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INDEXING THE COST OF PRODUCING HOUSING SERVICES: SITE I, 1973

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PREFACE

This working note was prepared for the Office of Policy Development and Research, U.S. Department of Housing and Urban Development (HUD). It reports the results of the first stage in a continuing task of the Housing Assistance Supply Experiment: constructing indexes of the cost of producing housing services in Brown County, Wisconsin; St. Joseph County, Indiana; and the five-state region that contains these counties.

Both counties are the sites of experimental housing allowance programs that may affect local demands for housing services. For the Supply Experiment to measure market response to the allowance programs, we need production cost indexes for each site and for the whole region.

This note presents comparable 1973 price and index data for Brown County and for the region. Similar data for subsequent years and for St. Joseph County (beginning in 1974) will be reported in later working notes.

The data were compiled by the author, aided by advice from members of the HASE Design and Analysis Group. C. Lance Barnett, Ira S. Lowry, and C. Peter Rydell were particularly helpful. The draft was typed by Linda K. Ellsworth. Doris Dong prepared the figure. Charlotte Cox edited the typescript and supervised production of final copy, typed by Joan Pederson.

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SUMMARY

Suppliers of housing combine various inputs to produce an annual flow of housing services. The design for the Housing Assistance Supply Experiment calls for measuring the real annual cost of these inputs, background inflation in their costs (inflation not caused by local events in the experimental sites), and locally caused inflation in factor costs. An index of the cost of producing housing services is necessary for all these tasks.

We use the terms "index" and "cost index" to refer to a set of annual index numbers: local and regional indexes for each major group of factor inputs. We calculate cost indexes for interest rates, land, improvements, property services, and maintenance and repair. The local indexes measure inflation rates in the experimental sites and are used to deflate actual factor input costs to obtain real costs. The regional index allows us to calculate a first approximation to program-induced inflation, which is inflation attributable to the increased demand for housing caused by the allowance program.

This note provides the baseline data that will be necessary to construct the two most frequently encountered types of indexes--the Laspeyres and the Paasche--for each major input group. Laspeyres and Paasche indexes are ratios of quantity-weighted prices of the component goods for the beginning and end points of the period being indexed. The Laspeyres index uses baseline (beginning) quantities, and the Paasche uses current quantities.

Alternatively, both indexes can be formulated as expenditure-weighted price relatives. The expenditure weight for an input is the proportion of total cost attributable to that input. The Laspeyres index is the sum of baseline-expenditure-weighted price relatives, and the Paasche index uses current expenditure weights.

To measure program-induced inflation, we will compare indexes for each experimental site with similar indexes for the five-state region--Michigan, Wisconsin, Illinois, Indiana, and Ohio--that contains both sites. The price relatives for Brown County presented in this note

can be used with comparable data for subsequent years to construct an index of local inflation.* Similarly, the regional, population-weighted average prices can be used to construct a first approximation to the inflation rate that would have prevailed in the absence of the experiment (called background inflation).

Since the average regional price changes are estimates of price changes in our sites in the absence of both local demand disturbances (including the allowance program) and random errors, the regional index is only an approximation of background inflation for the site. The difference between the local and regional indexes is, then, an approximation of the rate of program-induced inflation.

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*It can be either a Laspeyres or a Paasche index.

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I. INTRODUCTION

The Housing Assistance Supply Experiment (HASE) needs an index of the cost of producing housing services for three related but separate steps in measuring the elasticity of their supply.

First, we plan to use the annual cost of factor inputs in constant dollars as an estimator of the quantity of housing services produced.* The percentage change in the real value of factor inputs equals the percentage change in the quantity of factor inputs. Assuming that the quantity of output is proportional to the quantity of inputs, the percentage change in output equals the percentage change in inputs. In this way, given real value of the annual cost of factor inputs, we can calculate the percentage change in the quantity of housing services produced.

Second, we must decompose observed rent changes into changes in the quantity of housing services (estimated as described above), changes in producer markup, and changes in the cost of producing housing services. The last component is provided by an index of the cost of producing housing services, i.e., the cost index.

Third, we want to measure program-induced inflation, which is the pure price inflation attributable to the increased demand for housing caused by the housing allowance program. The difference between the actual inflation rate in the experimental site (called *local inflation*) and the rate that would have prevailed in the absence of the experiment measures allowance-induced inflation.** A regional price index, similar to those constructed for each site, is used to measure background inflation.

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*Ira S. Lowry (ed.), *General Design Report: First Draft*, The Rand Corporation, WN-8198-HUD, May 1973, Appendix B.

**The local inflation rate reflects both the effects of the allowance program and other local events bearing on the demand for housing services. Unfortunately, our measure of *background inflation* estimates the rate in the absence of *all* local events, not just the allowance program. Therefore, the difference between the local and background inflation rates is only a first approximation to allowance-induced inflation.

These three steps will decompose the change in rent between two years into four additive components:

- Change in the quantity of housing services produced (as measured by real factor costs of producing the services).
- Background inflation in factor prices (inflation not caused by housing allowances or other local events).
- Locally caused inflation in factor prices (reflecting the effects of housing allowances and other local events).
- Change in producer markup.

COMPONENTS OF THE INDEX

The first two uses of the price index determine which cost components are indexed. The input accounting plan divides annual cost of inputs into four categories: (a) opportunity cost of land and improvements, (b) cost of additions to improvements, (c) cost of property services, and (d) cost of maintenance and repairs. We either use existing indexes or construct our own for each of these categories.*

The opportunity cost of residential land and improvements is the market rate of interest on conventional residential mortgages multiplied by the base-year value of residential real estate.** Although the market rate may be higher or lower than the mortgage rate an owner actually pays, it measures what an investor must pay for the use of residential land and improvements, i.e., their opportunity cost.

In theory, the market value of the stock of residential capital should be affected by the longrun changes in the balance between rental

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*For more discussion of these components and a description of the sources used to index their costs, see *General Design Report*, Appendix D.

**Since completion of the *General Design Report* we have developed an alternative theory that the opportunity cost of capital equals the annual real rate of return times capital value. (See C. Peter Rydell, *Measuring the Supply Response to Housing Allowances*, The Rand Corporation, P-5564, January 1976, Appendix A.) This approach requires only an estimate of the (presumably constant) real rate of return to property value. Changes in the mortgage interest rate become relevant only in discussions of equity yield.

revenues and operating expenses. If housing allowances are perceived by landlords to alter the longrun net return, then property values will change. But if revenues and expenses change proportionally because of general price inflation, net return and property values will also change. We need an index of the capital gain caused by background price inflation to detect whether any allowance-induced change occurs. Therefore, we will make independent calculations of the index for the value of existing residential land and improvements and the producer markup for individual properties.

The value of residential land will be indexed by the national rate of growth in consumer prices, modified locally within the experimental site by a model of the effects of differential changes in neighborhood amenities. This report is concerned only with the general element of the index, the national inflation rate.

The value of existing improvements will be indexed with an index of residential construction costs. This procedure assumes a longrun equilibrium in the housing market such that existing improvements are valued at their replacement cost.

We should stress that neither the land value index nor the construction cost index is expected to be a true measure of the change in market value for specific properties. Rather, each is a benchmark against which the significance of actual changes can be assessed.

Additions to improvements are a small portion of annual factor costs; hence, the total input costs are quite insensitive to changes in the cost of such additions. We estimate that a 10 percent increase in the cost of additions to improvements causes an overall increase in factor costs of only 0.46 to 0.54 percent.* Because our results are so insensitive to these changes, it is unnecessary to construct an index that measures changes in the specific costs of rehabilitating or altering residential structures. Instead, we measure inflation for this component with a general index of residential construction costs.

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*For the underlying assumptions and supporting calculations, see *General Design Report*, pp. 266-69.

Property services are indexed using wages, costs of utilities, and insurance costs. Price relatives for these components are weighted by relative expenditures to form a Laspeyres index for this category. A similar procedure is followed for maintenance and repair costs, a category that includes wages, prices of supplies, and cost of repairs.

To summarize, we have six component indexes of a general index for the cost of producing housing services. Two components (existing and new improvements) are indexed with the same data. Thus, five different indexes must be constructed for each experimental site and for the region as a whole.

FORMULATING THE LOCAL INDEX

The cost index is a collection of indexes, one for each major category of commodities and services used to produce housing services. In the following development we consider an index composed of component prices.* Expenditure data are obtained annually for each component from the HASE landlord and homeowner surveys. A planned series of cost-index working notes will provide price relatives (ratios of prices in two different time periods) for each component. Combining expenditures and price relatives appropriately, an analyst can compute either a Laspeyres or a Paasche index.

A Laspeyres index is the ratio of (a) the cost of purchasing the baseline vector of inputs at current prices to (b) the cost of purchasing the baseline vector of inputs at baseline prices. Denoting baseline as time *1* and the current period as time t,

$$\lambda = \frac{\sum_i \left(P_{it}Q_{i1}\right)}{\sum_i \left(P_{i1}Q_{i1}\right)}, \qquad (1.1)$$

where λ = the Laspeyres index from time *1* to time t,

P_{i1}, P_{it} = the price of input i at baseline and time t respectively,

Q_{i1} = the quantity of input i at baseline.

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*Throughout this note, "price" refers either to the price of a commodity or service or to the wage for labor.

In its more frequent formulation, the Laspeyres index is the summation over all inputs of the baseline-expenditure-weighted price relatives:

$$\lambda = \sum_i \left(E_{i1} \frac{P_{it}}{P_{i1}} \right) , \tag{1.2}$$

where

$$E_{i1} = \frac{P_{i1}Q_{i1}}{\sum_i \left(P_{i1}Q_{i1} \right)} ,$$

or, the baseline expenditure weight for input i. Substituting the value for E_{i1} into Eq. (1.2) shows its equivalence to Eq. (1.1).

The cost-indexing scheme provides price relatives for each component.* Summing the product of each relative with the appropriate baseline-expenditure weight (E_{i1}) yields a Laspeyres index. Current expenditure weights yield a Paasche index--the ratio of (a) the cost of purchasing the current (period t) vector of inputs at current prices to (b) the cost of purchasing the current vector of inputs at baseline prices, or

$$\phi = \frac{\sum_i \left(P_{it}Q_{it} \right)}{\sum_i \left(P_{i1}Q_{it} \right)} . \tag{1.3}$$

Equation (1.3) can be rewritten in terms of inverse price relatives (P_{i1}/P_{it}) and current expenditure weights ($E_{it} = (P_{it}Q_{it})/\sum_i [P_{it}Q_{it}]$)

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*Some of the components are themselves composite commodities, and their price relatives are Laspeyres indexes. To the extent that such indexes approximate the composite price relatives, this procedure is legitimate. The fact that the component indexes are generally weighted with expenditures from a period other than our baseline creates a problem. This problem is more serious, though no different in principle, if the indexes are used as price relatives to construct a Paasche index, for which weights are current expenditures. However, we are forced by the realities of the available data to live with these qualifications.

to compute a Paasche index, as follows:

$$\phi = \frac{\sum_i \left(P_{it}Q_{it}\right)}{\sum_i \left(P_{it}Q_{it}\frac{P_{i1}}{P_{it}}\right)},$$

$$= \left[\frac{\sum_i \left(P_{it}Q_{it}\frac{P_{i1}}{P_{it}}\right)}{\sum_i \left(P_{it}Q_{it}\right)}\right]^{-1}, \tag{1.4}$$

$$= \left[\sum_i \left(\frac{\left(P_{it}Q_{it}\right)}{\sum_i \left(P_{it}Q_{it}\right)}\frac{P_{i1}}{P_{it}}\right)\right]^{-1},$$

$$= \left[\sum_i \left(E_{it}\frac{P_{i1}}{P_{it}}\right)\right]^{-1}.$$

Henceforth, we consider only Laspeyres indexes, and L refers to the local Laspeyres index. The reader should keep in mind, however, that the price relatives can be used with current expenditure weights to construct a Paasche index.

FORMULATING THE REGIONAL INDEX

Indexing Background Inflation

The regional index enables us to approximate program-induced inflation by netting background from local inflation. For Green Bay, the index of background inflation is

$$B = \frac{\sum_i \left(P'_{igt}Q_{ig1}\right)}{\sum_i \left(P_{ig1}Q_{ig1}\right)}, \tag{1.5}$$

where B = the index of background inflation between baseline and time t,

P'_{igt} = the price of input i in Green Bay at time t in the absence of the allowance program and other local events,

P_{ig1} = the observed price of input i in Green Bay at baseline,

Q_{ig1} = the purchased quantity of input i in Green Bay at baseline.

Equation (1.5) can be written in the form of expenditure-weighted price relatives:

$$B = \sum_i \left(E_{ig1} \frac{P'_{igt}}{P_{ig1}} \right) , \tag{1.6}$$

where

$$E_{ig1} = \frac{P_{ig1}Q_{ig1}}{\sum_i \left(P_{ig1}Q_{ig1} \right)} ,$$

or, the baseline expenditure weight for input i in Green Bay.

We collect local baseline price data and construct expenditure weights for all inputs. The only additional data necessary to compute background inflation are the program-absent prices of the inputs at time t. We postulate that, without the allowance program, a local factor price would equal its baseline value adjusted by the subsequent regional change in that factor's price:

$$P'_{igt} = P_{ig1} \left(\frac{P_{irt}}{P_{ir1}} \right) , \tag{1.7}$$

where P_{ir1} and P_{irt} are the baseline and time t regional prices of input i.

Modeling Regional Prices

Consider a geographic region containing our experimental sites: small enough that housing markets throughout it are subject to similar environmental influences and participate in the same regional trading area, yet large enough for the markets to escape influence by either of our sites. We assume the prices of an input to the production of housing services are distributed normally, with the same mean and variance throughout this region.

For many items, we collect prices for a subset of all metropolitan areas in the region.* Each price represents an average from a sample of prices that was drawn in the metropolitan area. Thus for a given input at a given time,

$$P_j = \frac{1}{n_j}\left(\sum_{k=1}^{n_j} P_{kj}\right) ,$$

where j = the city,
P_j = the published price for city j,
n_j = the sample size in city j,
P_{kj} = the kth observation (price) in city j.

Given the earlier normality assumption, the distribution of P_j is

$$P_j = \mu + \varepsilon_j \quad \text{where} \quad \varepsilon_j \sim N\left(0, \frac{\sigma^2}{n_j}\right).$$

The maximum likelihood estimator $\hat{\mu}$ provides an unbiased estimate of μ:

$$\hat{\mu} = \frac{\sum_{j=1}^{N}\left(n_j P_j\right)}{\sum_{j=1}^{N} n_j} , \tag{1.8}$$

where N is the number of cities in the region.

*Different sources publish data for different subsets of cities.

Assume that the sample in each city is proportional to its population, so that the larger a city, the more observations are taken. This proposition can be expressed as

$$n_j = cZ_j \ , \tag{1.9}$$

where c = a constant,

Z_j = the population of city j.

Substitute Eq. (1.9) into Eq. (1.8) to obtain

$$\hat{\mu} = \sum_j \left(W_j P_j \right) , \tag{1.10}$$

where

$$W_j = \frac{Z_j}{\sum_j Z_j} \ .$$

Note that W_j is the relative population weight for city j. The population-weighted average of the average prices for all cities in the region is an unbiased estimate of the mean price for any city.

We define the regional price for input i at time t to be the mean of the regional price distribution:

$$P_{irt} = \mu_{it} \ . \tag{1.11}$$

For a general input and time, Eq. (1.10) provides an unbiased estimator of the mean of the price distribution. Thus

$$\hat{\mu}_{it} = \sum_j \left(W_j P_{ijt} \right) = \overline{P}_{it} \ , \tag{1.12}$$

where $\overline{P}_{it}$ is the population-weighted regional average price for i at time t. We use $\overline{P}_{it}$ as an unbiased estimate of the regional price for i at time t, P_{irt}, which allows us to estimate the program-absent local price at time t using Eq. (1.7):

$$P'_{igt} = P_{ig1}\left(\frac{P_{irt}}{P_{ir1}}\right)$$

$$\simeq P_{ig1}\left(\frac{\overline{P}_{it}}{\overline{P}_{i1}}\right),$$

or

$$\frac{P'_{igt}}{P_{ig1}} \simeq \frac{\overline{P}_{it}}{\overline{P}_{i1}} \tag{1.13}$$

Constructing the Regional Index

Equation (1.13) reflects the implicit assumption that background inflation in input i's price in Green Bay between baseline and time t equals the inflation in the regional price of i over the same period, which we estimate with the population-weighted average of prices for i in cities throughout the region. Substituting into Eq. (1.6), we have

$$B \simeq \sum_i \left(E_{ig1}\,\frac{\overline{P}_{it}}{\overline{P}_{i1}}\right). \tag{1.14}$$

The righthand side is simply a regional price index. Indeed, we define our regional index to be

$$R = \sum_i \left(E_{ig1}\,\frac{\overline{P}_{it}}{\overline{P}_{i1}}\right). \tag{1.15}$$

Equation (1.15) says we can use the baseline expenditure weights developed for the local Brown County index (E_{ig1}) together with the price relatives composed of population-weighted regional averages to construct our regional index. Unfortunately, we will not have price and wage data for all components; in some cases we must rely on published regional price indexes. To use them requires only a slight modification of Eq. (1.15).

The components for which we use these indexes are either composite commodities or services for which the price is a step-function that depends on the service level. In either case there is no market price to use for calculating price relatives. The indexes we use are regional CPI components provided by the U.S. Bureau of Labor Statistics (BLS). They are population- and expenditure-weighted price relatives, and we assume that the index equals the regional price relative of the composite commodity or service, i.e., that $I_i = P_{irt}/P_{ir1}$, where I_i is the regional index for component i.

If we partition the M commodity, occupation, and service components of the price index into those for which we have price data (the first s) and those for which we have regional indexes (the remainder), we can redefine the regional index as follows:

$$R = \sum_{i=1}^{s} \left(E_{ig1} \frac{\overline{P}_{it}}{\overline{P}_{i1}} \right) + \sum_{i=s+1}^{M} \left(E_{ig1} I_i \right)$$

$$= \sum_{i=1}^{s} \left(E_{ig1} \frac{\overline{P}_{it}}{\overline{P}_{i1}} \right) + \sum_{i=s+1}^{M} \left(E_{ig1} \frac{P_{irt}}{P_{ir1}} \right)$$

$$\simeq \sum_{i=1}^{s} \left(E_{ig1} \frac{P_{irt}}{P_{ir1}} \right) + \sum_{i=s+1}^{M} \left(E_{ig1} \frac{P_{irt}}{P_{ir1}} \right)$$

$$= \sum_{i=1}^{M} \left(E_{ig1} \frac{P'_{igt}}{P_{ig1}} \right) = B \ . \qquad (1.16)$$

Thus our reformulation of the regional index given by Eq. (1.16) does not change the fact that R is an approximation of the index of background inflation, B.

ESTIMATING PROGRAM-INDUCED INFLATION

Program-induced inflation is measured by a Laspeyres index, where the current (time t) price for input j is the difference between its observed and program-absent prices:

$$A \simeq \frac{\sum_i \left[\left(P_{igt} - P'_{igt}\right) Q_{ig1}\right]}{\sum_i \left(P_{ig1} Q_{ig1}\right)}, \tag{1.17}$$

where A indexes program-induced inflation.*

Equation (1.17) can be rewritten as the difference between the indexes of local and background inflation:

$$A \simeq \frac{\sum_i \left(P_{igt} Q_{ig1}\right)}{\sum_i \left(P_{ig1} Q_{ig1}\right)} - \frac{\sum_i \left(P'_{igt} Q_{ig1}\right)}{\sum_i \left(P_{ig1} Q_{ig1}\right)}$$

$$\simeq L - B .$$

Equations (1.14) and (1.15) show that $B \simeq R$. Hence $A \simeq L - R$, or the difference between the local and regional indexes is a first approximation to the amount of program-induced inflation.

CHOOSING THE REGION

We sought an area that included both experimental sites, was large enough to escape influence by either of them, and had some economic

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*Because the prices are subtracted in the numerator of Eq. (1.17), A is not an index number. We would have to add one to it to make it a true index number. As noted earlier, A is not an exact measure of program-induced inflation because B does not accurately measure inflation in the absence of *only* the allowance program.

reason for being considered as a single unit. By combining seven major trading areas* in the East North Central U.S., we obtained a region large enough to be unaffected by the allowance program yet small enough to be related to the type of housing market operating in the experimental sites. The boundaries of the combined region correspond closely to those of the area composed of Michigan, Wisconsin, Illinois, Indiana, and Ohio.** We defined this five-state area to be the region of interest for cost-indexing purposes.

Regional data collection was constrained by the geographic coverage of the sources. These geographic areas do not always coincide with each other or with our defined region, but this note carefully documents the areas (or cities) covered by each source.

Some sources provide price data for a subset of all metropolitan areas within our region. For these sources, we calculate the average prices ($\bar{P}_i$) with baseline-period population estimates compiled by the Census Bureau for standard metropolitan statistical areas (SMSAs) as the Z_j (see Eqs. (1.9) and (1.10)).

All sources report data only for SMSAs in the region. Figure 1 illustrates the SMSAs in the region for which we collect data and calculate average prices.*** SMSAs with boundaries that do not lie entirely within the region are included only if the central city or cities that designate the SMSA are within the five states. Table 1 lists the metropolitan areas shown in Fig. 1 and presents population estimates as of 1 July 1973.

Data for Green Bay, Wisconsin (Site I), and South Bend, Indiana (Site II), are not included in the weighted regional averages. We are estimating prices in these two SMSAs in the absence of the allowance

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*1972 *Commercial Atlas and Marketing Guide*, Rand McNally and Company, Chicago, 1972. The trading areas defined in the atlas were "determined after an intensive study of such factors as physiography, population, newspaper circulation, economic activities, highway facilities, railroad services, suburban transportation, and field reports of experienced sales analysts" (p. 65).

**For a comparison of the boundaries of the trading areas and the five-state region, see *General Design Report*, p. 280.

***Not every source reported data for all SMSAs in the region. But we did not collect data for SMSAs not indicated in Fig. 1.

Figure--States and SMSAs in the cost index region

Table 1

ESTIMATED POPULATION OF SMSAs IN FIVE-STATE REGION
AS OF 1 JULY 1973

State and SMSA	Population	State and SMSA	Population
Illinois		Michigan (cont.)	
Bloomington-Normal	114,100	Lansing-East Lansing	439,100
Champaign-Urbana-Rantoul	164,400	Muskegon-Muskegon Heights	177,000
Chicago	6,999,800	Saginaw	225,300
Decatur	124,900	Ohio	
Peoria	352,000	Akron	675,100
Rockford	270,600	Canton	405,200
Springfield	177,000	Cincinnati	1,384,100
Indiana		Cleveland	2,004,000
Anderson	140,300	Columbus	1,055,900
Evansville	288,800	Dayton	845,300
Fort Wayne	372,200	Hamilton-Middletown	238,700
Gary-Hammond-East Chicago	643,800	Lima	211,700
Indianapolis	1,133,200	Lorain-Elyria	263,700
Lafayette-West Lafayette	111,300	Mansfield	130,800
Muncie	132,400	Springfield	188,900
Terre Haute	175,600	Toledo	780,900
Michigan		Youngstown-Warren	541,500
Ann Arbor	243,800	Wisconsin	
Battle Creek	181,600	Appleton-Oshkosh	281,500
Bay City	119,400	Kenosha	121,200
Detroit	4,446,200	La Crosse	82,500
Flint	518,500	Madison	297,700
Grand Rapids	556,100	Milwaukee	1,421,600
Jackson	144,700	Racine	172,900
Kalamazoo-Portage	260,100	TOTAL	30,062,200

SOURCE: *Current Population Reports, Federal-State Cooperative Program for Population Estimates,* U.S. Department of Commerce, Bureau of the Census, Series P-26, Nos. 110, 113, 120, 122, 126, and 128.

program and do not want their actual prices, which the program may influence, to affect the estimate.

COMPILING THE BASELINE DATA

The remainder of this note details the sources and methods used to compile baseline prices for individual commodities or services and price indexes for groups of commodities and services for Brown County, Wisconsin, and for the five-state region in which Brown County is located.*

*Brown County constitutes the Green Bay SMSA. Our second experimental site, St. Joseph County, Indiana, is also in the five-state region. It is part of the South Bend SMSA, which consists of St. Joseph and Marshall counties.

We first surveyed landlords, tenants, and homeowners in Brown County early in 1974, collecting housing expenditure data for calendar year 1973. The allowance program there began open enrollment in June 1974. Thus, 1973 is our preprogram baseline year.

To index expenditures reported for that year, we have sought price data for the midpoint of 1973 or as near thereto as our sources permit. The reference date for each price is given as precisely as the source reports it.

The baseline data alone do not measure price changes. For that purpose, comparable data sets must be computed for subsequent years. However, by compiling, formatting, and publishing the baseline data, we have tested the practicality of our plans, resolved many of the technical problems, identified the sources that must be consulted, and ensured the retrievability of the 1973 data.

Each section that follows describes the sources of the data used to construct the cost index for one of the five components that enter our overall index of the cost of producing housing services: opportunity cost, land, improvements, property services, and maintenance and repair. Each also presents the 1973 data that were obtained from these sources for both Brown County and the region, and explains how the data were manipulated to obtain the appropriate baseline price or index number.

II. INDEX OF OPPORTUNITY COST

Interest rates are used to index the opportunity cost of residential land and structural improvements. This cost is the market rate of interest on conventional residential mortgages multiplied by the base-year value of residential real estate. The indexing scheme requires measuring the annual change in the interest rate that is to be multiplied by the baseline land and improvement value. For both the local and background indexes, we use market interest rates obtained from surveys of major lending institutions.

REGIONAL INDEX

The Roy Wenzlick Research Corporation surveys mortgage interest rates annually. Questionnaires are sent to lending institutions in major cities throughout the country late in April of each year. The questionnaires include the following question: "What is the prevailing rate of interest on conventional residential mortgages currently being made by your organization?" The data represent prevailing market rates in late April and May of each year. The rates, averaged for each city, are published in the June issue of *The Real Estate Analyst.*[*]

Table 2 shows the 26 SMSAs from our region covered by the Wenzlick survey and presents the prevailing interest rate for each city in late April and May of 1973. The population-weighted average of the rates in Table 2 is 7.51, the average market interest rate that prevailed in the region at that time.

BROWN COUNTY INDEX

Unfortunately, the Wenzlick survey of mortgage interest rates does not include Green Bay. Rand, however, conducts a survey of financial institutions in Brown County as part of the study of market

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[*]Although Rand does not subscribe to this publication, it is available by appointment in the library of the corporate headquarters of the Security Pacific National Bank, Los Angeles.

Table 2

INTEREST RATES ON CONVENTIONAL FIRST MORTGAGES:
APRIL-MAY 1973

State and SMSA	Interest Rate (%)	State and SMSA	Interest Rate (%)
Illinois		Ohio	
Chicago	7.30	Akron	7.40
Decatur	7.75	Canton	7.40
Peoria	7.50	Cincinnati	7.75
Springfield	7.25	Cleveland	7.30
Indiana		Columbus	7.90
Evansville	7.25	Dayton	7.60
Fort Wayne	7.75	Hamilton-Middletown	7.70
Gary-Hammond-East Chicago	7.50	Springfield	7.70
Indianapolis	7.60	Toledo	7.80
Michigan		Youngstown-Warren	7.20
Detroit	7.60	Wisconsin	
Flint	7.75	Madison	7.50
Grand Rapids	8.00	Milwaukee	7.50
Lansing-East Lansing	7.80	Racine	7.75
Saginaw	7.75	Weighted Regional Average	7.51

SOURCE: *The Real Estate Analyst*, Roy Wenzlick Research Corporation, No. 20, June 1973, pp. 237-260.

intermediaries for HASE. During one portion of this survey, conducted in June 1975, the following question was asked of the financial intermediaries: "In May of 1973, what was the prevailing rate of interest on conventional residential mortgages being made by your organization?" The responses to this question yielded data on interest rates in Brown County comparable with the Wenzlick data.

Data for the nine financial institutions in Brown County that responded to the Rand survey question are tabulated in Table 3. Also given are the outstanding balances of residential mortgage loans held by each of these institutions in 1973, from which we calculate a weighted average of the interest rates.* For Brown County in May 1973, the weighted average mortgage interest rate is 7.58 percent.

*We would prefer to use as weights the dollar amounts of residential first mortgages each institution wrote during May 1973, but these data are not available. Should we obtain them, the weighted Brown County average interest rate will be recalculated.

Table 3

PREVAILING INTEREST RATES AND ESTIMATED VOLUME OF RESIDENTIAL MORTGAGE LOANS BY LENDER: BROWN COUNTY, WISCONSIN, 1973

Lender[a]	Interest Rate (%)	Outstanding Balance of Mortgages[b] ($ million)
A	7.625	61.0
B	7.500	13.5
C	7.375	51.8
D	8.000	8.0
E	7.375	12.8
F	7.500	27.0
G	7.250	17.3
H	7.625	6.0
I	8.250	24.7

SOURCE: Interest rates were obtained by Rand staff members during interviews conducted in June 1975; outstanding balances are from William G. Grigsby, Michael Shanley, and Sammis B. White, *Market Intermediaries and Indirect Suppliers: Reconnaissance and Research Design for Site I*, The Rand Corporation, WN-8577-HUD, February 1974, p. 14.

[a]Names of the financial institutions are on file at Rand and are available only for purposes of future survey work.

[b]Outstanding balance in December 1973.

SUMMARY

Regional and local interest rates for the interest rate index are compared below:

1973 Interest Rate for Conventional Residential Mortgages

Weighted Regional Average	Brown County
7.51	7.58

III. INDEX OF LAND COST

Land is an input to the production of housing, and if its price increases, the price of housing will rise to cover it. The allowance program may contribute to changes in land prices. For example, if allowance recipients prefer a certain neighborhood, their attempts to obtain housing there could cause a localized increase in land prices. Most changes in land prices, however, will presumably come from non-allowance sources: better roads, new schools, new shopping centers, and general price inflation. Since neighborhoods change slowly, the most important source of change in land prices during the experiment will be changes in the general value of the dollar, which we measure with the consumer price index.

REGIONAL INDEX

As part of the HASE analysis, we will construct an index of land price in a given neighborhood, P_l, using the following approach:

$$P_l = [CPI]f(C_j) ,$$

where P_l = the price of land,
CPI = the consumer price index,
C_j = neighborhood characteristic j, e.g., accessibility to schools.

The functional form will be determined by future analysis, and neighborhood data will be obtained from the HASE surveys. The only value reported in this note is the consumer price index.

We intend to use the all-items U.S. city-average CPI index and to check its validity as the general inflator for land value by doing cross-sectional studies of land value similar to the one done at baseline (see below). The baseline CPI value (July 1973, with 1967 = 100) is 132.7.*

*_CPI Detailed Report for 1973_, U.S. Department of Labor, Bureau of Labor Statistics, October 1973, p. 8. The figure is the unadjusted index.

BROWN COUNTY INDEX

The local index will be constructed from annual estimates of land prices in Brown County. The procedure is described elsewhere.* For each neighborhood at baseline, land price is the ratio of assessed land value to assessed property value, multiplied by total property value (obtained from HASE survey data) and divided by area (square feet), then averaged for the neighborhood.** In succeeding waves, either this procedure will be repeated or we will subtract an up-to-date estimate of the value of improvements from total property value to obtain land value. This value will again be divided by area to obtain a price per unit of land, then averaged for the neighborhood. The local index is the ratio of the county averages for any two years. Since this procedure uses no outside data, none are reported here. Actual land prices will be reported elsewhere.

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*C. Peter Rydell, *Rental Housing in Site I: Characteristics of the Capital Stock at Baseline*, The Rand Corporation, WN-8978-HUD, August 1975, pp. 24-26.

**Ratios of assessed land value to assessed property value will probably be modified using regression techniques. We will investigate using hedonic indexes to account for the effect of blocks with above- or below-average land values.

IV. INDEX OF IMPROVEMENT COST

As explained in Sec. I, we index both the cost of improvements and the cost of additions to improvements with the same source, an index of residential construction costs. American Appraisal Associates, Inc., publishes a bimonthly index of building construction costs in over 200 cities in the U.S. and Canada.* Called Boeckh building cost modifiers, the indexes cover two categories of residential structure, distinguished by type of exterior wall material: (a) siding or stucco, or (b) masonry veneer.

The modifiers are Laspeyres indexes with expenditure weights calculated from baseline cost studies of standard building types. The weights reflect factor shares and construction costs generally encountered in the North Central U.S. in 1967, the baseline period for the modifiers. At that time, the index for Milwaukee was set to 1.00, and the indexes for all other cities reflected the baseline cost of the standard building type in any city divided by its cost in Milwaukee. Thus the modifiers are also geographic indexes.

REGIONAL INDEX

The modifiers are published for 29 SMSAs in the geographic area defined for purposes of the background inflation index. Table 4 presents the index figures for these cities for July-August 1973.** The Boeckh modifiers are indexes, not prices. Given the index for any two dates, however, it is possible to calculate the percentage change over the period in question.

Since the modifiers are geographic as well as temporal indexes, it is legitimate to average the data for the same building type but

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*_Boeckh Building Cost Modifier_, American Appraisal Associates, Inc., Milwaukee, Wisconsin.

**Siding and stucco are more common in Brown County than masonry veneer. Hence we index the cost of improvements with the modifiers for siding or stucco residential construction. As mentioned in Sec. I, data for the two experimental sites are not included in the regional average. Hence Table 4 presents data for only 27 SMSAs.

Table 4

INDEX OF RESIDENTIAL CONSTRUCTION COSTS
BY STATE AND SMSA: JULY-AUGUST 1973

State and SMSA	Boeckh Modifier for Residential Construction[a]	State and SMSA	Boeckh Modifier for Residential Construction[a]
Illinois		Ohio	
Chicago	1.66	Akron	1.70
Peoria	1.54	Cincinnati	1.66
Rockford	1.45	Cleveland	1.71
Springfield	1.53	Columbus	1.59
Indiana		Dayton	1.60
Evansville	1.48	Toledo	1.71
Fort Wayne	1.50	Youngstown	1.61
Gary	1.62	Wisconsin	
Indianapolis	1.57	Kenosha	1.54
Michigan		La Crosse	1.46
Detroit	1.70	Madison	1.53
Flint	1.61	Milwaukee	1.65
Grand Rapids	1.48	Oshkosh	1.50
Kalamazoo	1.54	Racine	1.53
Lansing	1.62	Unweighted	
Saginaw	1.59	Average	1.58

SOURCE: *Boeckh Building Cost Modifier*, American Appraisal Associates, Inc., Pub. 6, No. 4, July-August 1973.

NOTE: Base year is 1967.

[a]Siding or stucco exteriors.

for different cities. The Appendix presents a proof and justifies using a simple arithmetic average rather than the usual population-weighted average. Averaging the index figures in Table 4 over the 27 SMSAs yields a 1973 regional index of 1.58.

BROWN COUNTY INDEX

Green Bay being one of the cities for which a modifier is published, we will index the cost of improvements in Brown County with the Green Bay modifier. The 1973 value for Brown County is 1.52.

SUMMARY

Regional and local Boeckh modifier values are compared below:

Average Boeckh Modifier for the Region	Boeckh Modifier for Brown County
1.58	1.52

V. INDEX OF PROPERTY SERVICE COST

The index of the cost of property services has three components: wages, utilities, and insurance. The first two also have subcomponents. Documentation of sources and data for the subcomponents are presented by component. The price relative for each subcomponent will be weighted by its share of the baseline cost of services obtained from HASE surveys. Summing these expenditure-weighted price relatives yields the index for the cost of services.

WAGES

Most employees who provide services for residential properties in Brown County are either managers or janitors. Wage data obtained from Area Wage Survey (AWS) publications are used to index the wage component of services. Wage averages for two occupational groups reported in the AWS are used--(a) office and clerical workers, and (b) janitors, porters, and cleaners.

Regional Index

AWS publications provide wage data for these two groups for 14 metropolitan areas in the region. Table 5 presents the 1973 wage rates by state and metropolitan area. The population-weighted average regional wage for office and clerical workers is $140.59 per week; for janitors, porters, and cleaners, it is $3.21 per hour.

Brown County Index

The AWS for Brown County reports wages of $120.63 per week for office and clerical workers, and $3.28 per hour for janitors, porters, and cleaners.*

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*_Area Wage Survey_, U.S. Department of Labor, Bureau of Labor Statistics, Green Bay, Wisconsin, Metropolitan Area, Supplement 1 to Bulletin 1775-1, July 1973, Tables A-1 and A-5. See note to Table 5 for a description of the coverage.

Table 5

WAGES FOR OCCUPATIONS IN THE PROPERTY SERVICE COMPONENT OF THE COST INDEX: 1973

State and SMSA	Month of Publication (1973)	Janitors, Porters, and Cleaners[a] ($/hour)	Office and Clerical Workers[b] ($/week)
Illinois			
Chicago	May	3.14	140.56
Rockford	June	3.63	125.49
Indiana			
Indianapolis	October	2.90	132.92
Michigan			
Detroit	March	3.69	159.29
Muskegon-Muskegon Heights	June	3.51	131.15
Ohio			
Akron	December	3.43	140.25
Canton	May	3.17	124.22
Cincinnati	February	2.69	126.18
Cleveland	September	3.16	136.06
Columbus	October	2.67	125.45
Dayton	December	3.51	141.00
Toledo	April	3.37	139.41
Youngstown-Warren	November	3.12	137.95
Wisconsin			
Milwaukee	May	2.85	130.26
Weighted Regional Average		3.21	140.59

SOURCE: *Area Wage Survey*, U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 1775, various cities and dates as noted in columns 1 and 2, Tables A-1, A-4, A-5, and A-6.

[a]Wages are mean wages for men and women in all industries and all-sized establishments. For Chicago, Rockford, Muskegon-Muskegon Heights, Canton, Cincinnati, Dayton, Toledo, Youngstown-Warren, and Milwaukee, wages were reported separately for men and women. In these cases, the two wages (weighted by the number of workers) were averaged to obtain the average wage for men and women.

[b]These wages are the weighted average of the mean wages for men and women in 13 occupational groups from Table A-1 (Office Occupations: Weekly Earnings) from each AWS. The categories are as follows: (1) accounting clerks, class A; (2) accounting clerks, class B; (3) file clerks, class B; (4) order clerks; (5) payroll clerks; (6) keypunch operators, class A; (7) keypunch operators, class B; (8) secretaries; (9) general stenographers; (10) senior stenographers; (11) switchboard operator-receptionists; (12) typists, class A; (13) typists, class B. The wage for each was weighted by the number of workers in the category and averaged. The entry for Muskegon-Muskegon Heights represents the weighted average of only 12 categories (of the above 13) that were reported. All wages are for all industries and all-sized establishments.

Summary

The table below compares the weighted regional average wages for these two categories with the wages for Brown County in 1973:

Category	1973 Wages: Weighted Regional Average	1973 Wages: Brown County
Office and clerical workers ($/week)	140.59	120.63
Janitors, porters, and cleaners ($/hour)	3.21	3.28

UTILITIES

Electricity

The Federal Power Commission (FPC) annually publishes typical residential electric bills for all cities in the U.S. with populations of at least 2,500. These bills are computed for various levels of consumption according to the rate schedules applicable to the majority of residential customers in the area.

Regional Index. In 1972 the average annual usage of electricity in the East North Central U.S.* was 6,029 kWh,** or approximately 502 kWh per month. Given this average, we index the typical electric bills published for 500 kWh per month of residential electricity consumption. The FPC population-weights the bills for each city to derive typical bills for both states and regions. For January 1973, the typical residential bill for 500 kWh of electricity in the East North Central U.S. was $11.70.***

Brown County Index. Although no typical bill is published for Brown County, the entire county is served by Wisconsin Public Service

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*The FPC's definition of the East North Central U.S. coincides with our cost index area: Illinois, Indiana, Michigan, Ohio, and Wisconsin.

**_Typical Electric Bills_, Federal Power Commission, FPCR-82, January 1974, p. 165.

***_Typical Electric Bills_, p. xi. All bills are based on rates in effect on 1 January 1973.

Corporation. Since their rate schedules do not vary within the county, we index electricity costs with the typical bill for Green Bay. The typical bill in Brown County for 500 kWh is $13.45, based on rates in effect on 1 January 1973.*

Gas

We use rate schedules for natural gas in Brown County to measure local inflation in the cost of residential gas service and the CPI regional index to measure background inflation. The rate schedule applicable to most users in Brown County when applied to an average consumption yields a typical gas bill. These bills are calculated annually on the basis of the existing rate structure, and the ratio of the typical bills provides the Brown County index of the price of natural gas.

Regional Index. BLS provides us with an annual index for the gas component of the Region V CPI.** It is based on three gas bills priced at the prevailing rates for cities in which BLS obtains gas data for the CPI. With July 1972 as the base, the July 1973 index is 104.71.

Brown County Index. We must do our own local pricing. Average household consumption of residential gas in the North Central U.S. was 110.42 therms per month in 1970.*** Table 6 gives the gas rates for the predominant type of residential service in Brown County during July 1973.

The typical gas bill was calculated by applying the rates in Table 6 to the average consumption figure of 110.42 therms per month. In July 1973, the typical monthly residential gas bill for Brown County was $13.17.

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*_Typical Electric Bills_, p. 124.

**Region V includes Minnesota in addition to the five states that compose our region.

***Kent P. Anderson, _Residential Energy Use: An Econometric Analysis_, The Rand Corporation, R-1297-NSF, October 1973, p. 53. The consumption figures in this publication are for the entire U.S. The figures in the text above are for the North Central U.S., obtained from the primary data compiled for R-1297-NSF.

Table 6

RATE SCHEDULE FOR RESIDENTIAL GAS SERVICE
IN BROWN COUNTY, WISCONSIN: JULY 1973

Quantity Consumed (therms)	Price ($/therm)
First 20	.1552
Next 30	.1118
All additional	.0987

SOURCE: Paul F. Ernst, *Residential Utility Rate Changes in Brown County, Wisconsin from September 1973 through January 1, 1976*, Housing Allowance Office of Brown County, BC/HAO-2, January 1976, Appendix Table 2.

NOTE: In addition to the above charges, there is a monthly fixed charge of $.75. Rate schedule shown is for RG-1, residential service in urban areas, and covers most residential users in Brown County. It became effective on 18 November 1972 and was still in effect with no adjustments on 1 July 1973.

Fuel Oil

Regional Index. BLS bases its annual index for the fuel oil component of the Region V CPI on the price of fuel oil No. 2, sampling outlets in 10 metropolitan areas. With July 1972 as the base, the index for July 1973 is 111.93.

Brown County Index. There are no published fuel oil prices or indexes for Brown County. Unlike the other utilities we priced, fuel oil is not supplied by a regulated public service corporation with published rates, but rather by independent retailers. As a result, we priced fuel oil directly, a procedure that will be repeated annually.

To make the Brown County and BLS indexes comparable, we priced fuel oil No. 2 at the six retail outlets (out of 25 in the county) listed in Table 7. Our original sample of firms was reduced to only those

Table 7

RETAIL PRICES OF FUEL OIL NO. 2
AT SELECTED OUTLETS IN
BROWN COUNTY, WISCONSIN:
JULY 1973

Outlet	Price ($/ gallon)
A	.2890
B	.1890
C	.2190
D	.2280
E	.1475
F	.1930
Average	.2109

SOURCE: Compilations by the staff of the Rand site office, Green Bay, Wisconsin. Names and addresses of the six outlets are on file at Rand, but are available only for survey purposes.

that responded to telephone price inquiries. Since we did not begin these inquiries until September 1974, we were further limited to firms that had records for July 1973.

The fuel oil market in Brown County was somewhat chaotic in the middle of 1973. The range of fuel oil prices for that month was extreme, from 15 to 29 cents per gallon; we would not expect the prices to differ by more than a few cents. Because of this range, the average price we will use to index fuel oil costs ($.2109) bears little relationship to the actual price anyone paid in 1973. Thus, the index value for the period between baseline and the end of the first year will not accurately reflect fuel oil price inflation. As the market evens out, however, the index will become more accurate.

Summary

For convenience, Table 8 gives the local and regional utility data described above. Only the electricity data are comparable, however;

Table 8

DATA FOR THE UTILITY COMPONENT OF THE PROPERTY SERVICE COST INDEX: BROWN COUNTY, WISCONSIN, AND REGIONAL AVERAGE, 1973

Utility	Regional Data	Brown County Data
Electricity	11.70[a]	13.45[a]
Gas	104.7[b]	13.17[a]
Fuel oil	111.9[b]	.2109[c]

SOURCE: *Typical Electric Bills*, Federal Power Commission, FPCR-82, January 1974, pp. xi, 124; tabulations by the HASE staff from Tables 6 and 7, above; and special tabulations by BLS.

[a]Dollars per month.

[b]Index number.

[c]Dollars per gallon.

the local data for gas and fuel oil are in dollars (actual bills and prices) whereas the background data are indexes.

INSURANCE

Insurance, like gas and fuel oil, is priced directly for Brown County, the procedure paralleling that used to price natural gas: We first specify average consumption levels, then price them with rate schedules in effect at the time to obtain insurance bills. These bills are averaged across property types and areas within the county, and the ratio of the average for two different years provides the local price index. The background index is provided by BLS.

Regional Index

BLS collects homeowner insurance premium data for 14 metropolitan areas in Region V and provides us with an annual index for this component of the CPI. With July 1972 as the base, the index for July 1973 is 105.0.

Brown County Index

Insurance companies write two types of property insurance--homeowner and "multiple peril." The first provides comprehensive coverage to homeowners and resident landlords of small multiple-unit buildings. Other residential properties are insured under combined coverages called multiple-peril insurance. Since rate schedules differ by area, type of building, and insurance company, our method for obtaining typical insurance bills was complex. First, we identified the three largest writers of homeowner insurance in the county: Allstate, American Family, and State Farm. Only the latter two write many multiple-peril policies. We used rate schedules of all three suppliers to price homeowner insurance and schedules of American Family and State Farm to price multiple-peril insurance.

Next, we identified four property types and priced policies for each: (a) single-family owner occupied, (b) single-family rental, (c) duplex with a resident landlord, and (d) duplex without a resident landlord or buildings with three or more units. The first and third types are insured with homeowner policies; multiple-peril policies cover the second and fourth.

Insurance rates depend on the protection class of the area where a property is located. These protection classes are based on ratings of an area's water supply, fire department, fire alarm system, fire prevention, building department, and structural conditions. The lower the protection class, the less risk to property, and thus the lower the rate schedule. Table 9 classifies the 24 minor civil divisions (MCDs) in Brown County by insurance protection class as of July 1973.

Tables 10 through 13 present baseline insurance premium data for the county's MCDs. For each property type and area, the tables give the number of properties and average value of improvements (rounded to the nearest thousand). Premiums are averaged across all companies priced.

Table 9

RESIDENTIAL PROPERTY INSURANCE PROTECTION CLASSES FOR MINOR CIVIL DIVISIONS IN BROWN COUNTY, WISCONSIN: JULY 1973

Minor Civil Division	Protection Class	Minor Civil Division	Protection Class
Green Bay	4	Lawrence	10
De Pere	5	Morrison	10
Allouez	6	New Denmark	10
Ashwaubenon	6	Pittsfield	10
Bellevue	10	Rockland	10
Town of De Pere	10	Scott	10
Eaton	10	Suamico	10
Glenmore	10	Wrightstown	10
Green Bay town	10	Village of Denmark	6
Hobart	10	Village of Howard	8
Holland	10	Village of Pulaski	7
Humboldt	10	Village of Wrightstown	8

SOURCE: *Index to Rated Cities and Villages (Wisconsin)*, Insurance Services Office of Wisconsin, 1 June 1974.

NOTE: The data were verified and additional data were obtained by the staff of the Rand site office, Green Bay, Wisconsin.

Each combination of property type and MCD has an average insurance premium. When weighted by the number of properties and averaged, these yield an average annual premium for all county residential properties in July 1973 of $40.83.

Summary

The table below presents the index of background inflation and the average annual premium for property insurance in Brown County. Again, the figures are not directly comparable.

Data for the Insurance Component of the Property Service Cost Index

Regional Index	Brown County Average Annual Premium
105.0	$40.83

Table 10

HOMEOWNER INSURANCE PREMIUMS FOR AVERAGE VALUE OF IMPROVEMENTS IN MINOR CIVIL DIVISIONS IN BROWN COUNTY, WISCONSIN: SINGLE-FAMILY, OWNER-OCCUPIED RESIDENCES, JULY 1973

Minor Civil Division	Number of Properties[a]	Average Value[b] ($)	Annual Premium ($)			
			Company A[c]	Company B[d]	Company C[e]	Average
Green Bay	16,799	16,000	33	34	33	33.33
De Pere	2,764	17,000	35	38	37	36.67
Allouez	3,257	22,000	43	46	45	44.67
Ashwaubenon	1,840	20,000	39	42	41	40.67
Bellevue	214	20,000	63	63	62	62.67
Town of De Pere	166	16,000	54	53	52	53.00
Eaton	90	8,000	42	38[f]	41	40.33
Glenmore	45	12,000	46	46	45	45.67
Green Bay town	0	--	--	--	--	--
Hobart	387	28,000	89	88	87	88.00
Holland	83	23,000	72	71	70	71.00
Humboldt	128	16,000	54	53	52	53.00
Lawrence	310	20,000	63	63	62	62.67
Morrison	67	12,000	46	46	45	45.67
New Denmark	90	18,000	58	58	57	57.67
Pittsfield	173	16,000	54	53	52	53.00
Rockland	77	62,000	224	222	221[g]	222.33
Scott	106	17,000	56	55	54	55.00
Suamico	658	20,000	63	63	62	62.67
Wrightstown	83	22,000	69	68	67	68.00
Village of Denmark	224	12,000	29	31	30	30.00
Village of Howard	1,124	22,000	50	52	51	51.00
Village of Pulaski	297	20,000	44	44	44	44.00
Village of Wrightstown	166	17,000	41	42	41	41.33

SOURCE: Tabulations by the HASE staff from the baseline survey of homeowners for Brown County, Wisconsin, and homeowner insurance premium schedules published by the indicated insurance companies.

[a]The total number of properties with only a single-family, owner-occupied residence. The count excludes mobile homes and farms.

[b]The average of the assessed value of improvements for all properties defined in the preceding note. Assessed values were equalized before being averaged, so that they represent full value. Averages are rounded to the nearest thousand.

[c]Premiums are for homeowner insurance of the following type: standard policy for $50 deductible insurance on a frame house. They are computed from the rate schedule for Wisconsin published by Allstate Insurance Company that was effective on 26 March 1973. This schedule was in effect in Brown County on 1 July 1973.

[d]Premiums are for homeowner insurance of the following type: homeowner broad-form 2, $50 deductible, for frame construction. They are computed from the rate schedule for Wisconsin published by American Family Mutual Insurance Company that was effective on 4 August 1971. This schedule was in effect in Brown County on 1 July 1973.

[e]Premiums are for homeowner insurance of the following type: homeowner form 2, $50 deductible, for frame construction. They are computed from the rate schedule for Wisconsin published by State Farm Fire and Casualty Company that was effective on 1 August 1972. This schedule was in effect in Brown County on 1 July 1973.

[f]The minimum quoted coverage is $12,000. Premium was extrapolated using a rate of $2 per $1,000 of coverage.

[g]The premium for $62,000 coverage was interpolated between the premiums quoted for coverages of $60,000 and $65,000.

Table 11

MULTIPLE-PERIL INSURANCE PREMIUMS FOR AVERAGE VALUE OF IMPROVEMENTS IN MINOR CIVIL DIVISIONS IN BROWN COUNTY, WISCONSIN: SINGLE-FAMILY RENTAL RESIDENCES, JULY 1973

Minor Civil Division	Number of Properties[a]	Average Value[b] ($)	Annual Premium ($)		
			Company B[c]	Company C[d]	Average
Green Bay	957	10,000	28	27	27.50
De Pere	130	11,000	30	29	29.50
Allouez	43	9,000	28	24	26.00
Ashwaubenon	30	11,000	30	29	29.50
Bellevue	12	12,000	46	39	42.50
Town of De Pere	12	45,000	154[e]	110	132.00
Eaton	24	13,000	48	41	44.50
Glenmore	15	11,000	44	37	40.50
Green Bay town	18	13,000	48	41	44.50
Hobart	23	19,000	61	54	57.50
Holland	32	18,000	58	52	55.00
Humboldt	10	10,000	42	34	38.00
Lawrence	13	27,000	84[f]	71	77.50
Morrison	27	11,000	44	37	40.50
New Denmark	16	10,000	42	34	38.00
Pittsfield	49	12,000	46	39	42.50
Rockland	21	10,000	42	34	38.00
Scott	18	10,000	42	34	38.00
Suamico	19	11,000	44	37	40.50
Wrightstown	14	14,000	50	44	47.00
Village of Denmark	34	10,000	29	27	28.00
Village of Howard	37	13,000	36	34	35.00
Village of Pulaski	25	10,000	31	29	30.00
Village of Wrightstown	8	7,000	30	21	25.50

SOURCE: Tabulations by the HASE staff from the baseline survey of landlords for Brown County, Wisconsin, and homeowner and multiple-peril insurance premium schedules published by the indicated insurance companies.

NOTE: If a landlord does not live on the rental property that he is insuring, he cannot cover it with an extension of his homeowner policy. Such properties must be insured with multiple-peril policies. Company A is not included in the above table. Allstate writes almost no multiple-peril insurance in Brown County, so their rate schedules were not included in the calculation of average premiums.

[a]The total number of properties with only a single-family rental residence. The count excludes mobile homes and farm properties.

[b]The average of the assessed value of improvements for all properties defined in the preceding note. Assessed values were equalized before they were averaged so that they represented full value. Averages are rounded to the nearest thousand.

[c]Premiums are for homeowner insurance of the following type: homeowner broad-form 2, $50 deductible, for frame construction. They are computed from the rate schedule for Wisconsin published by American Family Mutual Insurance Company that was effective on 4 August 1971. This schedule was in effect in Brown County on 1 July 1973. American Family's multiple-peril schedules do not cover single-family residences, even though rented. Such coverage is provided by a special rate package calculated by American Family. Premiums for this coverage are slightly higher than but similar to its homeowner premiums. For this company, coverage for single-family rental properties is calculated from the homeowner schedule.

The minimum quoted coverage is $12,000. All premiums for values of less than $12,000 were extrapolated using a rate of $1 per $1,000 of coverage, except those for protection class 10, where a rate of $2 per $1,000 of coverage was used.

[d]Premiums are for the following multiple-peril coverage: (a) frame construction; (b) basic coverage (Coverage A) from Table I (including the apartment special form) for $50 flat deductible; (c) loss of rents coverage (Table V) assuming monthly rent equals $120 times number of units and repair or rebuilding is estimated to take 10 months; and (d) increased limits of liability and medical payments coverage (Table II) with a $100,000 limit of liability, and limits of $1,000 per person and $10,000 per accident for medical payments. Premiums for values indicated in the table were calculated by State Farm Fire and Casualty Company and reflect rate schedules in effect during June 1973 in Brown County Wisconsin.

[e]The premium for $45,000 coverage was interpolated between the premiums quoted for coverages of $44,000 and $46,000.

[f]The premium for $27,000 coverage was interpolated between the premiums quoted for coverages of $26,000 and $28,000.

Table 12

HOMEOWNER INSURANCE PREMIUMS FOR AVERAGE VALUE OF IMPROVEMENTS IN MINOR CIVIL DIVISIONS IN BROWN COUNTY, WISCONSIN: DUPLEXES WITH RESIDENT LANDLORDS, JULY 1973

Minor Civil Division	Number of Properties[a]	Average Value[b] ($)	Annual Premium ($)			
			Company A[c]	Company B[d]	Company C[e]	Average
Green Bay	1,054	18,000	35	37	36	36.00
De Pere	98	17,000	35	38	37	36.67
Allouez	45	22,000	43	46	45	44.67
Ashwaubenon	30	10,000	28	29[f]	30	29.00
Bellevue	9	30,000	96	95	94	95.00
Town of De Pere	8	25,000	79	77	76	77.33
Eaton	0	--	--	--	--	--
Glenmore	0	--	--	--	--	--
Green Bay town	0	--	--	--	--	--
Hobart	0	--	--	--	--	--
Holland	0	--	--	--	--	--
Humboldt	3	12,000	46	46	45	45.67
Lawrence	3	36,000	120	118	117	118.33
Morrison	6	15,000	51	51	50	50.67
New Denmark	3	9,000	43	40[f]	42[h]	41.67
Pittsfield	12	21,000	66	65	64	65.00
Rockland	3	32,000	104	102	101	102.33
Scott	3	13,000	48	48	47[i]	47.67
Suamico	3	37,000	124	122[g]	121	122.33
Wrightstown	14	14,000	50	50	49	49.67
Village of Denmark	37	14,000	31	33	32	32.00
Village of Howard	31	20,000	46	47	46	46.33
Village of Pulaski	8	16,000	38	39	38	38.33
Village of Wrightstown	6	34,000	81	83	82	82.00

SOURCE: Tabulations by the HASE staff from the baseline survey of landlords for Brown County, Wisconsin, and homeowner insurance premium schedules published by the indicated insurance companies.

NOTE: A landlord may cover an entire duplex with his homeowner comprehensive coverage package, provided he lives in the building. We assume that all landlords in this situation opt for homeowner coverage rather than multiple-peril coverage.

[a]The total number of properties with a duplex residence with a resident landlord. The count excludes properties with mobile homes and farms.

[b]The average of the assessed value of improvements for all properties defined in the preceding note. Assessed values were equalized before they were averaged so that they represented full value. Averages are rounded to the nearest thousand.

[c]Premiums are for homeowner insurance of the following type: standard policy for $50 deductible insurance on a frame house. They are computed from the rate schedule for Wisconsin published by Allstate Insurance Company that was effective on 26 March 1973. This schedule was in effect in Brown County on 1 July 1973.

[d]Premiums are for homeowner insurance of the following type: homeowner broad-form 2, $50 deductible, for frame construction. They are computed from the rate schedule for Wisconsin published by American Family Mutual Insurance Company that was effective on 4 August 1971. This schedule was in effect in Brown County on 1 July 1973.

[e]Premiums are for homeowner insurance of the following type: homeowner form 2, $50 deductible, for frame construction. They are computed from the rate schedule for Wisconsin published by State Farm Fire and Casualty Company that was effective on 1 August 1972. This schedule was in effect in Brown County on 1 July 1973.

[f]The minimum quoted coverage is $12,000. Premium was extrapolated using a rate of $1 per $1,000 of coverage, except for protection class 10, where a rate of $2 per $1,000 of coverage was used.

[g]The premium for $37,000 coverage was interpolated between the premiums quoted for coverages of $36,000 and $38,000.

[h]The premium for $9,000 coverage was interpolated between the premiums quoted for coverages of $8,000 and $10,000.

[i]The premium for $13,000 coverage was interpolated between the premiums quoted for coverages of $12,000 and $14,000.

Table 13

MULTIPLE-PERIL INSURANCE PREMIUMS FOR AVERAGE VALUE OF IMPROVEMENTS IN MINOR CIVIL DIVISIONS IN BROWN COUNTY, WISCONSIN: DUPLEXES WITHOUT RESIDENT LANDLORDS AND ALL PROPERTIES WITH MORE THAN TWO UNITS, JULY 1973

Minor Civil Division	Number of Properties[a]	Average Value[b] ($)	Average Number of Units	Annual Premium ($)		
				Company B[c]	Company C[d]	Average
Green Bay	2,426	24,000	3	49	61	55.00
De Pere	175	31,000	4	68	71	69.50
Allouez	133	38,000	3	71	82	76.50
Ashwaubenon	183	45,000	4	85	93	89.00
Bellevue	28	25,000	3	79	69	74.00
Town of De Pere	9	32,000	2	87	83	85.00
Eaton	6	11,000	2	43	38	40.50
Glenmore	0	--	--	--	--	--
Green Bay town	5	13,000	2	47	43	45.00
Hobart	3	33,000	6	177	130	153.50
Holland	3	57,000	2	140	137	138.50
Humboldt	3	12,000	2	45	40	42.50
Lawrence	5	15,000	2	52	47	49.50
Morrison	5	15,000	2	52	47	49.50
New Denmark	0	--	--	--	--	--
Pittsfield	9	30,000	2	83	79	81.00
Rockland	0	--	--	--	--	--
Scott	8	14,000	2	49	45	47.00
Suamico	8	29,000	3	87	81	84.00
Wrightstown	6	15,000	2	52	47	49.50
Village of Denmark	28	26,000	4	62	65	63.50
Village of Howard	65	46,000	4	101	105	103.00
Village of Pulaski	43	19,000	2	44	46	45.00
Village of Wrightstown	17	18,000	2	46	44	45.00

SOURCE: Tabulations by the HASE staff from the baseline survey of landlords for Brown County, Wisconsin, and multiple-peril insurance premium schedules published by the indicated companies.

NOTE: As noted in Table 11, a landlord cannot cover a residential property on which he does not reside with an extension of his homeowner policy. Although 3- and 4-unit properties could be covered by such an extension if the landlord resides on the property, nearly all properties with 3 or more units are covered with multiple-peril coverage. Company A is not included in the above table. Allstate writes almost no multiple-peril insurance in Brown County, so their rate schedules were not included in the calculation of average premiums.

[a]The total number of properties with either two units and no resident landlord or more than two units. The count excludes properties with mobile homes and farms.

[b]The average of the assessed value of improvements for all properties defined in the preceding note. Assessed values were equalized before they were averaged so that they represented full value. Averages are rounded to the nearest thousand.

[c]Premiums are for the following multiple-peril coverage: (a) frame construction; (b) special package--apartment owners' coverage, Section I, 90 percent coinsurance with no personal property coverage, $50 deductible; (c) coverage for rent loss of $120 per unit per month for 10 months; and (d) injury and liability coverage (Section II) for territory 2 with a $100,000 limit of liability and limits of $1,000 per person and $10,000 per accident for medical payments. Premiums are computed from the rate schedules for Wisconsin published by American Family Mutual Insurance Company that were effective on 1 January 1973. These schedules were in effect in Brown County on 1 July 1973.

[d]Premiums are for the following multiple-peril coverage: (a) frame construction; (b) basic coverage (Coverage A) from Table I (including the apartment special form) for $50 flat deductible; (c) loss of rents coverage (Table V) assuming monthly rent equals $120 times number of units and repair or rebuilding is estimated to take 10 months; and (d) increased limits of liability and medical payments coverage (Table II) with a $100,000 limit of liability, and limits of $1,000 per person and $10,000 per accident for medical payments. Premiums for values indicated in the table were calculated by State Farm Fire and Casualty Company and reflect rate schedules in effect during June 1973 in Brown County.

VI. INDEX OF MAINTENANCE AND REPAIR COST

The component costs of maintenance and repair--for employees, supplies, and repairs--are indexed with wage rates and material prices. Wages are obtained primarily from AWS publications, using union wage scales for some occupations and cities. Material prices are indexed with Wholesale Price Index (WPI) components. Because the WPI is a national index, all cities in the region have the same index. We cannot distinguish local or regional price changes from national ones; however, the commodities indexed in this way are generally supplied in a national market. A local increase in demand for them could result in either shortages or price increases, but only briefly until local stocks were replenished. There would be at most a temporary divergence between the local and background inflation indexes.

EMPLOYEES

The employee component is indexed with the wage for janitors, porters, and cleaners. Wage rates for gardeners, the other main residential maintenance group in Brown County, are not available. The data for the region were presented earlier (see Table 5, on p. 26). Here we present the average regional and local wages, taken from the summary table on p. 27:

1973 Wages for Janitors, Porters, and Cleaners

Weighted Regional Average ($/hour)	Brown County ($/hour)
3.21	3.28

SUPPLIES

Ten commodity groups--commonly used maintenance supplies--make up the component for supplies. Table 14 gives the WPI code and July 1973 index for each group. As noted above, the WPI is a national index; thus, the data in Table 14 will be used for both the local and the background inflation indexes. We have no expenditure data for these detailed categories, so the ten commodity groups will be weighted equally in the component.

Table 14

WHOLESALE PRICE INDEX DATA FOR COMMODITIES IN THE SUPPLY COMPONENT OF THE MAINTENANCE AND REPAIR COST INDEX: JULY 1973

Commodity Group	Code Number	Index
Soap and synthetic detergent	0671	112.5
Liner, refuse	07220205.01	91.0
Builders hardware	104101	124.8
Furniture hardware	104104	141.5
Metal doors, sash, and trim	1071	124.1
Lighting fixtures, residential, incandescent, ceiling, enclosed bowl	10830103.05	128.9
Insect screening, galvanized	10890126.01	120.6
Electric lamps/bulbs, incandescent, 100 watts, inside frosted	11770101.02	124.4
Paint brush	15970141.05	112.5
Household maintenance brushes	159703	135.8

SOURCE: *Wholesale Prices and Price Indexes, Data for July 1973*, U.S. Department of Labor, Bureau of Labor Statistics, September 1973.

NOTE: For all items except refuse liners, 1967 = 100. For refuse liners, December 1970 = 100.

REPAIRS

Table 15 lists nine components of the repair index. Because cost breakdowns are not available, a proportion of the total cost for each repair type is allocated to labor and material. Wage and material price relatives are weighted with these proportions--in effect, expenditure weights.* We treat the resulting indexes as price relatives for each repair type and weight them with HASE baseline expenditure data to compute the repair index.

The items to be indexed (both occupations and commodities) as well as the weights within each repair category are indicated in the last two columns of Table 15. Nine commodities and nine occupations will be priced.

*The weights are from a study for the Housing and Development Administration of New York City (see the note to Table 15). The data are for 1967 to 1969 and are directly applicable to large, rent-controlled buildings in New York. We have been unable to find a set of weights based on properties like those in our experimental sites.

Table 15

WAGES, COMMODITIES, AND WEIGHTS FOR THE REPAIR COMPONENT OF THE MAINTENANCE AND REPAIR INDEX

Repair Category	Type of Item to Be Indexed		Item to Be Indexed	Indexed Item Weight
Carpentry	1.00	Wages	1.00 Carpenters	1.00
Electrical work	.75	Wages	1.00 Electricians	.75
	.25	Commodities	1.00 Electrical machinery and equipment	.25
Flooring work	.60	Wages	1.00 Carpenters	.60
	.40	Commodities	1.00 Floor coverings	.40
Glass work	.75	Wages	1.00 Helpers, maintenance trades	.75
	.25	Commodities	1.00 Flat glass	.25
Masonry work	.75	Wages	1.00 Helpers, maintenance trades	.75
	.25	Commodities	1.00 Concrete products	.25
Miscellaneous repairs	1.00	Wages	.50 Janitors, porters, cleaners	.50
			.50 Helpers, maintenance trades	.50
Painting	.80	Wages	1.00 Painters	.80
	.20	Commodities	1.00 Prepared paint	.20
Plumbing and heating work	.60	Wages	.10 Engineers, stationary	.06
			.20 Firemen, stationary boilers	.12
			.70 Plumbers	.42
	.40	Commodities	.10 Hardware	.04
			.20 Heating equipment	.08
			.70 Plumbing fixtures	.28
Roofing work	.60	Wages	1.00 Roofers	.60
	.40	Commodities	1.00 Prepared asphalt roofing	.40

SOURCE: Ira S. Lowry (ed.), *General Design Report: First Draft*, The Rand Corporation, WN-8198-HUD, May 1973, Table D-5, p. 275.

NOTE: Most of the categories, indexed items, and weights are given in George Sternlieb, *The Urban Housing Dilemma*, Department of Rent and Housing Maintenance, Housing and Development Administration, New York, 1972, pp. 245-259.

Regional Index

Table 16 presents July 1973 WPI data for the commodities given as items to be indexed in Table 15. Price relatives for the indexes of background and local inflation will be computed from these data.

Table 16

WHOLESALE PRICE INDEX DATA FOR COMMODITIES IN THE REPAIR COMPONENT OF THE MAINTENANCE AND REPAIR COST INDEX: JULY 1973

Commodity	Code Number	Index
Concrete products	133	132.3
Electrical machinery and equipment	117	112.7
Floor coverings	123	102.7
Flat glass	1311	117.9
Hardware	104	124.5
Heating equipment	106	120.9
Plumbing fixtures and brass fittings	105	126.3
Prepared asphalt roofing	1361	139.8
Prepared paint	0621	121.0

SOURCE: *Wholesale Prices and Price Indexes, Data for July 1973*, U.S. Department of Labor, Bureau of Labor Statistics, September 1973.
NOTE: For all items, 1967 = 100.

Table 17 gives rates for the wage categories listed in Table 15. In each case, wages are presented for all SMSAs in the region for which they were available (except for Green Bay and South Bend). Data for the first seven categories were obtained from AWS publications. Wage rates for plumbers and roofers are from the *Engineering News Record*, a construction industry weekly. Rates for these categories do not appear in any AWS publications.

Every rate was not available for every city. This inconsistency is a consequence of using different sources, each having different characteristics. The last row of Table 17 shows the population-weighted average of each wage category for the region, based on the cities for which wage data were available.

Table 17

WAGES FOR OCCUPATIONS IN THE REPAIR COMPONENT OF THE MAINTENANCE AND REPAIR COST INDEX BY STATE AND SMSA: 1973

State and SMSA	Month of Publication[a] (1973)	Carpenters, Maintenance[b] ($ per Hour)	Electricians, Maintenance[b] ($ per Hour)	Engineers, Stationary[b] ($ per Hour)	Firemen, Stationary Boilers[b] ($ per Hour)	Helpers, Maintenance Trades[b] ($ per Hour)	Janitors, Porters, and Cleaners[c] ($ per Hour)	Painters, Maintenance[b] ($ per Hour)	Plumbers[d] ($ per Hour)	Roofers[d] ($ per Hour)
Illinois										
Chicago	May	6.07	5.65	6.20	4.98	4.13	3.14	6.16	10.67	9.57
Peoria	(e)	--	--	--	--	--	--	--	8.33	--
Rockford	June	4.56	5.24	4.77	--	3.51	3.63	4.70	--	--
Indiana										
Evansville	(e)	--	--	--	--	--	--	--	9.77	--
Indianapolis	October	5.78	5.79	5.48	4.44	3.93	2.90	5.48	8.99	--
Michigan										
Detroit	March	5.68	6.07	5.83	5.83	4.56	3.69	5.69	11.65	10.38
Grand Rapids	(e)	--	--	--	--	--	--	--	9.06	--
Lansing	(e)	--	--	--	--	--	--	--	9.44	--
Muskegon-Muskegon Heights	June	4.59	4.81	--	4.55	--	3.51	--	--	--
Ohio										
Akron	December	5.39	5.47	5.46	5.09	4.56	3.43	5.38	--	--
Canton	May	4.98	5.11	5.24	4.68	4.06	3.17	4.90	--	--
Cincinnati	February	5.35	5.15	5.38	4.59	4.15	2.69	4.53	10.22	10.07
Cleveland	September	5.69	5.63	5.43	4.74	4.24	3.16	5.53	10.86	10.33
Columbus	October	5.03	5.42	5.19	4.13	4.37	2.67	5.16	10.72	9.73
Dayton	December	5.76	5.76	5.59	4.66	4.33	3.51	5.72	9.70	--
Toledo	April	5.23	5.53	5.32	5.06	4.50	3.37	5.01	10.44	--
Youngstown-Warren	November	5.80	5.90	5.68	--	--	3.12	5.86	--	--
Wisconsin										
Madison	(e)	--	--	--	--	--	--	--	8.97	--
Milwaukee	May	5.19	5.89	5.03	4.48	4.61	2.85	5.62	9.95	--
Weighted Regional Average		5.67	5.69	5.72	4.99	4.29	3.21	5.66	10.54	9.95

SOURCE: *Area Wage Survey*, U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 1775, various cities and dates as noted in columns 1 and 2, Tables A-1, A-4, A-5, and A-6. Wages for plumbers and roofers were obtained from *Engineering News Record*, vol. 191, no. 12, 20 September 1973, pp. 75-81.

NOTE: The wages in columns 3 through 10 were obtained from the AWS. Dashes in these columns indicate either that no AWS is published for the SMSA or that the wage for a trade in a particular SMSA was suppressed. The wages in the last two columns are union wage rates including fringe benefits. Dashes in these columns indicate that the union rate for the SMSA was not published in the source.

[a] Dates are the AWS data collection dates for the indicated SMSA. They do not apply to wages appearing in the last two columns.

[b] Wages are mean wages for men only in all industries and all size establishments.

[c] Wages are mean wages for men and women in all industries and all size establishments. For Chicago, Rockford, Muskegon-Muskegon Heights, Canton, Cincinnati, Dayton, Toledo, Youngstown-Warren, and Milwaukee, wages were reported separately for men and women. In these cases, the two wages (weighted by the number of workers) were averaged to obtain the average wage for men and women.

[d] Wages for plumbers and roofers are union rates, including fringe benefits, as approved by the Construction Industry Stabilization Committee. All rates are rounded to the nearest cent. All rates are those in effect on 1 August 1973 except for the plumbers' wages for Peoria, Indianapolis, Grand Rapids, Lansing, Dayton, Toledo, Madison, and Milwaukee, which are the rates in effect on 2 July 1973.

[e] Dates in column 2 refer only to AWS data, and no AWS publication is available for these SMSAs.

The second column of Table 17 indicates the month when BLS collected wage data for the first eight categories. In every instance, we have used the AWS that is closest to 1 July 1973, although the dates actually range from February to December of 1973. The last two columns give union wage rates in effect on 2 July 1973 or 1 August 1973.

For our purposes, the AWS figures, which come from a BLS survey of both union and nonunion workers in each metropolitan area, are the most desirable. Mean wage rates are published for each occupation in each area, although rates for several categories are not reported for every city. When such is the case, the regional average is the average over the reported wages.

BLS does not publish wage data pertaining to either of the last two trades listed in Table 17 for any of the region's metropolitan areas. Data were obtained instead from the *Engineering News Record*'s lists of union wage rates (which include fringe benefits), published quarterly for selected metropolitan areas.

However, using union rates to index wages for plumbers and roofers may slightly understate the inflation rate in these trades. This is because first, the county's home construction industry is largely nonunion (especially remodelers), and second, although union rates are higher than nonunion rates, they generally change by the same absolute amount.

For example, suppose that both union and nonunion plumbers receive a wage increase of 50 cents per hour. If the initial nonunion rate was $7 per hour, it increased by 7 percent. If the union rate was originally $10 per hour, the increase was only 5 percent. We believe, however, that such an error is too small to justify the expense of periodic special surveys to obtain nonunion wage rates.

Brown County Index

The local index for the commodities listed in Table 15 will be obtained from the WPI. As explained above, there will be no difference

between the local and regional indexes for these commodities, given that the WPI is a national index. The data for this portion of the local index are the same as those in Table 16.

Table 18 presents the county's July 1973 mean wage rates for the trade categories in Table 15, including both union and nonunion workers. Six rates were obtained from the AWS for Green Bay. Wages for carpenters, painters, plumbers, and roofers are the union rates (including fringe benefits). As noted above, union wage rates are usually higher than nonunion rates, but they undergo similar changes. Thus, using union rates to index a category may slightly underestimate a percentage increase.

Summary

Table 18 also compares the local and regional wage rates for the ten indexed trades. The rates for Brown County are those described above, and the regional rates are the population-weighted averages presented in the last row of Table 17.

Table 18

WAGE RATES FOR TRADES IN THE REPAIR COMPONENT OF THE MAINTENANCE AND REPAIR COST INDEX: BROWN COUNTY, WISCONSIN AND REGIONAL AVERAGE: 1973

Trade	Weighted Regional Average Wage ($/hr)	Brown County Wage ($/hr)
Carpenters, maintenance	5.67	7.85
Electricians, maintenance	5.69	4.86
Engineers, stationary	5.72	5.06
Firemen, stationary boilers	4.99	4.58
Helpers, maintenance trades	4.29	4.31
Janitors, porters, and cleaners	3.21	3.28
Painters, maintenance	5.66	6.95
Plumbers	10.54	9.15
Roofers	9.95	6.75

SOURCE: *Area Wage Survey*, U.S. Department of Labor, Supplement 1 to Bulletin 1775-1, Green Bay, Wisconsin, July 1973, Tables A-1, A-4, A-5, and A-6; Green Bay Building and Construction Trades Council, publication of union wage rates, 1 July 1973; and Table 17 above, p. 45.

NOTE: For Brown County, all rates except four are mean wages for the metropolitan area in July 1973, obtained from the AWS in conformance with the notes to Table 17. Wage rates for carpenters, painters, plumbers, and roofers are union scale including fringe benefits, as of 1 July 1973. The rates are obtained from the Green Bay Building and Construction Trades Council. Regional average rates are from the last row of Table 17. The rates for carpenters and painters are not comparable (one is the mean rate for the area, whereas the other is the union rate).

APPENDIX

REGIONAL INDEX OF IMPROVEMENT COST

Section IV discusses how we use the Boeckh building cost modifiers to index inflation in the cost of improvements and additions to them. This appendix demonstrates that the ratio of (a) the arithmetic average of all modifiers in the region to (b) the Green Bay modifier at baseline forms the regional index for this component. In addition, it justifies our use of an unweighted arithmetic average rather than the weighted average used for all other components. First we describe in detail the modifiers and their construction. A discussion of the index that measures background inflation follows. Finally, we show the equivalence between the desired index and our regional index.

Boeckh has specified production functions for 11 standard residential, agricultural, commercial, and industrial buildings. The functions indicate the percentage of total cost attributable to each of 83 factor inputs (called elements) in a base period (1967). The derivation and geographic reference of these relative input costs (element weights) is obscure, but they are based on averages for each structural type and were developed from 1965 to 1967. We do know that the 83 input elements (19 building trades and 64 materials) are maintained in American Appraisal's computer, together with baseline element prices (probably for Milwaukee) and cost weights for each structure type.

The cost weights are not city-specific but refer to some larger geographic region. They are the same for all cities (at least for all cities in our region) and are constant over time. The result is similar to a standard "market-basket" index, i.e., a fixed, baseline-quantity-weighted price index. It is thus a Laspeyres cost-of-production index. The modifiers, however, differ from simple single-location indexes in

that they are also geographic indexes. To show how this affects the index, we must first look at the equations for a Laspeyres index.

The algebra in this appendix includes triple-subscripted expenditure, price, and quantity variables. The first subscript (denoted i in general) indicates the element or input. The second subscript (denoted j in general) indicates the city of reference; we assume there are N cities in the region. The third variable indicates the time to which the variable refers. Denoted t in general, this subscript takes a value of 1 at baseline (for the Boeckh modifiers) and s at HASE baseline. If a variable does not vary across inputs, i.e., if it has been summed over all inputs in each city, i will be replaced with a dot. If a variable does not vary across cities (the value for a given input applies in all cities), the city subscript (j) will be replaced with a dot.

Most indexes refer to a particular city (denoted by a j subscript) but have already been summed over inputs. The input subscript will therefore be dropped. Unless otherwise noted, index numbers refer to the period from baseline (time 1) to time t, and no time subscripts appear. Where it is necessary to refer to a different period, a double subscript indicates the beginning and end of the period. Such cases are noted in the accompanying text.

The equation for a Laspeyres index is

$$\lambda_j = \frac{\sum_i \left(P_{ijt} Q_{ij1}\right)}{\sum_i \left(P_{ij1} Q_{ij1}\right)}, \qquad \text{(A.1)}$$

where λ_j = the Laspeyres index between baseline and time t in city j,

P_{ij1}, P_{ijt} = the price of input i in city j at baseline and time t,

Q_{ij1} = the quantity of input i in city j at baseline.

The Boeckh modifiers are constructed with baseline quantities that are not city-specific. Instead, they are average quantities needed to

construct a model building, and they are the same for all cities in the region. We indicate this by replacing the city subscript (j) with a dot, e.g., $Q_{i\cdot 1}$ is the baseline quantity of input i. The baseline price of each input also exists, but prices for Milwaukee were used to compute the baseline cost shares. Again we replace the city subscript with a dot: $P_{i\cdot 1}$ is the baseline price for input i used to compute the cost share. Each modifier is the sum of expenditure-weighted price relatives. The expenditure weight for input i is the relative cost share at baseline, and the price relative is the ratio of the price in city j at time t (P_{ijt}) to the baseline price in Milwaukee ($P_{i\cdot 1}$). The resulting modifier for city j is*

$$M_j = \sum_i \left(E_{i\cdot 1} \frac{P_{ijt}}{P_{i\cdot 1}} \right) , \tag{A.2}$$

where M_j = the Boeckh modifier from baseline to time t in city j, and

$$E_{i\cdot 1} = \frac{P_{i\cdot 1} Q_{i\cdot 1}}{\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right)}$$

or, the baseline expenditure weight for input i. Equation (A.2) is similar to a Laspeyres index (see Eq. (A.1)):

$$\begin{aligned} M_j &= \sum_i \left[\frac{P_{i\cdot 1} Q_{i\cdot 1}}{\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right)} \left(\frac{P_{ijt}}{P_{i\cdot 1}} \right) \right] \\ &= \frac{\sum_i \left(P_{ijt} Q_{i\cdot 1} \right)}{\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right)} . \end{aligned} \tag{A.3}$$

*This procedure is described in *Boeckh Building Cost Modifier*, Pub. 2, No. 4, August 1969.

The peculiar formulation in Eq. (A.3) allows the modifier to update the baseline cost of the model building in city j to time t, i.e., it is both a temporal and a geographic modifier. This is shown as follows:

Let $$C_{\cdot 1} = \sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right)$$

or, the baseline cost of the model building (as given in the Boeckh valuation manual); and

$$C_{jt} = \sum_i \left(P_{ijt} Q_{i\cdot 1} \right)$$

or, the cost of using the baseline quantities of inputs at time t prices in city j.

Then $$C_{jt} = M_j C_{\cdot 1}$$

$$= \frac{\sum_i \left(P_{ijt} Q_{i\cdot 1} \right)}{\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right)} \left[\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right) \right]$$

$$= \sum_i \left(P_{ijt} Q_{i\cdot 1} \right) .$$

If we denote the Green Bay variables by replacing the city subscript with g, the modifier for Green Bay can be written as follows:

$$M_g = \sum_i \left(E_{i\cdot 1} \frac{P_{igt}}{P_{i\cdot 1}} \right) = \frac{\sum_i \left(P_{igt} Q_{i\cdot 1} \right)}{\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1} \right)} . \qquad \text{(A.4)}$$

Section I describes our need for and method of constructing an index of background inflation for the experimental sites. Given Eqs. (1.6) and (A.4), we can define the index of background inflation between baseline and time t.

$$B = \sum_i \left(E_{i \cdot 1} \frac{P'_{igt}}{P_{i \cdot 1}} \right) . \tag{A.5}$$

In Sec. I we proposed using a population-weighted average of prices throughout the region in the construction of the index of background inflation. That proposal assumed that sample size is directly proportional to population, in which case the variance of the published (average) price for each city is indirectly proportional to population. American Appraisal, however, has the same sample size for pricing input i in all cities. Thus, the variance of its average price for any input is constant for all cities, and the arithmetic average of the prices for all cities is an unbiased estimate of the mean of the distribution:

$$\hat{\mu}_{it} = \frac{1}{N} \sum_{j=1}^{N} P_{ijt} . \tag{A.6}$$

For all other index components, we approximate regional price relatives (P_{irt}/P_{ir1}) with either the ratio of average regional prices or a regional index. We have no regional Boeckh modifier; to construct one requires a more restrictive assumption than was needed in Sec. I. We postulate that, without the allowance program, the local input price would equal the regional price, approximated by our estimate of the mean of the price distribution for the index:

$$P'_{igt} = P_{irt} \simeq \hat{\mu}_{it} = \frac{1}{N} \sum_{j=1}^{N} P_{ijt} . \tag{A.7}$$

We cannot use Eq. (1.7) to estimate P'_{igt} because we do not have the price data necessary to estimate the regional price relative. As we will see, it is not necessary to compute Eq. (A.7); assuming it to be true will be sufficient to allow us to average the Boeckh modifiers.

Equation (A.5) defines the index of background inflation between baseline and time t. But the baseline year for the modifiers differs from that for HASE. If we let s be our baseline year, the background index is

$$B_{st} = \frac{\sum_i \left(P'_{igt} Q_{i\cdot 1}\right)}{\sum_i \left(P_{igs} Q_{i\cdot 1}\right)}, \tag{A.8}$$

where the double subscript on the index indicates the beginning and end of the period indexed. Substituting Eq. (A.7) into Eq. (A.8), we obtain an expression for the desired background index:

$$B_{st} \simeq \frac{\sum_i \left[\left(\frac{1}{N} \sum_{j=1}^{N} P_{ijt}\right) Q_{i\cdot 1}\right]}{\sum_i \left(P_{igs} Q_{i\cdot 1}\right)}. \tag{A.9}$$

Define the regional index of cost of improvements (from time 1 to t) to be the arithmetic average of the modifiers:

$$R = \frac{1}{N} \sum_{j=1}^{N} M_j . \tag{A.10}$$

The Green Bay modifier constructed for the HASE baseline period is denoted by M_{gs}:

$$M_{gs} = \frac{\sum_i \left(P_{igs} Q_{i\cdot 1}\right)}{\sum_i \left(P_{i\cdot 1} Q_{i\cdot 1}\right)}. \tag{A.11}$$

Then the desired background index is computed as the ratio of these two indexes:

$$B_{st} = \frac{R}{M_{gs}} . \qquad \text{(A.12)}$$

Equations (A.10) and (A.12) show that our regional index of construction cost inflation will be the ratio of (a) the arithmetic average of the modifiers for all cities in the region to (b) the Green Bay modifier for HASE baseline.