# Repair Expenses, Selling Contracts and House Prices



Authors

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Abstract

This article examines the impact of repair expenses on the selling price of a house. Using data that include the actual dollar amount of repairs stipulated in the settlement statement, we investigate the frequency and extent to which the performance of major repairs is part of the sales contract. We find that most homes are restored to a ''normally maintained'' state each time the home changes hands, and that the cost of bringing the home to this condition is included as part of the house selling price. This implies that it may be unnecessary to measure maintenance levels when using transaction data to study components of house price or to construct house price indexes.

## Introduction

Homeowners and landlords regularly perform maintenance and make minor repairs to their properties in order to enjoy a normal level of housing services. Major repairs, however, are often deferred until their need is obvious or until the property is sold or prepared for sale. Existing homeowners logically put off repairs as long as possible, but prospective buyers are aware of impending major repairs and require that either the seller complete repairs prior to closing, discount the price to allow the buyer to make needed repairs or provide the buyer with a repair allowance as part of the settlement agreement. Roof repair or replacement, carpet replacement, exterior painting, and heating, ventilation and air conditioning replacement are major upkeep requirements that fall into this category.

Lack of data has been the major obstacle to studying the relationship between homeowner maintenance activities and house price. As Reschovsky (1992) notes: ''The factors influencing household decisions regarding home upkeep and improvement remain one of the least studied aspects of housing economics. This relative lack of attention most likely reflects the scarcity of good data rather than the lack of importance.''

The level of maintenance, because it is unobserved in most data, usually goes unmeasured in hedonic house price regressions. This raises concerns about bias

in the estimates of other components of house prices as well as concerns about bias in house price indexes constructed using transaction data. The data we use in this study are very rich in information relating repair expenditures to the associated home sales.

In this article, we look at the detail of house sales contracts. We have the dollar amount of repairs and maintenance associated with under-maintained homes. This sheds light not only on the frequency and cost of major repairs at point-of-sale, but also on the nature of the transaction itself. We find evidence that a home's transaction price represents the value of a normally maintained home even when the home has been substantially under-maintained prior to being marketed. As a result, concern over omitting extraordinary maintenance as a variable in transaction-based hedonic equations appears misplaced.

The article is organized as follows. In the next section, we briefly review the theoretical and empirical literature surrounding property maintenance. Also germane are studies of the capitalization of contract concessions and contingencies into house selling price. The following section develops the theory describing buyer and seller behavior with respect to under-maintained houses. Next, we describe typical behavior of sellers and buyers with respect to repairs and maintenance. The following sections describe the data and statistical model used and the results. The final section is the conclusion.

## Literature Review

Hedonic theory (Rosen, 1974) provides a framework for studying the contribution of individual product characteristics to the value of differentiated products such as houses. Marginal values of almost every conceivable amenity and disamenity, ranging from physical characteristics such as living area and quality of construction to locational attributes such as proximity to public transportation, have been the subjects of previous research. Hedonic regressions have also been used to estimate depreciation rates and the impact of noise and air pollution on house value.

Relatively few empirical studies to date have focused on the details of the sales contract itself, despite the direct impact of contractual agreements on the selling price of a house. Allen, Shilling and Sirmans (1987), the first to employ the hedonic framework to investigate the effect of differences in sales contracts on house prices, found that the price premium exacted by the market for contract contingencies is dependent on the number of contingencies and the manner of their bundling within the contract. Similarly, Shilling, Sirmans, Turnbull and Benjamin (1992) found that contingent contracts result in lower sales prices when property and market characteristics are held constant. Seller concessions related to financing costs and major repairs, proxied by a dummy variable for the existence of such provisions, were found to have an insignificant impact on selling price.

Financing concessions have been the subject of most of the literature relating the details of the sales contract to house selling price. Of particular interest in these studies is the degree to which creative financing and seller financing concessions are capitalized into the transaction price. Brueckner (1984) provides the theoretical foundation for this area of study. Generally, empirical investigation of this issue (Sirmans, Smith and Sirmans, 1983; Smith, Sirmans and Sirmans, 1984; and Ferreira and Sirmans, 1986) has revealed that seller concessions are partially, but not fully, capitalized into the transaction price. This implies that buyers and sellers share the benefit and cost of such an arrangement. Ferreira and Sirmans (1989) extend this inquiry by looking not only at the impact on selling price, but also at the effect on selling period. They discover that, in certain markets, the financing concessions may manifest their benefits in terms of a reduced time-on-market rather than in a higher selling price.

While the value of maintenance and repairs has been the subject of a number of theoretical (*e.g.*, Dildine and Massey, 1974; Sweeney, 1974; and Arnott, Davidson and Pines, 1983) and empirical (*e.g.*, Chinloy, 1980; Malpezzi, Ozanne and Thibodeau, 1987; and Knight and Sirmans, 1996) housing studies, we know of only one (Shilling, Sirmans, Turnbull and Benjamin, 1992) that looks at the provision for maintenance and repair costs within the sales contract. In this latter study, major repairs are combined with financing concessions as a single dummy variable in a hedonic regression that controls for other property characteristics. In contrast, we have data that include the dollar amount of major repairs stipulated in the settlement statement and are therefore able to isolate these concessions from others that may appear in the contract for sale.

An understandable preconception may be that repair allowances, much like financing concessions, would be capitalized, at least partially, into the transaction price of a house. We elaborate the ways that a buyer wishing to acquire a ''normally maintained'' home might approach a purchase. We also develop a theory that relates the unobserved willingness to pay and the cost of needed repairs to the observable selling price and repair allowances.

## Theory

We assume that buyers wish to purchase a ''normally maintained'' home. Four possible situations cover the range of methods by which the buyer might acquire such a home:

Case 1: The buyer might purchase a home that has received a normal level of maintenance and repairs over the holding period of the current owner. In this case, no special arrangements are included in the sales contract, and the transaction price represents the value of the home.

Case 2: The buyer might require the seller to make the repairs necessary to bring the house to a normal level of maintenance as part of the purchase agreement. The selling price represents the value of a

normally maintained home, the repairs are accomplished before closing and repair expenditures appear in the closing statement as a reduction in the proceeds available to the seller at closing.

Case 3: The buyer might receive a repair allowance as part of the closing settlement. Once again, the selling price represents the value of a normally maintained home. Although the house is undermaintained at closing, it is presumed that the buyer makes the needed repairs soon thereafter.

Case 4: The buyer might purchase, without contingencies or allowances, a home that does not fall into the category of a normally maintained home. In this case, the selling price represents the value of a normally maintained home plus or minus the difference in value associated with the home's repair level.

To formalize these cases, let $W_N$ be the amount that a household is willing to pay for a normally maintained house, and let $R \geq 0$ be the cost of repairs needed to bring the house up to the normal level. Assume that a fraction $\alpha(0 \leq \alpha \leq 1)$ of this amount is to be paid by the buyer, while the seller pays the remaining fraction, $1 - \alpha$. The household's net willingness to pay for the house is therefore:

$$W_N - \alpha R. \tag{1}$$

Note that neither $W_N$ nor $\alpha R$ is generally observable. Instead, we observe the quoted price of the house, $P$, and either the repair expense of the seller or the repair allowance to the buyer at closing (if any), $A$. The household's net payment for the house is therefore $P - A$. In equilibrium, it must be true that:

$$P - A = W_N - \alpha R. \tag{2}$$

Equation (2) should hold for all houses if the hypothesis that the housing market correctly capitalizes repair expenses is true.

Consider how this equation relates to the above cases. In Case 1, a normally maintained house is sold, so $R = A = 0$. That is, no repairs are needed and no repair allowance is given at closing. It follows from (2) that the sale price should equal the value of a normally maintained house, or $P = W_N$. In Case 2, the house has not received normal maintenance, but the seller agrees to make all necessary repairs prior to closing. Thus, $R > 0$, but $A = \alpha = 0$, implying that $P = W_N$. That is, the sale price should also equal the value of a normally maintained house regardless of the value of $R$.

In Case 3, the house has again received sub-normal maintenance, but here the buyer agrees to pay a share $\alpha$ of the required repairs. That is, $R$, $A$ and $\alpha$ are all

positive. Suppose that the repair allowance at closing exactly equals the buyer's share of repairs, or $A = \alpha R$. Then (2) implies that in equilibrium the price should be $P = W_N$; the price again equals the value of a normally maintained house. Alternatively, suppose that $A < \alpha R$, or the repair allowance is less than the buyer's share of repairs. In the extreme, suppose that the buyer receives no allowance for maintenance ($A = 0$) and plans to finance all repairs himself. This is the scenario in Case 4. Equation (2) implies that in equilibrium, $P = W_N - \alpha R$, or the sale price should equal the value of a normally maintained house discounted by the buyer's expected maintenance costs.

The preceding analysis implies that in all but Case 4, the sale price should equal the value of a normally maintained house; that is, it should be independent of any repair expenses needed to bring the house up to a normal level of maintenance. Only in Case 4 do we predict that the price will be negatively related to the required repairs. Unfortunately, we can not separate Case 4 homes from Case 1 homes. Therefore, the extent to which our theory holds empirically depends on the prevalence of Case 4 homes for the sample in question.

Before turning to the empirical analysis, it is interesting to speculate on why at least some buyers and sellers transact at a gross sale price that includes repairs rather than just a net price equal to $W_N - \alpha R$ (Case 4). One possibility has to do with the financing of the repairs. Note that by obtaining a mortgage for $W_N$ rather than $W_N - \alpha R$, the buyer is in effect financing the required repairs via the mortgage, which may be the cheapest source of funds given the lower interest rate on mortgages compared to personal loans and the tax deductibility of mortgage interest. At the same time, the lender is willing to finance repairs because it brings the house up to the normal level of repair, at which time it is worth $W_N$.

## Repairs and Maintenance

Homeowners differ in the extent they engage in repairs and maintenance during their period of ownership. Some of this relates to behavioral differences, such as the tolerance levels for house imperfections, or even differences in perception of what constitutes an imperfection. Some differences in repair and maintenance levels may be caused by income constraints that prevent an owner's maintaining the home in the desired condition. Thus, for whatever reason, some homes are maintained continuously in a ''like new'' condition, while some houses proceed during the course of ownership to a ''needs work'' state.

Most home buyers are quite fussy about the condition of the house they buy. They typically insist that all plumbing and electrical equipment work properly and they are concerned as well about faded or chipping paint and worn or damaged carpet. Many buyers go to the expense of hiring an inspector to check the condition of house components and to diagnose structural problems that may not be apparent to the layman.

Regardless of differences in homeowner behavior with respect to repairs and maintenance during tenancy, the attitudes and actions of home buyers toward the

condition of the house at point of purchase bring most homes to a ''normal'' level of maintenance by the time the transaction reaches close of escrow. This result may be reached by the continuous attention of homeowners, or it may occur by stipulation of the buyer as a condition of sale.

## Data and Model

To investigate the effect of maintenance level on the quoted selling price of homes, we examined the details of all the closed sales of Coldwell Banker Grupe, a large brokerage firm in Stockton, California. This firm participates, as either listing or selling broker, in about 20% of all residential transactions in the area. In all, 342 sales contracts were examined, with particular focus on the dollar amount of repairs stipulated in the settlement statement. Stockton is a medium sized city in the San Joaquin Valley located about forty miles south of Sacramento and about eighty miles east of San Francisco.

We filtered the data to reduce the impact of outliers, eliminating those properties that sold for less than $50,000 or more than $325,000, properties with less than 700 or more than 5,000 square feet of living area, and properties on less than one-tenth acre or more than five acres of land. The remaining data set consists of 264 transactions occurring between July, 1997 and December, 1998, a period during which home prices were generally rising.

Summary statistics for the data appear in Exhibit 1. The average home had about 1,725 square feet of living area with three bedrooms, was about twenty-three years old and sat on a quarter-acre lot. The average home sold for about $138,000. The dollar amount of the repairs enumerated in the settlement statement ranged from zero to $25,000, and on average constituted about 1% of the selling price, or about $1,380.

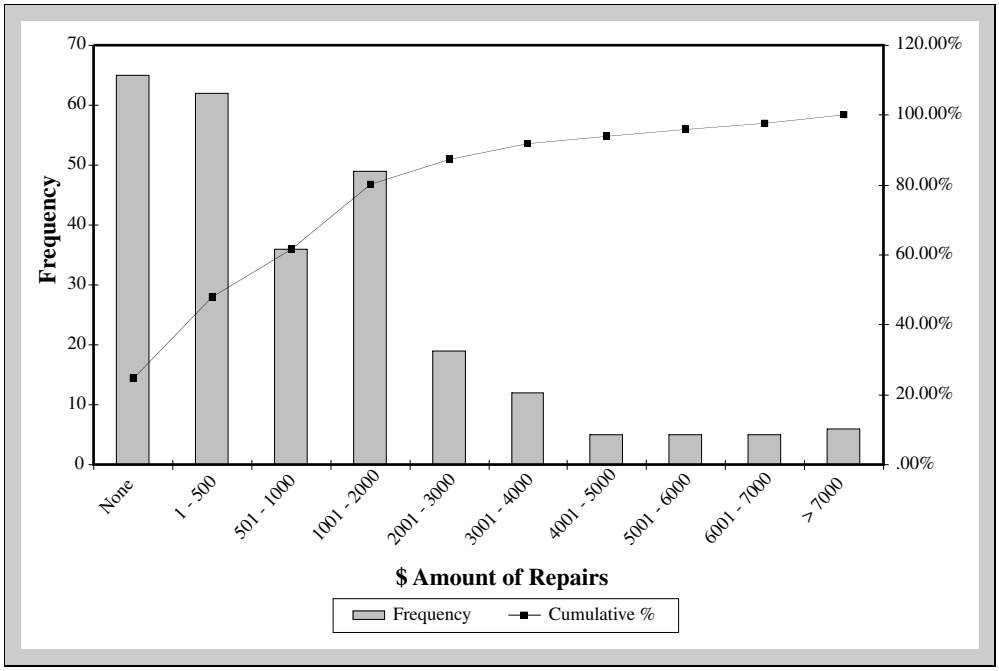
Further evidence of the importance of repairs in negotiations between buyers and sellers is provided by Exhibit 2, which shows the frequency distribution of repairs by dollar amount. Fully 75% of the contracts provided for the performance of repairs. Over half of the homes in the sample had repairs of at least $500, and about 38% of the transactions included amounts of over $1,000. The preponderance of contracts involving such repairs implies that a large percentage of home sales fall into the category of either Case 2 or Case 3, situations wherein the homes are restored to a normal level of maintenance at the time of sale. Only 25% of the home sales involved no repairs; these transactions would meet the criteria of Case 1, in which no repairs are needed, or Case 4, where premiums (discounts) apply for over- or under-maintained homes.[1]

We employ hedonic pricing theory (Rosen, 1974) to construct the statistical model. The theory holds that the composite price of a multi-attribute product is simply the sum of the marginal prices of the individual attributes. Attribute prices can be obtained statistically by regressing the sales price of homes on the characteristics of the homes thought to influence price. Hedonic pricing has been widely used in

**Exhibit 1** | Summary Characteristics of Data

| Variable | Description | Mean | Std. Dev. | Min. | Max. | Percentage of Sample | Observations |
|---|---|---|---|---|---|---|---|
| *SPRICE* | Selling price | 137,996 | 57,726 | 56,000 | 320,000 | | |
| *LIVAREA* | Square feet of living area (100's) | 17.24 | 5.17 | 8 | 41 | | |
| *BEDS* | Number of bedrooms | 3.22 | 0.67 | 2 | 6 | | |
| *TREND* | Market trend variable for time of sale | 10.49 | 3.74 | 2 | 18 | | |
| *ACRES* | Lot size in acres | 0.25 | 0.34 | 0.11 | 2.92 | | |
| *AGE* | Age of dwelling in years | 22.78 | 17.76 | 1 | 80 | | |
| *MR* | Dollar amount of repairs in closing statement | 1,379 | 2,553 | 0 | 25,000 | | |
| *PMR* | Repair expense as a percentage of selling price | 1.1 | 1.8 | 0 | 14.1 | | |
| *MRDY* | Repair expense part of closing statement | | | | | 75.4 | 199 |
| *SCD2* | House in school district 2 | | | | | 33.0 | 87 |
| *SCD3* | House in school district 3 | | | | | 25.4 | 67 |
| *SCD4* | House in school district 4 | | | | | 12.9 | 34 |

**Exhibit 2** | Frequency Distribution of Repairs




the house price and house price index literature to measure the effect of various characteristics on house price and to measure the change in house prices over time.

The statistical model is:

$$y = xB + \varepsilon, \tag{3}$$

where $y$ is a vector of selling prices for the homes in the sample, $x$ a matrix of the physical characteristics explaining the selling price, $\beta$ a vector of coefficients representing the marginal contribution of each characteristic on composite house price and $\varepsilon$ a homoskedastic error term with mean zero.

The matrix of explanatory variables in our study includes the number of square feet of living area, the number of bedrooms, the size of the lot on which the house sits, and the age of the home at the time of sale. We also include a trend variable to control for the fact that market prices were rising during the study period,[2] and a dummy variable for the school district associated with the home. In addition to valuing the educational differences among the school districts, this latter dummy variable proxies for many of the unmeasurable but value-laden amenities

associated with a home's location. We augment this basic hedonic model with information regarding the repair expenditures included as part of the sales agreement. The augmented model:

$$y = x\beta + z\delta + \varepsilon, \quad (4)$$

includes a vector $z$ of house repairs, with the coefficient $\delta$ measuring the contribution of repairs to the selling price of the home. We operationalize the repair characteristic in two ways: first, as a dollar amount of repairs itemized in the closing statement; and second, as a dummy variable, one if any repairs were stipulated in the selling agreement and zero otherwise. In accordance with our theory, we hypothesize that the coefficient, $\delta$, will be statistically insignificant.

This hypothesis of insignificance differs from the positive and significant coefficient encountered in the literature surrounding the capitalization of financing concessions into selling price. The difference is in the ability to distinguish between subsets of comparison. Homes with financing concessions are clearly distinct from those without, and the cash equivalence of concessions imparts value only to the homes with concessions.

In our case, except for Case 4 homes, the values of homes with point-of-sale repairs are no different from the values of homes that have been maintained and repaired throughout the duration of the seller's occupancy. Homes with time-of-sale repairs sell for no more or less than homes without, because the repairs merely bring the value of the house to the norm at one discrete point rather than continuously over time.

The possibility of Case 4 homes in the sample causes us to modify our hypothesis somewhat. Insignificance of the repair coefficient is consistent with three possible situations. First, all transactions are categorized as Case 1, 2 or 3. That is, all homes are normally maintained, either over time or by repairs performed at point-of-sale. Second, there are Case 4 homes in the sample, but the degree of over- and under-maintenance is mild. Finally, there are Case 4 homes, and some may be substantially over- or under-maintained, but the extreme outcomes offset the effects of each other.

In a practical sense, it matters little which of the above situations produces an unimportant repair variable. The fact that, on average, homes are at a normal level of maintenance and repairs when sold would be sufficient to allay concerns about omitting the variable when using transaction-based data.

## Results

Exhibit 3 provides the model estimation results. We report the results of the semi-log model, $ln(Y) = X$, the most common specification for hedonic regressions of

**Exhibit 3** | Parameter Estimates for Hedonic Models of House Value

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| Variable | Estimate | Std. Error | Estimate | Std. Error | Estimate | Std. Error |
| Constant | 11.003 | 0.076<br>145.4 | 10.997 | 0.077<br>143.7 | 10.998 | 0.077<br>143.0 |
| Sq. ft. of living area (100's) | 0.058 | 0.003<br>20.3 | 0.059 | 0.003<br>20.0 | 0.058 | 0.003<br>20.1 |
| Number of bedrooms | −0.062 | 0.022<br>−2.8 | −0.062 | 0.022<br>−2.8 | −0.061 | 0.022<br>−2.8 |
| School district 1 | −0.184 | 0.030<br>−6.1 | −0.183 | 0.030<br>−6.1 | −0.184 | 0.030<br>−6.1 |
| School district 2 | −0.193 | 0.033<br>−5.9 | −0.192 | 0.033<br>−5.9 | −0.191 | 0.033<br>−5.8 |
| School district 3 | −0.159 | 0.040<br>−3.9 | −0.159 | 0.040<br>−3.9 | −0.160 | 0.040<br>−4.0 |
| Time trend (monthly) | 0.010 | 0.003<br>3.3 | 0.010 | 0.003<br>3.4 | 0.010 | 0.003<br>3.3 |
| Acreage | 0.163 | 0.036<br>4.5 | 0.166 | 0.037<br>4.5 | 0.162 | 0.036<br>4.4 |
| Age | −0.003 | 0.001<br>−4.4 | −0.003 | 0.001<br>−4.0 | −0.003 | 0.001<br>−4.4 |
| Dollar repairs | | | −0.003 | 0.005<br>−0.59 | | |
| Repairs dummy | | | | | 0.012 | 0.028<br>0.42 |
| Adj. $R^2$ | .758 | | .757 | | .757 | |

*Notes:* All models take the functional form $\ln(Y) = X$. Model 1 contains no information regarding the performance of maintenance and repairs as part of the sales agreement. Model 2 adds the dollar amount of repairs contained in the sales contract. Model 3 is a repair dummy that is one if repairs exceeded $500 and zero otherwise. *t*-Statistics appear beneath the standard errors.

house price on house characteristics. Analysis was also performed using linear and log-log functional forms. The results of those analyses are nearly identical to those reported here.

Model 1 estimates house attribute values without any information regarding repairs. This relatively parsimonious model explains 76% of the variation in the selling price of homes in the sample. All coefficients are significant at the 1% level, and all are of the expected sign.[3]

Model 2 imposes additional information regarding the dollar amount of any repairs listed in the settlement statement. As hypothesized, the coefficient on this variable is insignificant. Note also that adding this variable has negligible impact on the house characteristic parameter estimates. The model in fact has a lower adjusted $R^2$ and a lower $F$-value than the model that excludes repair information.

In Model 3, we represent repair information as a binary variable, distinguishing transactions that involved repairs of any magnitude from those that had no repairs. Comparing Model 1 with Model 3 in Exhibit 3, we see once again that repair information is insignificant in explaining variation in transaction price. Parameter estimates of house characteristics are virtually unaffected, and again model performance as measured by adjusted $R^2$ and the $F$-Statistic is degraded.

Support for our proposition that the transaction price represents the value of a normally maintained home is provided by the *insignificance* of the maintenance and repair estimates in Models 2 and 3 as presented in Exhibit 3. One possible source of insignificance is the high variance of parameter estimates associated with multicollinearity, a data problem known to exist in hedonic models. For this reason, we subjected the data to a barrage of tests for ill-conditioned data. We examined simple correlations, variance inflation factors, auxiliary regressions, condition numbers of the normalized data and a collinearity diagnostic table showing the proportion of variance for each explanatory variable associated with each characteristic root of the data. As summarized in Exhibit 4, none of these

**Exhibit 4** | Data Collinearity Diagnostics

| | Model 2 | Model 3 |
|---|---|---|
| Collinearity Test | Dollar Amount of Repairs | Dummy Variable for Repairs |
| Simple correlations | Highest correlation was 0.28 with the age variable. | Highest correlation was 0.16 with the age variable. |
| Variance inflation factor[a] | 1.2 | 1.1 |
| Auxiliary $R^{2}$[b] | 0.16 | 0.07 |
| Highest condition number[c] | 20.1 | 21.0 |
| Variance proportions | No two variables had a high proportion of variance associated with the same characteristic root. | No two variables had a high proportion of variance associated with the same characteristic root. |

[a] A variance inflation factor of 10 or higher would indicate a collinearity problem.
[b] $R^2$ from regressing the maintenance and repair variable on the other explanatory variables in the model. A high $R^2$ would reveal a problem.
[c] Pertains to normalized data. A condition number greater than 30 denotes ill-conditioned data.

tests reveals a collinearity problem associated with the maintenance and repair variables.

## Conclusion

This article contains important information about the performance of repairs at point-of-sale. We find evidence in our sample that about three-fourths of residential transactions provide for repairs within the contract, and that many of these repairs entail significant dollar amounts. According to local residential brokers, requiring that the repairs be accomplished prior to closing (Case 2) is the usual manner by which the buyer acquires the desired normally maintained home; the occurrence of repair allowances to the buyer (Case 3) is less frequent. From this, in a large majority of transactions, we are able to infer the buyer's willingness to pay for such normally maintained home, a value that is not directly observable in the data. The 25% of transactions that did not involve repairs would be split in unknown proportions among homes that needed no repairs (Case 1), and homes that were over- or under-maintained and were sold as such (Case 4). Only in the latter case would the selling price represent other than the value of a normally maintained home. Moreover, if the number of over- and under-maintained homes were roughly equal in a sample, as seems reasonable, the effects of these observations would be likely to statistically counterbalance each other.

As hypothesized, the variables used to represent the existence and level of repairs called for in the contract were insignificant. This gives further support to the notion that the selling price measured in transaction-based data is representative of the value of a normally maintained home. We further note that the hedonic model we choose is relatively parsimonious in the number of explanatory variables, allowing ample opportunity for the repair variables to explain variation in selling prices if they were capable of doing so. Collinearity diagnostics are fully supportive of this assertion.

The major implication of our study is that maintenance, repair and upkeep data, notoriously difficult to measure in transaction-based data, may be unnecessary in hedonic price regressions. Inasmuch as the measured selling price represents the value of a normally maintained home in the vast majority of cases, unbiased estimates of the value of house characteristics, and accurate estimation of hedonic house price indexes may be accomplished without such information. Of course, our conclusions pertain only to the sample we studied, and in general would depend on the preponderance of Case 4 homes in any given sample. Replication of our results in other data scenarios would be needed to generalize the conclusions.

## Endnotes

[1] Unobserved in our study is the bargaining process between buyer and seller. Some sellers may resist the concessions required by prospective buyers and wait for a less demanding

buyer. This creates sample selection bias if the population of interest is both sold and unsold homes. Our focus is on the homes that culminate in a transaction, and our results pertain only to this censored sample.

[2] The trend variable summarizes the price effect of the various components of the real economy during the study period. The practice is common in house price and house price index literature. A trend variable was chosen over periodic dummy variables because the time effect was steadily upward during the study period as indicated by a house price index for the Stockton area using dummy variables and a much larger data set.

[3] The bedroom coefficient is negative because it represents the marginal value of an additional bedroom while holding square feet of living area constant. The result is common in hedonic regressions of price on house characteristics.

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