11.433J / 15.021J Real Estate Economics

Fall 2008

MIT 11.433/15.021
Real Estate Economics
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Project II
(Due: 10/2/2008 in class)

The time is June, 1998. A developer, Mr. F, in the town of Hamilton outside of Boston is debating with the county zoning committee. He recently bought a 10 acre land parcel, and plans to develop single-family housing. Currently this land is zoned at 1 unit per acre. Mr. F feels that higher density is more profitable, but the zoning committee believes that the "market" is very strong for the density of 1 unit per acre. To resolve this debate, Mr. F hires you as a consultant to write a report to the zoning committee (not to exceed 5-pages, double spaced, excluding regression output or other attachments) to provide a professional opinion regarding the optimal "market" density for residential development in the town. The report should include an introduction, a description of your methodology, including both your theoretical model or assumptions and your statistical results, an analysis or interpretation of these results, and conclusions or recommendations.

(Please note that this assignment and the data you have been given, are, like the real world, messy. There are outliers, and you can certainly obtain counter intuitive results if you try. However, in general, the data are consistent with what you might expect, i.e. there are no "tricks" in this assignment. Nonetheless, you may find it helpful to make assumptions regarding the data, the market, the time period, or the technological constraints involved in development. If you do, please state all of your assumptions up front and be realistic, all assumptions are not equal.)

In order to approach this problem using statistical analysis, you collected recent lot transaction data in Hamilton (data attached). You recorded 40 transactions in 1992-97, with the YEAR and MONTH when the transaction occurred (month 11 means November, etc.), SQFT as the area of the lot (in 1,000 sqft), and SALE$ as the amount of money the lot was sold (in $1,000). For example, the data shows that in November 1996, a lot with 72,000 sf was sold at $220,000. Note that each lot represents the land for one single-family house.

Step 1: Using these data, you try to estimate the relationship between Sale$ per lot and density. You need to convert the lot size into a density variable (DENSITY) that measures lots per acre. Pay attention to the measurement units in the conversion. You might also think that lot prices generally, though not necessarily, appreciate over time. Therefore you should create a discrete time variable TIME that measures the months from the beginning of the data period to capture the appreciation effect over time. Specify a simple **linear** relationship (model) between price and density (and time) and estimate that model. What are your regression results, and how should you interpret the parameters and R^2?

Step 2: Using your model, and assuming developers maximize profit, derive a formula for the optimal density as a function of time. Derive the optimal density that Mr. F would use in 1992.6? In 1997.6? In 1998.6?

Step 3: With your optimal density formula, you can calculate the value of Mr. F's 10 acres if he has to follow the zoning proposed by the town, 1 lot per acre. What is the difference between this value and what his land is worth if he develops it at your suggested density? What is the loss if Mr F uses the Board's 1 acre rule in 1998.6? What limitations might there be in the applicability of your analysis. Can you make any statements as to the possible sources, directions, or magnitudes of bias in your estimates?

Step 4: To confirm your results, consider another approach to estimating price appreciation. If the market does not move smoothly over time, an alternative model may be estimated using dummy variables for the years 1993 (D93), 1994 (D94), 1995 (D95), 1996(D96), and 1997 (D97) (not for 1992!). For example, D93 = 1 if year equals 1993, but zero otherwise. Construct these variables and run the regression. What are the regression results, and how do you interpret the parameters and R^2? Repeat Steps 1,2 and 3 using your new parameters – estimating what the dummy value for 1998 is. Compare results. Are they the same? Why/why not? Which model provides a better estimate of optimal density?

Data

(Note: 1 acre = 43,560 sf)

Year	*Month*	*Sqft (1000s)*	*Sale Price ($1000s)*	*Year*	*Month*	*Sqft (1000s)*	*Sale Price ($1000s)*
1997	6	46	270	1995	10	44	182
1997	4	43	230	1995	9	26	140
1997	3	81	360	1995	8	168	300
1996	11	72	220	1995	8	81	189
1996	11	25	106	1995	7	196	354
1996	11	24	138	1995	6	78	183
1996	11	29	130	1995	4	89	148
1996	10	20	145	1995	3	24	131
1996	10	28	152	1995	1	63	195
1996	9	40	184	1994	12	27	111
1996	8	105	219	1994	9	90	169
1996	7	290	233	1994	2	39	126
1996	6	100	191	1993	12	26	133
1996	5	188	267	1993	5	66	155
1996	5	151	216	1993	5	45	131
1996	4	200	218	1993	4	80	145
1996	4	41	181	1992	2	80	107
1996	3	281	183	1992	4	225	161
1996	1	34	162	1992	5	86	88
1996	1	167	195	1992	6	152	88