

Money Illusion and Residential Real Estate Transfers

James E. Larsen*

Abstract. This paper reports the results of a study of single-family, detached home transfers, conducted to determine if rational expectations holds as a function of owner-tenure. A counter-rational expectations notion, which has intuitive appeal, is that sellers with relatively long owner-tenure may be more willing to accept "low" offers compared to sellers with short owner-tenure. The study supports this notion. Owner-tenure is found to be significantly related to the real profit realized by sellers. This implies that rational expectations does not hold as a function of owner-tenure and that owner-tenure is a relevant factor for buyers to consider in formulating a purchase offer.

Introduction

Those that hold the rational expectations view assert that economic behavior is based on real rather than nominal values. Such rational behavior is possible only if the market participants are free of money illusion. When one is not free of money illusion economic behavior is based on nominal values. Market participants subject to money illusion think themselves better off than they really are simply because they have more money, ignoring the fact that price levels have increased so as to erode (or even decrease) their purchasing power. The rational expectations theory has been used to test for the degree of efficiency in various segments of our economy. For example, in securities markets the theory has been applied to test how well market participants use information to estimate future conditions and price financial assets.¹ This study applies the theory in a retroactive manner to real assets.

Real estate markets offer an interesting venue to test for rational expectations. The opportunity for homeowners to fall victim to money illusion is certainly present. This can be demonstrated with a hypothetical example. Let us say there are two identical properties for sale, each property is listed with a broker at \$100,000. Assume property *N* was acquired by its present owner two years ago at a price of \$92,500, while property *O* was acquired by its present owner fifteen years ago for \$50,000. Each owner receives an offer of \$95,000. If neither owner is under any pressure to sell, the owner of property *N* is more likely to reject the offer than is the owner of property *O* because he can readily calculate that after paying the brokerage commission he will lose money if he accepts the offer. While the owner of property *O* may be just as unhappy as the owner of property *N* with what each considers to

*Department of Finance, Insurance and Real Estate, Wright State University, Dayton, Ohio 45435.
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be a low offer, the fact that owner *O* acquired the property long ago at a low price, by today's standards, allows him to rationalize acceptance of the offer. The profit that property owner *O* uses in this rationalization is likely to be in nominal, rather than inflation adjusted, or real terms.² In fact, it is possible that the offer is less than what the owner paid for the property in real terms, i.e., he will incur a loss of purchasing power by accepting the \$95,000.

The above example has intuitive appeal and illustrates a view held by some, that buyers may find sellers with relatively long owner-tenure more willing to accept "low" offers compared to sellers with short owner-tenure. If this view is true, rational expectations does not hold with respect to owner-tenure, and knowledge of owner-tenure would be an important piece of information for potential buyers to incorporate in formulating a purchase offer. A review of the literature indicates that this topic has not been the subject of previous formal research. At least no published studies on this subject were discovered.

This paper reports the results of a test to determine whether rational expectations holds as a function of owner-tenure in the single-family, detached home market. A multiple regression model is employed. It is found that, *ceteris paribus*, owner-tenure is significantly related to the real profit realized by sellers. This implies that rational expectations does not hold in the market, and therefore, that owner-tenure does appear to be a relevant factor for buyers to consider in formulating a purchase offer.

The balance of this paper is organized as follows. The data is discussed in the second section. In the third section the methodology and results are presented. A summary and conclusions are presented in the last section.

Data

The data used in this study was secured from the Dayton, Ohio Multiple Listing Service (MLS) and the office of the Greene County, Ohio Tax Assessor. The sample consists of 144 transfers of detached single-family homes sold in Greene County, Ohio between August 1, 1987 and January 31, 1988. A total of 605 homes in Greene County were sold through the MLS during this period.

Transactions were eliminated from the larger sample for two reasons. First, most of the excluded transactions were eliminated because of missing, or confusing, property characteristic information on the listing sheet. Second, many transactions were deleted because the transfer that preceded the most recent sale was evidenced by a special purpose deed such as a gift deed. Transfers where a person acquired an (increased) interest in a property due, for example, to a divorce, or where an interest in property is acquired by inheritance result in a seller with an artificially low basis that may distort the test results.

A statistical summary of the transactions included in the study is shown in Exhibit 1.

Methodology and Results

A multiple regression model is employed to test the following null hypothesis.

H_0 : The real profit realized by the seller is unrelated to the amount of time the seller has owned the property, *ceteris paribus*.

Real profit is defined as the ratio of deflated selling price and acquisition price. The selling price was deflated by multiplying it by the ratio of the Consumer Price Index at the

Exhibit 1
Summary of Included Transactions

item	Mean Value	Standard Deviation	Minimum Value	Maximum Value
Selling price	76,433	33,033	25,900	190,000
Lot size (sq. ft.)	28,614	97,821	5,478	1,090,000
Bedrooms	3.333	.757	2.0	6.0
Bathrooms	1.861	.673	1.0	4.0
Garage places	1.569	.676	0	3
Structure age	27.007	18.280	2.0	104.0
Tenure	6.637	3.590	0.75	13.92
Central air*	0.563	0.498	0	1
Fireplace*	0.667	0.473	0	1

*Dummy variables equal to one if property had characteristic, equal to zero otherwise.

month of acquisition and the Consumer Price Index that prevailed two months prior to the month in which a purchase offer was accepted. Both of these values were observable at the time the offer was accepted.

To reduce specification error in the model, tests were conducted to determine both the correct functional form of the regression equation and for homoskedasticity of the error term.³ The first step in our methodology was to test the following equation for functional form.

$$\begin{aligned}
 RP = & \beta_0 + \beta_1 \text{Tenure} + \beta_2 \text{Lot} + \beta_3 \text{Age} + \beta_4 \text{Conv} \\
 & + \sum_{i=5}^7 (\beta_i \text{Bed}_i) + \sum_{i=8}^{11} (\beta_i \text{Bath}_i) + \sum_{i=12}^{14} (\beta_i \text{Gar}_i) \\
 & + \beta_{15} \text{Air} + \beta_{16} \text{Fire} + \sum_{i=17}^{22} (\beta_i \text{Area}_i) + \epsilon
 \end{aligned} \tag{1}$$

where:

- RP = the real profit realized by the seller,
- β_0 = the intercept,
- β_i = the coefficients,
- $Tenure$ = the time the seller has owned the property,
- Lot = the size of the lot in square feet,
- Age = the age of the structure in years,
- $Conv$ = a dummy variable equal to one if disposition of the property was financed with a conventional mortgage, equal to zero otherwise,⁴
- Bed = a dummy variable equal to one if the house had two bedrooms, four bedrooms, or five or more bedrooms, respectively, equal to zero otherwise,⁵
- $Bath$ = a dummy variable equal to one if the house had more than one but less than two full bathrooms, two bathrooms, more than two but less than three full bathrooms, three or more than three full bathrooms, respectively, equal to zero otherwise,⁶
- Gar = a dummy variable equal to one if the house had no garage, a garage with one car place, or three or more car places, respectively, equal to zero otherwise,⁷
- Air = a dummy variable equal to one if the house had central air conditioning, equal to zero otherwise,

Fire = a dummy variable equal to one if the house had a fireplace, equal to zero otherwise,

Area = a dummy variable equal to one if the property is located in a particular area of the county as defined by the MLS, equal to zero otherwise, and

ϵ = the error term.

The extended Box-Cox [4] form where both the dependent and all positive value (i.e., non-dummy) independent variables are transformed by the same power transformation was utilized.⁸ Therefore, equation (1) becomes:

$$\begin{aligned} \ln(RP) = & \beta_0 + \beta_1 \ln(Tenure) + \beta_2 \ln(Lot) + \beta_3 \ln(Age) \\ & + \beta_4 Conv + \sum_{i=5}^7 (\beta_i Bed_i) + \sum_{i=8}^{11} (\beta_i Bath_i) \\ & + \sum_{i=12}^{14} (\beta_i Gar_i) + \beta_{15} Air + \beta_{16} Fire \\ & + \sum_{i=17}^{22} (\beta_i Area_i) + \epsilon, \end{aligned}$$

where:

\ln = the natural logarithm.

Equation (2) was estimated and the Goldfeld–Quandt [7] test was conducted on the continuous independent variables; $\ln(Lot)$, $\ln(Age)$ and $\ln(Tenure)$, to determine if the error terms were homoskedastic. The results of the test indicate that all three continuous variables introduce heteroskedasticity.⁹ Therefore, equation (2) was estimated using generalized least squares regression (GLS).¹⁰

The sign of, and significance level for, the estimated coefficient for the explanatory variable representing owner-tenure, $\ln(Tenure)$, is used to evaluate the null hypothesis posed above. An insignificant relationship between the real profit and owner-tenure would indicate that the null hypothesis cannot be rejected. Such a finding would be evidence that sellers are not subject to money illusion which is consistent with the rational expectations theory. A finding of a significant, negative relationship between real profit and owner-tenure would result in rejection of the null hypothesis. Such a finding would indicate that the longer the owner-tenure of the seller the lower the real profit he or she realizes. This would be consistent with the counter-rational expectations theory.

There is no a priori reason to expect a particular sign on the remainder of the explanatory variables, and no interpretation is given to the regression coefficients for these variables. Their function is solely to control, as a group, the variation in real profits that relates to property characteristics.

The results of the GLS estimation (adjusted for the logarithm of age) of equation (2) are shown in Exhibit 2.¹¹

The null hypothesis is rejected. The estimated coefficient for tenure is negative and significant at the 99% confidence level. This implies that rational expectations does not hold as a function of owner-tenure, and therefore, owner-tenure is a relevant factor for buyers to consider in formulating a purchase offer.

The estimated coefficients are not dollar values but can be easily interpreted. They are elasticities and, for continuous variables such as $\ln(Tenure)$, represent the expected percentage change in the dependent variable given a percentage change in the independent variable. For example, the coefficient on $\ln(Tenure)$ is -0.082003 , or 8.2003% . Therefore, if one owner's tenure is greater than another's by 10% (e.g., eleven years compared to ten years), the real profit to be realized by the seller with eleven years tenure is expected to be

Exhibit 2
Results of the GLS Estimation of Equation (2)

Variable	Estimated Coefficient	t ratio
<i>ln(Tenure)</i>	-.082003	-5.492
<i>ln(Lot)</i>	-.016276	-0.892
<i>ln(Age)</i>	.001932	0.563
<i>Conv</i>	-.018027	-0.872
<i>Bed₂</i>	.131417	1.770
<i>Bed₄</i>	.047939	1.998
<i>Bed_{≥5}</i>	.094079	1.891
<i>Bath_{>1,<2}</i>	-.052338	-1.290
<i>Bath₂</i>	-.039839	-0.828
<i>Bath_{>2,<3}</i>	-.103515	-2.083
<i>Bath_{≥3}</i>	-.143974	-2.703
<i>Gar₀</i>	-.139064	-2.481
<i>Gar₁</i>	-.059027	-1.482
<i>Gar₃</i>	-.198734	-0.966
<i>Air</i>	.041275	1.181
<i>Fire</i>	-.039175	-1.019
<i>Area1</i>	-.119291	-3.647
<i>Area2</i>	-.032892	-1.017
<i>Area3</i>	.120264	1.584
<i>Area4</i>	-.088009	-2.284
<i>Area5</i>	-.026484	-0.196
<i>Area6</i>	-.219801	-2.786
Intercept	0.384156	2.086
$r^2 = .7342$	Adj. $r^2 = .6858$	

0.82003% less than the real profit realized by the seller with ten years tenure, *ceteris paribus*.¹²

Summary and Conclusions

This paper reports the results of a study of single-family, detached home transfers, conducted to determine if rational expectations holds as a function of owner-tenure. The rational expectations theory conflicts directly with an intuitively appealing notion that there is an inverse relationship between selling price and owner-tenure. A multiple regression model was employed and owner-tenure was found to be significantly related to the real profit realized by sellers. This finding implies that, for the sample market, rational expectations does not hold as a function of owner-tenure. In essence, *ceteris paribus*, sellers with long owner-tenure are more willing to accept "low" offers compared to sellers with short owner-tenure. Therefore, owner-tenure appears to be a relevant factor for buyers to consider in formulating a purchase offer. Additional empirical testing is required to determine if the results of this study hold over different time periods and markets.

Notes

¹See, for example, Echols and Elliott [6]. For a good bibliography of papers on rational expectations, see: Shaw [13].

²If the owners in the example are under pressure to sell, the probability that either owner would accept the "low" offer increase. Owners under pressure to sell are less likely to have the freedom to be

concerned with nominal versus real profit. There is generally some impetus to sell a house and some motivations may result in a greater urgency to sell than others (e.g., a job transfer compared to the desire to move into a "nicer" house), but it is difficult to determine the degree to which each owner was under pressure to sell. Studies by Belkin, Hempel and McLeavey [2], Miller [11], and Zerbst and Brueggeman [16] found that the ratio of selling price to list price is negatively related to time on market. These findings are consistent with pricing strategies proposed by Miller [11a] which suggest that time on market may serve as a proxy for pressure to sell. In essence, an owner with high selling costs will price the property attractively low and obtain a bid at or close to the list price relatively quickly, while an owner who has low selling costs sets a relatively high list price and makes concessions that vary positively with time. It is plausible that the owner's urgency to sell constitutes a significant portion of selling costs differentials, and one may argue that properties that sell quickly did so because they were offered by owners under pressure to sell. It is also plausible, however, that pressure to sell increases with time on market. There is no compelling reason to suggest that pressure to sell is systematically related to owner-tenure over a protracted time period. The time on market data available did not adequately account for properties that were relisted, therefore, this item was excluded from the model.

³Specification errors occur when the formulation of the regression equation or one of the underlying assumptions is incorrect. There are several causes of specification errors, including: incorrect functional form of the regression equation, incorrect specification about the way the error term enters the regression equation, including an irrelevant explanatory variable, and omission of a relevant explanatory variable. Each of these can cause ordinary least squares estimators to be both biased and inconsistent, or inefficient. For a discussion of specification errors see Kmenta [10], pages 391-405.

⁴Several studies, including; Agarwal and Philips [1], Colwell, Guntermann and Sirmans [5], Guntermann [8], Sirmans, Smith and Sirmans [14], and Zerbst and Brueggeman [16] show that loan assumptions as well as F.H.A. or V.A. financing (compared to new origination conventional loans) result in price premiums. Therefore, transactions where F.H.A., or V.A. loans and those where loan assumptions were employed are used as the holdout category for this dummy variable. Only information about the general type of financing employed in each transaction occurring during the study period was available; no information about points or interest rates was available. Information regarding financing type at the acquisition date was unavailable for most observations. Therefore, this was not included in the model.

⁵Using dummy, rather than continuous, variables for bedrooms, bathrooms and garage car places allows us to account for the possibility that the incremental value of these variables is not linear (e.g., the incremental value of a one-car garage compared to no garage is likely to be different than the incremental value of a four-car garage compared to a three-car garage). The holdout classification for the purpose of bedroom dummy variable creation was three bedrooms. This was the most prevalent value for bedrooms in the sample.

⁶The holdout category for the purpose of bathroom dummy variable creation was one bathroom. This was the most prevalent value for bathrooms in the sample.

⁷The holdout category for the purpose of garage dummy variable creation was two car places. This was the most prevalent value for garages in the sample.

⁸The test used to determine this was the correct functional form for the model is available in the econometrics program SHAZAM, written by White [15]. It employs log likelihoods and can be used to determine whether a model's mathematical form is best specified as linear, log-linear, or log. In order to reject a null hypothesis using this technique the difference between the two log likelihoods (one from the restricted model, the other from an unrestricted) must exceed 1.92 (one half the chi-square critical value with one degree of freedom at $\alpha = .05$). The null hypothesis that both the dependent variable and positive value independent variables are logarithmic could not be rejected. The test statistic was 1.378.

⁹The critical F-test statistic, with $\alpha = .05$, and with 40 and 40 degrees of freedom is 1.69. The test statistics were 2.231 for $\ln(\text{Lot})$, 2.985 for $\ln(\text{Tenure})$ and 2.686 for $\ln(\text{Age})$.

¹⁰OLS estimates will have desirable statistical properties only if certain conditions are true for the error term (e.g., homoskedasticity). When these ideal conditions are violated, in some cases, more sophisticated estimation techniques can be used to achieve the desired statistical properties. GLS is such a technique. It generalizes, or extends, the results of least squares regression to cases where OLS is not appropriate. In the case of heteroskedasticity both the dependent and all independent variables for

each observation are weighted by the inverse value of the culprit variable. For a more detailed discussion of GLS see Kmenta [10], 499-508.

¹¹A collinearity diagnostics program that follows the approach of Belsley, Kuh and Welch [3], available on SAS, was conducted. The results indicate that there is a moderate degree of multicollinearity (not enough to be harmful in the sense that the estimates of the regression coefficients are highly imprecise) in the model reported in Exhibit 2. The degree of multicollinearity in the transformed data is higher than it was in the untransformed data and is the direct result of correcting for heteroskedasticity. In essence, because $\ln(\text{Age})$ was used to transform the data, $\ln(\text{Age})$ is highly correlated with several variables. The model was also estimated, adjusting for $\ln(\text{Lot})$ and $\ln(\text{Tenure})$. In the model adjusted for $\ln(\text{Lot})$ the estimated coefficient and t -ratio for $\ln(\text{Tenure})$ were -0.09280 , and -5.077 , respectively. The r^2 and adjusted r^2 for this model were $.3376$ and $.2171$, respectively. The degree of multicollinearity was low in this model. In the model adjusted for $\ln(\text{Tenure})$ the estimated coefficient and t -ratio for $\ln(\text{Tenure})$ were -0.02089 , and -3.858 , respectively. The r^2 and adjusted r^2 for this model were $.9992$ and $.9991$, respectively. Multicollinearity was severe in this model.

¹²The estimated coefficients for the dummy variables would be more accurately reported if adjusted as per Kennedy [9]. Because they were included only to control for various property characteristics the adjusted estimates are not reported here.

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