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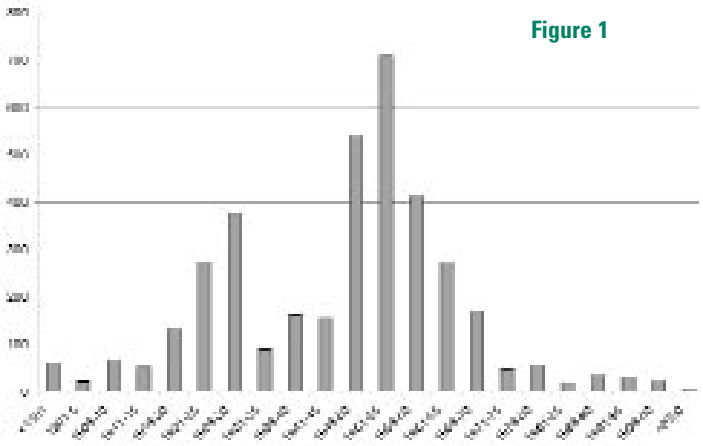
The analysis of housing markets differs from the analysis of most other markets because of the virtually unique combination of three key characteristics of housing. The first is durability. A reasonably well constructed house can provide services for a century or more. The second is the extent of differentiation across houses in their characteristics. Houses range widely in size, number and types of rooms, construction quality, and architectural style. Finally, houses are difficult to move; they're fairly immobile. This immobility means that the value of a house varies with the characteristics of the other houses in the neighborhood and the quality of the public services offered by the local jurisdiction. A thorough housing market analysis requires consideration of each of these factors.

A Century of Home Construction in East Grand Rapids

Figure 1



Though houses are durable, one expects to see depreciation over time. The house shows more wear over time, and the style of the house becomes less popular, while newer houses incorporate a variety of more advanced building materials and technologies. In addition, as the market value of the house decreases, the characteristics of the occupants also change; relatively lower-priced houses tend to go to households with relatively lower incomes. These lower incomes reduce the household demand for local public services, which further reduces the market value of the house. This is known in economics as the "filtering" model of the housing market. The result is that, all else the same, one would expect to see a house depreciate in market value over its entire life relative to newer houses with similar characteristics.

But the other characteristics of a house can intervene to affect its rate of depreciation. The style of a relatively well-built older house and the characteristics of the neighborhood in which it resides may enjoy a return to popularity, and the quality of public services may not fall over time. In a jurisdiction with a wide range of housing, the continued demand for the newer housing props up the demand for good-quality public services throughout the jurisdiction, including the parts of the jurisdiction with older housing. In addition, home owners may recognize the impact of public-service quality on the value of their homes, whatever the age, and work to prevent deterioration in the quality of public services. Depending on the costs of renovation to modern standards, a well-constructed older house with desirable features could not only stop depreciating, but could command a premium over similar, but newer, houses.

The purpose of this study is to employ statistical regression analysis to look systematically at sale prices of houses in East Grand Rapids (EGR). The objective is to get a feel for rates of house-price depreciation and how those rates have changed, if at all, over the last fifteen years. Figure 1 shows the year and the number of houses that were built in EGR. The older houses, built before 1920, are mostly either original farm houses or houses built near what is now Gaslight Village near Reeds Lake, and what was then the area around Ramona Park. At that time most of what is now EGR was rural. Urban development started in earnest in the 1920s as Grand Rapids development spread east into the then Village of East Grand Rapids. The Great Depression and World War II slowed construction. EGR developed quickly after the War, with the peak in housing construction in the early 1950s. The great majority of the housing stock in EGR was built during the fifty years between 1920 and 1970. Our objective is to estimate the differences in the rates of house-price appreciation over the last fifteen years among the houses of different vintages.

Table 1 Characteristics of Houses in East Grand Rapids

	Mean	Median	Std Dev	Min	Max
Year house built	1946	1950	19.1	1834	2002
House size in sq ft.	2,093	1,920	910.8	672	15,646
Lot size in sq. ft.	13,125	10,200	12,123	1,496	171,626
Street frontage in ft.	79	75	31.8	16	347
Number of baths	2.2	2	0.9	1	9
Garage size in sq. ft.	460	441	216.5	0	4413

The characteristics of the houses and neighborhoods in East Grand Rapids vary. The EGR assessor's office maintains records on 3,740 single-family dwelling units. Table 1 summarizes the characteristics of these houses. Consistent with Figure 1, there are as many houses built before 1950 as after. Houses range tremendously in size, from a 700 square foot cottage to a 15,000 square foot mansion. But the typical house is, well, typical of suburban housing at about 2,000 square feet on a quarter-acre lot (10,000 sq. ft.), with two baths and a two-stall garage.

Table 2 Estimated Effects of Changes in House Characteristics on Sale Prices

Change in House Characteristic	Average Effect	Min 95%	Max 95%
100 square feet of floor space	3.15%	2.84%	3.45%
1000 square feet of lot space	0.89%	0.74%	1.05%
One additional bathroom	9.58%	7.57%	11.58%
100 square feet of garage space	1.70%	1.01%	2.39%
10 years older	-2.24%	-2.86%	-1.63%
Lake-front property	28.77%	19.13%	38.42%
Bi-level house	-33.09%	-48.95%	-17.24%
Tri-level house	-14.90%	-19.86%	-9.94%
Ranch-style house	-6.51%	-9.46%	-3.55%
On Robinson Rd	-9.80%	-22.57%	2.97%
On Cascade Rd.	-23.39%	-35.34%	-11.45%
On Wealthy St.	-19.32%	-26.67%	-11.96%
On Lake Dr.	-8.84%	-13.54%	-4.13%
On Breton Rd.	-10.14%	-16.98%	-3.30%
On Hall St.	-2.76%	-7.84%	2.31%
Year of sale since 1987	6.89%	6.65%	7.13%
Constant term	10.45	10.38	10.51

Note: 2,214 sales from 1987 through mid-2003 of houses with 1,600 to 3,600 square feet floor space.

This analysis focuses on the houses with relatively typical characteristics that make up the bulk of the housing in EGR. Specifically, the analysis focuses on the prices of the 2,214 sales of houses of between 1,600 and 3,600 square feet that occurred from 1987 through the middle of 2003. Statistical regression analysis allows us to estimate the average effect on the sale prices of the houses with a specific change in characteristics, holding all other characteristics constant.

Table 2 shows the results of a relatively simple regression analysis. The left-hand column of the table shows the house characteristics that we collected from assessment records.[1] The second column shows the average percentage effect on sale price of the change in house characteristics identified in the left-hand column. For example, adding 100 square feet of floor space adds, on average, about 3.15% to the price of a house, holding all other characteristics constant. Importantly, this estimate of the average is just that: an estimate. The right-hand two columns of the table show the interval within which we are "95% confident" that the "true" estimate lies. For example, given what we know about this sample of house prices, if we could find more samples of house sales, the estimate of the average effect of an additional 100 square feet of floor space would 95% of the time be between 2.84% and 3.45%. In any statistical analysis it is as important to look at this confidence interval as it is to look at the estimated average effect.

So, what do the estimates in the table tell us? First, more house and lot is better. Another 1,000 square feet of lot space adds about 1% to the sale price. Another bath adds about 10%, and an additional 100 square feet of garage space adds about half as much as additional interior floor space. Second, location matters. Lake-front property generates an average premium of almost 30% (this premium grew to almost 50% by year 2000). Location on a busy street generates a discount on sale price. Houses on Cascade Rd. sold at an average discount of more than 20% (in contrast to the lake-front premium) and these street-front discounts changed little over the time period. Third, house style matters. The most common "style" in EGR is a two-story house. Bi-levels, tri-levels, and ranch-style houses all suffer discounts, holding other characteristics constant. Fourth, house prices rose an average of 6.9% per year over the time period. Finally, and importantly for the purposes of this study, the age of the house affects sale price. The estimates indicate that houses depreciate *on average* by about 2.24% per ten years of age. The question is: Does this average depreciation rate hold over the full range of ages and over time?

Figure 2 shows our answer to this question. To obtain these figures, we broke the total sample of 2,214 sales into three roughly equal sub-samples based on when the sale occurred. The "early" sub-sample consists of sales from 1987 through 1993. The lowest curve in the figure shows how the regression estimates indicate the price of a house with average characteristics varied with the age of the house. That is, we hold all characteristics constant at their means while varying age. Over this early period house prices fell with the age of the house, as one would expect. This began to change, however, during the "middle" period, 1994 through mid-1998. Houses that were between 40 and 60 years old had essentially stopped depreciating. In the "late" period, from mid-1998 through mid-2003, houses older than about 50 years actually rose with age.

Further investigation reveals that some of the relatively large price effects were on houses built in the 1920s and 1930s. Many of these are two-story houses with brick facades and a good deal of ornamental trim. These houses and their neighborhoods apparently "caught on" over the course of the 1990s, and relatively low interest rates made it easier to make the expensive renovations to these older character houses that bring them up to modern standards. The popularity of these older houses, combined with the substantial investments in renovations, resulted in relatively brisk appreciation rates over the 1990s. Conversely, there was little change in the *rates* of depreciation of relatively new houses. Clearly, the older "character" houses have made a comeback in East Grand Rapids.

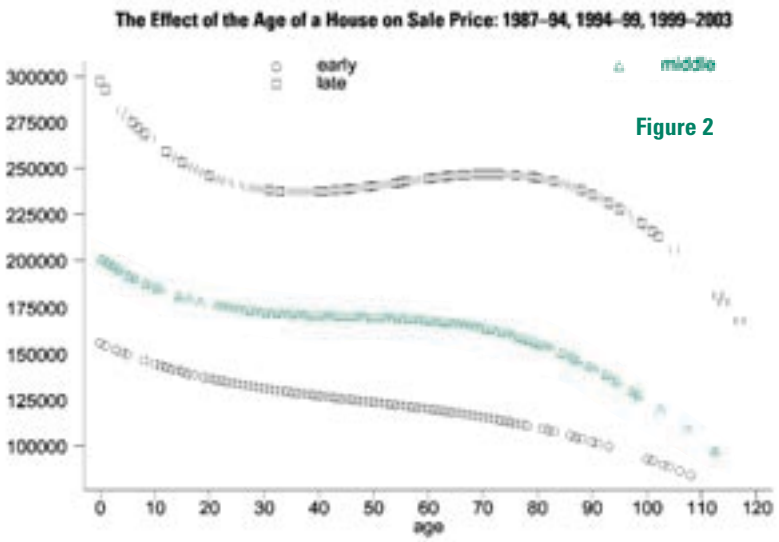


Figure 2

[1]Thanks to Vicki Mesik, the EGR assessor, for providing the data analyzed in this study.