



## Deed Types, House Prices and Mortgage Interest Rates

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When houses are sold they come with a deed attached that spells out the legal guarantees on good title. Some deeds give clues about the characteristics of the seller or the house. Using a 37,043-observation house price hedonic with a Bayesian spatial error model, we find the type of deed attached to a housing sale can have a dramatic correlation with the sale price. Ten deed types command a discount, and one commands a premium relative to warranty deeds. Mortgage rates for sheriff's deeds and foreclosure deeds are lower than for warranty deeds, indicating more sophisticated buyers.

A deed is a written document that conveys a real asset from one party to another. A deed sometimes contains guarantees of good title, freedom from encumbrances and protection from competing claims against the property; other deeds make no such guarantees. The circumstances surrounding the sale determine the type of deed a property will sell with. Investigating the relation between deed type and house price is interesting for several reasons. A universal criticism of house price hedonics is that they fail to control for the condition of the house. The deed type often imparts information about the condition of the house at the time of sale, abating this source of omitted variable bias. Property tax assessors care about deed type if the use of this information yields a better prediction of the underlying structural value of the house than even the sale price does. General warranty deeds have the most robust guarantees of clear title. When a property is transferred with a general warranty deed, the seller is guaranteeing that he holds clear title to the property, and the clear title guarantee extends back to the origin of the property. Discounts and premiums for houses sold with certain alternative deed types, relative to the general warranty deed sales, suggest interesting stories, such as seller motivation for corporation deed sales. Additionally, the discounts associated with foreclosure and sheriff's deeds may indicate suboptimal mechanism design for foreclosure auctions and sheriff's sales.

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Closely related to the security of property rights is title insurance. Title insurance on a property covers the owner for all title defects that occurred prior to closing on the property. Most banking institutions require title insurance to be purchased to protect the loan they issue for the purchase of the property. In addition, the buyer may opt to purchase a supplementary policy that would cover her losses in the event of a title challenge. In most regional markets, it is customary for the seller of a property to pay for the supplementary policy, but there are cases in which the buyer wants to purchase a more robust policy than the seller provides. In these cases, either the buyer will purchase the policy herself, or the sale of the property will not occur.

We construct a data set of 37,043 housing sales that have the deed type listed. We control for outliers, omitted variables and heteroskedasticity using a Bayesian spatial error model (LeSage 1997). We find that the deed attached to a house can have a dramatic link with the sale price. Houses selling with general warranty deeds sell for almost 100% more than those selling with quit claim deeds, while those selling with survivorship deeds sell at a slight premium to those with a general warranty deed attached. General warranty deeds are the most common in our sample. Unlike general warranty deeds, limited warranty deeds only shield a buyer from claims for the time the seller owned the property, leaving the buyer open to claims from prior periods. We find that houses with limited warranty deeds sell for a 19% discount relative to houses sold with general warranty deeds. There may be a discount when guardians sell property on behalf of their incompetent wards. Executor's deeds convey the property of a person who has died with a will. Such houses sell for an 8% discount. In all, housing sales with 10 deed types command a discount, and one commands a premium relative to houses sold with general warranty deeds.

Last, we regress the mortgage rate of the transactions on the deed types. We find lower interest rates for survivorship deeds and higher interest rates for special warranty deeds. We find lower mortgage interest rates for buyers of houses with sheriff's deeds and foreclosure deeds, suggesting that people who buy these houses are savvier in finding cheap lenders and are more credit-worthy than the typical buyer. We find higher mortgage interest rates in racially heterogeneous neighborhoods, probably indicating that these residents do not shop around as much for the best interest rate.

## Data

Housing data with deed type information are fairly widely available from county auditors and real estate companies. We collect a sample of 37,043 houses that were sold in Ohio in 2000 that contain information about the type

of deed attached to the house at the time of sale (FARES 2002). The houses come from five metropolitan areas: Akron, Cincinnati, Cleveland, Columbus and Youngstown. All houses are single-family detached structures that sold for more than \$30,000, to help ensure that our sample only includes arms' length transactions.

We have information about 14 structural characteristics of the houses. These characteristics are the number of fireplaces, bedrooms and full and partial bathrooms in the house; the number of detached structures on the lot; the age of the house; the size of the house and yard and dummy variables for whether the house is one-story, made of brick and has a deck, patio, garage or finished basement.

The traditional identification strategy in cross-sectional house price studies is to include controls for the characteristics of the neighborhood (*e.g.*, Haurin and Brasington 1996). To this end, we match our houses to data from seven different sources.

A substantial literature investigates the relation between house prices and school quality (Ross and Yinger 1999). Brasington and Haurin (2006) suggest that proficiency test scores are good measures of homeowners' valuation of the quality of the public schools. The percentage of students in each public school district who failed the Ohio 12<sup>th</sup> grade proficiency test is used to capture school quality (or the lack of it). The other public services in the hedonics measure police protection and environmental quality, and the tax rate is included as well.

Archer, Gatzlaff and Ling (1996) find that growing areas have higher house price appreciation rates, so fast-growing communities might also have higher sale prices than slower growing communities. To this end, a variable *HOT MARKET* is included to capture development activity in the community. Other community descriptors include racial heterogeneity and the prevalence of single-parent households. Variables are described in Table 1.

The focus variables are the types of deeds associated with the houses at the time of sale. Fully 15 deed types are represented in our data set. Of the 15 deed types, our research into Ohio's real property statutes and interviews with title attorneys has yielded viable explanations for what 13 of the deed types mean with respect to the situation surrounding the sale. The two that remain unexplained are the execution deed and the final distribution deed. The deed types and brief explanations are given in Table 2. While a formal study of the real property statutes in the 49 other states has not been conducted, our research indicates that the real property conveyance institutions are very similar across the United States.

**Table 1 ■** Variable definitions, sources and means.

Variable Name	Definition (Source)	Full Sample Means (Std. Err.)
<i>LN HOUSE PRICE</i>	Sale price of house in 2000 in U.S. dollars (1); natural log used in hedonic regressions, but unlogged mean is shown	145,685 (116,841)
<i>ONESTORY</i>	Dummy variable = 1 if house is one story (1)	0.46 (0.50)
<i>BRICK</i>	Dummy variable = 1 if house is constructed of bricks (1)	0.41 (0.49)
<i>FINISHED BASEMENT</i>	Dummy variable = 1 if house has a finished basement (1)	0.08 (0.27)
<i>GARAGE</i>	Dummy variable = 1 if house has a garage (1)	0.57 (0.49)
<i>FIREPLACES</i>	Number of fireplaces the house has (1)	0.52 (0.59)
<i>OUTBUILDINGS</i>	Number of exterior buildings on the lot (1)	0.01 (0.09)
<i>BEDROOMS</i>	Number of bedrooms the house has (1)	3.12 (0.75)
<i>FULLBATHS</i>	Number of full bathrooms the house has (1)	1.49 (0.63)
<i>PARTBATHS</i>	Number of partial bathrooms the house has (1)	0.47 (0.54)
<i>AGE</i>	Age of house in hundreds of years (1)	0.41 (0.31)
<i>HOUSE SIZE</i>	Thousands of square feet of building size (1)	1.68 (0.73)
<i>YARD SIZE</i>	Size of yard of house in acres, where 1 acre = 43,560 square feet (1)	0.53 (1.93)
<i>PATIO</i>	Dummy variable = 1 if house has a patio (1)	0.10 (0.30)
<i>DECK</i>	Dummy variable = 1 if house has a deck (1)	0.12 (0.33)
<i>BAD SCHOOL</i>	Percentage of students in school district who are below proficient on Ohio 12th grade math proficiency test in 2000–2001 school year (6)	36.7 (12.9)
<i>SINGLE PARENTS</i>	Single-parent returns as a percentage of total returns in school district, for 1999 income tax returns (7)	10.9 (5.2)
<i>HOT MARKET</i>	Value of new agricultural and residential (class 1) buildings constructed between 1999 and 2000 per pupil in school district in tens of thousands of U.S. dollars (8)	0.24 (0.38)
<i>TAX RATE</i>	Tax year 2000 class 1 (agricultural and residential) tax rate in school district in effective mills (2)	32.0 (5.6)
<i>AIR POLLUTION</i>	Air releases in census tract of the house in hundreds of thousands of pounds (3)	0.30 (3.56)

Table 1 ■ continued

Variable Name	Definition (Source)	Full Sample Means (Std. Err.)
<i>RACIAL HETEROGENEITY</i>	Leik index of racial heterogeneity of census block group of the house, where 0 is racially homogeneous and 1 is racially heterogeneous (4)	0.10 (0.10)
<i>POLICE PROTECTION</i>	Number of police officers per 1,000 residents in police district in 1997 (5)	15.3 (14.2)
<i>GENERAL WARRANTY DEED</i>	Dummy variable = 1 if house is sold with a general warranty deed; 26,327 observations; a description of all relevant deeds is given in Table 2 (1)	0.70 (0.46)
<i>EXECUTION DEED</i>	Dummy variable = 1 if house is sold with an execution deed; 12 observations (1)	0.00032 (0.018)
<i>ADMINISTRATOR'S DEED</i>	Dummy variable = 1 if house is sold with an administrator's deed; 9 observations (1)	0.00024 (0.015)
<i>CORPORATION DEED</i>	Dummy variable = 1 if house is sold with a corporation deed; 86 observations (1)	0.0023 (0.048)
<i>EXECUTOR'S DEED</i>	Dummy variable = 1 if house is sold with an executor's deed; 410 observations (1)	0.011 (0.10)
<i>QUIT CLAIM DEED</i>	Dummy variable = 1 if house is sold with a quit claim deed; 344 observations (1)	0.0090 (0.095)
<i>SHERIFF'S DEED</i>	Dummy variable = 1 if house is sold with a sheriff's deed; 195 observations (1)	0.0052 (0.072)
<i>TRUSTEE'S DEED</i>	Dummy variable = 1 if house is sold with a trustee's deed; 45 observations (1)	0.0012 (0.034)
<i>FINAL DIST DEED</i>	Dummy variable = 1 if house is sold with a final distribution deed; 21 observations (1)	0.00056 (0.024)
<i>SURVIVORSHIP DEED</i>	Dummy variable = 1 if house is sold with a survivorship deed; 8,773 observations (1)	0.24 (0.43)
<i>FIDUCIARY COVENANT</i>	Dummy variable = 1 if house is sold with a fiduciary covenant; 573 observations (1)	0.015 (0.12)
<i>GUARDIAN DEED</i>	Dummy variable = 1 if house is sold with a guardian deed; 11 observations (1)	0.00029 (0.017)
<i>SPECIAL WARRANTY DEED</i>	Dummy variable = 1 if house is sold with a special warranty deed; 18 observations (1)	0.00048 (0.022)
<i>LIMITED WARRANTY DEED</i>	Dummy variable = 1 if house is sold with a limited warranty deed; 138 observations (1)	0.0037 (0.061)
<i>FORECLOSURE DEED</i>	Dummy variable = 1 if house is sold with a foreclosure deed; 81 observations (1)	0.0022 (0.047)
<i>MORTGAGE AMOUNT</i>	Amount of mortgage in thousands of U.S. dollars (1)	104.83 (77.00)
<i>MORTGAGE FREQUENCY</i>	Frequency, in years, with which the mortgage rate can change (1)	0.35 (1.26)
<i>MORTGAGE RATE</i>	Interest rate of mortgage in percentage points (1)	1.16 (3.17)

Sources: (1) FARES (2002); (2) Ohio Department of Taxation (2003); (3) U.S. Environmental Protection Agency (2002); (4) GeoLytics (2002); (5) GeoLytics (2000); (6) Ohio Department of Education (2002); (7) Ohio Department of Taxation (2002); (8) Ohio Department of Taxation (2000).

**Table 2** ■ Explanation of deed types.

Deed Name	Explanation
Administrator's deed	Used by a court appointed administrator to convey the property of one who has died without a will.
Corporation deed	Used when a corporation, not an individual, sells a property.
Executor's deed	Used to convey the property of someone who has died with a will.
Fiduciary covenant	These covenants do not specifically and absolutely provide warranty for all claims against the title.
Foreclosure deed	Used to convey a property sold in a foreclosure auction. In our sample, we believe these are analogous to sheriff's deeds.
General warranty deed	Upon transferring a property with this deed, the seller guarantees that he holds clear title to the property, and the clear title guarantee extends back to the origin of the property.
Guardian deed	Used by a guardian to convey the property of an infant or incompetent.
Limited warranty deed	Used when the seller cannot guarantee the entire history of the title. Often used for commercial transactions, although all observations in this study are residential sales.
Quit claim deed	This deed does not state the nature of the rights conveyed in a transaction and provides no warranties of ownership.
Sheriff's deed	Used to convey a property sold during a sheriff's sale, usually to satisfy a court judgment.
Special warranty deed	This deed requires the grantor to defend title against claims of only those related to the grantor in the same way.
Survivorship deed	When a survivorship deed is used a joint tenant maintains ownership rights following the death of another joint tenant.
Trustee's deed	Used to convey title of a property out of a trust.

A previous study includes two deed types as explanatory variables. Colwell and Yavas (1993) regress land prices as a function of acreage and deed types, using 148 tracts that sold in 1829. They find that tracts with general warranty deeds and bargain-and-sale deeds sell for a premium over quit claim deeds. They attribute the premium to more secure property rights, which signals higher land quality to buyers. Another related study is Hite *et al.* (2001). Although it does not study deed types *per se*, this study includes variables in a house price hedonic to represent intrafamily sales, financial institution sales, sales in which realtors or limited partnerships were grantor or grantee and houses purchased from estates.

### State of Real Estate Market Around the Time of the Sample

The relative state of the real estate market at the time our sample was drawn has important implications for the analysis we undertake. If, for example, the

market was in doldrums in the time directly preceding our sample, that may entice the economically stable households to keep their houses off the market until “better times” prevail while the economically challenged may be forced into a foreclosure situation. Case and Shiller (1988) find that during downturns in real estate markets, homeowners have a lower propensity to sell their houses because they are unwilling to accept the lower selling price. This could manifest unusually low selling prices of houses sold under duress whether that be in foreclosure auctions, sheriff’s sales or in any other situation in which a quick sale is desirable.

Our sample is drawn from the state of Ohio in the year 2000, and of the deed types discussed in this article there is a fairly even spread across the metropolitan statistical areas (MSAs). Ohio is an economically diverse state, in which some parts of the state can be flourishing while others are economically downtrodden simultaneously. Therefore, it is not enough to simply look at Ohio’s aggregate real estate market, but rather we must examine the markets at the MSA level. The observations in our sample come from five MSAs: Akron, Cincinnati, Cleveland, Columbus and Youngstown. During the ten-year period preceding our sample, Columbus had the strongest growth in housing at roughly 21.1%, followed by Cincinnati and Akron with roughly 14% and 10.5% growth in housing, respectively. The percentage changes in housing in Cleveland and Youngstown were the lowest at 7.1% and 4.4%, respectively. The relative percentage changes in housing in the MSAs reflect the relative percentage changes in population growth in the areas. During the period between 1990 and 2000, Columbus, Cincinnati and Akron populations grew at 16%, 8.7% and 5.7%, respectively, while Cleveland’s population grew at a mere 2.7% and Youngstown’s population actually contracted by roughly 1%. These figures tell a familiar story about the transition in the United States from a manufacturing economy to a service sector economy. MSAs like Cleveland and Youngstown are driven economically by manufacturing and extraction, while Columbus’ economy is driven by service sector jobs like insurance and banking.

Approximately 70% of our sample comes from the Akron, Cincinnati and Columbus MSAs, while the remaining 30% comes from the Cleveland and Youngstown MSAs. Because our observations of unusual deed types are fairly evenly spread across the MSAs, and because our MSAs vary in strength of housing market, the parameter estimates from our study are probably pretty representative of a “normal” housing market. Future research could use two time periods to compare estimates across strong and weak housing markets.

### **Estimation Issues**

The traditional ordinary least squares (OLS) house price hedonic takes the following form:

$$\ln V_i = X\beta + \epsilon, \epsilon \sim N(0, \sigma^2), \quad (1)$$

where  $V$  is the value of house  $i$ ,  $X$  is the matrix of explanatory variables with parameters  $\beta$  to be estimated, and the error term  $\epsilon$  is assumed to have a zero mean and constant variance  $\sigma^2$ .<sup>2</sup> There is no need to instrument for deed type; the circumstances of the sale determine the deed type for the title company, and buyers cannot upgrade from one deed type to another, so the deed type is exogenous to each buyer. With the included neighborhood characteristics controlling for the influence of omitted variables, a house price hedonic is performed using Equation (1). The results appear in the OLS column of results in Table 3.

Adjusted  $R^2$  for the OLS model of Equation (1) is 0.71. Most of the house and neighborhood controls have the expected sign. With general warranty deeds as the omitted category, many of the other deed types show up as statistically significantly related to sale price.

Many of our deed types have a small number of observations, so outliers may influence the parameter estimates. However, randomly sampling a subset of observations from each of the uncommon deed types shows that the parameter estimates are robust and not influenced by outliers.<sup>1</sup> In 38 of our 40 random subset experiments, the parameter estimate is robust. For the other two experiments, the parameter estimate changes markedly in magnitude and statistical significance (for special warranty and guardian deeds). For both of these deeds, we had three parameter estimates: one for the full sample and two for random draws of the observations. One random draw showed robust results, the other did not. So we took two additional random draws, and each of these additional random draws showed similar parameter estimates to the full sample. Thus, even for these two deed types the parameter estimates are robust, suggesting that our low number of observations is not affecting our parameter estimates.

Despite these reassuring robust findings, our deed types with a small number of observations may not be representative. For example, all 11 of our guardian deeds may unluckily come from the same types of neighborhoods or have some unmeasured house characteristic in common. A larger sample of uncommon deed sales would add confidence to our results, and without a larger sample, we must be careful not to claim that our results extend to the population at large.

With 37,043 housing observations, great precision in parameter estimates is expected. One concern is that deed types with few observations may show up as statistically significant in our sample, when they would not be significant

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<sup>1</sup> Results of our outlier checks are available from the authors.

in a smaller sample. However, even with our large sample, four deed types are statistically insignificant, so a large housing sample does not guarantee statistical significance. A more detailed examination of results is delayed until we reach our preferred estimation approach.

While OLS is the traditional approach, other research suggests that omitted variables bias the parameter estimates. Ries and Somerville (2004) find that by adding fixed-effect dummy variables, their school quality parameter estimate becomes weaker, for example. However, dummy variables are coarse ways of capturing the influence of omitted variables; they fail to capture a myriad of more localized influences on house prices like the presence of parks and abandoned houses. To better capture the influence of omitted variables, we adopt spatial statistics. An intuitive explanation of how spatial statistics addresses omitted variables is found in Brasington and Hite (2005). A mathematical proof is available in Pace and LeSage (2006). A likelihood ratio test for spatial dependence in the residuals of the OLS model of Equation (1) reveals its presence; with a critical chi-squared test statistic of 6.6 at the 1% level, the calculated test statistic of 6,215.7 rejects the null hypothesis of no spatial dependence.<sup>2</sup>

There are two main approaches to modeling spatial dependence. One approach is the spatial autoregressive (SAR) model, which models spatial dependence by including an autoregressive term to the set of explanatory variables. Another approach is the spatial error model (SEM), which models spatial dependence by including an autoregressive term to the errors of the model. We follow Lacombe (2004) to help decide which model is more appropriate for our sample. We perform both SAR and SEM regressions and find that the SEM model captures more spatial dependence than the SAR model.<sup>3</sup> We therefore adopt the SEM model for our hedonic regressions, and we use Delauney triangularization to construct our spatial weight matrix (Pace 2003).

Because we wish to make the most correct inferences possible, we must be wary of heteroskedasticity and outliers. Heteroskedasticity will cause inefficient parameter estimates and invalidate hypothesis testing, and outliers can dramatically alter parameter estimates. White's test rejects the null of homoskedasticity at the 1% level.<sup>4</sup>

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<sup>2</sup> The test is the *L*-ratios test of LeSage (2004), described in LeSage (1999, p. 73).

<sup>3</sup> The spatial parameter from the SAR model is 0.16 with an asymptotic *t* ratio of 89.7, while the spatial parameter from the SEM model is 0.56 with an asymptotic *t* ratio of 334.29. In addition, the explanatory power of the SEM model exceeds that of the SAR model; adjusted  $R^2$  is 0.71 for SAR and 0.78 for SEM.

<sup>4</sup> The calculated chi-square test statistic is 1,525.9.

Anselin (1988) suggests a heteroskedasticity correction for maximum likelihood spatial routines, but there are many reasons to favor a spatial Bayesian SEM model instead (LeSage 1999, p. 141). A Bayesian model does not require a restrictive specification for the heteroskedastic disturbance term. Bayesian models are more robust to outliers than maximum likelihood. Maximum likelihood methods require normally distributed errors, which may be an erroneous assumption. And although the Bayesian approach uses conditional distributions in its sampling methodology, with a large sample of draws it converges in the limit to the true joint posterior distributions of the parameters.

The Bayesian spatial error model is that of LeSage (1997).

$$\begin{aligned}
 V_i &= X\beta + \epsilon \\
 \epsilon &= \lambda W \epsilon + \mu, \quad \mu \sim N(0, \sigma^2 V) \\
 V &= \begin{bmatrix} v_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & v_n \end{bmatrix} \tag{2} \\
 \frac{r}{v_i} &\sim \frac{x^2(r)}{r} \\
 \frac{1}{\sigma^2} &\sim \Gamma(\eta, \delta).
 \end{aligned}$$

A big difference between Bayesian and non-Bayesian estimation is the use of prior information. We allow diffuse priors for  $\lambda$ ,  $\beta$  and  $\sigma^2$ .<sup>5</sup> Ordinarily, the term  $r$  in Equation (2) would be distributed gamma with two parameters. Instead, following LeSage (1999, p. 121), we set  $r = 4$  as our informative prior on  $v_i$ . This particular prior yields relatively constant estimates of  $v_i$  in the presence of homoskedasticity, while at the same time accommodating nonconstant error variances in the presence of heteroskedasticity and outliers.<sup>6</sup> The computational tricks of Barry and Pace (1999) and Pace and Barry (1998) must be used to allow the large sample to run in a reasonable amount of time.

The Bayesian spatial error model in Equation (2) depends on having a large number of draws to converge to the true joint posterior distribution of the parameters. If you don't have enough draws, you can't trust your parameter estimates. Although convergence diagnostics are available, the true test of

<sup>5</sup> With a diffuse prior for  $\sigma^2$ ,  $\eta$  and  $\delta$ , which determine the mean and variance of  $\sigma^2$  in the gamma distribution, are set to zero.

<sup>6</sup> An alternative is to set the two parameters of the gamma distribution for  $r$  to the informative priors of 8 and 2. Nearly identical estimates are achieved either way.

convergence is when the estimates do not change with added draws. We run a model with 300 draws (with 30 additional burn-in draws) and a model with 1,000 draws (with 100 additional burn-in draws) and achieve similar results, suggesting that 300 draws are sufficient.

Our results in Table 3 show that adjusted  $R^2$  rises from 0.71 in the OLS model to 0.77 in the Bayesian model. The results show a 0.49 estimate for our spatial error lag parameter, suggesting fairly high error correlation across space. Going from OLS to the Bayesian SEM model makes *ADMINISTRATOR'S DEED* become statistically significant, makes *PATIO* and *AIR POLLUTION* lose their significance, makes the *BEDROOMS* and *SURVIVORSHIP DEED* parameter estimates larger, makes the *ONESTORY*, *PARTBATHS* and *FINISHED BASEMENT* parameter estimates smaller and changes the relationship between a house's age and its price. The remaining parameter estimates change little. Having settled on our theoretically preferred econometric model, we are ready to interpret the key parameter estimates in the Bayesian spatial error model column of Table 3.

### Deed Type Estimation Results

Our omitted deed category, the general warranty deed, represents a typical sale as houses selling with that deed comprise 70% of our sample. With the exception of houses selling with a survivorship deed, which command a 1.4% premium over those selling with a general warranty deed, houses selling with alternative deed types sell at a discount compared to the typical sales. With a mean house price of 145,685, the 1.4% premium for survivorship deeds translates to almost \$2,040. The survivorship deed is one in which a joint tenant maintains ownership rights following the death of another joint tenant. Title companies often opt to use this deed over a general warranty deed when a couple is purchasing a property. The 1.4% premium may reflect the ease of selling a house with a survivorship deed. Under a general warranty deed, if two divorcees marry, if there are stepchildren and if one spouse dies, a buyer may have to negotiate a sale price with the widow and her stepchildren. A survivorship deed makes it clear that the widow has sole ownership and sole authority to negotiate a sale price. As an alternative explanation, if we assume that singles and couples are bidding for the same houses and that a couple constitutes dual salaries, then the 1.4% premium may be associated with the ability of the dual salary couple to outbid the singles.

Three deed types have insignificant parameter estimates, implying that we cannot reject the null hypothesis that houses with these types of deeds sell for the same price as houses with general warranty deeds. These three types are execution deeds, trustee's deeds and final distribution deeds.

**Table 3** ■ Regression results.

Dependent variable is <i>LN HOUSE PRICE</i>			
Explanatory Variable	OLS	Bayesian Spatial Error Model	Bayesian SEM w/o Deeds
<i>EXECUTION DEED</i>	-0.030 (0.35)	-0.015 (0.23)	-
<i>ADMINISTRATOR'S DEED</i> <sup>ψ</sup>	-0.13 (1.30)	-0.16* (2.00)	-
<i>CORPORATION DEED</i>	-0.11** (3.45)	-0.11** (3.93)	-
<i>EXECUTOR'S DEED</i>	-0.085** (5.68)	-0.078** (6.53)	-
<i>QUIT CLAIM DEED</i>	-0.48** (29.80)	-0.51** (27.60)	-
<i>SHERIFF'S DEED</i>	-0.34** (15.77)	-0.31** (17.63)	-
<i>TRUSTEE'S DEED</i>	-0.001 (0.023)	-0.034 (0.85)	-
<i>FINAL DIST DEED</i>	-0.0089 (0.14)	-0.018 (0.28)	-
<i>SURVIVORSHIP DEED</i>	0.0052* (1.38)	0.014** (4.35)	-
<i>FIDUCIARY COVENANT</i>	-0.098** (7.77)	-0.090** (7.89)	-
<i>GUARDIAN DEED</i> <sup>ψ</sup>	-0.21* (2.35)	-0.27** (3.33)	-
<i>SPECIAL WARRANTY DEED</i> <sup>ψ</sup>	-0.17* (2.39)	-0.14** (2.51)	-
<i>LIMITED WARRANTY DEED</i>	-0.17** (6.78)	-0.19** (7.45)	-
<i>FORECLOSURE DEED</i>	-0.32** (9.49)	-0.36** (11.37)	-
<i>ONESTORY</i>	0.058** (14.42)	0.037** (9.43)	0.035** (8.81)
<i>BRICK</i>	0.025** (7.08)	0.031** (9.00)	0.030** (9.84)
<i>FINISHED BASEMENT</i>	0.034** (5.85)	0.015** (2.67)	0.017** (2.84)
<i>GARAGE</i>	0.098** (27.5)	0.066** (16.27)	0.067** (16.73)
<i>FIREPLACES</i>	0.10** (30.65)	0.068** (21.71)	0.069** (21.57)
<i>OUTBUILDINGS</i>	0.049** (2.75)	0.050** (3.06)	0.056** (3.63)
<i>BEDROOMS</i>	0.0039* (1.39)	0.0084** (3.62)	0.0080** (2.96)
<i>FULLBATHS</i>	0.059** (16.04)	0.046** (13.03)	0.048** (13.23)

Table 3 ■ continued

Dependent variable is <i>LN HOUSE PRICE</i>			
Explanatory Variable	OLS	Bayesian Spatial Error Model	Bayesian SEM w/o Deeds
<i>PARTBATHS</i>	0.058** (15.80)	0.038** (12.95)	0.039** (11.79)
<i>AGE</i>	-0.36** (20.34)	-0.61** (32.83)	-0.61** (31.94)
<i>AGE SQUARED</i>	0.12** (8.79)	0.27** (18.82)	0.27** (17.77)
<i>HOUSE SIZE</i>	0.45** (53.43)	0.39** (44.95)	0.39** (44.59)
<i>HOUSE SIZE SQUARED</i>	-0.020** (14.54)	-0.017** (11.33)	-0.017** (11.03)
<i>YARD SIZE</i>	0.040** (29.11)	0.047** (24.92)	0.045** (23.98)
<i>YARD SIZE SQUARED</i>	-0.00019** (18.54)	-0.00023** (15.97)	-0.00022** (16.06)
<i>PATIO</i>	-0.023** (4.22)	-0.0039 (0.75)	-0.0036 (0.74)
<i>DECK</i>	0.027** (5.41)	0.029** (7.08)	0.032** (7.06)
<i>BAD SCHOOL</i>	-0.0051** (25.50)	-0.0055** (19.04)	-0.0054** (19.48)
<i>SINGLE PARENTS</i>	-0.0044** (8.85)	-0.0050** (6.92)	-0.0050** (6.82)
<i>HOT MARKET</i>	0.033** (6.64)	0.026** (4.31)	0.027** (4.28)
<i>TAX RATE</i>	0.0025** (7.80)	0.0030** (6.61)	0.0031** (6.76)
<i>AIR POLLUTION</i>	-0.00088* (2.00)	-0.000034 (0.06)	-0.00009 (0.14)
<i>RACIAL HETEROGENEITY</i>	-0.26** (15.34)	-0.22** (9.28)	-0.22** (9.45)
<i>POLICE PROTECTION</i>	0.0017** (14.46)	0.0014** (8.47)	0.0014** (9.02)
<i>CONSTANT</i>	11.00** (604.64)	11.23** (498.15)	11.22** (497.17)
Spatial error parameter $\lambda$	-	0.49** (99.59)	0.48** (253.39)
Adjusted $R^2$	0.71	0.77	0.76

Number of observations = 37,043 housing transactions. Parameter estimates shown with absolute value of (asymptotic) t ratios in parentheses below. \*\*Statistically significant at the 1% level. \*Statistically significant at the 10% level.  $\psi$  Results are based on a particularly small number of observations and may not be representative of population as a whole. *GENERAL WARRANTY DEED* is the omitted deed category.

The remaining ten deed types are associated with lower house prices, all else constant. Some discounts may be attributed to a level of urgency associated with selling a house, and other discounts reflect the condition of the house at time of sale. In cases where the typical market mechanism does not allocate the assets, such as foreclosure auctions and sheriff's sales, suboptimal mechanism design may be responsible for the houses selling at a discount.

The largest discount (51%) is attached to houses with quit claim deeds. Quit claim deeds do not state the nature of the rights conveyed in a transaction and provide no warranties of ownership. These deeds merely convey the grantor's rights or interests in the real estate. Some houses sold with quit claim deeds have title problems, indicating a higher chance of previous claimants surfacing. But there are many circumstances under which quit claim deeds are issued. Because of the ease with which they are issued, family members may sell property to each other using quit claim deeds (Hite 2005). We attempted to eliminate such sales by requiring houses in our sample to sell for at least \$30,000, but some within-family sales may remain. Furthermore, our data are not rich enough to enable us to rule out all fractional transfers of property. A large percentage of the quit claim deed observations may be fractional sales.

The second largest discount is for houses with foreclosure deeds (36%). A foreclosure occurs when the owner defaults on the mortgage and the lender acquires ownership rights to the property. The lender then sells the asset quickly, usually by auction. As a result, the property sells for a discount compared to what it would have sold for had it been left on the market longer. However, given the average time a house spends on the market, the time-value-of-money argument does not fully explain the 36% discount. Typically, when houses are sold the sellers paint the house and do other things to make it look nice for prospective buyers. Houses in foreclosure are not generally prepped for sale, and the occupants have little incentive to care for the house if they are about to be evicted, so part of the discount for foreclosure deeds may reflect the condition of the house. A house may be in foreclosure for up to six months before it is put up for auction. During this time, the owner may sell his property to a buyer who is willing to pay the back mortgage plus a portion of the value of the house. Even though the original owner will not receive the full value of the house, it is better than being evicted and getting nothing for the house, and the sale price will reflect the discount. Finally, the discount may reflect a poorly designed auction mechanism, which is discussed below.

The 36% discount for foreclosure deeds is followed closely in magnitude by the 31% discount for sheriff's deeds. It is important to note that in Ohio, the state in which our sample was drawn, only judicial foreclosures are allowed. Judicial foreclosures conclude with the conveyance of a sheriff's deed to the highest

bidder in the sheriff's auction. We have reason to believe that the sheriff's deed and the foreclosure deed are analogous in our sample. A sheriff's deed is issued when a court orders the conveyance of a property to comply with a judgment. Typically, in states in which the nonjudicial foreclosure is allowed, sheriff's deeds result from nonpayment of property taxes, but in Ohio they are used as part of the judicial foreclosure process. As in the foreclosure case, seller urgency helps explain the discount: local governments have no interest in owning private residences, and they want to avoid having abandoned properties in their jurisdictions. The seized houses are sold at a discount at government auctions instead of waiting for a higher offer at some undetermined future date. While part of the discount reflects seller motivation, part of the discount reflects the condition of the house. As with foreclosure deed sales, occupants about to be evicted for failure to pay property taxes have little incentive to maintain the house or prep it for sale. Property taxes are sometimes paid as part of a mortgage payment. An elderly owner who has paid off her mortgage may fail to pay her taxes because of hospitalization and medical bills. Such an owner may have neglected upkeep on her house during her hospitalization. The discount also reflects the fact that the delinquent taxes must be paid when the house is purchased.

The condition of the house, delinquent taxes and financing issues help account for the discounted sale price of houses at foreclosure and sheriff's auctions. However, some of the 31% and 36% discounts may stem from auction design flaws. Foreclosure auctions and sheriff's sales may not be revenue-maximizing mechanisms. Under some fairly general assumptions about the independence of bidders' values and auction rules, Riley and Samuelson (1981) show that the seller's revenue is maximized if an appropriate reserve price is chosen and announced. In the case of foreclosure and sheriff's auctions, the reserve price may not always be set high enough, so that bidders may be able to snap up a real bargain in thin auctions. For example, in the foreclosure process in Ohio requires that the courts obtain three property appraisals before the sheriff's sale can occur. The court then takes two-thirds of the average of the appraisals as the reserve price at the auction. It may be the case that the "two-thirds rule" is not revenue maximizing, but rather that the reserve price should fluctuate between sales based on the characteristics of the property being sold and the condition of the local housing market at the time.

Guardian deed sales only appear 11 times in our sample. These 11 observations may be unrepresentative of the population of guardian deeds as a whole. We cannot say with much confidence, then, that guardian deed sales command a 27% discount, that the typical house would sell for nearly \$39,335 more if it had a general warranty deed rather than a guardian deed. We must therefore limit most of our discussion to theorizing. If a larger sample were to show a similar

discount to the ones in our study, we might say that seller motivation plays a role with guardian deeds. A guardian deed is used to convey the property of an infant or incompetent. As an example, a minor may reach the predetermined age of conveyance of the property and need the monetary value of the asset rather than the physical value, perhaps to pay for college. This situation would merit a quick sale of the house. A guardian may sell the house quickly to pay for his elderly ward's medical bills or legal bills from an unexpected lawsuit. Guardian deed discounts may also reflect a principal-agent problem: guardians don't get paid any more for selling the house for a high price, and therefore they may wish to sell as quickly as possible to minimize the amount of time they have to spend selling the property. We return to this important issue later. Although our 27% discount is robust to resampling, in the end we have only 11 guardian deeds in our sample upon which to base our findings, so we await further research to see if guardian deeds really command a discount.

The next highest discounts belong to houses with limited warranty deeds (19%), administrator's deeds (16%) and (perhaps) special warranty deeds (14%). In both the limited and special warranty deeds, the buyer of the house typically relies on title insurance for protection. The limited warranty is often used for commercial transactions when the seller cannot guarantee the entire history of the title. It can also be used for the settlement of a debt or for a foreclosed property. The special warranty deed requires the grantor to defend title against claims of only those related to the grantor in the same way. This means that only claims brought by the grantee and those claiming under him are guaranteed to be defended by the grantor. However, the discussion of title insurance that follows this section explains why this added title risk is an incomplete explanation for the \$27,680 discount for limited warranty deed sales. If the parameter estimate is to be believed, the discount for special warranty deed sales would be \$20,396, but there are only 18 such sales in our data set. The result is robust to resampling, but all 18 observations may be unrepresentative of special warranty deeds as a whole. We therefore await future research to see if special and limited warranty deeds are as similar in their discounts as they are in their definitions.

An administrator's deed is used to convey the property of a person who dies without a will. The results show a 16% discount for such houses, and the result is robust across observations. These results, however, are based on only nine observations, so that we cannot make any claim that our results extend to the population of administrator's deeds. With a larger number of administrator deed observations, the discount may drop from 16% to the 8% seen for executor deed sales, as both of these situations involve fiduciary responsibilities.

Houses sold with corporation deeds sell for an 11% discount relative to general warranty deeds. If a corporation relocates an employee, it may buy the

employee's house at market price to speed the employee's relocation. But having no interest in holding real estate, the corporation sells the property quickly at a discount, possibly to another employee new to the area. Corporation deeds are also used by some real estate development companies to convey title to buyers of new houses. However, in an unreported regression, we find that it is the used houses that have a discount for corporation deeds; new houses with corporation deeds do not have the discount, which supports the employee relocation explanation.

The smallest discounts belong to houses with fiduciary covenants (9%) and executor's deeds (8%). A fiduciary covenant, unlike a general warranty deed, does not specifically and absolutely provide warranty for all claims against the title. An executor's deed conveys the property of one who has died with a will. This is similar to the administrator's deed in that the grantor is now dead. However, unlike an administrator's deed, an executor's deed is issued when the deceased has a will. The presence of a will decreases the probability of costly legal battles among heirs for the property, so the 8% discount may be attributed to the fact that the house has not been prepped for sale. Administrator deed sales were not prepped for sale, either. Therefore, the 8% difference between the 16% discount for administrator's deeds and the 8% discount for executor deeds may be attributable to the higher probability of heirs' legal battles when a house is sold by a person without a will.

Guardian deeds and administrator deeds are rare in our sample, so our 27% and 16% discounts may not be representative of guardian and administrator deeds as a whole. If future work shows a larger discount for guardian deeds than administrator deeds, we can theorize on why this might be. Guardian deeds and administrator's deeds are both issued when counsel sells a house on behalf of the owner. It takes effort to keep a house on the market and sell for the highest price possible, and yet counsel gets paid the same regardless of how much the house is sold for. One might expect it would be more difficult for a lawyer to short change his client with a low effort, cheap sale for a house with a living client than a dead client, and yet guardian deeds may have a larger discount than administrator's deeds. If this result holds up under larger samples, it may point to a principal-agent problem between the incompetent ward and his lawyer. On the other hand, if future research shows a smaller discount for guardian deed sales than administrator deed sales, it may suggest counsel is especially keen to look out for the interests of underage and incapacitated clients.

### **Implications of Title Insurance**

The state of Ohio regulates the price of title insurance. Title insurance companies cannot charge higher rates for higher risk properties. A minimal title

insurance policy covers liens from a previous owner, problems with legal access to the house, undisclosed heirs, competing ownership claims, fraud and forgery and public record errors, and it costs \$5.75 per thousand dollars for properties under \$150,000. The rate is graduated above \$150,000, so that a minimal policy costs less than 0.575% of the value of the property. A maximal policy covering a broader range of potential title defects such as improper building permits, zoning violations and encroachment issues costs 15% more than the minimal policy. This means that a maximal policy costs approximately \$6.61 per thousand dollars for properties under \$150,000 and is graduated like the minimal policy. Thus, a maximal policy costs less than 0.661% of the value of the property, or \$1,121.25 for a \$175,000 house. The relatively low cost of title insurance, and the fact that title insurance rates are the same for all houses, suggests that the discounts we find for houses with various deed types are not driven by the cost of title insurance. With cheap title insurance available, title risk often plays a small role in house price determination. This is not to say that title insurance can always be purchased regardless of the level of title risk. There are cases in which the purchase of a title insurance policy may be refused due to certain irresolvable title defects. In these cases, the property either will not be sold or it will go through the subprime lending channels.

### Implications of Omitting Deed Types

House price hedonic studies are published fairly often by economists and real estate researchers. The preceding analysis suggests that the type of deed associated with a house can have a dramatic effect on the price it sells for, either because of the type of deed itself or because the type of deed signals something about the quality of the house or the motivation level of the seller. A failure to include deed type in house price hedonics may cause biased parameter estimates and incorrect inference about parameters of public policy interest, such as police services, school quality or environmental quality. The Bayesian spatial error model is performed again, this time omitting information on deed type.

The “Bayesian SEM w/o Deeds” column of Table 3 suggests that excluding deed types does not appreciably alter any parameter estimates. Many parameter estimates are completely unchanged, in fact.<sup>7</sup> So the exclusion of deed type information seems not to hurt inferences made from house price hedonics. On the other hand, including deed types adds information and thereby shifts the

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<sup>7</sup> House sales with nonwarranty deeds may be most affected by the exclusion of deed type information. We performed OLS house price hedonics with and without deed type for the 10,716 sales with nonwarranty deeds, but we found few changes even with this sample. Adjusted  $R^2$  rose from 0.71 to 0.74, *AIR POLLUTION* lost its significance, and *TAX RATE* became significant when deed types were added to this sample.

constant term, which is important for predicting house prices and certain other applications.

### **The Influence of Deed Types on Mortgage Interest Rates**

Deed types are determined by the circumstances surrounding the sale of a house. People who tend to buy houses in certain circumstances may have better credit ratings than other people, or they may shop around for better mortgage interest rates. And for houses for which title companies refuse to offer title insurance, buyers may need to turn to subprime lending institutions and pay higher interest rates. We regress mortgage interest rates as a function of deed types and control for the mortgage amount, frequency of mortgage payments, racial heterogeneity of the neighborhood, size of the house and quality of public schooling. The results are shown in Table 4.

Of the 37,043 houses with deed types, only 4,893 have the necessary mortgage data. While our data limit us from doing an exhaustive study of this issue, we conclude that there appears to be a relationship between certain deed types and mortgage rates.

We find higher mortgage interest rates for houses in racially heterogeneous neighborhoods. We also find higher mortgage interest rates for houses in underperforming school districts. In contrast, we find lower interest rates for larger houses. If people with good credit buy larger houses than people with bad credit, then house size serves as a proxy for credit risk, which would explain our finding of more favorable interest rates for buyers of large houses. But if house size proxies for credit risk, then, holding credit risk constant, we still find higher interest rates being charged in racially heterogeneous neighborhoods. However, these claims cannot be substantiated without a better measure of credit risk for each house buyer. The results may simply suggest that people who live in racially heterogeneous neighborhoods buy houses that do not qualify for title insurance, or that such people do not shop carefully for low mortgage rates. It surely does not indicate a violation of the Fair Housing Act.

Survivorship deeds have lower interest rates and special warranty deeds have higher interest rates than general warranty deeds. However, sheriff's and foreclosure deeds have lower interest rates than general warranty deeds. This somewhat surprising result suggests that buyers at foreclosure and sheriff's auctions are more sophisticated than the typical buyer. Many of the leads for lenders of these mortgages come from the internet, suggesting that these buyers know how to shop around for the lowest mortgage rate. Such savvy buyers also are likely to be good credit risks, which also helps to explain the lower interest rates. These savvy buyers may in fact be investors who plan to flip the house or rent it out, rather than individuals who purchase a house to be owner-occupiers.

**Table 4** ■ Interest rates and deed types.

Dependent variable is <i>MORTGAGE RATE</i>		
Explanatory Variable	Variable Means (Standard Deviation)	OLS Results
<i>CONSTANT</i>	1.0 (0.0)	8.74** (79.11)
<i>RACIAL HETEROGENEITY</i>	0.09 (0.09)	1.88** (7.48)
<i>MORTGAGE AMOUNT</i>	150.05 (108.62)	-0.002** (4.78)
<i>MORTGAGE FREQUENCY</i>	2.55 (2.49)	-0.124** (7.79)
<i>BAD SCHOOL</i>	34.155 (12.48)	0.024** (11.58)
<i>HOUSE SIZE</i>	1.95 (0.91)	-0.222** (5.11)
<i>CORPORATION DEED</i>	0.001 (0.032)	-0.731 (1.43)
<i>EXECUTION DEED</i>	0.0004 (0.02)	0.398 (0.54)
<i>EXECUTORS DEED</i>	0.009 (0.0965)	-0.069 (0.22)
<i>FIDUCIARY COVENANT</i>	0.016 (0.124)	0.068 (0.42)
<i>FINAL DIST DEED</i>	0.00061 (0.025)	0.089 (0.15)
<i>FORECLOSURE</i>	0.0002 (0.014)	-1.345** (20.47)
<i>GUARDIAN DEED</i> <sup>ψ</sup>	0.00061 (0.025)	0.482 (1.07)
<i>LIMITED WARRANTY DEED</i>	0.004 (0.065)	0.063 (0.26)
<i>QUITCLAIM DEED</i>	0.006 (0.078)	0.323 (1.26)
<i>SHERIFF'S DEED</i>	0.003 (0.059)	-0.579* (2.35)
<i>SURVIVORSHIP DEED</i>	0.289 (0.45)	-0.230** (4.54)
<i>SPECIAL WARRANTY DEED</i> <sup>ψ</sup>	0.0002 (0.014)	1.221** (33.61)
<i>TRUSTEE'S DEED</i>	0.0014 (0.038)	0.560 (1.01)

Parameter estimates shown with absolute value of t ratios in parentheses below.

\*\*Statistically significant at the 1% level. \*Statistically significant at the 10% level.

<sup>ψ</sup>Results are based on a particularly small number of observations and may not be representative of population as a whole. *GENERAL WARRANTY DEED* is the omitted deed category. Number of observations = 4,893. Adjusted  $R^2 = 0.20$ .

**Table 5** ■ Premium or discount for house sales with each deed type, relative to general warranty deed.

Survivorship deed	+1%
General warranty deed	0%
Execution deed	0%
Trustee's deed	0%
Final distribution deed	0%
Executor's deed	-8%
Fiduciary covenant	-9%
Corporation deed	-11%
Special warranty deed <sup>ψ</sup>	-14%
Administrator's deed <sup>ψ</sup>	-16%
Limited warranty deed	-19%
Guardian deed <sup>ψ</sup>	-27%
Sheriff's deed	-31%
Foreclosure deed	-36%
Quit claim deed	-51%

<sup>ψ</sup>Results are based on a particularly small number of observations and may not be representative of population as a whole.

## Conclusion

Houses can sell for a much different amount depending on the type of deed. The difference in sale price can reach 52.4%. The cost of title insurance is set by the state, costs less than 1% of house value and does not vary by deed type, so the difference in price is driven by something other than title insurance. The most common type of deed is a general warranty deed. The premium or discount for the average house selling with each deed type is summarized in Table 5.

Some of the discounts reflect motivated sellers who are willing to get rid of the house without waiting for a higher bidder, such as an administrator's deed. An administrator's deed is given when someone dies without a will, so the seller motivation may stem from having less than perfectly guaranteed property rights. The 26% discount for guardian deed sales cannot be called a general finding, because it is based on 11 observations. The discounts for foreclosure and sheriff's deed sales reflect motivated sellers, but they also may reflect suboptimal auction reserve price.

Property tax assessors and automated valuation models can obtain a more reliable estimate of the underlying value of a house by factoring in the type of deed. For example, the discount for a corporation deed may stem from unique seller motives and not from the structural condition of the house. So houses with corporation deeds may be worth about 11% more than the sale price of the

house, which affects property tax collections. States like California assess taxes based on the sale price of a home. Sales of houses with deeds that command a discount are underassessed in states like California, and we can estimate the extent of the tax revenue loss for such states using our Ohio data. If assessment in Ohio were based on sale price like it is in California, Ohio would have undercollected \$60,680,570 in property taxes in 2000 for houses whose deed types command a discount.<sup>8</sup> This is enough money to pay the salaries of all the teachers in the Dayton City School District.<sup>9</sup>

States like Ohio that use comparable house sales for assessment also improperly estimate house value if some of the comparable house sales have nontraditional deed types. In our sample, 30% of houses are sold with something other than general warranty deeds. So if houses are assessed based on the nearest ten comparable sales, three of these ten comparable houses will have sale prices that do not accurately reflect the structural value of the house, causing the assessed value of the house to be improperly estimated. In addition to the guidance this study provides to local governments, it also provides guidance to real estate agents: all else equal, commissions are 19% larger for houses that sell with general warranty deeds than for houses that sell with limited warranty deeds.

We investigate whether there is a relationship between deed types and mortgage interest rates. Our analysis suggests that only special warranty deeds have significantly higher interest rates. In fact, sheriff's deeds and foreclosure deeds have lower interest rates than general warranty deeds—perhaps indicating more sophisticated or institutional buyers.

Additional work could investigate the discount or premium for sale of houses by banks or between family members (Hite 2005). House price hedonics often omit information about the physical condition of a house, leaving parameter estimates open to omitted variable bias. Deed type information could be included in house price hedonics to capture the condition of a house, but we find parameter estimates are robust to the exclusion of this information.

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<sup>8</sup> These calculations assume the discounts reflect seller motivation and uncertainty of title. It also assumes that the distribution of deed types in our sample is representative of the state. The dollar figures are based on the average effective millage rate in 2000 of 49.81 and the \$119,281,000,000 of assessed residential property value in 2000.

<sup>9</sup> The 2000–2001 pupil–teacher ratio for Dayton City School District is 15.1, and average daily enrollment is 20,586, which implies that there are 1,363 teachers. Average teacher salary in Dayton is \$41,860, so Dayton spent \$57,068,209 on teacher salaries, less than the \$60,680,570 by which Ohio would have undercollected tax revenues.

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