

INVESTING IN HOUSING CHARACTERISTICS THAT COUNT: A CROSS-SECTIONAL AND LONGITUDINAL ANALYSIS OF BATHROOMS, BATHROOM ADDITIONS, AND RESIDENTIAL SATISFACTION

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Abstract

This article examined how bathrooms (and half-bathrooms) were associated with the self-reported satisfaction of residents in comparison to bedrooms, other rooms, overall size, and the presence of such amenities as a dishwasher, disposal, fireplace, balcony/patio, and garage. Cross-tabulations, ordinary least squares, and cumulative logit analyses of data from the 2005 American Housing Survey demonstrated a particularly strong positive relationship between residential satisfaction and the number of bathrooms, greater than for any other housing characteristic measured. A “before and after” longitudinal analysis of homes with remodeling occurring between 1997 and 2005 also revealed a significant positive impact of bathroom additions on the satisfaction of residents. These results appear consistent with housing theory suggesting that privacy and control are major components of residential satisfaction.

Introduction

The residential environment can significantly influence individuals' and families' functioning and sense of well-being (Morris & Winter, 1976). Because of the multi-faceted nature of housing norms and structures, understanding which components of the environment are particularly important can be challenging. This article focuses on the impact of a single component in the household environment—the number of full and half-bathrooms—to uncover its relationship with residential satisfaction.

After reviewing previous research on the subject of bathrooms and residential satisfaction, this article uses three different analytical approaches to address the question: to what extent does the number of bathrooms improve residential satisfaction? First, a cross-tabulation compares full and half-bathroom counts

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with overall residential satisfaction using data from the 2005 American Housing Survey (AHS). Second, ordinary least squares and cumulative logit cross-sectional analyses compare the satisfaction levels associated with full and half-bathrooms to a variety of other residential features. Finally, longitudinal analyses examine the “before and after” residential satisfaction, specifically considering homes that underwent remodeling either increasing or decreasing the number of full or half-bathrooms during the period of 1997 to 2005.

Literature Review

The bathroom is uniquely associated with issues of privacy and control. In an early academic text devoted to the subject of bathrooms, Kira (1976) found that the desire for multiple bathroom facilities was driven, in large part, by the desire for privacy. Because bathrooms are typically considered private and off-bounds, even by other family members, they are often used as a haven of privacy for emotional needs, in addition to their normal hygiene-related functions (Kira, 1976). Thus, more so than perhaps any other residential feature, an increased number of bathrooms allows individual household members to have greater control over their residential environment.

Inman and Sinn (1987) examined a variety of different family social climate issues for potential relationships with the number of residential bathrooms. They employed a 90-item instrument designed to measure the family social climate in 10 different areas. In their survey of 200 Indiana families they found only two of these areas significantly related to the number of bathrooms: independence and control. Similarly, Zimring (1981) found that multiple private bathroom spaces were related to a greater sense of control.

Although it is possible to design other spaces as private areas, the role of physical design is limited by the social system. Physical design may create the potential for privacy and control, but without the support of accepted norms and practices, that potential becomes irrelevant (Zimring, 1981). The strong social norms of privacy associated with the residential bathroom create a space with special privacy characteristics unequalled by other residential spaces. Although the design options in the modern bathroom seem almost limitless (Tremblay & Ahn, 2007), it is these core social norms that make bathrooms a fundamentally unique private space.

The issue of control is central to satisfaction in a variety of life domains. A greater sense of control over one’s environment has been found to predict satisfaction in such diverse areas as job satisfaction (Spector, 1986), satisfaction with government (Frey & Stutzer, 2000), financial satisfaction (Sumarwan & Hira, 1993), satisfaction with one’s body shape (Furnham & Greaves, 1994), and the satisfaction of renters (LeBrassuer, Blackford, & Whissell, 1988).

Control is a persistent issue in residential satisfaction. For example, in a dense living environment the ability to control one's environment and interactions with others can prevent feelings of overcrowding. Indeed, perceived residential overcrowding is not strongly related to objective measurements of space per person, but is more closely related to a lack of zones of individual control that allow household members to control their interactions with others (Edwards, Fuller, Sermsi, & Vorakitphokatorn, 1994). Similarly, perceptions of lack of privacy are not driven by physical proximity so much as by a lack of control of interpersonal interactions (Day, 2000). As Zimring explained, "If built environments are not to be stress-inducing, they must allow participants to change their type and level of interaction to suit their needs" (1981, p. 157).

The connection between the number of bathrooms and residential satisfaction appears quite reasonable. An increased number of bathrooms increases the ability to immediately access an unoccupied bathroom for purposes of either privacy or hygiene. Thus, residents with more bathrooms will have a greater sense of control over their environment. This greater sense of control, in turn, should generate greater satisfaction.

Many studies of residential satisfaction omitted any inclusion of the number of bathrooms. Some chose instead to use measurements of overall residence size or person-to-size ratios (see for example Lu, 1999; McCrea, Stimpson, & Western, 2005). Others included only the total number of rooms (see for example Elsinga & Hoekstra, 2005). Although rarely the focus of the study, some studies of residential satisfaction reported results suggesting a positive association of bathrooms with residential satisfaction. Inman and Sinn's (1987) study, which did specifically focus on the number of bathrooms, found that residents in homes with two or more bathrooms had a significantly higher level of residential satisfaction than those in homes with only one bathroom. However, this study did not control for other residential characteristics. Consequently, these satisfaction results may have been driven by the generally larger size or the greater number of other rooms found in homes with two or more bathrooms. In a survey of 438 Spanish residents Gomez-Jacinto and Hombrados-Mendieat (2002) found a positive relationship between bathrooms and residential satisfaction. However, this study also failed to control for overall housing size. Warren and Bell (2000) indicated that in a health services environment, shared bathrooms may have a negative impact on satisfaction.

The present study seeks to extend existing knowledge on the relationship between bathrooms and residential satisfaction by examining not only the cross-sectional association of full and half-bathrooms with residential satisfaction, but also the changes over time in residential satisfaction associated with renovations altering the number of full or half-bathrooms.

Method

Cross-Sectional Data

Data for the cross-sectional analysis came from the 2005 American Housing Survey (AHS). The AHS is a comprehensive national survey focused on the characteristics of homes and residents. Every two years the U. S. Census Bureau conducts the national AHS for the U.S. Department of Housing and Urban Development. The Census conducts these surveys both in-person and by telephone (ICF Consulting, 2006).

The measurement of residential satisfaction used as the dependent variable in the analyses came from the question, “On a scale of 1-10 (10 is best, 1 is worst) how would you rate your unit as a place to live?” (ICF Consulting, 2006, p. 226). The 2005 AHS included 43,360 occupied housing units. Of these, 1,455 residents did not answer the satisfaction question, leaving 41,905 observations with a unit satisfaction rating.

The AHS defines a full-bathroom as “a room with a flush toilet, bathtub or shower, a sink, and hot and cold piped water in the structure for the exclusive use of the occupants of the unit” (ICF Consulting, 2006, p. 115). A room that is not a full-bathroom, but still has “either a flush toilet or a bathtub or shower for exclusive use” qualifies as a half-bathroom (ICF Consulting, 2006, p. 115).

Two kitchen characteristics are included in some analyses; these are the presence of a dishwasher or disposal. Other housing unit characteristics include the number of bedrooms and the number of other rooms. The “other rooms” variable does not include unfinished attics or basements or typically smaller areas such as halls, foyers, balconies, closets, pantries, laundry rooms, or furnace rooms. Total interior space includes all finished enclosed spaces, and excludes garages or unheated porches. To aid in coefficient readability this variable is reported in 1,000 square foot units (for example, a 1,200 square foot home is calculated as 1.2). The variable measuring the number of residences in the building distinguishes between single-family homes (1), duplexes (2), and other multi-family structures (3 or greater). Central air refers to the presence of central air conditioning in the dwelling. A fireplace refers to a working fireplace, excluding “fireplaces that have been blocked off or whose chimney or flue has been filled, decorative or artificial fireplaces and wood stoves, even if shaped like a fireplace, like a Franklin stove” (ICF Consulting, 2006, p. 1053).

Subsidized rent indicates that the resident renter answered yes to the question, “Does the federal, state, or local government pay some of the cost of the unit?” (ICF Consulting, 2006, p. 527) but excludes those units owned by the public housing authority. Homeowner tenure is one if the home is owner-occupied and zero if it is not. Household income includes all forms of income from all household members aged 14 and above. The resident age, gender, race, and education

variables are collected for the first person listed as owning or renting the home. A child in the home indicates the presence of a minor living in the home.

Analysis

Table 1 presents a simple cross-tabulation of residential satisfaction ratings grouped by the number of full and half-bathrooms in the residence. Residences with three or more half baths or six or more full baths were excluded from the analysis due to infrequency of observations. (This exclusion reduced the total number of observations from 41,905 to 41,755.) Residential satisfaction ratings below seven constitute only about 15% of the sample. Thus, these are reported in the single compressed category of “six and below.”

Table 2 presents three cross-sectional regressions. Columns (1) and (2) present ordinary least squares regressions, with and without control variables, where the dependent variable is the unit satisfaction rating, ranging from 1-10. These results are presented in part because of the natural ease in understanding the coefficients. The coefficient represents the satisfaction scale point increase or decrease resulting from the presence of the item (for dummy variables) or from a one-unit increase in the independent variable.

Despite the advantage in the ease of interpretation of coefficients, the ordinary least squares results must be taken with caution, as the dependent variable violates the assumptions of the model. First, the outcome variable is discrete, not continuous; residents can rate their home as a 7 or 8, but not as a 7.2 or 7.75. Second, although the outcome variable is numerical, it is essentially a subjective measurement. This suggests that the difference between each rating may not be identical. In other words, the subjective distance between a rating of 2 and 3 may differ from the subjective distance between a rating of 9 and 10.

In order to address these problems, column (3) presents the results of a cumulative logit (also known as ordered logit) analysis. A cumulative logit model does not require the outcome variables to be continuous, numerical outcomes, but requires only that the outcome categories are ordered in an ascending sequence. Thus, the subjective distance between each outcome response need not be identical, so long as each higher category represents a higher rating than the previous category. Lu (1999) argued that such methods produce more reliable results than ordinary least squares regression when analyzing residential satisfaction.

The ordered logit analysis measures the likelihood that an individual will be in a higher outcome level in the presence of some level of an independent variable. The cumulative probability of any individual, i , being in a particular category, k , or higher is

$$\sum_{m=k}^K p_{im}$$

where K is the highest category and p represents the probability of individual i being in any particular category m . Considering this cumulative probability for each division of the dependent variable (e.g., 9 or higher, 8 or higher, 7 or higher, etc.) creates a series of cumulative probabilities, F_k , for each individual i .

$$F_{ik} = \sum_{m=k}^K p_{im}$$

The logit model is then the set of equations

$$\log\left(\frac{F_{ik}}{1 - F_{ik}}\right) = \alpha_k + \beta \mathbf{x}_i \quad k = 1, \dots, k - 1$$

where $\beta \mathbf{x}_i = \beta_1 x_{i1} + \dots + \beta_z x_{iz}$ and z is the number of independent variables.

This results in different intercepts for each separate division, but a single set of coefficients (Allison, 1999).

Following Chapman and Lombard (2006), this analysis modifies the previous model by compressing the lowest satisfaction ratings into a single category of six and below. About 85% of the unit ratings in the current dataset are seven or above, suggesting the reasonableness of this grouping strategy.

Longitudinal Data

The AHS is a panel survey tracking the same housing structures over time, while also adding new structures in each new survey to reflect changes brought about by new construction. Although the AHS has had the same core sample since 1985, a change to the survey methodology and to several questions occurred in 1997 with the introduction of a computer-aided interviewing mechanism. As a result, this article uses 1997 as the base year for comparison.

To examine the impact of changes to the housing structure, the longitudinal analysis considers only those housing structures in both the 1997 and 2005 surveys where residents answered the housing satisfaction question in both years. This approach limits the sample to 28,999 housing units, each found in both the 1997 and 2005 AHS. The variables used in the longitudinal analyses measure only the change in the underlying characteristics between 1997 and 2005. For example, housing units undergoing the addition of a bathroom during this period would register a +1 in the independent variable “ Δ Full-Bathrooms.” A housing structure where a half-bathroom was expanded to a full-bathroom would register a +1 in the “ Δ Full-Bathrooms” variable and a -1 in the “ Δ Half-Bathrooms” variable. Changes in household income are measured slightly differently; these changes are reported in terms of percentage increases or decreases from 1997 levels, rather than as changes in dollar amounts.

Because the AHS tracks housing units rather than residents, many units had different residents in 2005 than in 1997. To account for satisfaction changes associated with changes in the demographic characteristics of the residents, these

change variables are also included. Total years of education replaced the education categories used in the cross-sectional analyses in order to more easily report the effect of changes.

Table 3 presents results from three models, similar to those used in the cross-sectional analysis. Column (1) presents an ordinary least squares model showing the relationship between changes in bathrooms and changes in resident satisfaction. However, this simple relationship may be being driven by other factors associated with an increase (or decrease) in the number of bathrooms. For example, a remodeling resulting in the addition of a bathroom may have been accompanied by other changes (such as an increase in overall square footage or in the number of other rooms). The satisfaction change may have been brought about, at least in part, by these other alterations, rather than by the bathroom addition. Alternatively, it is possible that different demographic characteristics (such as higher income) may be positively associated with both satisfaction and the likelihood of adding a bathroom. To control for these potentially confounding influences, column (2) presents an ordinary least squares regression including changes in all control variables used in the cross-sectional analyses.

Finally, because of the limitations of the ordinary least squares model discussed in the cross-sectional analyses, column (3) presents results from a cumulative logit model. In this model the outcome variable has been condensed to three categories. Housing units where the satisfaction rating dropped between 1997 and 2005 are recorded as a -1 . If the satisfaction rating was unchanged the outcome is 0, and if the satisfaction rating increased the outcome variable is $+1$.

Results

Cross-Tabulations

Table 1 visually demonstrates the strong and consistent association between the number of bathrooms and residential satisfaction. It appears that the strongest association is with the number of bathroom areas, and then secondarily with the proportion of those areas that are full-bathrooms. So, for example, residences with two half-bathrooms (two spaces) are rated higher than residences with one full-bathroom (one space). Residences with one full and two half-bathrooms (three spaces) are rated higher than residences with two full-bathrooms (two spaces). Residences with two full and two half-bathrooms (four spaces) are rated higher than residences with three full-bathrooms (three spaces). This trend continues at every level, so that in no case does the average rating of residences with fewer total bathroom spaces exceed the average rating of residences with more total bathroom spaces.

Another general, but slightly less consistent, trend is that within the same categories of total bathroom spaces, homes with more full, rather than half, bathrooms have higher satisfaction ratings. However, this trend does not hold up

**Table 1. Bathrooms and Overall Satisfaction with Housing Unit:
American Housing Survey 2005** ($n = 41,755$)

Bathrooms (Full • Half)	Satisfaction with Housing Unit (1 - 10)					Average Rating
	6 and Below	7	8	9	10	
1 (0 • 1)	45.6%	11.4%	0.0%	16.7%	8.8%	6.74
1 (1 • 0)	19.9%	17.2%	28.1%	11.9%	22.8%	7.79
2 (0 • 2)	9.1%	27.3%	22.7%	18.2%	22.7%	8.09
2 (1 • 1)	11.6%	15.3%	30.6%	16.1%	26.3%	8.20
2 (2 • 0)	9.5%	12.7%	28.6%	17.3%	31.9%	8.41
3 (1 • 2)	5.8%	12.5%	32.8%	18.6%	30.4%	8.52
3 (2 • 1)	4.3%	10.0%	29.1%	22.0%	34.6%	8.70
3 (3 • 0)	3.0%	7.1%	27.5%	23.5%	39.0%	8.86
4 (2 • 2)	1.7%	6.8%	24.8%	24.8%	41.9%	8.97
4 (3 • 1)	1.9%	5.8%	23.4%	25.0%	43.9%	9.01
4 (4 • 0)	5.4%	5.9%	20.5%	21.8%	46.4%	8.93
5 (3 • 2)	4.9%	6.2%	12.4%	29.6%	46.9%	9.01
5 (4 • 1)	2.6%	5.2%	12.5%	26.0%	53.7%	9.20
5 (5 • 0)	0.0%	0.0%	41.7%	8.3%	50.0%	9.08
6 (4 • 2)	0.0%	3.5%	3.5%	24.1%	69.0%	9.59
6 (5 • 1)	2.6%	0.0%	15.4%	18.0%	64.1%	9.41
7 (5 • 2)	0.0%	0.0%	0.0%	25.0%	75.0%	9.75

as clearly as the number of bathroom spaces becomes larger. So, for example, the average rating of homes with four full-bathrooms is lower than that of homes with two full and two half-bathrooms or with three full and one half-bathroom. Similar inconsistencies occur within homes with five or six total bathroom spaces.

These cross-tabulations suggest that the convenience associated with the higher total number of bathroom spaces (more so than the division between full and half-bathrooms) may be a particularly critical factor for overall residential satisfaction.

Cross-Sectional

Consistent with the results seen in the cross-tabulations, column (1) of Table 2 demonstrates the association of bathrooms and residential satisfaction. In general, the presence of one more full-bathroom was associated with an almost $\frac{1}{2}$ -point increase in total residential satisfaction rating. Given that about 85% of all ratings varied from only 7 to 10, this $\frac{1}{2}$ -point increase is relatively large.

Table 2. Cross-Sectional Analysis of Determinants of Residential Satisfaction: American Housing Survey 2005 ($n = 41,755$)

Variable	(1)	(2)	(3)
Full-bathrooms	0.4853 (0.0111)***	0.1583 (0.0161)***	0.2253 (0.0191)***
Half-bathrooms	0.3066 (0.0153)***	0.0632 (0.0171)***	0.0698 (0.0199)***
Bedrooms		0.0222 (0.0112)***	0.0040 (0.0131)
Other rooms		0.0366 (0.0057)***	0.0464 (0.0067)***
Total interior space (1,000 sq. ft. units)		0.0381 (0.0052)***	0.0542 (0.0063)***
Number of residences in building		0.0012 (0.0002)***	0.0010 (0.0002)***
Central air		0.1484 (0.0186)***	0.1352 (0.0217)***
Dishwasher		0.1778 (0.0215)***	0.1727 (0.0250)***
Disposal		-0.0199 (0.0189)	-0.0692 (0.0220)**
Fireplace		0.1306 (0.0194)***	0.1624 (0.0226)***
Garage/carport		0.1796 (0.0193)***	0.1940 (0.0224)***
Porch/balcony		0.0604 (0.0247)*	0.0540 (0.0286)
Building age		-0.0042 (0.0004)***	-0.0058 (0.0004)***
Owned by public housing authority		0.1460 (0.0699)*	0.1974 (0.0809)*
Subsidized rent		0.2156 (0.0633)***	0.2765 (0.0735)***
Homeowner tenure		0.3424 (0.0227)***	0.2742 (0.0263)***
Household income (\$10,000 units)		0.0013 (0.0014)	0.0010 (0.0016)
Resident age		0.0121 (0.0006)***	0.0162 (0.0007)***
White resident		-0.0361 (0.1807)	-0.0819 (0.2047)
Single male resident		-0.2176 (0.0248)***	-0.2813 (0.0288)***
Single female resident		-0.0348 (0.0221)	-0.0466 (0.0257)

Table 2. Cross-Sectional Analysis of Determinants of Residential Satisfaction: American Housing Survey 2005 (*n* = 41,755) cont.

Variable	(1)	(2)	(3)
Child in home		-0.1663 (0.0197)***	-0.2020 (0.0229)***
Number of adults in home		-0.0654 (0.0118)***	-0.0851 (0.0136)***
Less than high school		0.0571 (0.0256)*	0.1166 (0.0298)***
Some college		-0.1381 (0.0212)***	-0.1619 (0.0248)***
College graduate		-0.1320 (0.0247)***	-0.1894 (0.0289)***
Graduate school		-0.1596 (0.0300)***	-0.2369 (0.0351)***
Intercept/Intercept 10	7.3637 (0.0195)***	6.9041 (0.0558)***	-2.4936 (0.0662)***
Intercept 9			-1.7185 (0.0656)***
Intercept 8			-0.4105 (0.0650)***
Intercept 7			0.4823 (0.0653)***
Observations with missing values	1,455	5,165	5,165
Observations used	41,905	38,195	38,195
R-squared	0.0548	0.1303	

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$; reporting coefficient (standard error)

Column Descriptions:

- (1) Ordinary least squares regression on housing satisfaction rating on a 1-10 scale without controls
- (2) Ordinary least squares regression on housing satisfaction rating on a 1-10 scale with controls
- (3) Cumulative logit analysis on housing satisfaction rating categories of 10, 9, 8, 7, and below 7

However, it is quite reasonable to assume that this association is being driven, at least in part, by other factors. For example, larger homes generally have more bathrooms. To the extent that residents were more satisfied with larger homes, the associations in column (1) could exist even if the bathrooms themselves were not related to residential satisfaction. Column (2) reports results including a wide variety of control variables to prevent this type of misunderstanding. By including a control variable for total square footage, this analysis measured the impact of an

additional bathroom when total square footage is held constant. After controlling for a wide range of housing and demographic characteristics, the association of bathrooms with residential satisfaction remained significant.

The impact of an additional full-bathroom was reduced in the regression with controls to about .16 points on the unit rating scale, but a comparison with other housing features is instructive. A full or half-bathroom was associated with higher satisfaction than an additional bedroom or other type of room. It is also important to note that bathrooms have greater potential to impact residential satisfaction because of the potential for multiple bathrooms. Although the positive impact of one full-bathroom is only slightly greater than, for example, the presence of central air conditioning, once central air conditioning is present there are no further satisfaction gains to be had from adding additional air conditioning systems.

The presence of two additional half-bathrooms was associated with greater residential satisfaction than one additional full-bathroom in the cross-tabulations and simple regressions, but once controls were included this was no longer the case. Thus, the association of higher residential satisfaction from the addition of two half-bathrooms as compared with one full-bathroom may have been driven by other factors, such as the potentially larger home size associated with the two additional half-bathrooms.

Column (3) presents results from the cumulative logit analysis. This statistical approach better fits the underlying outcome variable characteristics. (The only disadvantage being that coefficients are not as simply interpretable as with the ordinary least squares model.) The results in column (3) generally confirm the findings from the ordinary least squares model. However, under the cumulative logit model, the importance of additional bathrooms is more pronounced. Here, the presence of an additional full-bathroom is associated with a higher level of residential satisfaction than any other single physical characteristic of the home. Thus, using the more appropriate statistical model, the cross-sectional associations suggest the unsurpassed importance of the number of full-bathrooms in predicting residential satisfaction.

Longitudinal

The longitudinal analysis examined the impact of physically adding or removing residential features through equipment or structural changes. Here, the outcome variable was the change in residential satisfaction reported by residents in the same housing unit at two different times. Where the cross-sectional approach reflected the tendency for a characteristic and a certain level of satisfaction to occur together, the longitudinal approach provides a “before and after” comparison. Thus, the association examined was one between a change (addition or removal) of some physical characteristic in a home and a change (increase or decrease) in resident satisfaction of that same home following the alteration.

Table 3. Longitudinal Changes in Housing Unit Satisfaction Tracking the Same Housing Units in the American Housing Survey, 1997 and 2005 ($n = 28,999$)

Variable	(1)	(2)	(3)
Δ Full-bathrooms	0.1601 (0.0284) ^{***}	0.1521 (0.0328) ^{***}	0.1219 (0.0332) ^{***}
Δ Half-bathrooms	0.0919 (0.0292) ^{**}	0.0794 (0.0318) [*]	0.0665 (0.032) [*]
Δ Bedrooms		0.0555 (0.0219) [*]	0.0429 (0.0221)
Δ Other rooms		0.0251 (0.0087) ^{**}	0.0232 (0.0087) ^{**}
Δ Total interior space (1,000 sq ft units)		0.0083 (0.0102)	0.0020 (0.0103)
Δ Balcony/patio		0.1250 (0.0366) ^{***}	0.1220 (0.0369) ^{***}
Δ Central air		0.1967 (0.0401) ^{***}	0.1562 (0.0404) ^{***}
Δ Dishwasher		0.1308 (0.0423) ^{**}	0.1061 (0.0427) [*]
Δ Disposal		0.2113 (0.0479) ^{***}	0.1459 (0.0483) ^{**}
Δ Fireplace		0.0996 (0.0436) [*]	0.0778 (0.044)
Δ Garage/carport		0.0307 (0.0414)	0.0515 (0.0417)
Δ Homeowner tenure		0.3163 (0.043) ^{***}	0.2360 (0.0436) ^{***}
Δ Subsidized rent		0.7905 (0.1809) ^{***}	0.5245 (0.1849) ^{**}
Percentage point Δ in household income		0.0014 (0.0015)	0.0015 (0.0016)
Δ White resident		-0.1108 (0.0527) [*]	-0.1216 (0.0531) [*]
Δ Single male resident		-0.1451 (0.0386) ^{***}	-0.1381 (0.0389) ^{***}
Δ Single female resident		0.0365 (0.0346)	0.0434 (0.0349)
Δ Child in home		-0.1455 (0.0258) ^{***}	-0.1594 (0.026) ^{***}
Δ Number of adults in home		-0.0453 (0.0155) ^{**}	-0.0443 (0.0156) ^{**}
Δ Resident years of education		-0.0496 (0.0052) ^{***}	-0.0508 (0.0053) ^{***}

Table 3. continued

Variable	(1)	(2)	(3)
Intercept/Intercept 1	0.0362 (0.0118)**	-0.0308 (0.0147)*	-0.7346 (0.0168)***
Intercept 0			0.6588 (0.0166)***
Matched observations missing variables	0	10,359	10,359
Observations used	28,999	18,640	18,640

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$; reporting coefficient (standard error)

Column descriptions:

- (1) Ordinary least squares regression on the change in housing satisfaction rating on a 1-10 scale without controls
- (2) Ordinary least squares regression on the change in housing satisfaction rating on a 1-10 scale with controls
- (3) Cumulative logit analysis on any rating increase (1), no change (0), or decrease (-1)

Column (1) in Table 3 indicates that homes where the number of full or half-bathrooms was increased during the period of examination did experience a significant increase in residential satisfaction. Again, this may have been driven by other changes that occurred in the home along with the addition of the bathroom, so column (2) introduces controls for changes in the other variables examined in the cross-sectional analysis. Because the AHS tracks housing units rather than individuals, changes in satisfaction ratings could also have been brought about by changes in the residents. Consequently, the control variables also included changes in the socio-demographic characteristics of the residents.

With the addition of these controls, a change in the number of bathrooms remained a significant positive predictor of a subsequent change in residential satisfaction. Further, the addition of even a half-bathroom was associated with a greater improvement in residential satisfaction than was the addition of any other type of room.

Column (3) presents the results from a cumulative logit model when the outcome variable is limited to the three results of a drop in residential satisfaction (-1), no change in residential satisfaction (0), or an increase in residential satisfaction (+1). Again, in this specification renovating a home to add a full or half-bathroom was associated with an increase in residential satisfaction. However, unlike the cross-sectional model, the addition of a bathroom did not have the largest coefficient of all the changes to the physical housing characteristics. This could be due in part to the sometimes less-than-ideal nature of a bathroom addition to an existing home as compared with an additional bathroom planned into the original home. The changes with higher coefficients tended to be items more easily amenable to retrofitting such as the addition of a disposal, patio, or central air conditioning.

Conclusion

The number of bathrooms clearly has a powerful influence on residential satisfaction. Even when controlling for the size of dwellings and other dwelling characteristics, the number of full-bathrooms was the most dominant physical characteristic associated with residential satisfaction. Similarly, adding full or half-bathrooms through renovation was associated with positive changes in residential satisfaction.

Earlier research suggested that residential satisfaction may be driven by the sense of control (or lack of control) over one's environment. The bathroom provides a unique area of privacy. As such, the increased availability of such private spaces can improve one's sense of control over the residential environment. As noted in Table 1 there were no circumstances in which homes with more bathroom spaces had lower average ratings than homes with fewer bathroom spaces, even when the larger number of spaces came from half-bathrooms rather than full-bathrooms. The easy access to private space and lack of disturbance resulting from other household members having alternative bathroom spaces, generates an environment of residential control. This sense of control, in turn, may help to generate residential satisfaction.

Each of the analyses confirms that the importance of the bathroom in residential satisfaction is worthy of note. Planners and consumer advisors interested in increasing resident satisfaction may consider these results when comparing the relative impact of an additional bathroom with other potential uses of space. Spending money for a bonus room or extra square footage may often generate less satisfaction for the price than a well-placed additional full or half-bathroom. No other additional room generated the impact on residential satisfaction as the additional bathroom. For builders, designers, and consumers, the evidence presented here suggests that the addition of even a half-bathroom (in either the original or the renovation plans) will have a much greater impact on the residential satisfaction of the occupants than other more expensive additions.

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