for this new item was computed using a rather imprecise, shortcut technique from homeowners' estimates of what their homes would rent for, as reported in the 1972-73 Consumer Expenditure Survey. Finally, the price movement used for this new item was the price movement of the U.S. residential rent index.

Phase 1

In phase 1, these limitations of the CPI-U-X1 were addressed. First, the new index was computed from local-area item-strata cost weights. This process provides the precision, complete item and geographic detail, and proper geographic weighting associated with the official CPI. Second, new expenditure weights were calculated by means of the complex statistical estimating procedures used throughout the CPI. As described in detail below, weights were calculated for a new primary homeownership item, titled homeowners' equivalent rent, and recalculated for household insurance, maintenance and repairs, and household appliances. Finally, a new set of statistical weights for the sample of rental units was calculated so that its price movements could represent owner-occupied housing units as well as renter-occupied units.

Expenditure weight calculation

The expenditure weights currently used in the CPI refer to the 1972-73 period and are based upon a survey of consumer spending conducted at that time. Calculation of the base-period expenditure weights for the primary rental equivalence item, and for portions of the maintenance and repairs and the appliance strata, was straightforward since these weights were standard tabulations from expenditures reported in the 1972-73 survey. However, the calculation of secondary strata weights—those for insurance and for the homeowners' shares of maintenance and repairs and appliances—under the rental equivalence approach proved more complex. The relative importance of each index component resulting from this activity is shown in table E.

Owners' equivalent rent. The weights for the primary new stratum, owners' equivalent rent, are based on the owner's estimate of what the house would rent for. In the 1972-73 Consumer Expenditure Survey, each homeowner was asked: "If you were to rent out your home today, how much do you think it would rent for monthly, unfurnished and without utilities?" Studies of the responses to this question showed estimates to be reasonable. The responses, tabulated by geographic area, structure type, age, and other variables, were compared, cell by cell, with the rents on similarly classified renter-occupied residences. The estimated rents for owner units were, consistently, slightly higher than the actual rents for the renter units. This indicates that it is likely that owner-occupied homes are, as is generally thought, somewhat better than those occupied by renters even in the same geographic areas and the same age and structure type categories. Therefore, they command a higher rent.

Maintenance and repairs. The rental-equivalence items for maintenance and repairs contain both renters' and owners' expenditures. The renters' expenditure portion of each item weight was computed by aggregation of actual renter expenditures as reported in the 1972-73 survey. For the owners' portions of the maintenance and repair strata, weights were estimated by imputing expenditures from survey renters to survey homeowners. In each region, renters were sorted into cells by variables such as size of house, type of structure, and age of structure. The average expenditure by renters with the cell characteristics for each of the five maintenance and repair strata was assigned to each homeowner with the cell's characteristics. The resulting weights were consistent and reasonable for all but 1 of the 5 maintenance and repair strata. For one stratum, which included miscellaneous hardware items, the directly estimated owner weights were used because they are not particularly tenure sensitive and many of the items in the stratum are not likely to be provided by a landlord. Capital improvements made by homeowners are out of scope under the flow-of-services concept.

Household insurance. The rental-equivalence expenditure weights for insurance were obtained by reducing owners' total expenditures for property insurance to remove the share of insurance included in owners' equivalent rent. This was accomplished by adjusting the old method weights. Factors to do this were developed from insurance industry data for each of the four regions of the United States. It was assumed that the owners' estimated rents included property insurance on

their dwellings' structure, but did not include "tenant" coverages for contents or liability. The factors that removed the structure coverage were the ratios of premiums for tenant insurance policies to comparable homeowner policies. For example, a homeowner policy was priced for a $50,000 masonry, single-family home with $25,000 contents and liability coverages in selected rating areas for selected insurance companies. Then, a tenant's policy, which covered everything except damage to the house itself, was priced for the same coverages, areas, and companies. The ratios of the tenant policy prices to the owner policy prices were computed for a number of specifications. The ratios within each region were averaged to obtain the factors; they were 0.64, for the Northeast, 0.59 for the North Central, 0.60 for the South, and 0.68 for the West. These ratios were applied to the current weights for homeowners' insurance to produce the rental equivalence household insurance weight.

Appliances. For the four appliance strata, a similar, but more complex, reduction-factor scheme was devised using data for rental units in the 1972-73 survey. It was assumed that owners' expenditures for these appliances during the survey year were a reasonable estimate of the value of the flow of services provided by the entire stock of these appliances during the survey year. However, since some housing units were rented with certain appliances—that is, the services of the appliances are included in the rent—owner expenditures for these appliances needed to be scaled down by the proportion assumed to be in the implicit rent. For the four major appliance items (refrigerators/freezers, washers/dryers, dishwashers, and stoves), it was assumed that the proportion of homeowners who included the services of each appliance in their estimate of implicit rent was equal to the proportion of comparably specified rental units in the same geographic area in which the appliance was supplied. For the other appliance items (floor-cleaning equipment, sewing machines, office machines, window air-conditioners, and small electric kitchen appliances), the reduction factor was assumed to be 1.0; that is, it was assumed that no expense for these items was covered in homeowners' estimates of what their dwellings would rent for. Factors were computed for the 40 CPI publication areas and, within each area, for three types of dwellings (single-family, multifamily, and mobile homes). These appliance factors—the proportion of rental units in which the appliance was not provided for in the rent—were applied to the owners' appliance expenditure to obtain an estimateof the value of appliance services not included in the implicit rent and, consequently, the value which, when added to renters' appliance expenditures, produced the new appliance expenditure weight.[3]

Statistical reweighting of the rent sample

Rental units in the existing rent sample were selected with a multistage technique, using 1970 census data. First, using a stratified technique, a set of Census-defined areas called enumeration districts was chosen within each CPI pricing area. The selection was proportional to the number of renters. Enumeration districts are generally the smallest areas for which stratification variables are available. Among the stratification variables used for selection was the extent of owner occupancy; that is, whether the enumeration districts were mostly (more than 65 percent) owner-occupied residences, mixed (between 20 and 65 percent owner occupied), or mostly renter (under 20 percent owner occupied). BLS subdivided the selected enumeration districts into smaller areas called segments, usually containing between 40 and 125 housing units. One or more segments were selected, on a probability basis, for each enumeration district. All the housing units in the selected segments were screened to determine their tenure status (whether owner or renter) and a simple random sample of the renters in each segment was taken. This rent sample was designed to measure rent change for renters. Each sample unit was weighted according to the number of rent units it represented. Those units in mostly owner-occupied segments represented renters in those areas, and the units in mixed and mostly renter areas represented renters in those areas. Because the enumeration districts, segments, and sample units were selected with probability proportional to the number of renters, each unit in the sample for each CPI publication area had a weight of approximately the same magnitude; that is, the sample was efficiently designed to estimate rent change for renters.

In phase 1 of rental equivalence a new statistical weight for each unit in the rent sample was calculated so that the rent units would represent the owners. The new owner weights were computed by applying to each unit's original renter weight the ratio of owners to renters in its enumeration district. For example, the phase 1 owner weights for all the units located in an enumeration district that was 90-percent owner and 10-percent renter would be the old renter weights increased by a factor of 9 (90 ÷ 10). In an enumeration district which was 80-percent renter and 20-percent owner, the weight was multiplied by a factor of 0.25 (20 ÷ 80). Thus, with the recalculated statistical weights, the units in the existing rent sample are assumed to represent the owners in their enumeration districts. Ultimately, they also represent the owners in their CPI areas and the urban United

[3] The appliance weight estimate based on imputing renters' expenditures to owners does not produce satisfactory results because renters' households are, in general, younger than owners' households and, consequently, do a great deal of first-time appliance purchasing, which is investment, rather than replacement, expenditure.

States. With the original and the recalculated weights, two different measures of rent change can be calculated, rent change for renters using the original weights and rent change for owners using the recalculated weights. However, since the enumeration districts were chosen to represent renters, not owners, and since the recalculated weights are so varied, the rent change estimator for owners derived from the reweighted sample is not as efficient for owners as the rent change estimator is for renters, which uses the original weights.

Phase 2 – rent sample augmentation

As already noted, the original rental unit weights are all roughly the same size in each publication area, which makes the existing rent survey a reasonably efficient estimator for renters. However, the phase 1 owner weights varied greatly from one another, so that the phase 1 measure was not as efficient. The recalculated weights of some units were reduced to zero (those in 100-percent renter areas), while others' weights were increased by as much as 35 times. Consequently, while the phase 1 reweighting did represent owners, it was relatively inefficient; the variance of the estimates was higher than could be obtained for the sample size if the survey were focused on representing owners. The phase 2 augmentation was designed to mitigate this shortcoming, at least in part. The augmentation was concentrated in the heavily owner-occupied enumeration districts. New segments and sample units were selected from them and added to the sample. All statistical weights were then recalculated for a second time. First, the original weights (those representing renters) were recomputed, yielding lower values in the heavily owner-occupied areas where the additional units were concentrated as the fixed weight of each enumeration district was spread among more units. Second, the weights representing owners were recalculated from the new weights for renters in the same manner as phase 1. Because the weights representing renters became smaller in the areas with high ratios of owners to renters, the new statistical weights representing owners generally became lower, too. So the phase 2 augmentation lowered many of the very high owner weights, reducing the range of their magnitudes and thereby improving the estimate of rent change for owners. More importantly, the augmentation increased the sample size, thereby reducing the expected error of the estimators.

Phase 3

Although it may lead to more immediate technical improvements in measuring homeowners' implicit rent, phase 3 is primarily research into advanced rental equivalence methods to be implemented in the next CPI revision. For phase 3, BLS is developing a sample of homeowners to be resurveyed annually. Various techniques will be tested for estimating implicit rent for the owners.

Future improvements

The 1983 change in the CPI-U breaks new ground in applied economic measurement. Further improvements can undoubtedly be made. In addition to those which may result from the phase 3 research effort, more extensive changes for housing are planned in the next comprehensive index revision. Revision plans include a larger housing survey, based on the 1980 census and designed, from the outset, to support price change estimators for both homeowners and renters. Expenditure weights for housing will be based on a more current period, will use more precise calculation procedures, and will have more consistency among housing items.

Changing the Homeownership Component of the Consumer Price Index to Rental Equivalence

The Bureau of Labor Statistics introduced an important improvement in the Consumer Price Index for All Urban Consumers (CPI-U) with release of January 1983 data on February 25, 1983. The Bureau changed the homeownership component of the CPI to a "flow-of-services" approach. The change, first announced by Commissioner of Labor Statistics Janet L. Norwood in October of 1981,[1] was implemented by means of the rental equivalency technique.

The Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) will continue to use the old homeownership method until January 1985, when it also will be changed to incorporate a rental equivalence measure of homeownership costs. In both cases, BLS will publish indexes using the old method for a 6-month overlap period following the switch to the new method.

In essence, the change converted the homeownership component from a method that included investment as well as consumption elements, to a flow-of-services approach that measures only the cost of shelter services consumed by homeowners. The flow-of-services approach was implemented using the rental equivalence technique, which estimates the change in the cost of renting housing services equivalent to those provided by owner-occupied homes.

This article presents some background on the nature and purpose of the change and the steps involved in the conversion to the rental equivalence measure. The specific changes, discussed in detail below, are summarized in tabular form in table C.

Background

The change in the index followed many years of recommendations and research by BLS staff and by other government, academic, business, and labor economists and statisticians.

The Bureau conducted extensive research on measuring shelter cost for homeowners as part of the program that led to the comprehensive revision of the CPI in 1978. From these efforts came a BLS staff proposal to change the treatment of shelter costs in the CPI to a flow-of-services approach. This proposal was widely reviewed and discussed. However, difficulties in developing a workable flow-of-services measure and the diversity of views held by various advisory groups led to the decision not to change the component's concept at that time.

After the completion of the revision program, BLS continued its research on the measurement of homeownership costs. In 1980, the Bureau introduced five experimental measures (known as the CPI-U-X1 through the CPI-U-X5) to demonstrate the effect different homeownership concepts and techniques could have on the All Items CPI. The measure known as CPI-U-X1, which used a rent substitution technique, is the direct (although approximate) antecedent of the method the Bureau now has adopted. The development of the CPI-U-X1 increased confidence in the workability and credibility of a rental equivalence measure. The extraordinary changes that have occurred in real estate and mortgage markets in recent years, changes which called greater attention to the limitations of the old method, also influenced the timing of the Bureau's decision to change the homeownership component.

The asset approach to homeownership formerly used in the CPI-U was based in part on house prices and mortgage interest rates. In recent years, the Bureau has had serious difficulties in obtaining reliable data for both.

Important changes had occurred in financial markets which were not reflected in the CPI. Funds available for long-term mortgage commitments had declined sharply. New types of mortgage instruments, involving variable rates, shorter financing terms, and other special arrangements, had developed, making the standard, long-term, fixed-rate mortgage used in the CPI increasingly unrepresentative of the mortgage market. In fact, some of the new instruments had characteristics, such as variable rates and principal amounts, which made them impossible to use in computing the CPI, because the CPI assumed long-term mortgages at fixed interest rates. Furthermore, because of high interest rates and difficulties faced by home buyers in securing bank mort-

[1] Janet L. Norwood, "Statement Regarding Changes in the Consumer Price Index," News release 81-506, U.S. Department of Labor, Bureau of Labor Statistics, October 27, 1981.

gages, many owners were offering to sell their home by providing financing at below bank rates. These financing arrangements were not reflected in the CPI.

The house prices used in the CPI-U were obtained from the Federal Housing Administration (FHA) and pertained only to purchases financed with FHA-insured mortgages. This data base represented a very small, specialized, and declining segment of the housing market; the data were becoming less representative of the market and were causing serious estimation problems.

In addition to problems of data adequacy, the Economic Recovery Tax Act of 1981 (Public Law 97-34), which requires use of the CPI-U for escalation of income tax brackets and the personal exemption amount, made it even more important to improve the index. The law requires announcement of the new tax brackets in December 1984, based on CPI-U data for the prior 2 years. This major new use of the index will have a broad effect on total Federal Government revenues. This new use was among the factors which underscored the importance of action to ensure that the CPI reflects the consumption cost experience of consumers in the most accurate way possible.

Conceptual framework for homeownership

The appropriateness of a given homeownership method for use in the CPI is best judged in terms of its underlying conceptual framework. The old method of measuring homeownership costs—the so-called asset approach—is based on procedures that are largely definitional. The flow-of-services approach and the rental equivalence methods were developed directly from the economic theory of consumer price indexes.

In the overall conceptual framework for the Consumer Price Index,[2] it is assumed that the consumer's welfare is determined by the flow of consumption services received, where the services can be (1) directly provided, (2) obtained coincidentally with the consumption of a nondurable good (in which case, the distinction between a good and a service is unnecessary), or (3) obtained from the use of a durable good owned by the consumer. In each case, satisfaction is derived from the act of consumption. Ownership of a source of consumption service—a durable good—is an "investment," designed to provide consumption services over a future timespan.

Within this framework, the CPI should measure the change over time in the cost of the market basket of services consumed in the base period. For the services provided by directly purchased services and nondurable goods, this implies observing market prices and transaction levels in the base period, as well as the subsequent time path of market prices. However, for the services provided by durable goods owned by consumers, the implicit price of the services must be estimated, because market transactions do not take place each time the service is consumed. Consequently, the problem is basically one of estimation. This problem is not serious for many durable goods because aggregate service flows and aggregate purchase flows are closely related, and asset price movements are closely related to service price movements. For example, an automobile normally will depreciate fully over a period of years. New automobile purchases during a period can be viewed as replacing the depreciated stock, thus equaling the value of automobile services for all consumers. In these cases, standard techniques can be used. For housing, however, this pattern does not typically hold, and more complex procedures are required to capture its consumption cost.

The rental equivalence approach as incorporated into the CPI attempts to answer the following question: How much rental income do the owners of housing units forego when they choose to occupy the units themselves instead of renting them out? In what follows, this is called the "implicit rent." It is useful to stress that, although homeowners' rent is implicit, it is not hypothetical. It is a cost all homeowners actually incur. This cost includes both indirect and direct homeowner expense items. Indirect items include the cost of keeping wealth tied up as equity in one's home and the house's physical depreciation. Price appreciation can be an implicit negative cost, that is, a cost offset, when rising real estate prices give homeowners a gain in the value of their homes. Property taxes and insurance are examples of direct homeowners' expenditures which affect the level of homeowners' implicit rent.

Implementation of rental equivalence

Even before the October 1981 decision to adopt the rental equivalence method, work was underway to improve the experimental rental equivalence measure, CPI-U-X1, and to conduct further research on rental equivalence techniques. Funds were obtained to augment the CPI rent survey, adding more renters in heavily owner-occupied areas, and to begin observing a sample of owner-occupied housing units. With the decision to convert homeownership costs in the CPI-U to a rental equivalence measure, these activities were organized into three separate phases of work.

Phase 1 addressed the limitations of the experimental measure CPI-U-X1 and was completed with the publication of the January 1983 CPI. Phase 2 augmented the rent sample so as to improve both the homeowners' rent-

[2] For a fuller discussion, see Robert Gillingham, "A Conceptual Framework for the Revised Consumer Price Index," *Proceedings*, Business and Economics Statistics Section, American Statistical Association, 1974, pp. 246-52. See also Robert Gillingham and Walter Lane, "Changing the Treatment of Homeownership in the CPI," *Monthly Labor Review*, June 1982, pp. 9-14; and Robert Gillingham, "Estimating the User Cost of Owner-Occupied Housing," *Monthly Labor Review*, February 1980, pp. 31-35.

al equivalence and the regular rent components of the CPI. Although not originally announced for completion at this time, phase 2 also was completed with the publication of the January 1983 CPI. Phase 3, which is currently in progress, consists of research activities to identify improved rental equivalence estimating techniques.

Limitations of CPI-U-X1

Because the CPI-U-X1 was computed outside the CPI production system by restructuring indexes at the U.S. major group level, it lacked the precision and detail and, more importantly, the proper local area weighting of the official CPI. Further, the five homeownership items of the old method—home purchase, contracted mortgage interest cost, property taxes, property insurance, and maintenance and repairs—were simply replaced in the CPI-U-X1 by a single, new homeownership item. The weight for this new item was computed using a rather imprecise, shortcut technique from homeowners' estimates of what their homes would rent for, as reported in the 1972-73 Consumer Expenditure Survey. Finally, the price movement used for this new item was the price movement of the U.S. residential rent index.

Phase 1

In phase 1, these limitations of the CPI-U-X1 were addressed. First, the new index was computed from local-area item-strata cost weights. This process provides the precision, complete item and geographic detail, and proper geographic weighting associated with the official CPI. Second, new expenditure weights were calculated by means of the complex statistical estimating procedures used throughout the CPI. As described in detail below, weights were calculated for a new primary homeownership item, titled homeowners' equivalent rent, and recalculated for household insurance, maintenance and repairs, and household appliances. Finally, a new set of statistical weights for the sample of rental units was calculated so that its price movements could represent owner-occupied housing units as well as renter-occupied units.

Expenditure weight calculation

The expenditure weights currently used in the CPI refer to the 1972-73 period and are based upon a survey of consumer spending conducted at that time. Calculation of the base-period expenditure weights for the primary rental equivalence item, and for portions of the maintenance and repairs and the appliance strata, was straightforward since these weights were standard tabulations from expenditures reported in the 1972-73 survey. However, the calculation of secondary strata weights—those for insurance and for the homeowners' shares of maintenance and repairs and appliances—under the rental equivalence approach proved more complex. The relative importance of each index component resulting from this activity is shown in table D.

Owners' equivalent rent. The weights for the primary new stratum, owners' equivalent rent, are based on the owner's estimate of what the house would rent for. In the 1972-73 Consumer Expenditure Survey, each homeowner was asked: "If you were to rent out your home today, how much do you think it would rent for monthly, unfurnished and without utilities?" Studies of the responses to this question showed estimates to be reasonable. The responses, tabulated by geographic area, structure type, age, and other variables, were compared, cell by cell, with the rents on similarly classified renter-occupied residences. The estimated rents for owner units were, consistently, slightly higher than the actual rents for the renter units. This indicates that it is likely that owner-occupied homes are, as is generally thought, somewhat better than those occupied by renters even in the same geographic areas and the same age and structure type categories. Therefore, they command a higher rent.

Maintenance and repairs. The rental-equivalence items for maintenance and repairs contain both renters' and owners' expenditures. The renters' expenditure portion of each item weight was computed by aggregation of actual renter expenditures as reported in the 1972-73 survey. For the owners' portions of the maintenance and repair strata, weights were estimated by imputing expenditures from survey renters to survey homeowners. In each region, renters were sorted into cells by variables such as size of house, type of structure, and age of structure. The average expenditure by renters with the cell characteristics for each of the five maintenance and repair strata was assigned to each homeowner with the cell's characteristics. The resulting weights were consistent and reasonable for all but 1 of the 5 maintenance and repair strata. For one stratum, which included miscellaneous hardware items, the directly estimated owner weights were used because they are not particularly tenure sensitive and many of the items in the stratum are not likely to be provided by a landlord. Capital improvements made by homeowners are out of scope under the flow-of-services concept.

Household insurance. The rental-equivalence expenditure weights for insurance were obtained by reducing owners' total expenditures for property insurance to remove the share of insurance included in owners' equivalent rent. This was accomplished by adjusting the old method weights. Factors to do this were developed from insurance industry data for each of the four regions of the United States. It was assumed that the owners' estimated rents included property insurance on

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Statistical reweighting of the rent sample

Rental units in the existing rent sample were selected with a multistage technique, using 1970 census data. First, using a stratified technique, a set of Census-defined areas called enumeration districts was chosen within each CPI pricing area. The selection was proportional to the number of renters. Enumeration districts are generally the smallest areas for which stratification variables are available. Among the stratification variables used for selection was the extent of owner occupancy; that is, whether the enumeration districts were mostly (more than 65 percent) owner-occupied residences, mixed (between 20 and 65 percent owner occupied), or mostly renter (under 20 percent owner occupied). BLS subdivided the selected enumeration districts into smaller areas called segments, usually containing between 40 and 125 housing units. One or more segments were selected, on a probability basis, for each enumeration district. All the housing units in the selected segments were screened to determine their tenure status (whether owner or renter) and a simple random sample of the renters in each segment was taken. This rent sample was designed to measure rent change for renters. Each sample unit was weighted according to the number of rent units it represented. Those units in mostly owner-occupied segments represented renters in those areas, and the units in mixed and mostly renter areas represented renters in those areas. Because the enumeration districts, segments, and sample units were selected with probability proportional to the number of renters, each unit in the sample for each CPI publication area had a weight of approximately the same magnitude; that is, the sample was efficiently designed to estimate rent change for renters.

In phase 1 of rental equivalence a new statistical weight for each unit in the rent sample was calculated so that the rent units would represent the owners. The new owner weights were computed by applying to each unit's original renter weight the ratio of owners to renters in its enumeration district. For example, the phase 1 owner weights for all the units located in an enumeration district that was 90-percent owner and 10-percent renter would be the old renter weights increased by a factor of 9 (90 ÷ 10). In an enumeration district which was 80-percent renter and 20-percent owner, the weight was multiplied by a factor of 0.25 (20 ÷ 80). Thus, with the recalculated statistical weights, the units in the existing rent sample are assumed to represent the owners in their enumeration districts. Ultimately, they also represent the owners in their CPI areas and the urban United

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Phase 2 – rent sample augmentation

As already noted, the original rental unit weights are all roughly the same size in each publication area, which makes the existing rent survey a reasonably efficient estimator for renters. However, the phase 1 owner weights varied greatly from one another, so that the phase 1 measure was not as efficient. The recalculated weights of some units were reduced to zero (those in 100-percent renter areas), while others' weights were increased by as much as 35 times. Consequently, while the phase 1 reweighting did represent owners, it was relatively inefficient; the variance of the estimates was higher than could be obtained for the sample size if the survey were focused on representing owners. The phase 2 augmentation was designed to mitigate this shortcoming, at least in part. The augmentation was concentrated in the heavily owner-occupied enumeration districts. New segments and sample units were selected from them and added to the sample. All statistical weights were then recalculated for a second time. First, the original weights (those representing renters) were recomputed, yielding lower values in the heavily owner-occupied areas where the additional units were concentrated as the fixed weight of each enumeration district was spread among more units. Second, the weights representing owners were recalculated from the new weights for renters in the same manner as phase 1. Because the weights representing renters became smaller in the areas with high ratios of owners to renters, the new statistical weights representing owners generally became lower, too. So the phase 2 augmentation lowered many of the very high owner weights, reducing the range of their magnitudes and thereby improving the estimate of rent change for owners. More importantly, the augmentation increased the sample size, thereby reducing the expected error of the estimators.

Phase 3

Although it may lead to more immediate technical improvements in measuring homeowners' implicit rent, phase 3 is primarily research into advanced rental equivalence methods to be implemented in the next CPI revision. For phase 3, BLS is developing a sample of homeowners to be resurveyed annually. Various techniques will be tested for estimating implicit rent for the owners.

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