

## Hedonics Project Housing Market in San Leandro, CA

### DATA

After selecting the city of San Leandro, CA (illustrated in Figure 1-1) as the subject area to which a hedonic regression analysis would be performed, I collected market data via REALTOR.COM (www.Realtor.com.) The source data was taken on April 14, 2004 and comprised of all available housing units available for sale via Realtor.com. One hundred matches were found, of which thirty-one were immediately eliminated from this analysis as they pertained solely to land or large complex units for sale. Table 1-4 represents the original data of 69 properties. Three additional properties were then removed from the hedonic data since critical characteristic data was either not available (i.e. age) or data that would unjustly askew the results (i.e. \$2MM home not representative of typical homes in the area). A total of 66 properties were evaluated as part of this Hedonic Regression Analysis, as shown in Table 1-3.

### METHODOLOGY

The fundamental difference from the Original Data, Table 1-4, and the Hedonic Data, Table 1-3, relates to the following:

- 1) Converting the dependent variable "Price" into log form expressed "LN Price". Using a semi-log format allows for a variation in the dollar value of a particular characteristic so that the price of one components depends in part on the house's other characteristics, as opposed to a linear model which evaluates each characteristic independently regardless of other characteristics of the house.
- 2) Adding Square Age of Structure to better approximate coefficient results
- 3) Creating dummy variables by omitting key variables Two bedrooms, One bathroom, and Single Family Structures, Bedrooms were evaluated for 1, 3, and GE (greater or equal to) 4 bedrooms and Bathrooms were evaluated for 1.5, 2, 2.5 and GE3 bathrooms.

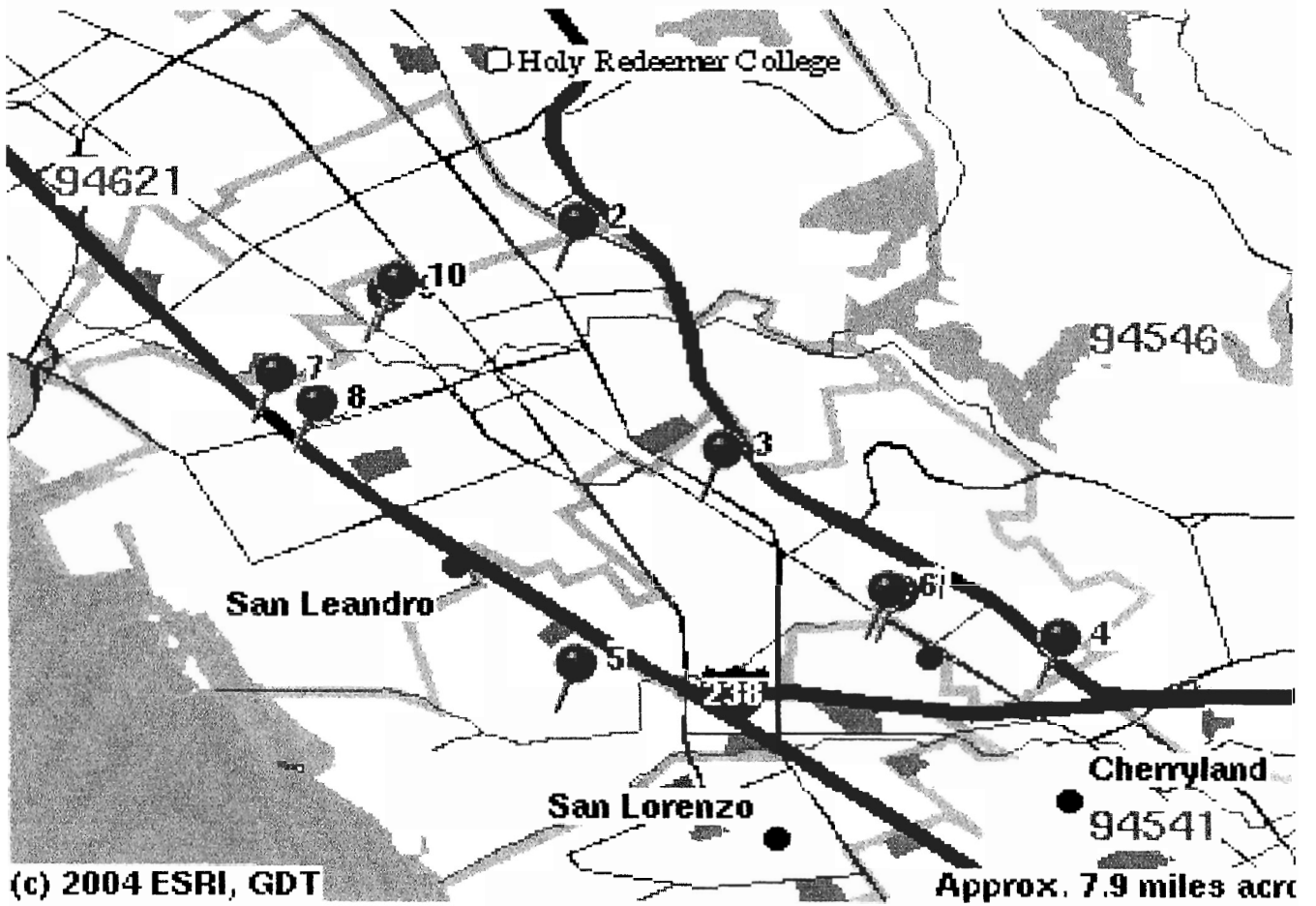
After all data was manipulated to reflect the above categories, a hedonics regression model was run via Excel and is illustrated in Table 1-2. After reviewing this regression, Halverson and Palmquest's approximation correction was sought for all dummy variables. It should be noted that GE categories do not represent dummy variables.

### RESULTS

The final log-linear (semi-log) results is presented in Table 1-1. As expressed from R-Square results, this regression model explains about 84 percent of the total observed variance in the natural logarithm of market prices (dependent variable) for homes in San Leandro, CA. As noted in Table 1-3, we find that for during this time period the minimum price was \$269,960, the median price was \$499,500, and the maximum price was \$995,000 for home for sale in San Leandro, CA.

From evaluating the "t Statistics", we find that Three Bedrooms, 1.5 Bathrooms, Square Feet, and Multi-Family characteristic are all statistically significant since the results for these characteristics show an absolute value of greater than 1.96 which represents a 95 percent confidence level. As an approximation, it can be interpreted that having a three bedrooms adds about 13.29 percent to the price (compared to two bedrooms - our omitted variable); having 1.5 bathrooms adds about 35.76 percent to the price (compared to one bathroom); square feet value can be computed as having a value of 0.03%/sf; and owning a multifamily home can be expected to yield a price lower than a single family home by 34.16 percent.

**Figure 1-1  
San Leandro, CA  
Area Map**



**Table 1-1**  
**A Hedonic Regression for Market Housing in San Leandro, CA**

<b>Dependent Variable: Log of Market Prices</b>				
<b>R-Square:</b>	<b>0.84</b>			
<b>Variable Name</b>	<b>Coefficients</b>	<b>t Statistic</b>	<b>Variable Label</b>	<b>For Dummy Variable<sup>1</sup>: exp(b)-1</b>
Intercept	12.6000	131.7224	Intercept	
Age	-0.0008	-0.3785	Age of Structure	
AgeSq	0.0000	0.5040	Square Age	
Bed 1	-0.2276	-1.6307	One Bedroom	-0.2036
Bed 3	0.1248	2.1241	Three Bedrooms	0.1329
Bedge4	0.1222	1.4922	Number of Beds When GE 4	
Bath 1.5	0.3057	4.0794	1.5 Bathrooms	0.3576
Bath 2	-0.0356	-0.5740	2 Bathrooms	-0.0350
Bath 2.5	-0.0518	-0.7143	2.5 Bathrooms	-0.0504
Bathge3	-0.0868	-0.9538	Number of Bath When GE 3	
Sq Ft	0.0003	5.7459	Square Feet	
MultiFamily	-0.4179	-5.9400	MultiFamily Unit	-0.3416

Note 1: Halverson & Palmquist' correction that allows for a better approximation of the percent change for dummy variables  
denotes statistically significant results, t-stats >= |1.96|

Table 1-2  
Semi-Log Results  
House Prices and Characteristics  
San Leandro, CA

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.915925875
R Square	0.838920209
Adjusted R Square	0.806107659
Standard Error	0.133545061
Observations	66

ANOVA

	df	SS	MS	F	Significance F
Regression	11	5.015670779	0.455970071	25.56705307	1.48053E-17
Residual	54	0.963051305	0.017834283		
Total	65	5.978722084			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	Dummy Variable exp(b)-1
Intercept	12.60002681	0.095655884	131.7224443	2.04621E-69	12.40824815	12.79180548	12.40824815	12.79180548	
Age	-0.00079036	0.002087873	-0.37854775	0.70650795	-0.004976298	0.003395578	-0.004976298	0.003395578	
AgeSq	9.17871E-06	1.82104E-05	0.50403603	0.616286407	-2.7331E-05	4.56885E-05	-2.7331E-05	4.56885E-05	
Bed 1	-0.22764033	0.139594274	-1.630728271	0.108767273	-0.507510242	0.052229582	-0.507510242	0.052229582	0.203589
Bed 3	0.124782726	0.058744972	2.124133102	0.03825385	0.007006047	0.242559405	0.007006047	0.242559405	0.132902
Bedge4	0.122173463	0.081875653	1.492183062	0.141470747	-0.041977481	0.286324407	-0.041977481	0.286324407	
Bath 1.5	0.305722969	0.075053181	4.073417897	0.000152704	0.155250271	0.456195667	0.155250271	0.456195667	0.357606
Bath 2	-0.035629657	0.062073684	-0.57398973	0.568358001	-0.160080007	0.088820694	-0.160080007	0.088820694	0.035002
Bath 2.5	-0.051758427	0.072461403	-0.714289612	0.478124513	-0.197034918	0.093518064	-0.197034918	0.093518064	0.050442
Bathge3	-0.08684418	0.091054677	-0.953758581	0.34445591	-0.269397974	0.095709615	-0.269397974	0.095709615	
Sq Ft	0.000317164	5.51984E-05	5.74589341	4.34337E-07	0.000206498	0.000427831	0.000206498	0.000427831	
MultiFamily	-0.417922534	0.070357743	-5.939965079	2.12818E-07	-0.558981437	-0.276863631	-0.558981437	-0.276863631	0.341587

denotes statistically significant results, t-stats >= |1.96|

**Table 1-3  
Hedonics Data  
San Leandro, CA**

Omitted Variable: Bed 2, Bath 1, Single Family Structure (Type)

	Price	LN Price	Age	AgeSq	Bed 1	Bed 3	Bedge4	Bath 1.5	Bath 2	Bath 2.5	Bathge3	Sq Ft	MultiFamily
1	\$ 269,950	12.506	23	529	0	0	0	1	0	0	0	1,022	1
2	\$ 270,000	12.506	28	784	0	0	0	1	0	0	0	956	1
3	\$ 279,000	12.539	53	2809	1	0	0	0	0	0	0	576	0
4	\$ 279,950	12.542	34	1156	0	0	0	0	0	0	0	811	1
5	\$ 299,000	12.608	23	529	0	0	0	0	0	0	0	811	1
6	\$ 309,000	12.641	10	100	0	0	0	0	0	1	0	1,311	1
7	\$ 328,888	12.703	25	625	0	1	0	0	1	0	0	1,030	1
8	\$ 335,000	12.722	62	3844	0	0	0	0	0	0	0	1,082	0
9	\$ 349,000	12.763	29	841	0	1	0	1	0	0	0	1,364	1
10	\$ 350,000	12.766	69	4761	0	0	0	0	0	0	0	720	0
11	\$ 360,000	12.794	62	3844	0	0	0	0	0	0	0	826	0
12	\$ 379,000	12.845	57	3249	0	0	0	0	0	0	0	856	0
13	\$ 394,999	12.887	21	441	0	0	0	0	1	0	0	1,406	1
14	\$ 395,500	12.888	64	4096	0	0	0	0	0	0	0	665	0
15	\$ 398,500	12.895	65	4225	0	0	0	0	0	0	0	1,180	0
16	\$ 399,000	12.897	57	3249	0	0	0	0	0	0	0	987	0
17	\$ 399,000	12.897	63	3969	0	0	0	0	0	0	0	1,059	0
18	\$ 399,800	12.899	62	3844	0	1	0	0	0	0	0	950	0
19	\$ 399,900	12.899	56	3136	0	0	0	0	0	0	0	1,018	0
20	\$ 399,950	12.899	58	3364	0	0	0	0	0	0	0	1,213	0
21	\$ 400,000	12.899	49	2401	0	1	0	0	1	0	0	1,154	0
22	\$ 409,000	12.921	84	7056	0	0	0	0	0	0	0	836	0
23	\$ 409,950	12.924	64	4096	0	1	0	0	1	0	0	1,418	0
24	\$ 420,000	12.948	57	3249	0	0	0	0	0	0	0	1,010	0
25	\$ 425,000	12.960	57	3249	0	0	0	0	0	0	0	969	0
26	\$ 439,900	12.994	86	7396	0	1	0	0	1	0	0	1,158	0
27	\$ 449,000	13.015	54	2916	0	1	0	0	0	0	0	1,114	0
28	\$ 449,000	13.015	6	36	0	1	0	0	0	1	0	1,544	0
29	\$ 465,000	13.050	80	6400	0	0	0	0	0	0	0	1,145	0
30	\$ 468,950	13.058	66	4356	0	1	0	0	0	0	0	1,302	0
31	\$ 479,000	13.079	59	3481	0	1	0	0	1	0	0	1,296	0
32	\$ 479,999	13.082	54	2916	0	1	0	0	1	0	0	1,508	0
33	\$ 494,000	13.110	48	2304	0	1	0	0	1	0	0	1,358	0
34	\$ 505,000	13.132	59	3481	0	1	0	0	1	0	0	1,800	0
35	\$ 509,000	13.140	64	4096	0	0	1	0	0	0	1	1,851	0
36	\$ 512,000	13.146	78	6084	0	1	0	0	1	0	0	1,602	0
37	\$ 518,000	13.158	47	2209	0	0	1	0	0	0	1	1,853	0
38	\$ 519,000	13.160	4	16	0	0	1	0	0	1	0	1,599	0
39	\$ 529,000	13.179	46	2116	0	1	0	0	1	0	0	1,734	0
40	\$ 529,000	13.179	37	1369	0	1	0	0	1	0	0	1,630	0
41	\$ 545,000	13.209	55	3025	0	0	1	0	0	0	1	1,764	0
42	\$ 549,000	13.216	94	8836	0	1	0	0	0	0	0	1,224	0
43	\$ 549,000	13.216	63	3969	0	1	0	0	0	0	0	1,525	0
44	\$ 549,000	13.216	7	49	0	0	1	0	0	1	0	1,817	0
45	\$ 574,000	13.260	55	3025	0	0	1	0	0	1	0	2,024	0
46	\$ 589,500	13.287	65	4225	0	1	0	0	0	1	0	1,945	0
47	\$ 595,000	13.296	26	676	0	1	0	0	1	0	0	1,517	0
48	\$ 595,999	13.298	37	1369	0	1	0	0	0	0	1	1,967	0
49	\$ 599,000	13.303	42	1764	0	0	1	0	0	1	0	1,812	0
50	\$ 600,000	13.305	1	1	0	0	1	0	0	0	0	1,972	0
51	\$ 605,000	13.313	10	100	0	0	1	0	0	1	0	2,099	0
52	\$ 614,500	13.329	65	4225	0	1	0	0	0	1	0	1,945	0
53	\$ 629,000	13.352	73	5329	0	1	0	0	0	1	0	2,405	0
54	\$ 629,000	13.352	70	4900	0	1	0	0	1	0	0	2,278	0
55	\$ 639,000	13.368	3	9	0	0	1	0	0	0	1	2,403	0
56	\$ 639,000	13.368	3	9	0	1	0	0	0	1	0	2,066	0
57	\$ 649,950	13.385	9	81	0	0	1	0	0	0	1	2,338	0
58	\$ 659,888	13.400	2	4	0	0	1	0	0	0	1	2,412	0
59	\$ 699,950	13.459	65	4225	0	0	1	0	1	0	0	2,117	0
60	\$ 699,950	13.459	52	2704	0	1	0	0	1	0	0	2,306	0
61	\$ 708,000	13.470	52	2704	0	1	0	0	0	1	0	2,462	0
62	\$ 825,000	13.623	57	3249	0	1	0	1	0	0	0	1,400	0
63	\$ 825,000	13.623	56	3136	0	1	0	1	0	0	0	1,220	0
64	\$ 879,000	13.687	45	2025	0	0	1	0	0	0	1	3,250	0
65	\$ 898,850	13.709	134	17956	0	0	1	0	0	0	1	3,166	0
66	\$ 995,000	13.810	52	2704	0	1	0	1	0	0	0	1,108	0
	\$ 995,000	max											
	\$ 269,950	min											
	\$ 499,500	median											

**Table 1-4  
Original Data Of Market Housing  
San Leandro, CA**

									Type:	0 = Single Family Structure 1 = Multi-family Structure
	Price	Age	Bedrooms	Bath	Sq Ft	Type	Lot Size	Year Built		
1	\$ 269,950	23	2	1.5	1,022	1	1,022	1981		
2	\$ 270,000	28	2	1.5	956	1		1976		
3	\$ 279,000	53	1	1	576	0	3,025	1951		
4	\$ 279,950	34	2	1	811	1		1970		
5	\$ 299,000	23	2	1	811	1	21,450	1981		
6	\$ 309,000	10	2	2.5	1,311	1		1994		
7	\$ 328,888	25	3	2	1,030	1				
8	\$ 335,000	62	2	1	1,082	0	4,981	1942		
9	\$ 349,000	29	3	1.5	1,364	1		1975		
10	\$ 350,000	69	2	1	720	0	3,424	1935		
11	\$ 355,000		2	1	1,070	0				
12	\$ 360,000	62	2	1	826	0				
13	\$ 379,000	57	2	1	856	0	5,301	1947		
14	\$ 394,999	21	2	2	1,406	1	89,298	1983		
15	\$ 395,500	64	2	1	665	0	3,920	1940		
16	\$ 398,500	65	2	1	1,180	0		1939		
17	\$ 399,000	57	2	1	987	0				
18	\$ 399,000	63	2	1	1,059	0	5,968	1941		
19	\$ 399,800	62	3	1	950	0	4,792	1942		
20	\$ 399,900	56	2	1	1,018	0	6,060	1948		
21	\$ 399,950	58	2	1	1,213	0		1946		
22	\$ 400,000	49	3	2	1,154	0	5,130	1955		
23	\$ 409,000	84	2	1	836	0	8,800	1920		
24	\$ 409,950	64	3	2	1,418	0	4,792	1940		
25	\$ 420,000	57	2	1	1,010	0	3,640	1947		
26	\$ 425,000	57	2	1	969	0	5,663	1947		
27	\$ 439,900	86	3	2	1,158	0	4,792	1918		
28	\$ 449,000	54	3	1	1,114	0	6,621	1950		
29	\$ 449,000	6	3	2.5	1,544	0		1998		
30	\$ 465,000	80	2	1	1,145	0	6,970	1924		
31	\$ 468,950	66	3	1	1,302	0		1938		
32	\$ 479,000	59	3	2	1,296	0	6,098	1945		
33	\$ 479,999	54	3	2	1,508	0	4,792	1950		
34	\$ 494,000	48	3	2	1,358	0		1956		
35	\$ 505,000	59	3	2	1,800	0	5,000	1945		
36	\$ 509,000	64	4	3	1,851	0	6,098	1940		
37	\$ 512,000	78	3	2	1,602	0	6,150	1926		
38	\$ 518,000	47	4	3	1,853	0	6,175	1957		
39	\$ 519,000	4	4	2.5	1,595	0	1,894	2000		
40	\$ 529,000	46	3	2	1,734	0		1958		
41	\$ 529,000	37	3	2	1,630	0	5,088	1967		
42	\$ 545,000	55	5	3.5	1,764	0	7,841	1949		
43	\$ 549,000	94	3	1	1,224	0	6,400			
44	\$ 549,000	63	3	1	1,525	0	17,765	1941		
45	\$ 549,000	7	4	2.5	1,817	0	3,450	1997		
46	\$ 574,000	55	4	2.5	2,024	0	6,850	1949		
47	\$ 589,500	65	3	2.5	1,945	0	3,920	1939		
48	\$ 595,000	26	3	2	1,517	0	4,500	1978		
49	\$ 595,999	37	3	3	1,967	0	5,663	1967		
50	\$ 599,000	42	4	2.5	1,812	0	5,000	1962		
51	\$ 600,000	1	4	0.25	1,972	0	3,485	2003		
52	\$ 605,000	10	4	2.5	2,099	0	4,456	1994		
53	\$ 614,500	65	3	2.5	1,945	0	4,000	1939		
54	\$ 629,000	73	3	2.5	2,405	0	4,472	1931		
55	\$ 629,000	70	3	2	2,278	0		1934		
56	\$ 639,000	3	5	3	2,403	0	3,837	2001		
57	\$ 639,000	3	3	2.5	2,066	0				
58	\$ 649,950	9	4	3	2,338	0	8,878	1995		
59	\$ 659,888	2	5	3	2,412	0	3,500	2002		
60	\$ 699,950	65	4	2	2,117	0				
61	\$ 699,950		4	2.5	2,300	0		1936		
62	\$ 699,950	52	3	2	2,306	0	5,194	1952		
63	\$ 708,000	52	3	2.5	2,462	0	16,660	1952		
64	\$ 825,000	57	3	1.5	1,400	0	28,000	1947		
65	\$ 825,000	56	3	1.5	1,220	0	28,000	1948		
66	\$ 879,000	45	5	3.5	3,250	0	9,148	1959		
67	\$ 898,850	134	6	3.5	3,166	0	16,850	1870		
68	\$ 995,000	52	3	1.5	1,108	0	26,663	1952		
69	\$ 2,200,000	4	4	3.5	1,942	0	41,106	2000		
	\$ 2,200,000	max								
	\$ 269,950	min								
	\$ 505,000	median								