

# Decisions to Renovate and to Move

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## Abstract

Housing renovation is the main alternative means of housing supply besides construction of new housing. Relatively little is known about the factors that affect decisions by households about whether to renovate and which sort of renovations to undertake. These questions are explored empirically. Separate analyses are conducted of the decision to undertake “major structural renovations” as opposed to other sorts (such as remodeling the kitchen or bathroom), and also of the decision to conduct renovations that add to the living space of the housing unit. Financial, household and geographic factors affecting this decision are analyzed econometrically.

At the level of the household, consumption of housing may be changed by means of moving to a different residential housing unit, by renovating the unit in which it already lives, or by doing both. While the body of research on household moving decisions is very large,<sup>1</sup> and in fact the entire literature on housing demand could be interpreted as referring to moving decisions, relatively little analysis has addressed the question of what determines when a household renovates. In this paper factors affecting the likelihood to renovate and/or to move are explored empirically.

There are two methods by which the residential housing stock and housing supply change. First, housing units can be newly constructed or demolished, changing the total number in use. Second, existing housing units can be altered, enlarged or made smaller, renovated, remodeled, or otherwise changed. That renovation represents an alternative mode of altering housing supply has been understood going back at least to Mendelsohn (1977). DiPasquale (1999) suggests that understanding housing renovation choices is among the leading research challenges for urban economics.

Housing renovation is a very large economic activity in terms of the amount of resources involved. Bendimerad (2007) reports that Americans in 2005 spent \$280 billion on home remodeling, and this number was projected by the author to increase at 3.7% in real terms until 2015. In the American Housing Survey data used below, almost half of home owners made some renovations during the previous two years.

In this paper the factors that affect the decisions of households to renovate the housing unit are examined empirically. Renovation decisions are examined when

households are *not* moving into different housing units and also for households who *are* moving. Little is known about the sequence in which households decide to move and renovate, that is, whether they first decide whether or not to move and then whether to renovate, or perhaps follow some other decision sequence. The different decision possibilities are examined here empirically by separate analysis of those who also move versus those who do not move.

Household decisions about whether or not to move and whether or not to renovate (as noted, it is possible for the household to do both) are presumed here to reflect other household, housing, and neighborhood characteristics and factors. In addition, once renovations have been elected, there are numerous options regarding their nature. If a household has decided to renovate, will it undertake major structural change in the property unit, such as by enlarging the unit or redividing the internal space to create new rooms, or does it make other changes? Examples of the latter might be changing the floor tiling, bathroom or kitchen remodeling. And if structural changes are made, do they enlarge the total size of the built unit or merely rearrange internal space? The factors that affect these different sorts of renovation decisions are explored in the empirical sections below. Logistic regressions to characterize the likelihoods of making the specific renovations choices are presented.<sup>2</sup>

The structure of this paper is as follows. In the next section the existing literature on housing renovations is reviewed. Following that, the American Housing Survey (AHS) data set used for the analysis is described. Summary statistics that describe different sets of households, based on whether they chose to move or renovate or both are presented. This is followed by logistic regression analyses of these renovation decisions. Decisions involving major structural changes and renovations that increase the floor space of units are analyzed in separate logistic regressions. The paper closes with concluding remarks.

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## Literature Review

There have been several interesting empirical papers on housing renovation decision making. Knight, Miceli, and Sirmans (2000) analyze the impact of renovations on the selling prices of properties. Baker and Kaul (2002) analyze the effect of dynamic factors, like changes in household composition on decisions to renovate. Potepan (1989) finds that these decisions are sensitive to interest rates and household income.

In other empirical work, Reschovsky (1992) finds that the demand for housing “improvement” behaves very differently from the demand for housing upkeep. Boehm and Ihlanfeldt (1986) investigate factors that affect urban household expenditure on housing improvement, noting the importance of neighborhood amenities and the cost of inputs. Helms (2003), in contrast, finds that amenities explain little in terms of the decision to renovate in “gentrifying” areas of Chicago. Simons, Magner, and Baku (2003) reverse the question and examine

how expenditure on renovation generates neighborhood externalities and benefits for the local economy.

Household “production” or repairs are examined using a behavioral economic approach by Eastwood and Garnerl (1986). McMillen and Thorsnes (2006) discuss incorporating renovation expenditures into housing indices. Gyourko and Tracy (2006) investigate the importance of housing maintenance and repair expenditure on household inequality in the United States. Some research on renovation decisions outside the U.S. has also been done, such as Carmon (1992) for Israel and Strassmann (1984) for Peru. Cyrenne, Fenton, and Warbanski (2006) find that renovation expenditure contributes significantly, although less than they anticipated, to assessed property value in Winnipeg.

There has also been some theoretical work on housing renovation. Wong and Norman (1994) examine renovation expenditures for commercial real estate, in a study of renovations of malls. Gyourko and Saiz (2004) develop a theoretical model of the decision to renovate, based on comparing the current value of a property to the equivalent of its construction materials and costs. Testing it with American Housing Survey data, they find that those with homes with market values below the value of construction materials are 50% less likely to renovate, controlling for income. Some theoretical papers, such as Arnott, Davidson, and Pines (1983), examine landlord decisions to invest in quality improvement through renovation. Simmons-Mosley (2003) uses a game theory type of analysis to explain decisions by landlords in a neighborhood to abandon property and to renovate.

The scope of housing renovation has been an area of focus and tracking for the Joint Center for Housing Research at Harvard University. Among its surveys and other papers that examine housing renovation are Reade (2001) and Guerrero (2003, 2004), which develops indicators of renovation activity and financing. Guerrero (2003) surveys the use of housing-related financial instruments in decisions to renovate housing.

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## The Data Set

Information about household moving, renovations, and the factors affecting their likelihoods are derived from the 2005 American Housing Survey (AHS), the latest available at the time this paper was written. The AHS is a national survey of housing conditions conducted by the U.S. Census Bureau and the Department of Housing and Urban Development. Every other year it analyzes a national sample, and during in-between years it analyzes specific cities.<sup>3</sup>

The entire 2005 AHS national sample covers about 106,000 occupied housing units, of which about 70% are owned and about 30% rental units. Parts of the data variables are household-based, with one household per housing unit. Others are individual-based, such as salary and age. Detailed combined housing and personal data are available for only part of the total sample for a number of

reasons. There are missing data for some variables, like housing value and size or housing physical features. In all, there is detailed usable housing information for about 42,000 households, of whom about 28,000 own their own home. These also include some missing values, and so the actual numbers used in the regressions below will be smaller.

Some data editing was necessary to create the file used in the empirical analysis. First, only current home owners are included in the analysis, while renters are excluded. Some households are excluded if variables seem unreasonable, such as if the head of the household is under age 18.<sup>4</sup> Renovations that were undertaken in response to natural disasters are identified in the survey and are excluded from the analysis, because in a sense they are not “rationally chosen,” but rather are “forced” upon the household by *force majeure*. Because many households contain multiple employed people, “double counting” of houses from the AHS was avoided when it was being combined with individual personal data. For each household a “head of household” is selected, identified as the member of the household with the highest salary. In cases of ties or zero salaries, the first person listed by the respondent on the survey questionnaire form was used to “represent” that household as “head of household.”

Household moving and renovations decisions can be analyzed using several sets of explanatory variables provided by the AHS. As noted above, household respondents are asked to report what they regard as “major renovations,” where a “major renovation” is undefined in terms of specific outlays.<sup>5</sup> In cases of such renovations, the household was asked to report costs, whether or not an outside contractor was used, and what sorts of renovations were made, inside and outside the housing unit. It is possible to separate renovations that made structural changes from those that did not.

The relevant explanatory variables for the analysis here fall into three categories:

- 1. Personal and Household Variables.** These include socio-demographic variables: gender, age, marital status, household size, education level, and race. There are also personal and household economic factors. These are salary (measured at the personal level for household “head of household”), household income from all sources, and indicators of household wealth, including number of cars, and whether or not there is income from dividends.
- 2. Housing Variables.** They include other housing-related variables: the value of unit, type of building (apartment, house, or manufactured housing), the level of property taxes (which is an indirect indicator of the level of local public services), the mortgage interest rate, and some physical features of the unit. The last group includes square footage of floor space, number of bedrooms, number of bathrooms, whether the unit has a garage or parking space included, whether it has a cellar, and the subjective quality rating of the unit.
- 3. Location and Neighborhood Variables.** These include several location variables: region of the U.S. and position within the metropolitan

statistical area (MSA) (the central city of MSA, urban area in MSA outside central city, rural within MSA, urban and rural areas outside MSA). These also include indicators of whether there are nearby shopping services, green areas, apartment buildings, commercial services, and whether the unit is in a gated neighborhood, etc.

### To Move and/or to Renovate?

The households in the AHS that renovate and/or relocate are described in Exhibit 1. Households that moved in the two years preceding the Survey are separated from those that did not, and households that carried out major renovations are separated from those that did not. For categorical descriptive variables, chi-square significance tests are shown.

As can be seen from these raw indicators, households that neither moved nor did renovations are less frequently headed by a male, less often contain a married couple, are considerably more likely to be non-white, and tend to be less well educated than the other groups. They also tend to earn lower income and salaries. Households that *both* moved and renovated have the highest incomes and salaries, are the youngest group, and have somewhat larger households than the others.

The four groups in Exhibit 1 do not differ much when it comes to the size of their housing units, or the number of bedrooms and baths in the unit. The homes of recent movers are worth more than those of non-movers, whether they renovated or not. For those having a mortgage, the interest rate is on average lower for households who neither moved recently nor renovated. There are also some differences in the physical features of housing units. Those who neither moved nor renovated are least likely to be in a single-family house. The four groups do not differ very much in terms of their distribution across the subregions within the metropolitan area, although non-movers tend to live in rural areas in relatively large numbers. Those on the West Coast are a bit more likely to be recent movers than households in other regions. There are some slight differences across the groups in terms of neighborhood features and amenities.

In Exhibit 2, the decision whether or not to renovate is analyzed, with separate logistic regressions for those who recently moved, those who did not move, and for all households together. The dependent variable in each case is the logit of the likelihood to renovate divided by the likelihood of no renovations. Here all forms of major renovations are included, while below subcategories of renovations are considered. About 40% of all households surveyed made some form of renovation in their property during the previous two years, which means that the base value of the ratio of the likelihoods for the entire sample is less than one.

Of household characteristics, several indicators of socioeconomic status are positively associated with the likelihood to renovate. Household income is positively associated with the likelihood of having performed renovations, other things equal. Doubling of income raises the logit by 17%, a bit less for recent

**Exhibit 1** | Characteristics of Housing and of Households that Relocate and/or that Renovate

|                                                                              | Households Did Not Move Recently and Had No Renovations or Repairs | Households Did Renovations or Repairs but Did Not Move Recently | Households Moved Recently but Did No Renovations or Repairs | Households Both Moved Recently and Did Renovations or Repairs | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|------------------------------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>Personal and Household Factors</b>                                        |                                                                    |                                                                 |                                                             |                                                               |                                                                                          |
| Of households in column, percent with male head of household                 | 59.67%                                                             | 62.29%                                                          | 64.18%                                                      | 64.53                                                         | 0.01%                                                                                    |
| Percent of those in columns whose household head married with spouse present | 56.65%                                                             | 66.86%                                                          | 57.05%                                                      | 60.59%                                                        | 0.01%                                                                                    |
| Percent of non-white household heads in column                               | 40.65%                                                             | 10.09%                                                          | 17.07%                                                      | 12.45%                                                        | 0.01%                                                                                    |
| Percent of head of households who are high school graduates only             | 37.88%                                                             | 53.78%                                                          | 51.75%                                                      | 51.41%                                                        | 0.01%                                                                                    |
| Percent who were college graduates                                           | 12.75%                                                             | 21.32%                                                          | 26.65%                                                      | 24.99%                                                        | 0.01%                                                                                    |
| Percent with postgraduate education                                          | 8.00%                                                              | 14.45%                                                          | 12.18%                                                      | 14.75%                                                        | 0.01%                                                                                    |
| Mean and S.D. household annual income                                        | 61,495<br>(68,328)                                                 | 78,335<br>(76,909)                                              | 69,729<br>(60,911)                                          | 80,576<br>(76,094)                                            |                                                                                          |
| Mean and S.D. annual salary of head of household                             | 35,240<br>(51,308)                                                 | 45,738<br>(57,589)                                              | 46,341<br>(46,273)                                          | 52,648<br>(58,435)                                            |                                                                                          |
| Mean and S.D. number of persons in household                                 | 2.40<br>(1.36)                                                     | 2.72<br>(1.40)                                                  | 2.85<br>(1.53)                                              | 3.04<br>(1.58)                                                |                                                                                          |
| Mean commute time for head of household—minutes                              | 34.07                                                              | 34.11                                                           | 30.53                                                       | 33.56                                                         |                                                                                          |

**Exhibit 1** | (continued)

Characteristics of Housing and of Households that Relocate and/or that Renovate

|                                                    | Households Did Not Move Recently and Had No Renovations or Repairs | Households Did Renovations or Repairs but Did Not Move Recently | Households Moved Recently but Did No Renovations or Repairs | Households Both Moved Recently and Did Renovations or Repairs | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|----------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Mean commute distance for head of household—miles  | 28.98                                                              | 28.57                                                           | 25.48                                                       | 28.28                                                         |                                                                                          |
| Mean and S.D. age of head of household             | 55.60<br>(16.53)                                                   | 52.29<br>(15.10)                                                | 42.63<br>(14.43)                                            | 41.88<br>(13.45)                                              |                                                                                          |
| Percent of households in column owning no car      | 11.45%                                                             | 15.37%                                                          | 15.44%                                                      | 13.95%                                                        | 0.01%                                                                                    |
| Percent owning two cars                            | 17.59%                                                             | 28.48%                                                          | 32.48%                                                      | 33.74%                                                        | 0.01%                                                                                    |
| Percent owning three or more cars                  | 5.67%                                                              | 11.03%                                                          | 8.76%                                                       | 11.83%                                                        | 0.01%                                                                                    |
| Housing Variables                                  |                                                                    |                                                                 |                                                             |                                                               |                                                                                          |
| Mean (SD) first mortgage interest paid (FRMs only) | 3.024<br>(2.34)                                                    | 3.460<br>(2.42)                                                 | 3.223<br>(2.42)                                             | 3.610<br>(2.44)                                               |                                                                                          |
| Percent of column in single home                   | 64.07%                                                             | 96.34%                                                          | 91.15%                                                      | 94.75%                                                        | 0.01%                                                                                    |
| Percent in gated neighborhood                      | 3.65%                                                              | 3.20%                                                           | 7.28%                                                       | 5.04%                                                         | 0.01%                                                                                    |
| Mean and S.D square foot of unit                   | 2,221.36<br>(1,866.72)                                             | 2,265.92<br>(1,781.03)                                          | 2,201.07<br>(1,732.74)                                      | 2,182.67<br>(1,767.93)                                        |                                                                                          |
| Mean and S.D. number of bathrooms                  | 1.68<br>(0.75)                                                     | 1.75<br>(0.74)                                                  | 1.87<br>(0.77)                                              | 1.81<br>(0.76)                                                |                                                                                          |
| Mean and S.D. number of bedrooms                   | 3.04<br>(0.87)                                                     | 3.20<br>(0.86)                                                  | 3.11<br>(0.91)                                              | 3.21<br>(0.96)                                                |                                                                                          |

**Exhibit 1** | (continued)

Characteristics of Housing and of Households that Relocate and/or that Renovate

|                                                             | Households Did Not Move Recently and Had No Renovations or Repairs | Households Did Renovations or Repairs but Did Not Move Recently | Households Moved Recently but Did No Renovations or Repairs | Households Both Moved Recently and Did Renovations or Repairs | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|-------------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Mean and S.D. value of unit                                 | 242,308<br>(281,931)                                               | 266,540<br>(287,050)                                            | 271,576<br>(288,459)                                        | 275,980<br>(289,181)                                          |                                                                                          |
| Mean and S.D. annual cost of homeowners insurance           | 746.00<br>(660.33)                                                 | 795.54<br>(641.75)                                              | 758.14<br>(621.91)                                          | 795.31<br>(639.47)                                            |                                                                                          |
| Mean and S.D. annual real estate taxes                      | 2,342.18<br>(2,986.11)                                             | 2,568.83<br>(2,964.89)                                          | 2,588.45<br>(3,386.15)                                      | 2,689.04<br>(3,155.97)                                        |                                                                                          |
| Percent with parking place as part of property              | 12.8%                                                              | 15.5%                                                           | 16.0%                                                       | 17.0%                                                         | 0.01%                                                                                    |
| Percent of properties with a cellar                         | 30.2%                                                              | 48.4%                                                           | 37.0%                                                       | 42.9%                                                         | 0.01%                                                                                    |
| Percent having their own garage                             | 53.0%                                                              | 82.2%                                                           | 81.3%                                                       | 80.3%                                                         | 0.01%                                                                                    |
| Neighborhood and location variables                         |                                                                    |                                                                 |                                                             |                                                               |                                                                                          |
| Percent of those from column who are in central city of MSA | 23.75%                                                             | 22.65%                                                          | 25.22%                                                      | 26.25%                                                        | 0.01%                                                                                    |
| Percent who are in secondary urban area within MSA          | 36.01%                                                             | 37.34%                                                          | 30.44%                                                      | 35.23%                                                        | 0.01%                                                                                    |
| Percent who are in rural areas of the MSA                   | 16.97%                                                             | 17.09%                                                          | 12.22%                                                      | 14.45%                                                        | 0.01%                                                                                    |
| Percent who are in urban areas outside MSA                  | 7.42%                                                              | 7.18%                                                           | 18.09%                                                      | 10.64%                                                        | 0.01%                                                                                    |



**Exhibit 1** | (continued)

Characteristics of Housing and of Households that Relocate and/or that Renovate

|                                                | Households Did Not Move Recently and Had No Renovations or Repairs | Households Did Renovations or Repairs but Did Not Move Recently | Households Moved Recently but Did No Renovations or Repairs | Households Both Moved Recently and Did Renovations or Repairs | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Percent who are in rural areas outside MSA     | 15.85%                                                             | 15.74%                                                          | 14.02%                                                      | 13.42%                                                        | 0.01%                                                                                    |
| Percent of those living on west coast          | 19.31%                                                             | 20.60%                                                          | 22.13%                                                      | 24.40%                                                        | 0.01%                                                                                    |
| Percent saying shopping nearby is adequate     | 82.43%                                                             | 82.67%                                                          | 84.91%                                                      | 83.69%                                                        | 1.8%                                                                                     |
| Percent with green open spaces nearby          | 37.58%                                                             | 41.41%                                                          | 38.02%                                                      | 41.06%                                                        | 0.01%                                                                                    |
| Commercial properties nearby                   | 16.7%                                                              | 17.8%                                                           | 17.5%                                                       | 18.6%                                                         | 5.2%                                                                                     |
| Percent having some apartment buildings nearby | 13.5%                                                              | 12.2%                                                           | 14.4%                                                       | 14.3%                                                         | 0.06%                                                                                    |
| <i>N</i>                                       | 9,837                                                              | 11,769                                                          | 2,454                                                       | 3,017                                                         |                                                                                          |

*Note:* Numbers in parentheses are standard deviations.

**Exhibit 2** | The Decision Whether or Not to Renovate; Logit Analysis

|                                                               | Non-Movers<br>Only | Movers<br>Only    | All<br>Households |
|---------------------------------------------------------------|--------------------|-------------------|-------------------|
| Intercept                                                     | 6.175<br>(14.32)   | 10.33<br>(15.39)  | 6.703<br>(24.89)  |
| Household Characteristics                                     |                    |                   |                   |
| Log of household income                                       | 0.170<br>(76.29)   | 0.144<br>(14.68)  | 0.168<br>(82.40)  |
| Dummy for head of household being high school graduate (only) | —                  | 0.31<br>(3.23)    | —                 |
| Dummy for head of household being college graduate            | 0.069<br>(2.024)   | 0.28<br>(2.44)    | 0.036<br>(0.75)   |
| Dummy for postgraduate education of head of household         | —                  | 0.38<br>(3.76)    | —                 |
| Age of head of household                                      | -0.006<br>(12.61)  | 0.005<br>(2.31)   | -0.002<br>(2.98)  |
| Dummy if head of household nonwhite                           | -0.097<br>(2.38)   | -0.330<br>(2.38)  | -0.172<br>(10.56) |
| Log of householder insurance premium                          | 0.106<br>(15.55)   | —                 | 0.089<br>(12.92)  |
| Property-Related Characteristics                              |                    |                   |                   |
| Mortgage interest rate (FRMs only)                            | 0.041<br>(29.4)    | 0.044<br>(10.3)   | 0.035<br>(26.3)   |
| Log of value of property                                      | 0.102<br>(20.41)   | 0.269<br>(37.32)  | 0.118<br>(26.71)  |
| Dummy for single family home                                  | 0.44<br>(15.0)     | —                 | 0.34<br>(9.54)    |
| Year current (new) unit built                                 | -0.006<br>(47.5)   | -0.009<br>(41.16) | -0.006<br>(78.8)  |
| Number of bedrooms in current (new) unit                      | 0.086<br>(11.61)   | 0.171<br>(19.85)  | 0.101<br>(23.79)  |
| Number of bathrooms in current (new) unit                     | 0.073<br>(5.45)    | 0.094<br>(2.78)   | —                 |
| Property tax rate                                             | —                  | —                 | 0.036<br>(2.78)   |
| Dummy if home has its own parking place                       | —                  | —                 | -0.079<br>(2.85)  |
| Neighborhood Characteristics                                  |                    |                   |                   |
| Dummy if reside in urban area outside MSA                     | —                  | -0.433<br>(15.73) | -0.182<br>(8.36)  |
| Dummy if unit is near a green area                            | 0.064<br>(2.93)    | 0.149<br>(4.73)   | 0.068<br>(4.03)   |
| Dummy if commercial property nearby                           | 0.083<br>(2.73)    | -0.147<br>(2.70)  | —                 |

**Exhibit 2** | (continued)

The Decision Whether or Not to Renovate; Logit Analysis

|                                                   | Non-Movers<br>Only | Movers<br>Only | All<br>Households |
|---------------------------------------------------|--------------------|----------------|-------------------|
| Percent concordant                                | 62.0%              | 64.1%          | 61.7%             |
| Somers' D                                         | 0.246              | 0.287          | 0.240             |
| Significance of chi square of likelihood ratio    | 0.01%              | 0.01%          | 0.01%             |
| Percent of households in regression who renovated | 39.4%              | 35.8%          | 40.0%             |

*Notes:* The numbers in parentheses are Wald Chi Square. For Non-Movers Only,  $N = 12,984$ , AIC (intercept and covariates) = 16,933; for Movers Only,  $N = 4,201$ , AIC (intercept and covariates) = 5,262; for All Households,  $N = 13,832$ , (intercept and covariates) = 20,739. Home owners only included in regressions.

movers. Households whose head is a college graduate are more likely to be among the renovators. Homeowner insurance premiums, indirectly a surrogate for the value of household chattel property, is positively associated with the likelihood of renovation, and this is probably a wealth effect. Older households are somewhat less likely to renovate. Non-white households are considerably less likely to be renovators, other things equal. This is even stronger among recent movers.

Interestingly, a higher mortgage rate is significantly and positively associated in all cases with the likelihood to renovate, and the coefficient is about the same for movers and non-movers. The higher rate probably reflects in part the credit quality of the household (after controlling for income). Higher interest rates could also reflect the fact that the household purchased the unit during periods within the business cycle when market rates were relatively high. For those who do not move, the positive coefficient of the interest rate could indicate that they prefer to finance renovations rather than moving to a different unit when mortgage interest rates are higher. For movers, it could indirectly reflect household decisions to purchase older or smaller units in periods when interest rates are higher, and then to renovate.

The current value of the property increases the likelihood of having conducted renovations. For non-movers this may indicate the presence of households who prefer to alter their existing property instead of moving; having a more valuable unit may motivate those households to renovate rather than move. Non-movers in single-family homes are more likely to be among the renovators than are those in other types of units, but this is not true of movers. Those with a larger number of bedrooms or a larger number of bathrooms are more likely to be among the renovators. (Of course the renovations in question may have been what added

those extra baths and bedrooms in the first place.) Unsurprisingly, those in units built more recently are somewhat less likely to be renovators.

Generally, location variables have very little effect on the likelihood to renovate. Those living in urban areas outside the MSA are less likely than those living in other subregions to renovate, especially among movers. Proximity to green areas is positively associated with the decision to renovate for all groups. Living close to commercial areas has an effect on the likelihood to renovate, but with opposing signs for movers and non-movers.

For purposes of comparison, Exhibit 3 shows a similar logit regression of the decision of whether or not to move. The dependent variable is the logit of the likelihood of having moved during the previous two years, divided by the likelihood of not having moved. About 25% of households in the sample moved during the previous two years.<sup>6</sup>

Several household variables affect the moving decision. As seen in Exhibit 3, household income has a fairly strong positive coefficient, where a doubling of income raises the logit by about 35%, other things equal. Age is negatively correlated with the likelihood of moving.<sup>7</sup> Households in which the head of household is not white are considerably more likely to be among the recent movers. College graduates are also more likely to be among the movers than other households, other things equal. Households with a larger number of members are less likely to be among the movers.

Having a large number of cars raises the likelihood to be among the movers, while having no car at all is associated with a lower likelihood. Paying a higher household insurance premium raises the likelihood of being among the movers, and this is probably a wealth effect consistent with the coefficient of the income variable. A longer commuting distance for the head of the household is associated with a lower likelihood to be among the movers. This may reflect the fact that the movers decided to move in the first place in part to shorten their commutes.

The moving likelihood logit is correlated with a number of features of the housing unit and neighborhood factors. A higher mortgage interest rate is weakly associated with a higher likelihood to be among the movers. As above, this could reflect either a somewhat lower level of credit quality among movers or a decision to move in “boom” periods when market interest rates are somewhat higher, or both. The size of the housing unit is strongly negatively associated with the likelihood to move. Those living in larger units appear to be less inclined to move. When controlling for size, having a larger number of bedrooms is associated with a higher likelihood of being among the movers.

There are some locational variables that are significant. Households living in the secondary urban areas or rural areas of the MSA are less likely to be among recent movers.<sup>8</sup> Those in gated communities are more likely to be recent movers, other things equal.

**Exhibit 3** | The Decision Whether or Not to Move; Logit Analysis

|                                                            |                   |
|------------------------------------------------------------|-------------------|
| Intercept                                                  | -9.05<br>(25.3)   |
| Household Characteristics                                  |                   |
| Log of salary for household head of household              | 0.355<br>(92.3)   |
| Dummy if head of household nonwhite                        | 1.041<br>(72.8)   |
| Dummy if household head of household is a college graduate | 0.340<br>(44.31)  |
| Age of head of household                                   | -0.097<br>(750.2) |
| Dummy for ownership of three or more cars                  | 0.384<br>(33.74)  |
| Household property insurance premium                       | 0.064<br>(4.95)   |
| Log of commuting distance for household head of household  | -0.098<br>(26.25) |
| Dummy if household owns no car                             | -0.125<br>(3.63)  |
| Number of persons in household                             | -0.062<br>(13.73) |
| Property Related Characteristics                           |                   |
| Mortgage interest rate (FRMs only)                         | 0.023<br>(6.47)   |
| Log of unit size in square feet                            | -0.147<br>(8.59)  |
| Year current (new) unit built                              | 0.005<br>(25.09)  |
| Number of bedrooms in current (new) unit                   | 0.086<br>(7.26)   |
| Neighborhood Characteristics                               |                   |
| Dummy if reside in secondary urban area of MSA             | -0.298<br>(33.29) |
| Dummy if reside in rural area within MSA                   | -0.455<br>(44.17) |
| Dummy if reside in urban area outside MSA                  | 0.545<br>(45.03)  |
| Dummy if unit is in gated community                        | 0.367<br>(10.89)  |
| Percent Concordant                                         | 80.2%             |
| Somers' D                                                  | 0.606             |

**Exhibit 3** | (continued)

The Decision Whether or Not to Move; Logit Analysis

|                                                |       |
|------------------------------------------------|-------|
| Significance of chi square of likelihood ratio | 0.01% |
| Percent of households in regression who moved  | 25.1% |

*Note:* The numbers in parentheses are Wald Chi Square. Default location is rural area outside MSA.  $N = 13,861$ . AIC (intercept and covariates) = 12,671.

## Whether and How to Renovate

In Exhibit 4 a closer look at subcategories of renovations undertaken by households that decided to renovate is displayed. Exhibit 4 describes a number of characteristics of households, based on whether they enlarged their home, carried out other structural renovations in their home, carried out non-structural major renovations, and households that conducted no renovations at all. Movers and non-movers are here included together.<sup>9</sup>

From Exhibit 4, it is seen that, in some things, these four groups are very similar, whereas in others they are quite different. Among the household characteristics, those undertaking structural changes are more likely than the other groups (non-structural changes or no renovations) to have a male head of household and to be a household composed around a married couple. They tend to be a bit younger, and with larger household size. They also have higher incomes.

The type of renovation is associated with some property and neighborhood features. Those making structural enlargements pay higher real estate taxes, and appear to have more non-housing property (as indicated by homeowners' insurance rates). They are also more likely to be living in rural areas than the other groups.

The type of renovation pursued is also the focus of Exhibits 5 and 6, which isolate major structural changes and changes that result in enlarged space in the unit, respectively.<sup>10</sup> Each exhibit shows two logistic regressions, one in which the alternative ("default") category in the logit is the set of all homeowners who did not pursue the renovation in question, and the second in which the alternative is the set only of households who did *other* renovations. That means those who carried out no renovations at all are excluded altogether in the second of the two regressions.

In Exhibit 5, logistic regressions for all structural renovations are shown. The likelihood of making such renovations rises with household income and with the size of the household, but falls somewhat with age. Households with a non-white head are somewhat more likely to make major structural changes if they renovate, other things equal. Larger households unsurprisingly are more likely to be among

**Exhibit 4** | Characteristics of Different Sets of Households, based on Type of Housing Renovation

|                                                                              | Major Structural Renovation that Added New Space to Unit | Internal Restructuring of Space that did Not add New Space to Unit | Other Renovations      | No Renovations         | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------|------------------------|------------------------|------------------------------------------------------------------------------------------|
| <b>Personal and Household Factors</b>                                        |                                                          |                                                                    |                        |                        |                                                                                          |
| Of households in column, percent with male head of household                 | 67.35                                                    | 68.37                                                              | 62.20                  | 60.66                  | 0.01%                                                                                    |
| Percent of those in columns whose household head married with spouse present | 74.64                                                    | 72.24                                                              | 64.88                  | 56.88                  | 0.01%                                                                                    |
| Mean and S.D. household annual income                                        | 93,035<br>(88,249)                                       | 94,703<br>(95,240)                                                 | 77,071<br>(74,291)     | 63,392<br>(66,969)     |                                                                                          |
| Mean and S.D. annual salary of head of household                             | 55,267<br>(68,572)                                       | 59,794<br>(73,019)                                                 | 45,920<br>(55,788)     | 37,671<br>(50,622)     |                                                                                          |
| Mean and S.D number of persons in household                                  | 3.19<br>(1.58)                                           | 3.27<br>(1.51)                                                     | 2.74<br>(1.42)         | 2.49<br>(1.41)         |                                                                                          |
| Mean and S.D. age of head of household                                       | 48.96<br>(13.44)                                         | 44.39<br>(12.71)                                                   | 50.79<br>(15.41)       | 53.36<br>(16.67)       |                                                                                          |
| <b>Housing Variables</b>                                                     |                                                          |                                                                    |                        |                        |                                                                                          |
| Percent of column in single home                                             | 99.13                                                    | 97.39                                                              | 95.82                  | 92.87                  | 0.01%                                                                                    |
| Mean and S.D square foot of unit                                             | 2,687.45<br>(2,138.48)                                   | 2,468.84<br>(2,028.09)                                             | 2,218.47<br>(1,742.92) | 2,213.58<br>(1,833.19) |                                                                                          |
| Mean and S.D square foot of space added to unit                              | 309.78<br>(2,491.46)                                     | —                                                                  | —                      | —                      |                                                                                          |

**Exhibit 4** | (continued)

Characteristics of Different Sets of Households, based on Type of Housing Renovation

|                                                             | Major Structural Renovation that Added New Space to Unit | Internal Restructuring of Space that did Not add New Space to Unit | Other Renovations      | No Renovations         | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|-------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------|------------------------|------------------------|------------------------------------------------------------------------------------------|
| Mean and S.D. number of bathrooms                           | 1.98<br>(0.80)                                           | 1.85<br>(0.87)                                                     | 1.75<br>(0.73)         | 1.72<br>(0.76)         |                                                                                          |
| Mean and S.D. number of bedrooms                            | 3.36<br>(0.90)                                           | 3.35<br>(1.02)                                                     | 3.18<br>(0.87)         | 3.05<br>(0.88)         |                                                                                          |
| Mean and S.D. current value of unit                         | 357,587<br>(383,509)                                     | 287,861<br>(307,654)                                               | 263,902<br>(281,297)   | 248,590<br>(283,846)   |                                                                                          |
| Mean and S.D. annual cost of homeowners insurance           | 947.93<br>(809.29)                                       | 821.54<br>(693.01)                                                 | 789.03<br>(631.31)     | 748.32<br>(651.37)     |                                                                                          |
| Mean and S.D. annual real estate taxes (owners only)        | 3,141.14<br>(3,705.97)                                   | 2,837.68<br>(3,391.20)                                             | 2,554.92<br>(2,943.90) | 2,391.72<br>(3,074.38) |                                                                                          |
| Neighborhood and Location Variables                         |                                                          |                                                                    |                        |                        |                                                                                          |
| Percent of those from column who are in central city of MSA | 16.03                                                    | 24.53                                                              | 23.46                  | 23.28                  | 0.01%                                                                                    |
| Percent who are in secondary urban area within MSA          | 34.11                                                    | 35.31                                                              | 37.08                  | 34.42                  | 0.01%                                                                                    |
| Percent who are in rural areas of the MSA                   | 20.12                                                    | 16.53                                                              | 16.50                  | 16.12                  | 0.01%                                                                                    |
| Percent who are in urban areas outside MSA                  | 8.45                                                     | 8.89                                                               | 7.80                   | 9.58                   | 0.01%                                                                                    |



**Exhibit 4** | (continued)

Characteristics of Different Sets of Households, based on Type of Housing Renovation

|                                              | Major Structural Renovation that Added New Space to Unit | Internal Restructuring of Space that did Not add New Space to Unit | Other Renovations | No Renovations | Chi Square Test that Division Significantly Related to Variable (Significant at alpha =) |
|----------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------|-------------------|----------------|------------------------------------------------------------------------------------------|
| Percent who are in rural areas outside MSA   | 21.28                                                    | 14.73                                                              | 15.15             | 16.60          | 0.01%                                                                                    |
| Percent of those living on West Coast        | 22.74                                                    | 16.98                                                              | 21.66             | 18.45          | 0.01%                                                                                    |
| Percent with green open spaces nearby        | 48.08                                                    | 45.32                                                              | 40.88             | 37.62          | 0.01%                                                                                    |
| Average (SD) of costs for structural changes | 60,756<br>(130,438)                                      | 19,567<br>(53,683)                                                 | —                 | —              |                                                                                          |
| <i>N</i>                                     | 343                                                      | 11,113                                                             | 13,337            | 12,127         |                                                                                          |

*Notes:* The numbers in parentheses are standard deviations.

**Exhibit 5** | The Decision Whether or Not to Make Major Structural Changes; Logit Analysis

|                                                         | Logit of Decision to<br>Make Any Major<br>Structural<br>Renovation vs. All<br>Other Choices <sup>a</sup> | Among those who<br>Renovated Only,<br>Logit of Decision<br>to Make Any<br>Major Structural<br>Renovation |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Intercept                                               | 12.85<br>(34.09)                                                                                         | 5.00<br>(3.10)                                                                                           |
| Household Characteristics                               |                                                                                                          |                                                                                                          |
| Log of household income                                 | 0.102<br>(13.14)                                                                                         | 0.077<br>(13.14)                                                                                         |
| Age of head of household                                | -0.006<br>(7.24)                                                                                         | -0.020<br>(72.00)                                                                                        |
| Dummy if head of household nonwhite                     | -0.095<br>(1.30)                                                                                         | 0.151<br>(2.24)                                                                                          |
| Number of persons in household                          | 0.123<br>(45.3)                                                                                          | 0.121<br>(27.13)                                                                                         |
| Dummy for household owning no car                       | 0.114<br>(2.35)                                                                                          | —                                                                                                        |
| Dummy if household has 3 or more cars                   | -0.118<br>(1.94)                                                                                         | -0.188<br>(3.58)                                                                                         |
| Log of distance household head of household<br>commutes | 0.032<br>(1.92)                                                                                          | —                                                                                                        |
| Property-Related Characteristics                        |                                                                                                          |                                                                                                          |
| Mortgage interest rate for FRMs                         | 0.018<br>(2.87)                                                                                          | 0.014<br>(1.09)                                                                                          |
| Year current (new) unit built                           | -0.009<br>(57.7)                                                                                         | -0.003<br>(5.34)                                                                                         |
| Number of bathrooms in current unit                     | 0.154<br>(15.98)                                                                                         | 0.141<br>(8.66)                                                                                          |
| Dummy if unit has its own garage                        | -0.175<br>(6.98)                                                                                         | -0.75<br>(12.53)                                                                                         |
| Dummy if property has cellar                            | 0.422<br>(58.16)                                                                                         | 0.526<br>(59.14)                                                                                         |
| Log of property tax paid                                | —                                                                                                        | -0.078<br>(4.14)                                                                                         |
| Neighborhood Characteristics                            |                                                                                                          |                                                                                                          |
| Dummy if unit is near a green area                      | 0.129<br>(5.60)                                                                                          | 0.092<br>(1.90)                                                                                          |
| Dummy if commercial property nearby                     | 0.208<br>(7.91)                                                                                          | 0.165<br>(4.80)                                                                                          |
| Dummy if shopping nearby described as<br>adequate       | -5.60<br>(3.06)                                                                                          | -0.197<br>(4.88)                                                                                         |

**Exhibit 5** | (continued)

The Decision Whether or Not to Make Major Structural Changes; Logit Analysis

|                                                                         | Logit of Decision to Make Any Major Structural Renovation vs. All Other Choices <sup>a</sup> | Among those who Renovated Only, Logit of Decision to Make Any Major Structural Renovation |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Dummy if reside in secondary urban area of MSA <sup>b</sup>             | — <sup>b</sup>                                                                               | −0.127<br>(4.25)                                                                          |
| Percent Concordant Somers' D                                            | 61.7%                                                                                        | 61.1%                                                                                     |
| Significance of Chi Square of Likelihood Ratio                          | 0.250                                                                                        | 0.231                                                                                     |
| Percent of households in regression who did major structural renovation | 0.01%                                                                                        | 0.01%                                                                                     |
|                                                                         | 9.30%                                                                                        | 18.8%                                                                                     |

*Notes:* The numbers in parentheses are Wald Chi Square. For Logit of Decision to Make Any Major Structural Renovation vs. All other Choices,  $N = 17,073$ , AIC (Intercept and Covariates) = 10,353; for Among those who Renovated Only, Logit of Decision to Make Any Major Structural Renovation,  $N = 6,428$ , AIC (Intercept and Covariates) = 6,074.

<sup>a</sup>Including no renovations at all.

<sup>b</sup>Default location is rural area outside MSA; subregions not listed in the table were non-significantly different from default subregion.

those carrying out major structural innovations. Car ownership appears to be negatively associated with making such structural renovations.

Higher mortgage interest rates are positively associated with carrying out major structural renovations. As above, this could be a reflection of a lower credit quality of the household or a decision to do the innovation during those parts of the business cycle when mortgage rates are high, or both factors together. Among property variables, the likelihood of structural renovation increases with the number of baths and with having a cellar, and decreases with having a garage. It decreases with the property tax rate (in the equation where other renovations are the default choice), a variable that serves as a proxy for neighborhood amenities. Some locational variables are statistically significant. Households who renovate and live in the secondary urban areas of the MSA are less likely to do structural renovations. Households living near green areas or near commercial areas are more likely to be among these structural renovators, while those who say the shopping nearby is adequate are less likely.

In Exhibit 6, a similar set of regressions is shown for structural changes only that enlarge the housing unit's floor space.<sup>11</sup> The logit is positively associated with household income when "all other choices" are the default in the logit, but is negatively associated with salary of the head of household when "other structural

**Exhibit 6** | The Decision Whether or Not to Add Space to Housing Unit; Logit Analysis

|                                                                                                  | Logit of Decision to Make Major Structural Renovation that Added New Space to Unit vs. All Other Choices <sup>a</sup> | Among those who Renovated Only, Logit of Decision to Make Major Structural Renovation that Added New Space to Unit |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Intercept                                                                                        | 8.78<br>(3.78)                                                                                                        | 11.31<br>(5.06)                                                                                                    |
| Household Characteristics                                                                        |                                                                                                                       |                                                                                                                    |
| Log of household income                                                                          | 0.122<br>(4.33)                                                                                                       | —                                                                                                                  |
| Log of head of household salary                                                                  | —                                                                                                                     | -0.105<br>(2.75)                                                                                                   |
| Number of persons in household                                                                   | 0.187<br>(26.36)                                                                                                      | 0.145<br>(12.50)                                                                                                   |
| Dummy if head of household nonwhite                                                              | -0.528<br>(5.53)                                                                                                      | -0.466<br>(3.51)                                                                                                   |
| Dummy for ownership of 3 or more cars                                                            | -0.305<br>(2.78)                                                                                                      | -0.379<br>(3.94)                                                                                                   |
| Property Characteristics                                                                         |                                                                                                                       |                                                                                                                    |
| Log of current value of property                                                                 | 0.211<br>(8.29)                                                                                                       | 0.343<br>(16.25)                                                                                                   |
| Log of unit size in square feet                                                                  | 0.232<br>(4.31)                                                                                                       | 0.246<br>(4.02)                                                                                                    |
| Dummy for single family home                                                                     | 1.266<br>(4.67)                                                                                                       | —                                                                                                                  |
| Year current (new) unit built                                                                    | -0.011<br>(21.33)                                                                                                     | -0.010<br>(16.78)                                                                                                  |
| Number of bathrooms in current (new) unit                                                        | 0.172<br>(4.58)                                                                                                       | 0.228<br>(6.75)                                                                                                    |
| Neighborhood Characteristics                                                                     |                                                                                                                       |                                                                                                                    |
| Dummy if reside in central urban area of MSA                                                     | -0.529<br>(10.57)                                                                                                     | -0.610<br>(11.54)                                                                                                  |
| Dummy if reside in secondary urban area of MSA <sup>b</sup>                                      | -0.413<br>(9.96)                                                                                                      | -0.445<br>(9.57)                                                                                                   |
| Percent Concordant                                                                               | 63.4%                                                                                                                 | 63.4%                                                                                                              |
| Somers' D                                                                                        | 0.339                                                                                                                 | 0.311                                                                                                              |
| Significance of Chi Square of Likelihood Ratio                                                   | 0.01%                                                                                                                 | 0.01%                                                                                                              |
| Percent of households in regression who did major structural renovation that added space to unit | 1.29%                                                                                                                 | 2.45%                                                                                                              |

**Exhibit 6** | (continued)

The Decision Whether or Not to Add Space to Housing Unit; Logit Analysis

Notes: The numbers in parentheses are Wald Chi Square. For Logit of Decision to Make Major Structural Renovation that Added New Space to Unit vs. All Other Choices,  $N = 25,520$ , AIC (Intercept and Covariates) = 3,409.60; for Among those who Renovated Only, Logit of Decision to Make Major Structural Renovation that Added New Space to Unit,  $N = 11,274$ , AIC (Intercept and Covariates) = 2,522.91.

<sup>a</sup>Including no renovations made at all.

<sup>b</sup>Default location is rural area outside MSA.

renovations” is the default category. As in Exhibit 5, the likelihood of enlargement renovations is positively related to household size, as would be expected, and negatively associated with owning three or more cars. Non-white households appear less likely to carry out enlargement renovations, other things equal.

The likelihood of enlargement renovations rises with the value of the property, with the size of the unit in square feet, with the number of baths, and with the unit being a single family house, but decreases when the unit was more recently built. Enlargement renovations are less likely in the urban subareas of the MSA, other things equal, compared with other subregions.

## Conclusion

Housing renovation is an important component of housing supply, yet one often ignored both in empirical analysis and in policy discussions about housing. In particular, the role of renovation as a substitute for moving is a matter that should be of greater interest. As such, it carries implications for such issues as geographic mobility and commuting behavior. As urban areas spread and as demolition costs rise, renovation represents an important alternative to construction of new units in metropolitan areas. As such, urban planners, zoning commissions, and policy makers need to take it into consideration. For all these reasons, a better understanding of household decision making regarding renovation can be a useful addition to the real estate literature and its related disciplines.

In this paper, it is shown that households choosing to renovate differ in some interesting ways from those who do not. In particular, socioeconomic status and race seem to affect the likelihood of making such decisions. Households that neither move nor do renovations appear to be on average those with lower socioeconomic status. They tend to earn lower income and salaries and they are less frequently headed by a male, less often contain a married couple, are considerably more likely to be non-white, and tend to be less well educated than the other groups. In contrast, households that both move and renovate have the

highest incomes and salaries, are the youngest group, and have somewhat larger households than the others. Those who move without renovating, or renovate without moving, on average tend to fall in between those two groups.

The chance that households move seems to be negatively associated with some indicators of higher socioeconomic status. In logistic regressions, household income has a positive effect on the chance of moving, age has a negative effect. Being non-white raises significantly the likelihood to be among movers. In contrast, the decision to renovate seems to be positively associated with indicators of socioeconomic status, including income, education, and some proxies for wealth. Household income is positively associated with the likelihood of having performed major renovations, other things equal, as is owning at least three cars. Non-white households are considerably less likely to be renovators, across the board. Non-white recent movers are even less likely to undertake renovations than others.

Some wealth indicators seem to operate on renovation decisions. The current value of the property increases the likelihood of conducting renovations. Those in single-family homes are much more likely to be among the renovators than those in other types of units.

In separate analyses of structural renovations compared with other types of changes (such as kitchen or bath remodeling, retiling, painting, replacing pipes), it was seen that households undertaking structural changes have higher incomes, have larger households, and own more cars. They are more likely than the other groups (non-structural changes or no renovations) to have a male head of household and to be a household composed around a married couple. Structural change decisions that enlarge the housing unit's floor space seem to behave somewhat differently from those involving other renovation decisions. The likelihood of enlargement renovation seems to be negatively correlated with the salary of the household head. This is the opposite of the impact of salary or income in the other regressions. The likelihood of enlargement renovations positively related to household size, and negatively associated with age, owning three or more cars, and with membership in non-white households.

Intra-household differences regarding housing remodeling and renovation may play an important role in housing inequality within and across metropolitan areas, and across demographic groups.

The interplay between renovation decisions and the employment and commuting choices made by households is one area in which insights valuable for planners may be derived in future research.

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## Endnotes

<sup>1</sup> Some of this is surveyed by Hardman and Ioannides (1995).

<sup>2</sup> The data set is based on a questionnaire in which households are asked about "major renovations only," but no specific amount is suggested to the respondent regarding what is considered a major renovation.

- <sup>3</sup> Sampling is described at length in <http://www.census.gov/hhes/www/housing/ahs/ahs01/appendixb.pdf>. The data are collected in a survey conducted by the U.S. Census Bureau and the Department of Housing and Urban Development, and so the responses are interview answers, including regarding such things as the current value of the property and its quality rating.
- <sup>4</sup> Data used here were further “cleaned” according to values of variables believed to be errors or extreme outliers, such as housing units with less than 10 square feet, non-positive incomes, housing units valued at less than \$1,000, rented for less than 10 dollars per month.
- <sup>5</sup> Renovations estimated at less than \$100 were excluded from the empirical analysis and treated as if they were no renovation at all.
- <sup>6</sup> In the overall population, the rate is somewhat lower, but the inclusion of the mortgage interest variable effectively removes from the sample households having no mortgage, and these tend to be among the non-movers.
- <sup>7</sup> Age and income are correlated, and the negative effect for age may be a reflection of this correlation, being picked up even after controlling for income. In any case, the two variables are not so highly correlated as to create problems of multicollinearity.
- <sup>8</sup> The default location variable is the rural subregion outside the MSA. Central city location in this regression was not significantly different from that default location.
- <sup>9</sup> If separated, the subsets would be too small to conduct statistical analysis.
- <sup>10</sup> There were so few cases of renovations that made the unit smaller, a mere six cases for the entire national sample, that these were not treated as a separate category.
- <sup>11</sup> The mortgage interest variable was non-significant in all versions of the regressions in Exhibit 6. When it is eliminated from the regressions, the sample size increases compared to regressions in some of the other tables because households with no mortgage at all are being included.

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## References

- Arnott, R., R. Davidson, and D. Pines. Housing Quality, Maintenance and Rehabilitation. *Review of Economic Studies*, 1983, 50, 467–94.
- Baker, K. and B. Kaul. Using Multi-period Variables in the Analysis of Home Improvement Decisions by Homeowners. *Real Estate Economics*, 2002, 30:4, 551–67.
- Bendimerad, A. Developing a Leading Indicator for the Remodeling Industry. Joint Center for Housing Studies Research Note Series, N07-1. 2007. Available at: [http://www.jchs.harvard.edu/publications/remodeling/n07-1\\_bendimerad.pdf](http://www.jchs.harvard.edu/publications/remodeling/n07-1_bendimerad.pdf).
- Boehm, T.P. and K.R. Ihlanfeldt. The Improvement Expenditures of Urban Homeowners: An Empirical Analysis. *Journal of the American Real Estate and Urban Economics Association*, 1986, 14, 1986, 48–60.
- Carmon, N. Housing Renovation in Moderately Deteriorated Neighbourhoods: Public-Individual Partnership in Israel and Its Lessons. *Housing Studies*, 1992, 7:1, 56–73.
- Cyrenne, P., R. Fenton, and J. Warbanski. Historic Buildings and Rehabilitation Expenditures: A Panel Data Approach. *Journal of Real Estate Research*, 2006, 28:4, 349–80.
- DiPasquale, D. Why Don’t We Know More about Housing Supply?. *Journal of Real Estate Finance and Economics*, 1999, 18:1, 9–23.

- Eastwood, D.B. and S.G. Garnerl. Home Repairs: A Household Production Perspective. *Journal of Behavioral Economics*, 1986, 15:1–2, 25–39.
- Guerrero, A.M. Home Improvement Finance: Evidence from the 2001 Consumer Practices Survey N03-1, Joint Center for Housing Studies, Harvard University, N03-1, 2003.
- . An Improved Method for Estimating Homeowner Improvement and Repair Activity Through Revisions to the Remodeling Activity Indicator. Joint Center for Housing Studies, Harvard University, WO4, 2004.
- Gyourko, J. and J. Tracy. Using Home Maintenance and Repairs to Smooth Variable Earnings. *Review of Economics and Statistics*, 2006, 88:4, 736–47.
- Gyourko, J. and A. Saiz. Reinvestment in the Housing Stock: The Role of Construction Costs and the Supply Side. *Journal of Urban Economics*, 2004, 55:2, 238–56.
- Hardman, A.M. and Y.M. Ioannides. Moving Behavior and the Housing Market. *Regional Science and Urban Economics*, 1995, 25:1, 21–39.
- Helms, A.C. Understanding Gentrification: An Empirical Analysis of the Determinants of Urban Housing Renovation. *Journal of Urban Economics*, 2003, 54:3, 474–98.
- Knight, J.R., T. Miceli, and C.F. Sirmans. Repair Expenses, Selling Contracts, and House Prices. *Journal of Real Estate Research*, 2000, 20:3, 323–36.
- McMillen, D.P. and P. Thorsnes. Housing Renovations and the Quantile Repeat-Sales Price Index. *Real Estate Economics*, 2006, 34:4, 567–84.
- Mendelsohn, R.O. Empirical Evidence on Home Improvements. *Journal of Urban Economics*, 1977, 4, 459–68.
- Potepan, M.J. Interest Rates, Income, and Home Improvement Decisions. *Journal of Urban Economics*, 1989, 25:3, 282–94.
- Reade, J. Remodeling Spending in Major Metropolitan Areas. Joint Center for Housing Studies, Harvard University, N01-4, 2001.
- Reschovsky, J.D. An Empirical Investigation into Homeowners Demand for Home Upkeep and Improvement. *Journal of Real Estate Finance and Economics*, 1992, 5, 55–73.
- Simmons-Mosley, T.X. Interdependence Effects of Housing Abandonment and Renovation. *Journal of Real Estate Research*, 2003, 25:4, 421–30.
- Simons, R.A., A.J. Magner, and E. Baku. Do Housing Rehabs Pay Their Way? A National Case Study. *Journal of Real Estate Research*, 2003, 25:4, 431–62.
- Strassmann, W.P. The Timing of Urban Infrastructure and Housing Improvements by Owner Occupants. *World Development*, 1984, 12:7, 743–53.
- Wong K.C. and G. Norman. The Optimal Time of Renovating a Mall. *Journal of Real Estate Research*, 1994, 9:1, 33–48.

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