SEASONAL FLUCTUATIONS IN THE PRICE OF EXISTING SINGLE FAMILY HOUSES

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The major objective of this study was to identify price changes in the existing single-family house market which occur in predictable seasonal patterns. National monthly sale prices from the NATIONAL ASSOCIATION OF REALTORS® were used to construct a monthly index which can be used to seasonally adjust existing single-family home prices.

Changes in the total number of sales were observed from 1968 through 1978. The pattern of volume changes indicated a strong market demand in the summer with sales falling 30 to 50 percent during the winter, suggesting a sharp seasonal drop in demand.

The "average" monthly sale price was adjusted for inflation using the Housing Price Index. This adjustment

left three patterns: a business cycle, a general upward trend in prices, and a strong seasonal pattern.

The seasonal price pattern appeared to begin at a low point in the winter months, increasing through the spring to reach a peak during the summer. The prices then dropped through September back to the low winter level. The pattern was reasonably consistant from month to month making a monthly seasonal index practical. The first step was to use a seasonal year of September through August to reduce the effects of the business cycle. Next, the average monthly price for each year was divided by the observed monthly prices for that year. This produced 12 indexes for each of the 12 months in each year. Each index for a specific month was averaged with the same month's index in the other years, to arrive at the monthly index which best fitted the total test period.

Observations of the application of the index to the national data, and Multiple Listing Service (MLS) data from Gainesville, Florida, and Charlotte, North Carolina, were made with a high percentage of reductions in the monthly variance from the average. Confidence intervals were calculated to determine the goodness of the estimated monthly index. The interval appeared to be of a small enough size to accept the index as representative of the true seasonal index.

Several examples of the application of the index to the appraisal process are provided, with resulting improvements

in standard comparable sales appraisals of approximately 400 percent. Several other applications of the index are discussed as well as obvious improvements which are expected for the index as a next step in the research.

CHAPTER I
INTRODUCTION

Basic economics teaches us that a change in the supply or demand of a product will affect the price of that product, other factors remaining constant. Real estate should be no different than any other product. Seasonal changes in the volume of sales of existing single-family houses (shifts in demand) have been observed for many years, yet corresponding price fluctuations have not been reported. This study has identified the seasonal price fluctuation and converted it into a seasonal index which can be used to seasonally adjust comparable single-family home selling prices.

National sales volume data from the NATIONAL ASSOCIATION OF REALTORS® (NAR) indicated that the sales of single-family houses declined sharply in the winter and peaked during the summer. The national prices fluctuated, but appeared to have little to do with the fluctuations in volume.

In an effort to adjust out unwanted price influencing factors, the NAR data were adjusted for inflation using the United States Housing Price Index. The graphed adjusted prices showed three distinct patterns:

1. An upward trend in prices which appeared to be caused by a general increase in the amenities associated with the average house, "frontloading" of costs, and possible long term shifts in the demand curve for housing.

2. The business cycle with a sharp increase in prices during expansion periods, a decrease in prices during recessions, and a generally level period during the initial part of the study period.

3. The seasonal cycle which appeared to repeat itself each year, when the cycle was begun in September and ended in August.

No adjustment was made to the data for the general upward trend in prices because of the relatively minor effect it had on prices in the short run. However, the business cycle had a noticeable effect on prices. But, because of a lack of sufficient data, no statistically valid conclusion could be made when the data were grouped into the various business phases. By beginning each year in September and ending it the following August, the effects of the business cycle were minimized. However, the observations made it clear that a seasonal index for each of the three business phases would produce a more accurate market adjustment than the index in this study, which was derived without consideration for the business cycle.

To derive the seasonal index, the inflation adjusted prices, grouped from September to August for each year, were compared to the mean price for each year. The individual monthly differences from the mean were added to the differences for the same month in the other years and divided by the number of observations for each month to arrive at the average differences for the test period. These average monthly differences became the seasonal index.

To test the index, the NAR national data were adjusted using the index. A comparison was made between the pre-adjusted and adjusted prices to determine if the overall

variances were reduced. In all but two years, the variance was decreased by using the index. The calculated confidence interval for the index produced a narrow interval indicating the index was a reasonable estimate of the seasonal pattern.

The index was then tested on two local markets, Charlotte, North Carolina, and Gainesville, Florida, using local multiple listing services (MLS) data. Both had monthly volume fluctuations similar to the national volume fluctuations. For both sets of data, the index reduced approximately 60 percent of the monthly differences. The overall variance was reduced in seven of nine years in Charlotte and eight of eleven years in Gainesville. The results appear to indicate the index can be used on the local level.

However it should be pointed out that the local markets are not always the same as the national market. Some markets may enjoy a booming business in the summer while others may boom in winter. Local MLS data should give the local analyst an indication of any differences from the national market. It is possible that future seasonal indexes would be provided on a regional and perhaps even local level to account for all the market variations.

The information gathered in this study confirms that prices of existing single-family homes change in the market, based solely on the month of the year. The seasonal index derived in this study provides an adjustment which reduces

the monthly price changes. Failure to use a seasonal adjustment may result in a less than accurate appraisal. It could also allow an additional error term in research data which use quarterly or monthly housing prices.

While the index derived in this study is by no means the ultimate seasonal index, it does reduce price fluctuations and is therefore better than using no index at all. It proves that the industry should recognize the existence of the seasonal pattern and begin making adjustments for it.

The following chapters present the logic behind the price changes and the mechanics of the derivation of the index.

CHAPTER II
SUPPLY AND DEMAND

Unger, in building a case for supply and demand forces in the real estate market, states:

> Generally, a market is defined as a sphere within which price-making forces operate and in which changes of title tend to be accompanied by actual movement of the goods affected. . . . But the term "market" as used in real estate means something much different. . . . In the final analysis, we find many isolated markets which tend to be connected with and affected by the overall real estate cycle. . . . We do, however, find in these isolated markets competitive forces at work that do tend to bring about a uniform price for similar properties. Those forces are supply and demand.[1]

Smith agrees that supply and demand determine the value of real estate, stating:

> We may also note that market value is the price resulting from the forces of supply and demand operating in the market. Supply is the other side of the scarcity coin and demand is the market manifestation of utility. The point of equilibrium between the supply curve and the demand curve . . . is the marketplace value.[2]

Reasoning for Seasonal Demand

If we concede that the real estate market is affected by the standard supply and demand theories, then we would expect prices to change if the demand for housing changed.

Unger states:

> The repetitive intra-annual changes are thought for the most part to be related to climate, holidays, vacation periods, and even differences in the number of working days within a month. These patterns frequently are repetitive because they are entrenched in custom.[3]

The United States has a school system based on a nine-month year, generally the first of September through the end

of May. It is common knowledge that families try to time moves they make with their children's school year. Thus, they will delay a move until the summer months to minimize the effects of a move on the child's life.

There are other factors which influence the time during the year prospective buyers are more likely to make a purchase. The weather has been suggested as a possible influencing factor. Bad weather, as is common during the winter, is likely to discourage people from moving, while good weather, as is common from April through fall, would not present the same obstacles to a move. Additionally, having to disrupt the family life during special holidays like Thanksgiving, Christmas, and New Year's would also discourage a move during November and December.

Given a preference, most people would probably choose to make their move during June, July, and August, when school is out and the weather is good. The worst time for a move would probably be November through February, because not only does that time interrupt the school year, it is also the period with the special holidays and the worst weather.

Shifts in Demand

The NATIONAL ASSOCIATION OF REALTORS® (NAR) has collected data on the volume of sales of existing single-family houses and determined seasonal indexes to adjust their sales volume figures. Table 1 shows the NAR volume indexes for

Table 1
Existing Single-Family Home Sales
Volume Index for U.S. Monthly, 1966-1974
1972=100
(Not Seasonally Adjusted)

Month	1966	1967	1968	1969	1970	1971	1972	1973	1974
January	49	42	53	60	55	67	78	91	88
February	52	48	60	64	56	74	90	100	95
March	67	66	71	74	64	97	110	120	117
April	62	73	72	78	72	99	101	114	121
May	62	63	77	82	75	98	111	121	126
June	67	79	75	82	85	106	119	125	114
July	62	72	82	81	85	104	110	120	121
August	67	80	82	78	86	101	120	119	113
September	52	65	73	72	78	90	103	91	90
October	46	63	75	69	73	84	99	96	88
November	41	55	62	54	63	80	87	83	75
December	34	43	50	49	56	66	72	63	62
Annual Index	55	62	69	70	71	89	100	104	101

1966 through 1974.[4] Figure 1 plots seasonally adjusted and unadjusted sales volume figures for the United States for 1968 through 1978.[5] The graph, Figure 1, records sharp increases in sales volume from January through August, then a sharp decline in sales volume from August to January.

Large changes in the monthly volume of sales are also evident from the index table. The largest change in volume for the 1966 to 1974 period appears to have occurred from January 1967 to August 1967, when the volume index jumped 90.4 percent, from 42 to 80 on an annual monthly average of 62. In other words, the sales of single-family houses jumped 90 percent from the winter month of January to the summer month of August. A closer inspection shows most winter-to-summer volume jumps are in the range of 55 to 65 percent.

Further inspection of the figures and the graph indicate that the highest volume of sales consistently occurs during May, June, July, and August. The lowest volume period is January, November, and December. February, March, and April appear to be transition months between the low and high periods, while September and October appear to be the transition months for the downward movement of sales volume.

If we assume for the moment that the supply curve remains constant, then we can make some predictions as to price movements based on the information on volume changes. Demand begins in the winter months at a given level, the

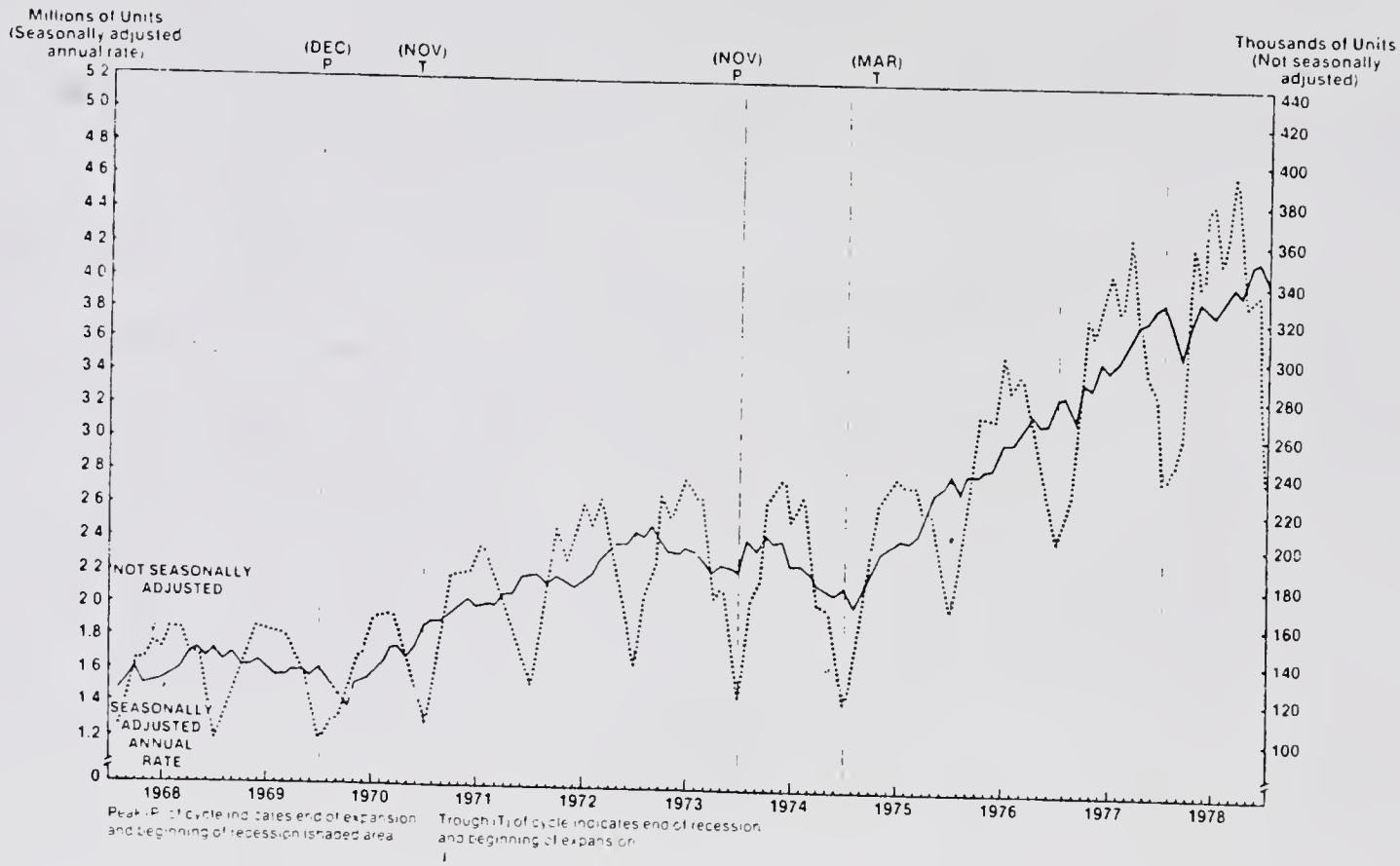

Figure 1
Existing Single-Family Home Sales for
the United States, Monthly, 1968-1978

base period. As the volume increases, the demand curve begins shifting to the right, a transition period. The summer months represent the peak period as the demand curve stabilizes. The fourth time period begins the shift back to the winter months and is similar to the earlier transition period. Thus, with the supply curve remaining stationary, it is easy to follow the expected resulting price changes. Prices should be at their lowest in the base period and their highest in the summer months.

The strength of the shift in demand will, of course, depend on factors such as personal income, consumer preferences for moving, interest rates, general market conditions, and many other factors. The strength of the shift should be a reflection of the change in the volume from winter to summer and back again.

Shifts In Supply

The above logic can also be applied to justify an expected shift in the supply of houses. If people are buying houses in a greater volume, it follows that there are probably more houses available for sale.

However, because of the high amount of capital and long length of time required to create a new house, the real short-term supply of houses is generally considered to be fixed. Weimer and Hoyt, in a discussion of the supply of real estate, state:

> Since the supply of properties and even of property service is relatively fixed, *demand* is the most important

factor in determining market prices and rents during short-run periods of a year or two."[6]

Additionally, even the marginal supply side houses will be delayed in entering the market. The serious buyers/sellers generally begin their search for new housing far in advance of the time they typically list their existing house for sale. The feeling is they wish to have plenty of time to find the right place to live, without being under pressure to move out of their existing home because it was already sold. This "lag" in adding to the supply should have the effect of pushing prices upward.

Notes

1. Maurice A. Unger, Principles and Practices, 4th ed. (Cincinnati: South-Western Publishing Co., 1969), p. 36.

2. Halbert C. Smith, Real Estate Appraiser (Columbus, Ohio: Grip, Inc., 1976), p. 6.

3. Unger, p. 29.

4. NATIONAL ASSOCIATION OF REALTORS®, Economics and Reasearch Division, Existing Home Sales, Annual Report (N.P.: NAR, 1977), p. 9.

5. Ibid, p. 13.

6. Arthur M. Weimer and Homer Hoyt, Real Estate, 5th ed. (New York: Ronald Press Co., 1966), p. 115.

CHAPTER III
REVIEW OF THE LITERATURE

Surprisingly, there appears to be little information or concern about seasonal price changes. A few publications mention it in passing. In a University of California study of Multiple Listing Service (MLS) data, which reviewed sales quarterly from 1953 through 1960, there is mention of a possible seasonal pattern.

> The index of the number of MLS sales shows a distinct seasonal pattern in which peaks were registered in the third quarter of five of the eight years and in the second quarter of the other years between 1953 and 1960.[1]

The study goes on to state:

> There was no strong seasonal pattern in average prices during a particular year; however, in all but 1954, the lowest average price was registered in the first quarter.[2]

The sales volume data for this California study are reported in Table 2 and plotted in Figure 2. A seasonal pattern is easily discernible. This study is important in that it substantiates the contention that the seasonal pattern has been around for longer than just the test period of this study.

Morton, in an article for The Appraisal Journal, studied 400 sales of single-family residences in southern California, using regression analysis. In passing, he noted:

> The last variable to enter the regression equation was the dummy variable representing the third quarter of each year, and this variable had

Table 2
Total Number of Sales, All Properties,
Reported in Seven Multiple Listing Systems,
Los Angeles County

Quarter	1953	1954	1955	1956	1957	1958	1959	1960
1	3,434	3,179	3,985	4,578	4,077	3,532	4,631	4,532
2	3,359	3,755	4,477	5,215	4,234	3,974	5,099	4,828
3	3,606	4,095	4,896	4,153	4,178	4,672	4,661	4,657
4	3,253	3,425	3,958	3,789	3,511	4,025	3,855	3,440
Annual Total	13,652	14,454	17,316	17,735	16,000	16,203	18,246	17,457

Index, Total Number of Sales, All Properties,
Reported in Seven Multiple Listing Systems,
Los Angeles County

Quarter	1953	1954	1955	1956	1957	1958	1959	1960
1	85	79	98	113	100	87	114	112
2	83	93	111	129	105	98	126	119
3	89	101	121	102	103	115	115	115
4	80	85	98	94	87	99	95	85
Annual Average	84	89	107	109	99	100	113	108

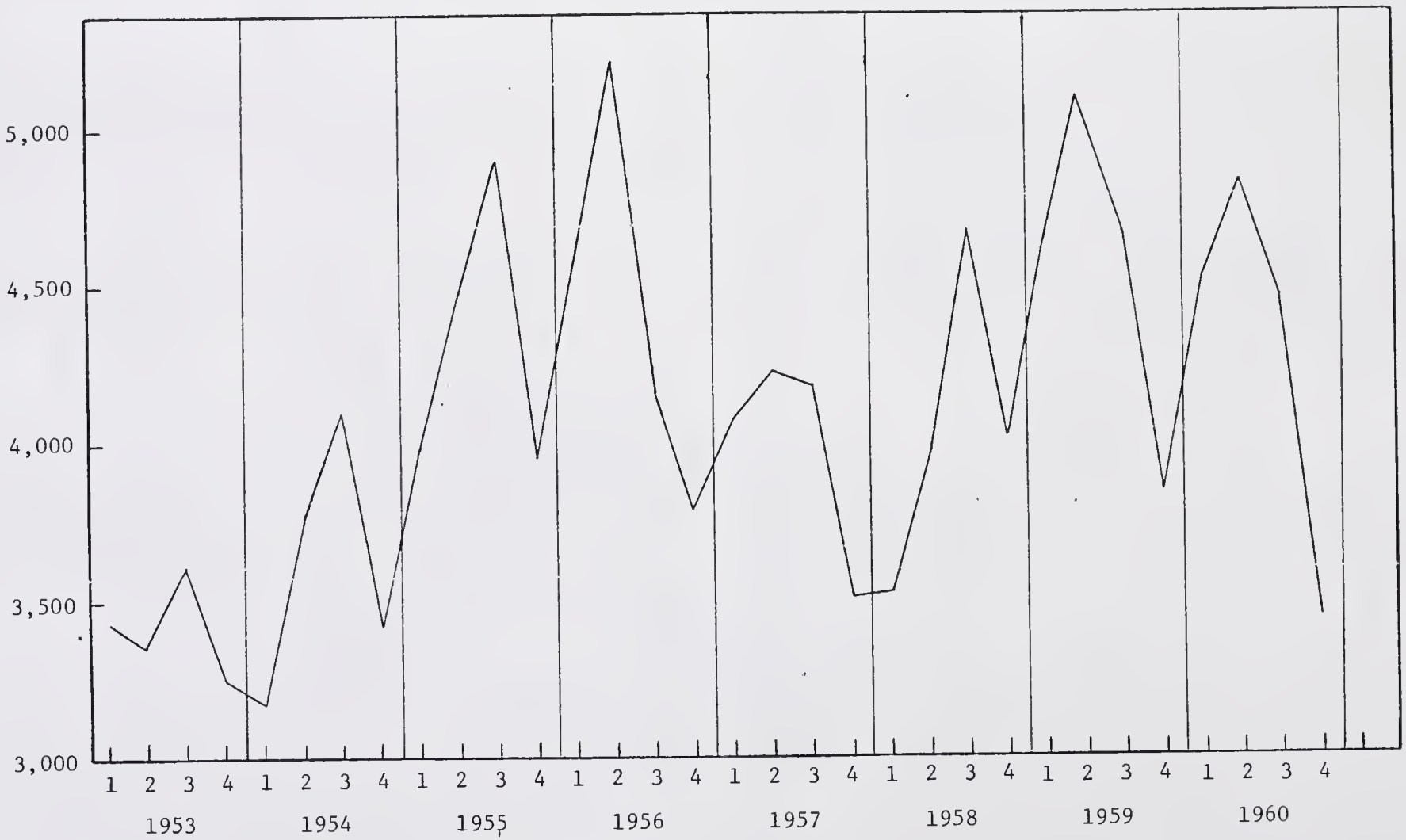

Figure 2
Total Number of Sales, All Properties,
Reported in Seven Multiple Listing Services
Los Angeles County

> a positive coefficient. The sign of this coefficient could indicate that, for the sample studied, the months of July, August, and September had a high demand in respect to the availability of properties in relation to the other quarters of the year.[3]

Unger, in a discussion of the general economic business cycles, includes a short paragraph on seasonal variations:

> Monthly, quarterly, and weekly data suggest that there exists a regular recurrence of *seasonal fluctuations*. For example, the construction industry is more active during certain periods of the year than other periods, and so is the manufacture and production of various goods such as the manufacture of ladies' handbags.[4]

In the NAR publication, Existing Homes Sales, they report:

> There is a modest degree of seasonal variation in reported selling prices. Sales prices tend to reach a seasonal peak in July, and then decline moderately over the next three months before experiencing a seasonal upturn.[5]

The same publication talks about the number of sales:

> Wide monthly fluctuations in sales volume indicate the high degree of seasonality which characterizes the existing home market.[6]

and continues:

> For all regions the spring and summer months are seasonally high volume periods, while January, November, and December are the lowest.[7]

All four note an obvious seasonal pattern in the volume of transactions. But the "wide fluctuations" in sales volume are masked in the resulting sales prices. This study attempts to remove that mask so that the seasonal variations in selling prices will become equally apparent.

Notes

1. Frederick E. Case, A Study of Multiple Listing Data (Los Angeles, California: University of California Printing Department, 1963), p. 11.

2. Ibid., p. 14

3. T. Gregory Morton, "Factor Analysis, Multicollinearity, and Regression Appraisal Models," The Appraisal Journal, (Volume XLV, Number 4, October, 1977), p. 583.

4. Maurice A. Unger, Principles and Practices, 4th ed. (Cincinnati: South-Western Publishing Co., 1969), p. 29.

5. NATIONAL ASSOCIATION OF REALTORS®, Economics and Research Division, Existing Home Sales, Annual Report (N.P.: NAR , 1977), p. 45.

6. Ibid.

7. Ibid.

CHAPTER IV
THE MODEL

A major problem in any research is the availability of data which are appropriate for the problem. Real estate is more of a problem because each piece of property is unique. Therefore, an observation of one parcel may have no relationship to another.

However, as Thompson and Harwood point out:

> Although land is nonhomogeneous, there can still be a high degree of physical and economic similarity. For example, in a city block containing 20 house lots of identical size and shape, there will be a high degree of similarity even though the lots are still nonhomogeneous. Finding similar properties is, in fact, the basis for the market-comparison approach to appraising real estate.[1]

The real estate problem is no more difficult than the observation of the stock market. Each company is unique. But each company, as represented by its stock, is influenced by business cycles and factors which affect similar companies. Models can and are constructed which represent the movements of groups of stocks which contain the individual stock. On the average, as the group of stocks (the model) moves, so moves the individual stock. These models are the "average" or norm from which deviations are measured and changes noted.

If a housing model can be constructed which will function "on the average," then observations of specific properties generally comparable to those making up the model or "average" can be measured or "adjusted" from the model. The model in

this study is designed to represent the price fluctuations of the average existing single-family house sold in the United States. The model is constructed from the observed prices for sales of existing single-family houses in the United States from 1968 through 1978, adjusted for inflation, as measured by the Housing Price Index (HPI), a subcomponent of the Consumer Price Index.

Using the existing single-family house market for the United States provides a broad base on which to ensure that most of the factors which make the individual house unique are lost or hidden when averaged with all other individual houses.

The Data

The NATIONAL ASSOCIATION OF REALTORS® (NAR) has collected from 142 Multiple Listing Services (MLS) monthly reports of existing single-family house sales since 1966. The data are collected from all over the United States which is subdivided into four regions (northwest, southwest, northeast, and southeast) for data collection. Collection of the data is described in the Existing Home Sales, an NAR annual publication:

> Participating MLS's report the number of single family sales which occurred during the month, sales prices and number of bedrooms in the unit. In 1978 data on nearly 650,000 existing single family home transactions were reviewed and processed.
>
> Participating MLS's are situated in every region of the country and provide wide geographic

> coverage of the existing home market. While all are located in, or adjacent to, Standard Metropolitan Statistical Areas, comparisons of their reports with Census data from the Annual Housing Survey show that, as a group, their experience is representative of the sales activity and prices that generally prevail in each region of the country.[2]

The broad base, consistency, and the large number of sales make these data appropriate for the construction of the model. NAR reports both median and average prices each month for the country and for each of the four regions. Median prices have been collected and reported from January 1966, while average prices have been reported from January 1968. Tables 3 and 4 contain the average and median monthly sale price of existing single-family homes for the United States. Both prices have been used in the research for this study; however, the average price figures have been used for the model.

Other supporting data have also been collected either to adjust the NAR data or to test the model. These data are contained in various tables in this study, referred to and explained as they apply in the study.

Notes

1. Marvin Thompson and Bruce Harwood, Florida Real Estate (Reston, Va.: Reston Publishing Co., Inc., 1980), p. 35

2. NATIONAL ASSOCIATION OF REALTORS®, Economics and Research Division, Existing Home Sales, Annual Report (N.P.: NAR, 1978), p. 45.

Table 3
Average Sales Price of Existing
Single-Family Homes in the United States

Month	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	$21,800	$23,200	$24,600	$26,100	$28,000	$30,900	$34,400	$36,900	$40,200	$44,000	$50,300
February	22,100	23,300	24,800	26,600	28,000	31,600	34,500	37,600	40,100	45,100	51,300
March	22,000	23,400	25,100	26,600	28,600	32,200	35,200	38,000	41,200	45,500	51,100
April	22,300	23,800	25,200	27,300	29,000	32,500	35,600	38,800	41,700	46,500	53,600
May	22,400	24,000	25,300	27,800	29,600	32,800	35,800	39,000	42,900	46,800	54,800
June	22,900	24,400	25,700	27,700	29,900	33,400	36,600	40,000	41,900	47,700	55,100
July	23,000	24,800	26,100	28,000	30,200	34,000	36,800	39,600	43,200	48,000	56,500
August	22,800	24,700	25,900	28,000	30,200	33,800	37,700	40,600	43,400	48,100	57,500
September	22,600	23,900	25,400	27,600	29,700	33,200	36,100	39,400	42,700	47,900	57,700
October	22,400	24,100	25,000	27,400	29,600	32,800	35,400	38,900	42,400	48,200	57,300
November	22,600	24,500	25,700	27,900	29,700	33,500	35,900	39,300	42,900	48,500	57,400
December	23,100	24,300	25,300	27,600	29,700	33,300	36,100	39,400	43,300	48,300	58,100

Table 4
Median Sales Price of Existing
Single-Family Homes in the United States

Month	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	$19,700	$21,100	$22,200	$23,700	$25,300	$27,400	$30,600	$33,200	$36,300	$39,600	$45,500
February	19,900	21,000	22,500	24,200	25,400	28,000	30,600	33,900	36,200	40,700	46,300
March	19,700	21,200	22,800	24,300	25,900	28,400	31,400	34,200	37,200	41,000	46,500
April	20,000	21,500	22,900	24,600	26,300	28,500	31,700	34,900	37,700	42,000	48,200
May	20,100	21,600	23,100	25,100	26,900	28,800	32,100	35,200	37,600	42,200	47,800
June	20,700	22,200	23,300	25,100	27,300	29,200	32,900	36,200	38,600	43,400	48,400
July	20,800	23,000	23,700	25,400	27,500	29,900	33,000	35,900	38,900	43,700	49,400
August	20,600	22,600	23,500	25,300	27,400	29,900	32,900	36,800	39,400	43,900	50,300
September	20,500	21,700	23,100	24,800	27,000	29,100	32,400	35,800	38,700	43,800	50,200
October	20,100	21,900	22,700	24,800	26,900	28,900	31,900	35,400	38,500	44,000	50,100
November	20,500	22,100	23,200	25,100	27,000	29,700	32,100	35,700	38,800	44,500	50,700
December	20,900	22,000	22,800	24,900	27,100	29,500	32,700	35,800	39,000	44,200	50,900

CHAPTER V
FACTORS AFFECTING PRICES

Many variables affect housing prices, including a change in the mortgage interest rates, a change in consumer tastes, an increase in the population, and the failure of a local business. These factors are at work on every level, from the local market to the national market. These many variables and their effects on prices are discussed in detail in basic appraisal and real estate books and do not need to be discussed in detail in this study.

In order to unmask the seasonal price change and accurately plot its movement, it is desirable and necessary to eliminate as much of the nonseasonal price fluctuations as possible. This study's model, using a large number of observations across the entire nation, has minimized the effects of most of the local influencing factors, which must be left to the local appraiser in determining their effects on the local market. This leaves us with the factors which are national in scope and which should be much more easily identified.

We would not expect to see any effect on the national model of a shut-down of a large government plant in Atlanta. We would expect to see effects on prices from changes in consumer tastes in housing which affect the nation, such as a trend toward larger homes or homes with more amenities. We would also expect to see changes in prices due to changes in national mortgage rates.

Most large changes in interest rates have been associated with business cycles, which contain other influencing factors such as drops in employment. Such factors affect the ability of people to buy houses. Thus, on a national level, influencing factors are often only subcomponents of a larger more easily identifiable factor which can be used to explain the observed price changes.

The most obvious factor affecting prices today is inflation. It probably accounts for the majority of house price changes. Inflation is also one of the easiest factors to measure. It is therefore the most logical first step to take, in adjusting out, unwanted factors. Because of the indexes published by the government, an adjustment for inflation can be done with reasonable accuracy.

The first problem, then, is to determine the best estimate for housing inflation. The three most obvious indicators are

1. The Consumer Price Index (CPI);
2. The Housing Price Index (HPI), a subcomponent of the CPI;
3. One of the subcomponents within the HPI.

Since the indexes are available monthly and the HPI is more directly related to the housing market, the HPI was selected for use over the CPI.

One potential problem in the use of the HPI is that housing prices directly affect the HPI and bias its results

more than the CPI. But this is the major reason for selecting the HPI. We will be looking at a given level of house prices (which is already reflected in the HPI). The HPI will be more sensitive to the changes in house prices from that given level than would the CPI, and thus should be a better indicator of market moves. The subcomponents within the HPI might do as well, particularly the "homeownership" subcomponent. However, the HPI is a broad index which should be less sensitive to minor aberrations which could negatively affect a specific item within the index. The HPI was therefore considered best for this study.

There has been some criticism of the CPI as not being a true measure of inflation. One of the major criticisms is that the interest rate, which is a part of the HPI, reflects the current market rate of interest to persons buying a house. It has nothing to do with the vast majority of people who are renting or who own existing housing. This argument adds support to the use of the HPI for this study. It is the purchase and sale of the existing single-family house at the time the interest rate contained in HPI affects the property that the study examines. The current interest rate affects the housing market at the point where the marginal buyer and the marginal seller find equilibrium in their prices. When interest rates change, the cost to one or the other party changes. Therefore, to represent the market realistically at the time of the transaction, the

index should contain the interest rate information that affects the transaction. The HPI figures used to adjust the NAR sales figures are contained in Table 5.[1]

Note

1. U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review (Washington, D.C.: Government Printing Office, 1965-1979).

Table 5
Housing Price Index
U.S. Bureau of the Census
1964 -1978

Month	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	0.935	0.946	0.955	0.990	1.018	1.074	1.147	1.227	1.273	1.314	1.422	1.613	1.732	1.831	1.970
February	0.936	0.947	0.957	0.992	1.023	1.079	1.157	1.226	1.276	1.320	1.434	1.628	1.738	1.843	1.982
March	0.937	0.947	0.959	0.991	1.026	1.089	1.169	1.224	1.279	1.324	1.449	1.636	1.745	1.855	1.999
April	0.936	0.947	0.965	0.994	1.028	1.096	1.176	1.225	1.282	1.328	1.460	1.647	1.749	1.867	2.016
May	0.935	0.947	0.969	0.997	1.031	1.101	1.182	1.232	1.285	1.333	1.476	1.653	1.756	1.876	2.032
June	0.937	0.947	0.972	0.998	1.038	1.105	1.186	1.240	1.290	1.339	1.492	1.664	1.765	1.890	2.053
July	0.937	0.948	0.974	1.000	1.046	1.111	1.192	1.245	1.295	1.342	1.509	1.671	1.775	1.905	2.071
August	0.938	0.947	0.976	1.004	1.051	1.118	1.199	1.251	1.299	1.352	1.528	1.677	1.784	1.914	2.086
September	0.940	0.950	0.978	1.006	1.054	1.125	1.206	1.255	1.302	1.366	1.549	1.689	1.795	1.927	2.109
October	0.942	0.954	0.982	1.009	1.058	1.131	1.212	1.259	1.304	1.381	1.567	1.698	1.801	1.936	2.130
November	0.943	0.956	0.985	1.011	1.065	1.136	1.219	1.264	1.308	1.394	1.583	1.713	1.807	1.946	2.141
December	0.943	0.957	0.989	1.015	1.070	1.142	1.226	1.268	1.312	1.406	1.599	1.722	1.816	1.956	2.150

CHAPTER VI
RESULTS OF ADJUSTING FOR INFLATION

The NAR observed monthly average prices from 1968 through 1978 were adjusted for inflation using the HPI, by dividing the observed price by the HPI for that particular month. The resulting adjusted price information is found in Table 6. The adjusted prices were graphed and are included in Figure 3.

Had inflation, as measured by the HPI, accounted for all changes in the price, we would expect to see a flat line on the graph. This does not occur. Three distinct patterns become obvious from looking at the NAR graphed data:

1. There is a general upward trend in prices. From 1971 through 1978, the upward trend accelerates.
2. There are distinct movements up and down during periods of business recessions and expansions.
3. There are sharp increases from the fourth quarter of each year to the third quarter of the following year, followed by a decline to the fourth quarter.

This study focuses primarily on the seasonal price changes noted in the third pattern listed above. But the general upward trend and the business cycle can influence seasonal price changes. Their potential influence on any model using the NAR data needs to be discussed to make this study complete.

Upward Trend of Prices

It appears from the graph of the NAR data that the HPI accounted for most of the nonseasonal price changes from 1968 to 1970. There is a slight rise, which becomes much

Table 6
Average Existing House Sales
Adjusted for Inflation
United States Data

Month	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	$21,414	$21,601	$21,447	$21,271	$21,995	$23,516	$24,191	$22,876	$23,210	$24,030	$25,333
February	21,603	21,564	21,434	21,696	21,943	23,939	24,058	23,095	23,072	24,471	25,882
March	21,442	21,487	21,471	21,732	22,361	24,360	24,292	23,227	23,610	24,528	25,562
April	21,692	21,715	21,428	22,285	22,620	24,472	24,383	23,558	23,842	24,906	26,587
May	21,726	21,798	21,404	22,564	23,035	24,606	24,254	23,593	24,430	24,946	26,968
June	22,061	22,081	21,669	22,338	23,178	24,944	24,530	24,038	23,739	25,238	26,838
July	21,988	22,322	21,896	22,490	23,320	25,335	24,387	23,698	24,338	25,196	27,281
August	21,693	22,093	21,601	22,382	23,248	25,000	24,672	24,209	24,327	25,130	27,564
September	21,442	21,244	21,061	21,992	22,811	24,304	23,305	23,327	23,788	24,857	27,358
October	21,172	21,308	20,627	21,763	22,699	23,750	22,590	22,909	23,542	24,896	26,901
November	21,220	21,566	21,082	22,072	22,706	24,031	22,678	22,942	23,741	24,922	26,809
December	21,588	21,278	20,636	21,766	22,637	23,648	22,576	22,880	23,843	24,693	27,023
Mean	-	21,676	21,479	21,681	22,441	23,915	24,212	23,287	23,552	24,447	25,965
Standard Deviation	-	349	183	729	607	1,007	292	549	584	633	1,039
Std Dev/Mean	-	1.6%	.9%	3.4%	2.7%	4.2%	1.2%	2.4%	2.5%	2.6%	4.0%

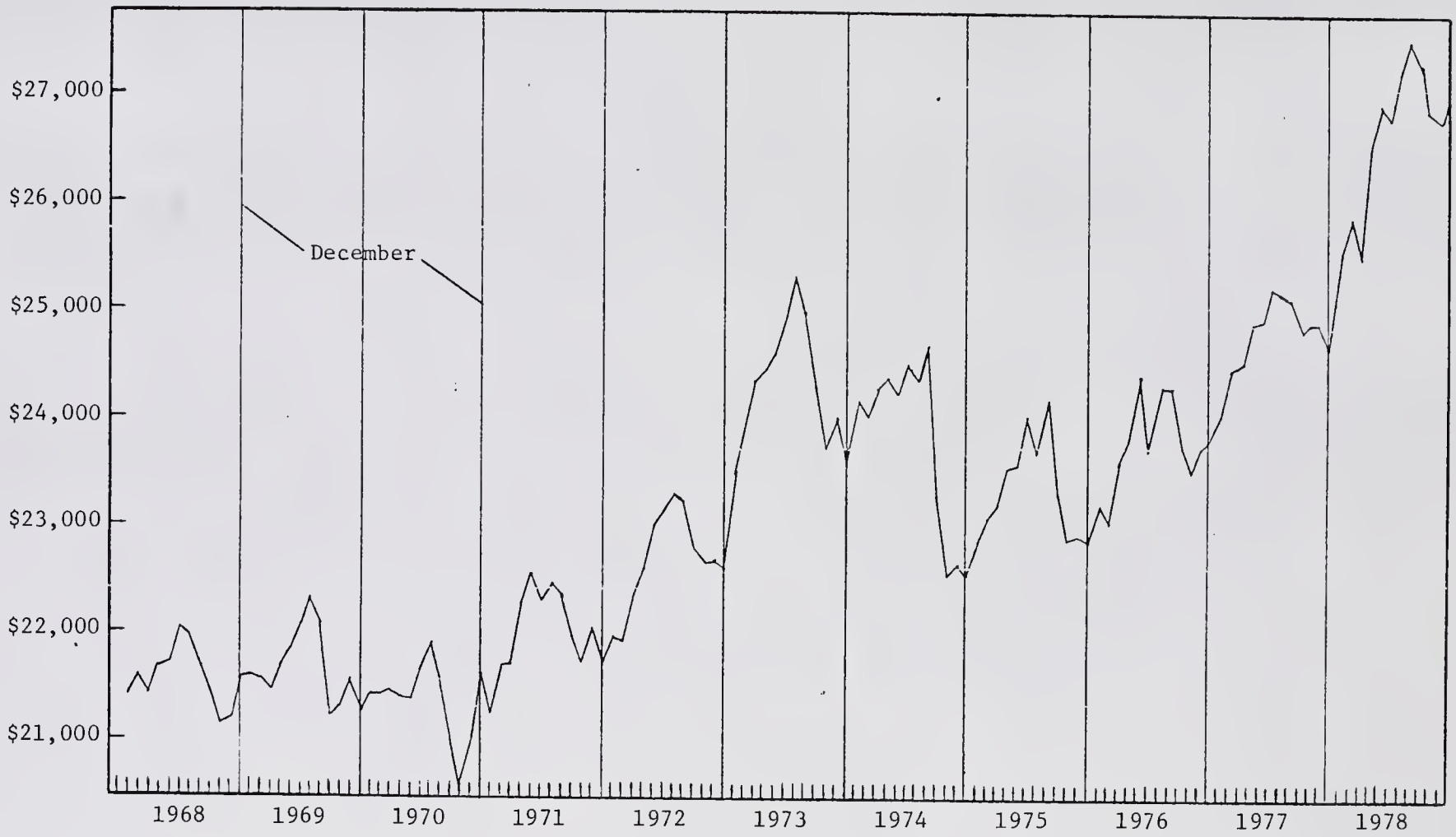

Figure 3
Average Existing Single-Family
House Sales Price
United States Data
Adjusted for Inflation

more pronounced from 1971 on. The growth appears to be approximately 2.0 percent per year (depending on when the rise is calculated as beginning). The next step in this study was to review the cause for this increase and determine its effect on the model.

A review of the NAR publication Existing Home Sales,[1] or any other publication which reports numbers of bedrooms or similar differences in amenities, shows that over time houses are becoming larger on the average and contain more amenities.

Since the NAR data report the average of all sales, it is possible that the "quality" of the average house is changing over time. A positive change in quality (adding amenities) would result in higher average prices over time, as older houses are replaced with new houses. This development could explain at least a part of the increase shown in Pattern 1. This appears to be the case, and is discussed in a report for the Council on Wage and Price Stability:

> Improvements in the quality of new housing are at least partly responsible for higher housing prices during 1977 and, more generally, over the past decade. Buoyed by gains in personal income since the last recession and by rising housing values, many current homeowners sold their previous houses and purchased bigger, fully equipped new houses on larger lots. Consequently, sales prices of all houses sold are increasing more rapidly than sales prices of houses with the average characteristics of a "fixed-quality house"[2] sold during 1974.[3]

Thus the Council's report also recognizes that house prices are increasing at a rate greater than inflation. It

attributes part of the difference to an increase in the average quality of housing in the nation.

If the increase in the average quality of housing accounted for all of the additional price increase, the "fixed-quality house" price should remain fairly constant over time. However, this is not the case. A comparison of the fixed-quality house with both the Consumer Price Index (CPI) and the Construction Material Index (CMI) shows the fixed-quality house increasing in price at a faster rate than justified by both indexes.[4] We must conclude that other factors are contributing to the extra increase.

The Council's report further points out that many new homes are subject to "frontloading," which requires the developers to pay for sidewalks, schools, sewer systems, parks, etc., which are added to the price of the new home and passed on to the buyer.[5] These increased initial costs have made the new house coming on the market more expensive than would have otherwise been justified by the increase in the HPI. It is perhaps these "additional" costs which are causing a large part of the unexplained growth in sale prices of both the quality adjusted new houses and existing houses.

These increased initial costs have made the existing houses more competitive with the new house because the new houses include these costs in their prices. This is a shift to the right in the supply curve for new housing. This

would cause marginal new home buyers not to buy a new house, because of the higher relative price, and to switch into the existing house market. This switch increases the number of buyers looking for existing houses. The result is a shift to the right in the demand curve for existing houses. This shift results in the sellers being able to command a higher price for their houses. It is difficult to determine from the information at hand whether this results in any difference in the rate of price increase between existing houses and fixed-quality new houses.

The period of time between the contract date and closing date is different between the two types of houses. The new house could have a delay of from one to eight months before the buyer moves into the house. The average delay is probably between four and six months, whereas the existing house sale delay normally does not exceed one month. This time difference could, if seasonal fluctuations are significant, mean greater differences in price between the two types of houses. The time of the year may be significant for the existing home buyer, because he may be in direct competition with many buyers during certain months. The buyer of a new house is not in competition for an existing supply of houses, and thus has some control over occupancy date, price, and other factors.

There are other logical explanations for the increase in prices which are greater than the HPI. As suggested in

the Council's report, more and more families can afford to buy houses. Also, the population has continued to increase, and the baby boom of the postwar period has added to the number of people in the market to buy houses. The average size of a household is decreasing, while the total population is increasing. All these factors could represent a long-term shift in the demand side of the housing market.

Other factors which could help explain the additional increases above the HPI are better financing terms, FHA and VA points being passed on to the buyer, increased awareness by more potential buyers of the inflation hedge provided by an investment in a house and that the HPI is not the best cost index for estimating house price increases.

In review, the upward trend in prices appears to be caused largely by

1. An increase in the quality of homes being sold;
2. An increase in the production cost through front-loading; and
3. Possible long-term shifts in the demand curve.

A decision whether to adjust the model based on this information had to be made. With one exception, the model is designed to represent the "average" sale price of all existing houses. Since the "average" house is affected by these factors, and that effect is a part of what the model is to measure, then eliminating these factors would adversly affect the model. Therefore no adjustment is desired. However, the one reason for eliminating these factors is so

that the model can be used to adjust the selling price of comparable properties in a standard house appraisal. To be technically accurate, it would be necessary to eliminate any changes in the data attributable to changes in quality. This should be the difference between the quality adjusted percentage price change and the average percentage price change reported over the same period by the U.S. Department of Commerce.[6] This adjustment would equate the model with a standard comparable house appraisal by holding constant the quality (the same amenities) of the house.

Unfortunately, there are several drawbacks to such an adjustment:

1. It assumes the quality adjustment index is accurate.[7] But the Department of Commerce notes:

   > . . . houses which are "the same" with regard to these particular characteristics may vary from one time period to the next in a number of ways, such as workmanship, materials, and mechanical equipment. . . . The ten characteristics account for approximately 70 percent of the variation in selling prices of new one-family houses.[8]

2. The difference between the two rates of change varies from quarter to quarter and year to year.

3. The model uses monthly data while the quality figures are available only quarterly and yearly. The model is not readily compatible with the data, although interpolation could be used.

4. The quality data are based on new house sales, while the model is based on existing house sales.

I did not feel that it was critical at this stage of the research to attempt any additional adjustments to the model because

1. The frontloading and demand shifts influencing the upward trend in the model should stay in the model because they affect all property.

2. A standard house appraisal generally looks only at comparable sales in a relatively brief time period (one to six months). The average error factor introduced by the changes in quality which should not be in the model would probably be less than one percent and therefore would not be significant.[9]

Therefore, no adjustment to the model was made for the upward trend pattern observed in the graph or for changes in quality.

The Business Cycle

The second pattern observed from the NAR graphed data was the business cycle. General declines in the graphed data are apparent in 1970 and in 1974/1975. These declines are followed by periods of rapid increases in prices. December 1969 through November 1970, and November 1973 through March 1975 are generally recognized as periods of recession. The years immediately following the recessions are considered growth periods.

Unger, in a discussion of real estate cycles, states:

> Although comparatively few studies have been made of the real estate cycle, it is generally agreed that building activity follows to a degree the business cycle in a wavelike movement. It is further indicated that the volume of real estate activity does not necessarily advance with the increases in general business, and declines in real estate activity generally precede general business declines. It appears that the troughs and peaks of the real estate cycle go deeper and higher than those of the business cycle.[10]

The NAR annual house survey discusses the business cycle and its effects on house sales:

> Like many other types of economic activity, the existing home market is subject to cyclical fluctuations. However, home sales generally feel the impact of cyclical change before many other sectors. In the last two business cycles the resale market led the economy at each turning point. In the 1970 recession existing home sales began to decline six months before the general economic downturn was underway. Resale activity then turned sharply upward in April 1970 - a full seven months before the economy had bottomed out. A similar pattern was traced out in the longer and deeper 1973-1975 recession.
>
> In both recessions the drop in resale activity was much more severe than the decline for the general economy and the recovery was much more buoyant. From the peak to the trough of the 1970 recession existing home sales declined 20 percent compared to just a one percent slump in the general level of economic activity. Similarly, in the 1973-1975 recession existing home sales slipped 18 percent while the overall economy fell six percent.[11]

From Figure 3, it appears that the general price level for the HPI adjusted average house price declined during the winter months in both 1969 and 1970 to below those levels which would be expected by general observation of previous years' data. The 1970 summer month price levels also did not reach expected levels. But, after the 1970 winter, prices recovered sharply. These price movements appear to follow closely the 1973/1975 recessionary period.

The 1969/1970 recession was mild compared to the 1973-1975 recession. The 1974 winter price drop was exceptionally steep, especially after considering the low 1974 summer price level. The prices did not appear to fully begin a strong recovery until early in 1976.

During the 1971/1973 and 1976/1978 business expansion periods, the NAR house prices increased at rates far in excess of the inflation rate, recovering not only the ground lost during the recessions, but moving far above any previous trend line.

These business phases appear to have marked effects on prices in the long and short run. While the long-run effect is not a major concern in this study, the short-run effect is, if it would distort the seasonal patterns.

By comparing an expansion year of 1977 with a recession year of 1974, the differences become obvious. In 1977, prices climbed well above the previous winter months. In 1977 winter prices dipped below the 1977 summer price levels, but were well above the previous winter prices. On the other hand, 1974 summer prices barely managed to exceed the earlier winter months and 1974 winter prices look as if they had the rug pulled out from underneath them as they plummetted to 1972 winter levels.

By expanding the visual comparisons, three patterns began to emerge

1. Growth or expansion period characterized by a rapid increase in prices from the winter to summer months, followed by a slight decline to the following winter months, establishing a new level well above the previous year's winter price levels.

2. Recession period characterized by a slight or modest increase in prices from the winter to summer months, followed by a sharp decline to the following winter months.

3. Stable or level period during the period from 1968 through mid-1969 the house market appeared to have a relatively stable price cycle. The only price changes not taken care of by the HPI appear to be the seasonal fluctuations. This period is generally "level" and is characterized by a modest increase in the price level from the winter months to the summer months, followed by a drop in prices back to their pre-summer levels.[12]

Because of the obvious differences which occur in the various business phases, the first inclination was to divide the data into the three phases: recession, growth, and level. The obvious problem with this division into business phases is that there are only two observations per month for the recession and level categories. The statistical test required for these data results in only one degree of freedom and an almost impossible restriction on the verification of success.

Fortunately an adjustment in the starting month for each year, discussed in the next section, reduced the differences between the phases enough to derive meaningful results. The appendix discusses the business cycle further and also provides the derived indexes for the three business phases. Although the division of the business cycle was not used in this model for lack of adequate observations, the refined seasonal index should allow for the division.

The Seasonal Year

While observing the business cycle, another characteristic of the housing data became apparent. The seasonal cycle appeared to begin in September and end in August. By beginning the seasonal year in September and looking at the

Table 7
Median Existing House Sales
Adjusted for Inflation
United States Data

Month	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	$19,120	$19,020	$19,351	$19,646	$19,354	$19,315	$19,874	$20,852	$21,519	$20,582	$20,958	$21,627	$23,096
February	19,467	19,334	19,452	19,462	19,446	19,739	19,906	21,212	21,338	20,823	20,828	22,083	23,360
March	19,489	19,152	19,200	19,467	19,503	19,852	20,250	21,450	21,670	20,904	21,318	22,102	23,261
April	19,057	19,134	19,455	19,616	19,472	20,081	20,514	21,460	21,712	21,190	21,555	22,496	23,908
May	19,226	19,368	19,495	19,618	19,543	20,373	20,933	21,605	21,748	21,294	21,412	22,494	23,523
June	19,156	19,338	19,942	20,090	19,645	20,241	21,162	21,807	22,050	21,754	21,869	22,963	23,575
July	19,149	19,710	19,885	20,702	19,882	20,401	21,235	22,280	21,868	21,484	21,915	22,939	23,853
August	19,455	19,581	19,600	20,214	19,599	20,233	21,093	22,115	21,531	21,943	22,085	22,936	24,113
September	18,681	19,423	19,449	19,288	19,154	19,761	20,737	21,303	20,916	21,196	21,559	22,729	23,802
October	18,625	19,038	18,998	19,363	18,729	19,698	20,628	20,926	20,357	20,848	21,377	22,727	23,521
November	18,700	19,109	19,248	19,454	19,032	19,857	20,642	21,305	20,278	20,840	21,472	22,867	23,680
December	18,584	18,945	19,532	19,264	18,597	19,637	20,655	20,655	20,450	20,789	21,475	22,597	23,674

subsequent patterns, the same pattern emerged for all years. Summer prices were always higher than the previous winter prices and winter prices were always lower than the previous summer's prices.

Of course the size of the increase from winter to summer and the size of the decrease from summer to winter depends on the phase of the business cycle the year was in. But, most importantly the direction of the change was always the same. By beginning the year in September it then became more precise to average the amount of the seasonal changes from year to year. Thus the best model for the existing single-family house price movements is a model which allows for the business cycle and which also uses a September to August year.[13]

Notes

1. NATIONAL ASSOCIATION OF REALTORS®, Economics and Research Division, Existing Home Sales, Annual Report (N.P.: NAR, 1979), p. 38.

2. The index of fixed-quality housing costs is constructed by the Census Bureau by holding constant a specific set of characteristics believed to measure change in quality. Executive Office of the President, A Quarterly Report of the Council on Wage and Price Stability with a Special Report on Inflation (Washington, D.C.: Government Printing Office, No. 13, April, 1978), p. 115.

3. Executive Office of the President, A Quarterly Report of the Council on Wage and Price Stability with a Special Report on Inflation (Washington, D.C.: Government Printing Office, No. 13, April, 1978), p. 115.

4. Ibid, p. 116.

5. Ibid.

6. Bureau of the Census, Price Index of New One-Family Houses Sold (Washington, D.C.: U.S. Department of Commerce, 4th Quarter, 1978), p. 3.

7. Perhaps the accuracy of the index would be improved if the information were seasonally adjusted.

8. Bureau of the Census, Price Index of New One-Family Houses Sold (Washington, D.C.: U.S. Department of Commerce, 4th Quarter, 1978), p. 2.

9. The average difference between the percentage change of the Fixed-Quality (1974) house index and the Housing Price Index from the fourth quarter 1967 to the fourth quarter 1977, is 1.453 percent per year or .121 percent a month. An error term this small is considered by the author to be very acceptable in today's real estate market.

10. Maurice A. Unger, Principles and Practices, 4th ed. (Cincinnati: South-Western Publishing Co., 1969), p. 32.

11. NATIONAL ASSOCIATION OF REALTORS®, Existing Home Sales (1979), p. 10.

12. The NAR median sale prices for the United States, adjusted for inflation, are in Table 7. Fortunately, information on median sales extends back to 1966. The earlier prices reflect level prices from 1966 to 1969.

13. The HPI has not accounted for all of the price increases over the test period. Perhaps a better index to use in future models would be the Home Purchase Index, a subcomponent of the HPI.

CHAPTER VII
BUILDING THE MODEL

Several steps in building the model have already been covered in previous discussions. The monthly sales prices (P) were divided by the HPI for the corresponding month to arrive at the adjusted monthly price (AP). The adjusted prices were then grouped by year, with each year beginning in September and ending in August.

The Model is an Index

The model constructed is an index which can adjust sales for the month (season) of the year under observation. The base of the index is 1.0, representing the average monthly price for a given year. For example, if there was no seasonal change, the average price (B) and the observed price (P) would be equal (P x 1.0 = B).

When the price is subject to seasonal fluctuations, the observed price and the average price are different. The seasonal index is the relationship of the two prices to each other (BMA =B/P), where BMA is the monthly index. The average price can be determined by multiplying P x BMA. With the average price then available, the expected price to be observed in another month can be determined by substituting the monthly index figure for the appropriate month into the above equation and solving for P.

Methodology

The observed monthly prices for the seasonal year adjusted for inflation are summed and divided by 12 to

arrive at the average monthly sale price for the year. This average figure is called the base price (B) for that particular year. The logic is that had the HPI accounted for all price changes, the price for each month of the year should equal the other monthly prices within the year (P x 1.0 = B). Any differences in prices can be measured from the base price (B). These differences should reflect the seasonal change. Observing enough of the variations for each month will allow a reasonable estimation of the expected difference between the observed price (P) and the base price (B).

The major assumption is that all external factors are constant except for the seasonal influences. In the short run of one year used in each period, this assumption seems reasonable. First, the large population used in the study minimizes the minor disturbances which might affect specific cities or local markets. Second, many disturbances such as changes in tastes and attitudes are gradual, stretching out over years. The September to August period is a short enough period not to be materially affected by these variables. Third, larger disturbances will affect the data, but more likely not to a major extent within the short period of the base year. The business cycle is probably an exception.

The monthly adjustment index for each year was then derived by dividing the adjusted monthly price into the average monthly price (B/P = MA), where MA equals the monthly adjustment factor.

A composite base monthly adjustment factor was derived

in a fashion similar to arriving at the base price. The monthly adjustment factors (MA) were grouped by month, all Aprils in one group, all Septembers in another, etc. The sum of the monthly adjustment factors for each month were then divided by the number of observations of that month to determine the new base monthly price (BMA) or the monthly adjustment factor $(\sum_{m=1}^{12} MA_m)/n = BMA_m$, where n is equal to the number of observations of a particular month.

Because this factor (BMA) is the average of all the observed adjustment factors for a given month, it represents the best estimate of the true adjustment factor for that particular month.

Summary and Results

In summary the index calculations are

$$AP_m = P_m/HPI_m$$

$$B_y = (\sum_{m=1}^{12} AP_m)/12$$

$$MA_{my} = B_y/AP_m$$

$$BMA_m = (\sum_{m=1}^{12} MA_m)/n$$

where

1. P = Observed Sale Price
2. HPI = Housing Price Index (a measure of inflation)
3. AP = Adjusted Price
4. B = Average Adjusted Sale Price for a Specific Year
5. MA = Monthly Adjustment Factor for a Specific Month in a Specific Year

6. BMA = Monthly Adjustment Factor for a Specific Month for all years

7. m = A Specific Month (January, February, etc.)

8. y = A Specific Year (1968, 1969, etc.)

9. n = Number of Observations

Note the 12 BMA's represent the monthly index for all years. The specific monthly (BMA) indexes are

1.011438 - January

1.006715 - February

0.999823 - March

0.987740 - April

0.980343 - May

0.976200 - June

0.970414 - July

0.972055 - August

1.018289 - September

1.031631 - October

1.024754 - November

1.029777 - December

CHAPTER VIII
VALIDITY OF THE MODEL

The base monthly adjustment factor (BMA) when combined with the BMA's for the other months is the model. It should accurately represent the seasonal variations from the base or average price for the NAR national data. But how good are the results produced by the model? Several tests were made to help determine whether the model could adjust out seasonal fluctuations.

Graphed Index Results

The first check was a visual observation of the index used on the data from which the index was derived. The solid line in Figures 4a, 4b and 4c depicts the average national sale prices adjusted for inflation. This is the same information plotted in Figure 3. The national prices were then multiplied by the model index. If the index accounted for all seasonality the graphed data should appear closer to a straight line.

The dotted line in Figures 4a, 4b and 4c represents the data seasonally adjusted. Visually it appears that the fluctuations in the data have been reduced. The business cycle is still pronounced, and the gradual annual increase in prices discussed in Chapter VI appears to be more determinable Thus the index appeared to reduce the seasonal fluctuations.

Variance of the Index

Confirmation of the visual observations was the next step. The monthly difference between the observed price and

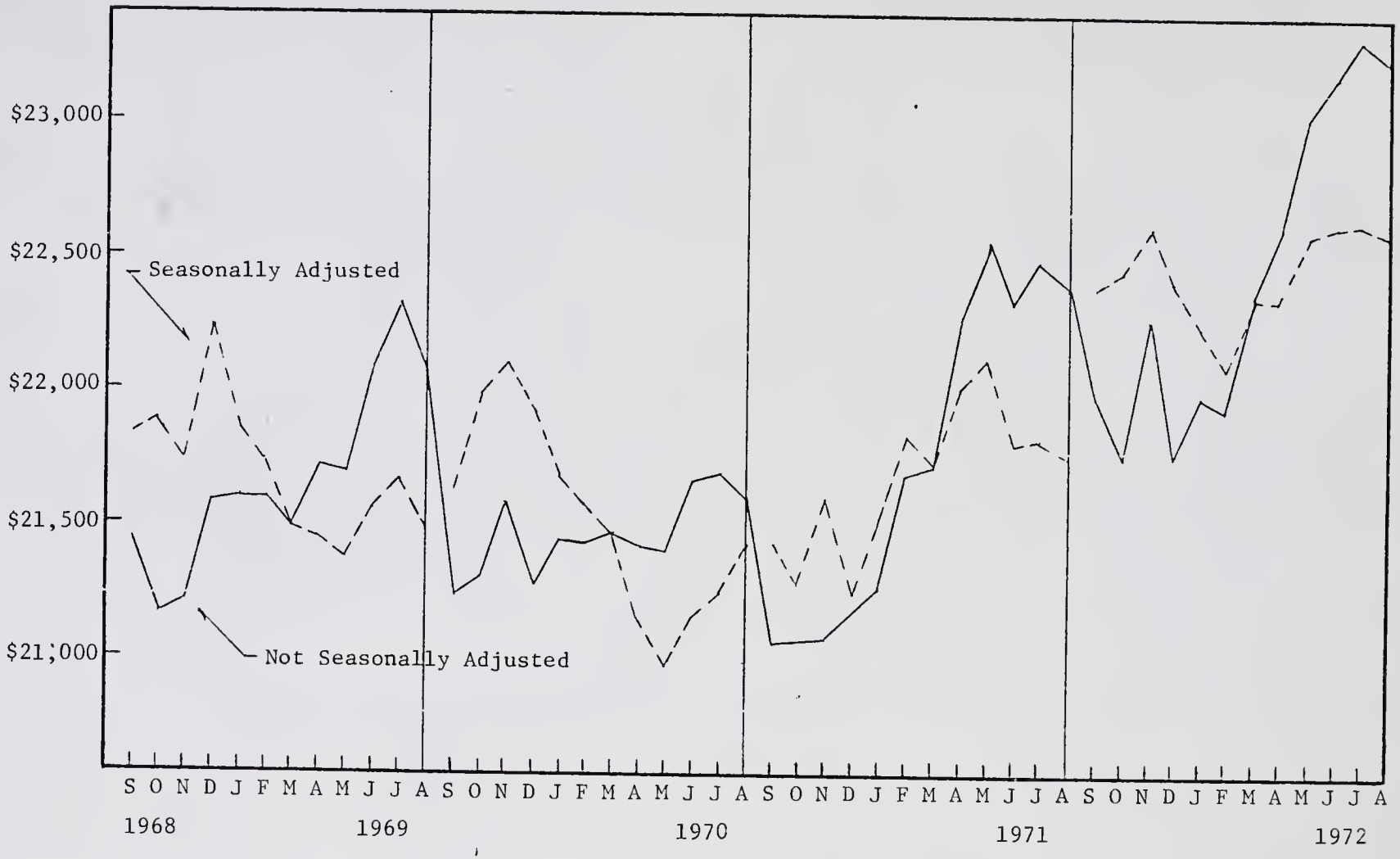

Figure 4a
Average Sales Price of Existing
Single-Family Homes for the U.S.
Seasonally Adjusted and Adjusted for Inflation

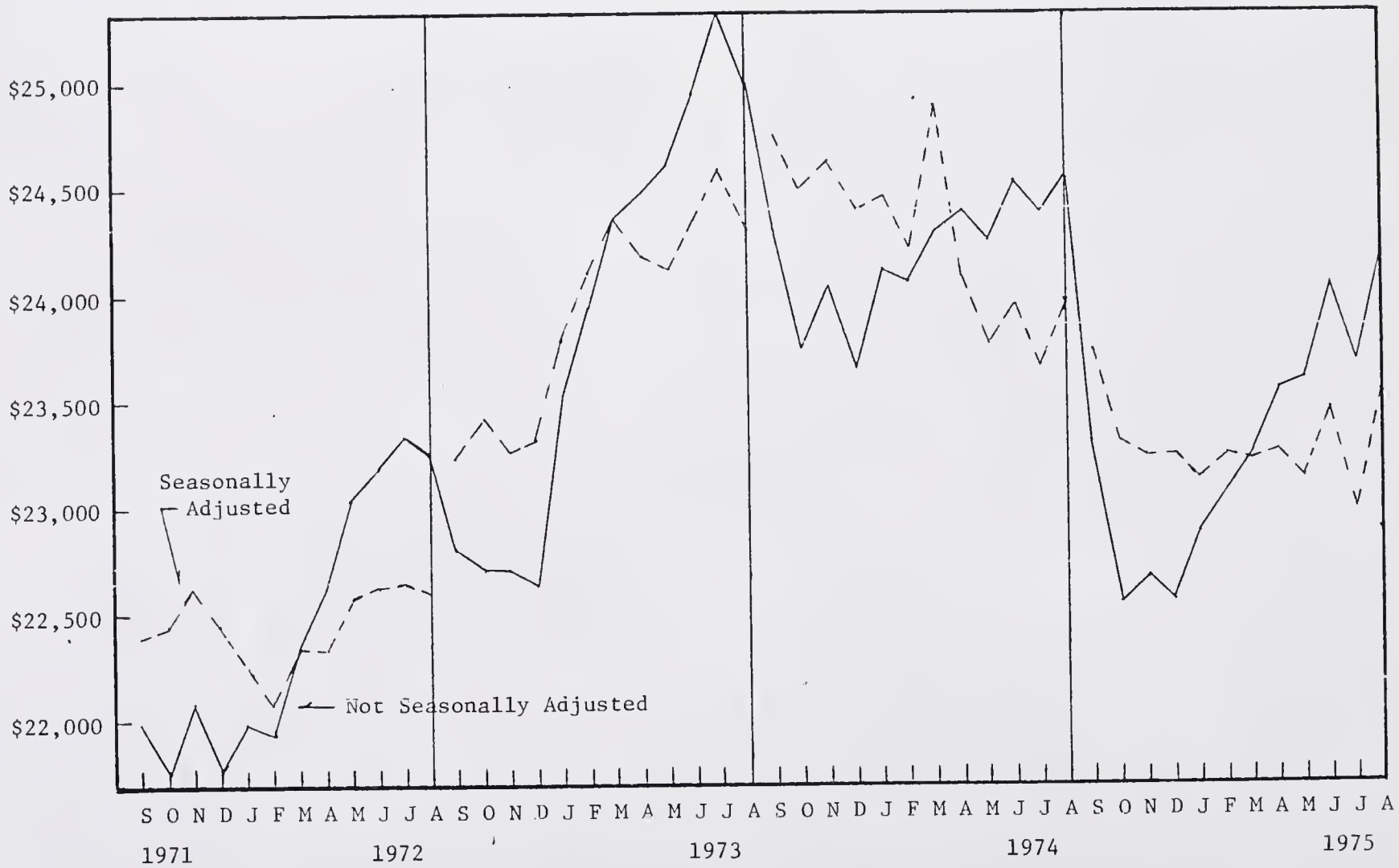

Figure 4b
Average Sales Price of Existing
Single-Family Homes for the U.S.
Seasonally Adjusted and Adjusted for Inflation

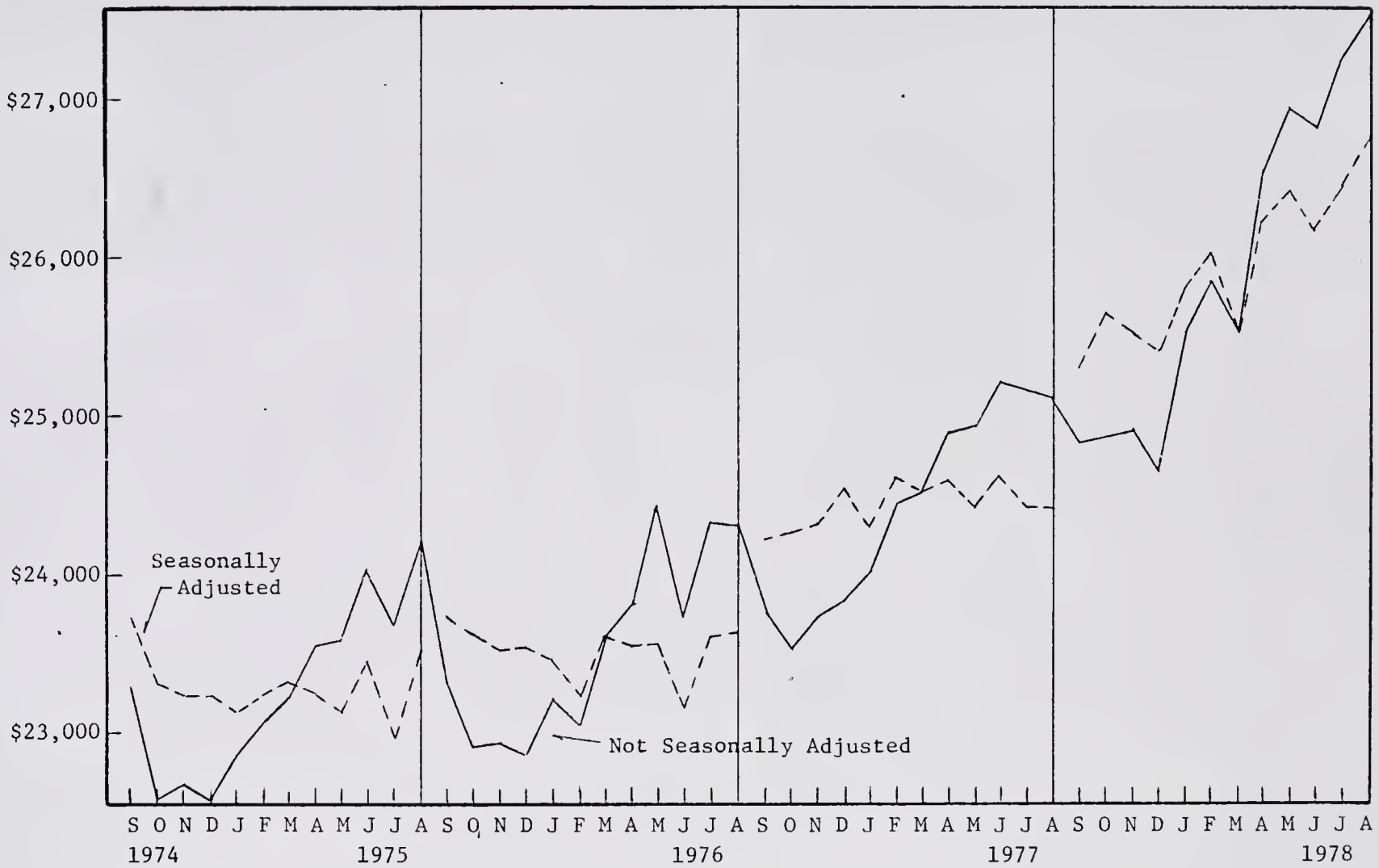

Figure 4c
Average Sales Price of Existing
Single-Family Homes for the U.S.
Seasonally Adjusted and Adjusted for Inflation

the average price for each seasonal year was calculated for comparison with the seasonally adjusted data. The variance was then calculated for each year using

$$\sum_{i=1}^{n} y_i^2 - \frac{(\sum_{i=1}^{n} y_i)^2}{n-1}$$

where Y_i = the monthly sale price (adjusted for the HPI)

n = the number of observations

The sales figures were then seasonally adjusted using the seasonal index; the resulting figures are reported in Table 8. The yearly variances were also calculated.

By comparing Table 8 with Table 3 it can be seen that of the 120 monthly differences, 92 were reduced when the seasonal index was used. February and March accounted for approximately one-third of the errors, suggesting the possibility that a slight refinement in the index for this transition period could increase the accuracy of the index. Additionally, when comparing one year to the next, it is interesting to note that 10 of the 12 months in 1970 were incorrect. That year represents about 36 percent of all the errors. That year was a recessionary year. Another recessionary year, 1974, accounted for an additional 18 percent of the errors. As noted previously this index was not adjusted for business cycles. If a business cycle adjusted index were applied, it appears that an even better adjustment factor might be derived.

The variances for the 10 years showed similar results. All were reduced except for the years 1970 and 1974. The 80

Table 8
Average Existing House Sales Price
Adjusted for Inflation and Seasonality
United States Data

Month	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	-	$21,848	$21,692	$21,514	$22,247	$23,785	$24,468	$23,139	$23,475	$24,306	$25,825
February	-	21,739	21,579	21,843	22,091	24,100	24,221	23,251	23,227	24,635	26,057
March	-	21,484	21,467	21,728	22,357	24,316	24,289	23,289	23,606	24,524	25,558
April	-	21,449	21,166	22,013	22,344	24,173	24,085	23,269	23,550	24,601	26,261
May	-	21,370	20,983	22,121	22,582	24,122	23,778	23,129	23,591	24,457	26,439
June	-	21,555	21,153	21,807	22,626	24,350	23,947	23,466	23,174	24,637	26,200
July	-	21,662	21,248	21,825	22,630	24,585	23,665	22,997	23,618	24,452	26,475
August	-	21,476	20,997	21,757	22,599	24,301	23,984	23,533	23,647	24,429	26,795
September	$21,834	21,633	21,446	22,394	23,228	24,750	23,731	23,754	24,223	25,312	-
October	21,842	21,983	21,279	22,451	23,417	24,502	23,306	23,634	24,287	25,685	-
November	21,746	22,101	21,605	22,619	23,268	24,627	23,239	23,510	24,329	25,540	-
December	22,232	21,912	21,250	22,415	23,311	24,389	23,249	23,561	24,554	25,428	-
Mean	-	21,686	21,493	21,682	22,446	23,913	24,225	23,294	23,559	24,453	25,965
Standard Deviation	-	240	386	271	172	487	334	198	209	142	475
Std Dev/Mean	-	1.1%	1.8%	1.3%	.8%	2.0%	1.4%	.8%	.9%	.6%	1.8%

percent success rate is considered excellent considering the volatility of the monthly prices.

The standard deviations for each year were calculated and are reported in Tables 6 and 8. The coefficient of variation was determined for each year by dividing the standard deviation by the mean. The percentage of the mean represented by the standard deviation (the tightness of the observations) for the pre-seasonal adjustment figures is 2.54, while after the seasonal adjustment it is 1.25 percent.

A general inference from these results is that the index has reduced the monthly fluctuations and that the fluctuations are reduced to a tight range around the mean price. The results indicate that the index reduces the monthly fluctuations in the sales data.

Student's t

A final test of the mean is made to determine how much confidence can be placed in the use of the index. Because of the small number of observations it is necessary to use the Student's t test.

To use the Student's t test it is necessary that the observations on which the BMA are calculated are normally distributed. Unfortunately, the true distribution of the observations is not known. However,

> . . . it can be shown that the distribution of the t statistic is relatively stable for populations which are non-normal but possess a mound-shaped probability distribution. This property of the t statistic and the common occurrence of mound-shaped distributions of

> data in nature enhance the Student's t for use in statistical inferences.[1]

The standard deviation for the BMA's was then calculated using

$$s' = \frac{\sum_{i=1}^{n} (y_1 - \bar{y})^2}{n-1}$$

where

n = the number of observations

y = the MA for the month from each year

$\bar{y}$ = the BMA for the year

A 95 percent confidence interval was calculated for each of the 12 means using the standard formula for finding a confidence interval for small sample populations:

$$\bar{y} = t_{a/2} s/ n$$

where

$t_{a/2}$ = critical value from the student's t table for .05. All other values are from the previous formula.

The width of the intervals range from a high for the month of September of .02326, or plus or minus 1.15 percent of the estimated mean to a low of .01020 for the month of February. These appear to be reasonably tight confidence intervals.

Confidence intervals for the means were calculated using a confidence coefficient equal to 99 percent (two tailed). This appeared to increase the confidence interval by about 0.004, which is still a tight confidence interval.

Table 9 contains the means, standard deviations, and confidence intervals.

Sample Size

A major problem with the study is the lack of a large sample, which makes the results less reliable. The test period covers 11 years (1968-1978). However, when the September-August year was adopted, it meant the loss of one year's observations. This reduced the number of observations for each month to only 10. While the above intervals are considered to be well within a reasonable tolerance for the purpose of this study, a few more years of data could produce results having a much smaller interval. Because the NAR has collected two more years of data on median sale prices, that information was also tested to determine the tightness of the confidence interval.

The median data contained 12 observations. A 95 percent confidence level produced intervals that ranged from a low of .000895 to a high of .01898. This range equates to a plus or minus .45 to .98 from the mean. It appeared that either the median data produce a better estimate of the mean or the larger number of observations indicates that the means are in fact very close to the true means. Table 10 contains the means, standard deviations, and confidence intervals for the NAR median price data. Table 7 contains the HPI adjusted median data.

Table 9
Monthly Index
With Student's t Confidence Ranges
for Average Sales Prices of Existing
Single Family Houses in the U.S.

Month	Monthly Index	Standard Deviation	Interval Width 95%	Interval Width 99%	Confidence Interval 95%	Confidence Interval 99%
January	1.01144	0.008816	0.01110	0.01555	1.00589-1.01699	1.00367-1.01921
February	1.00671	0.007973	0.01020	0.01406	1.00161-1.01181	0.99968-1.01375
March	0.99982	0.010016	0.01260	0.01766	0.99352-1.06612	0.99099-1.00865
April	0.98774	0.009797	0.01232	0.01728	0.98158-0.99390	0.97910-0.99638
May	0.98034	0.015541	0.01955	0.02742	0.97057-0.99012	0.96663-0.99405
June	0.97620	0.011275	0.01496	0.02120	0.96872-0.98368	0.96560-0.98680
July	0.97041	0.014832	0.01968	0.02778	0.96057-0.98025	0.95652-0.98430
August	0.97205	0.016700	0.02216	0.02128	0.96097-0.98314	0.95641-0.98769
September	1.01829	0.017520	0.02326	0.03282	1.00666-1.02991	0.00187-1.03469
October	1.03163	0.013928	0.01848	0.02608	1.02239-1.04087	1.01859-1.04467
November	1.02475	0.015349	0.02038	0.02880	1.01456-1.03494	1.01030-1.03910
December	1.02978	0.017227	0.02286	0.03226	1.01834-1.04120	1.01364-1.04590

Table 10
Monthly Index
With Student's t Confidence Ranges
for Median Sales Prices of Existing
Single Family Houses in the U.S.

Month	Monthly Index	Standard Deviation	Interval Width 95%	Interval Width 99%	Confidence Interval 95%	Confidence Interval 99%
January	1.01072	0.009034	0.01036	0.01438	1.0050 -1.01590	1.00353-1.01790
February	1.00420	0.010481	0.01202	0.01668	0.99819-1.01021	0.99586-1.01253
March	0.99832	0.007807	0.00895	0.01242	0.99385-1.00280	0.99211-1.00453
April	0.99136	0.010124	0.01161	0.01611	0.98555-0.99716	0.98330-0.99941
May	0.98706	0.011615	0.01333	0.01848	0.98121-0.99372	0.97782-0.99631
June	0.97776	0.012735	0.01526	0.02128	0.97013-0.98539	0.96712-0.98840
July	0.97038	0.011779	0.01411	0.01968	0.96332-0.97744	0.96054-0.98022
August	0.97596	0.015844	0.01898	0.02627	0.96650-0.98545	0.96273-0.98920
September	1.01547	0.010476	0.01255	0.01750	1.00919-1.02174	1.00671-1.02422
October	1.02769	0.010216	0.01224	0.01707	1.02157-1.03381	1.01915-1.03622
November	1.02127	0.009851	0.01180	0.01646	1.01537-1.02717	1.01304-1.02950
December	1.02641	0.012314	0.01480	0.02057	1.01902-1.03380	1.01613-1.03670

Conclusion

The graphed seasonally adjusted national data (Figure 3) pointed out the obvious need to determine appropriate adjustment factors for the business cycles and the upward price trends. However, the graphed seasonally adjusted data, the reduction in monthly variances from the average price, and the calculated confidence intervals all confirm the generated index reduces monthly variations (seasonal changes) in the national data.

Based on the above information I concluded that the calculated means were a reasonable estimate of the true monthly means for the national data and can be used to seasonally adjust the observed NAR monthly housing prices.

Note

1. NATIONAL ASSOCIATION OF REALTORS®, Economics and Research Division, Existing Home Sales, Annual Report (N.P.: NAR, 1978), p. 46.

CHAPTER IX
TESTING IN THE LOCAL MARKET

The tests thus far indicated the derived index (the model) is a good model for use with the national data. It would be a better model if it could be used for localized markets. However, more external variables add fluctuations to the local markets that are smoothed over in the national data. But, because the national market is made up of many local markets, on the average we should expect to see the same characteristics in the local markets that we have seen in the national market data.

Because of problems with small sample populations in statistical testing, we expect greater fluctuations in local data compared with the national data. But, if the underlying assumptions about seasonal demand are valid, then over time, the seasonal pattern should be observable on the local levels.

There are of course exceptions to most rules. There will be locations where the seasonal pattern is not the same as the rest of the country. This model shows a high demand in the summer months. In places like Vail, Colorado, the market may be reversed. Miami and other cities in Florida often experience an influx of people during the winter months. This could change the seasonal pattern for those locations. But, on the average, the local markets should behave as does the national market, of which local markets are part. Thus several local markets were used to compare

the model's ability to reduce any observed seasonal fluctuation.

Using MLS Data

The basic problem with real estate research again comes up, that of finding representative data. The logical source is one that is a part of the NAR data but more available to the local market analyst. This source is the local multiple listing services (MLS).

Most MLS's publish monthly summaries of local sales reported by their member offices. This information includes the gross dollar sales and the total number of sales. If the MLS data for a local market can be shown to fit the same seasonal pattern as the national data, a local analyst, could compare the local MLS sales information with the national trends to determine whether that market exhibits the same general characteristics. If it does, a seasonal adjustment using this study's model may produce a better representation of the local market. Some markets, as mentioned previously, may not exhibit the same seasonal pattern. But the comparison should give the analyst an idea of the type of seasonal adjustments warranted in his market.

The California study, noted previously in this paper on page 12, indicated that MLS data could be used as a good representative of the total area market. Additionally, in that California study it was noted that the sales data appeared to have seasonal characteristics similar to the national data characteristics. (See Figure 2).

Two local markets were selected for their availabliity of information through MLS, Charlotte, North Carolina, and Gainesville, Florida. Two monthly figures were available from each area, the total monthly dollar volume and the total monthly number of sales which make up the dollar volume. By dividing the first figure by the second, the average sale price for the month could thus be determined.

Sales in Charlotte, North Carolina

Data from 1966 through 1976 was available for the number of sales and are shown in Table 11. The total dollar volume was available from 1966 through 1975. The average sale price was calculated and shown in Table 12. The Charlotte data include only house sales. But, in reviewing the data, an occasional fluctuation was noticed which did not appear to be consistant with the other data. The explanation offered from the MLS people was that clerical errors are sometimes made. It might be that a large apartment complex sale was accidently included in the totals which would distort the average sale price upward.

This type of problem is typical of problems expected to be encountered with MLS data especially when the information has been collected primarily by hand. The greater the number of observations (sales) the less these errors will distort the average price.

If the Charlotte price data were to reflect the national seasonal fluctuations then the volume figures should probably

Table 11
Total Number of House Sales Reported to
Multiple Listing Service, Charlotte, North Carolina

Month	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
January	113	113	139	208	208	187	264	277	307	264	337
February	103	112	132	196	199	230	290	298	389	291	432
March	124	149	190	185	173	294	328	366	448	269	336
April	117	131	193	229	205	296	260	360	424	349	445
May	170	146	229	248	245	273	329	403	452	408	337
June	125	182	173	209	279	256	286	373	323	274	414
July	128	153	206	221	227	259	322	319	315	385	460
August	155	165	219	220	196	265	345	414	374	376	408
September	119	167	153	194	221	212	297	247	234	294	368
October	81	121	160	189	185	200	269	253	229	303	399
November	87	108	172	150	134	200	243	314	304	266	300
December	75	75	140	134	127	156	228	183	134	162	180

Table 12
Average Sales Price of All Sales Reported to
Multiple Listing Service, Charlotte, North Carolina

Month	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
January	$17,926	$18,962	$19,041	$19,195	$17,267	$22,924	$25,439	$27,951	$32,127	$34,444
February	18,529	18,432	20,503	21,816	22,673	22,835	25,819	27,542	30,466	35,540
March	19,097	17,876	18,959	21,073	21,572	24,427	25,606	28,656	30,982	36,077
April	20,378	19,682	19,222	20,557	21,723	25,422	26,660	30,793	34,273	35,512
May	18,667	19,778	19,155	22,048	22,997	26,597	27,974	31,464	34,073	36,126
June	19,105	20,343	19,563	21,743	24,033	26,130	29,309	30,855	34,110	36,074
July	21,628	20,057	19,698	22,560	24,579	26,971	28,604	31,026	33,907	40,090
August	19,284	20,223	19,299	22,424	23,204	27,375	27,957	31,533	34,904	35,639
September	19,043	18,533	20,703	22,637	25,124	25,663	26,993	30,323	32,550	35,347
October	20,773	19,836	19,465	20,965	23,775	24,157	27,172	31,470	35,240	35,039
November	19,904	20,112	20,591	23,499	24,909	25,453	28,395	31,121	32,870	37,729
December	20,820	20,705	19,632	20,918	22,225	26,990	27,393	28,219	35,800	37,359

have the same tendency to be low in the winter, expand in the spring and peak during the summer. From Table 11, it appeared that the volume does follow that pattern. The highest volume months appeared to be April through August. The lowest volume months appeared to be October through December. September, January, February and March are the transition months.

While the prices in Table 12 had not been adjusted for inflation it appeared that they experienced the same trend as the national data. Prices rose in the spring until they reach a peak in June, July and August. The prices level off or decline slightly during the winter. This is the same pattern shown by the national data before it was adjusted for inflation.

To observe the data further, the prices were adjusted for inflation using the HPI as was the national data. The adjusted prices are contained in Table 13. These figures have been graphed in Figure 5 to show the seasonal patterns.

The initial impression from the data was confirmed by the adjusted figures and the graph. A distinct seasonal pattern similar to the national seasonal pattern is apparent. As mentioned earlier there are abnormalities which appear from time to time. Because of the previous background information these abnormalities are believed to be caused by errors in collecting and reporting the data.

To determine whether the index can be used on a local level, the Charlotte prices were manipulated in the same

Table 13
Average Sales Price of All House Sales
Reported to MLS, Adjusted for Inflation Charlotte, N.C.

Month	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
January	$18,771	$19,154	$18,704	$17,872	$15,054	$18,683	$19,984	$21,272	$22,593	$21,354
February	19,362	18,581	20,042	20,219	19,596	18,626	20,234	20,865	21,245	21,830
March	19,913	18,038	18,479	19,351	18,453	19,957	20,020	21,644	21,382	22,052
April	21,117	19,801	18,698	18,756	18,472	20,753	20,796	23,188	23,475	21,562
May	19,264	19,838	18,579	20,025	19,456	21,588	21,770	23,604	23,085	21,855
June	19,655	20,384	18,847	19,677	20,264	21,073	22,720	23,043	22,862	21,679
July	22,205	20,057	18,832	20,306	20,620	21,663	22,088	23,119	22,470	24,298
August	19,758	20,142	18,363	20,057	19,353	21,882	21,522	23,323	22,843	21,252
September	19,471	18,422	19,642	20,122	20,833	20,449	20,732	22,198	21,014	20,928
October	21,154	19,659	18,398	18,537	19,616	19,187	20,837	22,788	22,489	20,635
November	20,207	19,893	19,334	20,686	20,434	20,137	21,709	22,325	20,764	22,025
December	21,052	20,399	18,348	18,317	18,128	21,285	20,879	20,070	22,389	21,695
Mean	-	19,823	19,076	19,332	19,077	20,270	20,849	22,018	22,278	21,878
Standard Deviation	-	915	715	812	1,531	1,273	1,034	1,141	948	920
Std Dev/Mean	-	4.6	3.7	4.2	8.0	6.3	5.0	5.2	4.3	4.2

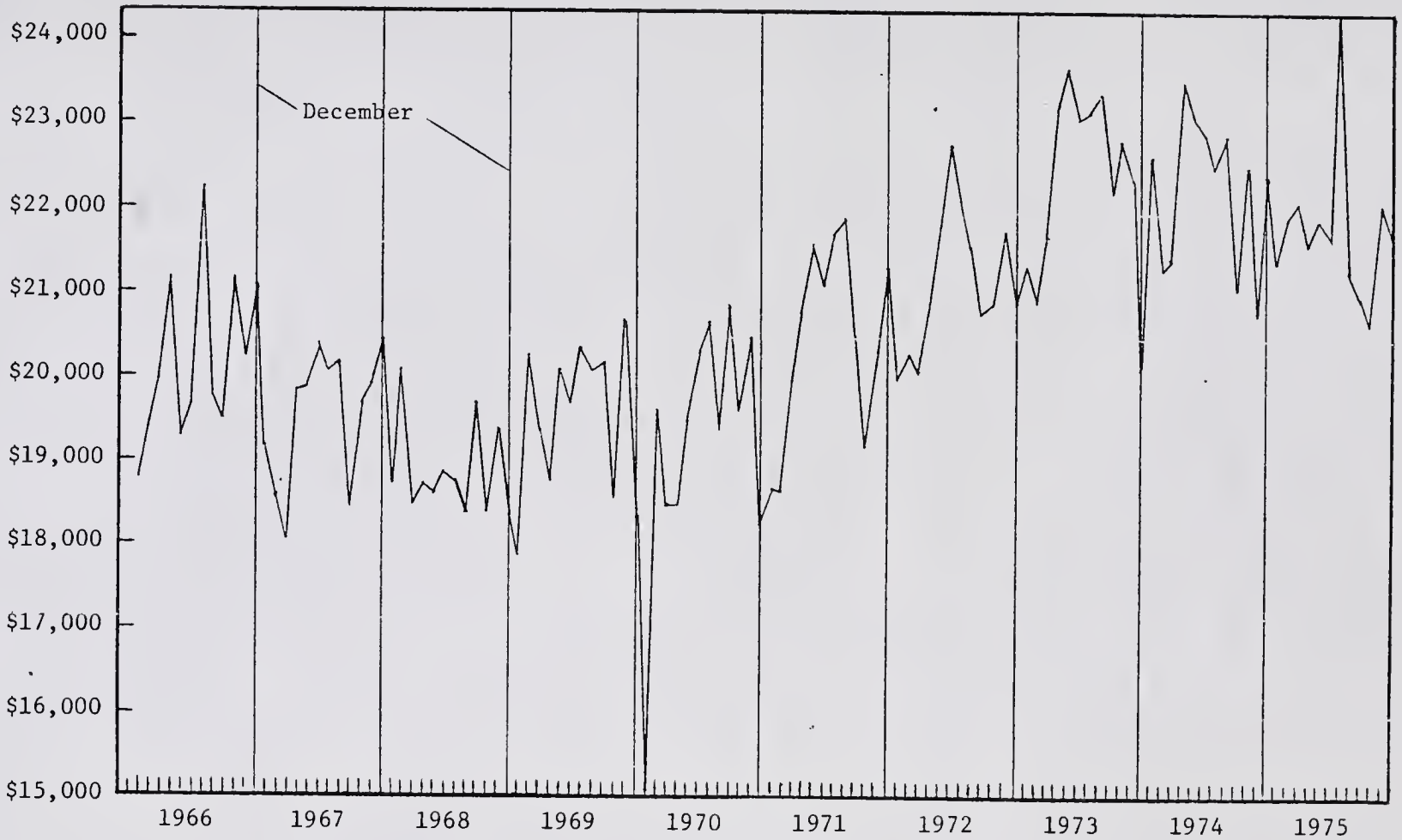

Figure 5
Average House Sale Prices Reported
to Charlotte, North Carolina MLS
Adjusted for Inflation

fashion as the national prices. The prices were grouped into seasonal years, from September to August. The adjusted prices for each month in a year were summed and divided by 12 to obtain the average monthly price for the year. That average price was compared with each monthly price by subtracting the monthly price from the mean. If all other factors are held constant, the difference between the two prices should be caused by seasonal demand changes.

The variance for the year was then calculated using the formula described previously. Two comparisons were made, one to determine how many of the monthly differences were reduced by the application of the seasonal index and the other to determine whether the variance was reduced.

To accomplish these comparisons, the national seasonal index was used to adjust the HPI-adjusted Charlotte prices, and the same information found above was calculated for the adjusted data. The results were that 64 of the 108 monthly observations, or 59.3 percent, resulted in lower differences between the monthly price and the average price. Additionally, seven of the nine yearly variances, or 77.8 percent, were reduced. Table 14 provides a list of the monthly seasonally adjusted prices and the standard deviations derived from the variances.

There are several interesting features in the results. First, 23 percent of the wrong adjustments (where the index did not work) occurred in 1968. Of the 12 monthly adjustments

Table 14
Average Sales Price of all House Sales
Reported to MLS, Adjusted for Inflation and Seasonality
Charlotte, N.C.

Month	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
January	-	$19,373	$18,918	$18,077	$15,226	$18,897	$20,212	$21,515	$22,851	$21,598
February	-	18,705	20,177	20,354	19,728	18,751	20,370	21,005	21,388	21,977
March	-	18,035	18,475	19,347	18,450	19,953	20,017	21,640	21,378	22,048
April	-	19,558	18,469	18,526	18,245	20,498	20,541	22,903	23,187	21,297
May	-	19,448	18,214	19,632	19,074	21,164	21,342	23,140	22,631	21,425
June	-	19,899	18,398	19,209	19,782	20,571	22,179	22,495	22,318	21,163
July	-	19,464	18,275	19,705	20,010	21,023	21,435	22,435	21,805	23,579
August	-	19,580	17,849	19,497	18,812	21,271	20,921	22,671	22,205	20,658
September	$19,827	18,759	20,002	20,490	21,214	20,823	21,111	22,604	21,398	-
October	21,823	20,281	18,980	19,123	20,237	19,794	21,497	23,509	23,200	-
November	20,707	20,386	19,813	21,198	20,940	20,635	22,246	22,878	21,278	-
December	21,678	21,006	18,894	18,862	18,668	21,919	21,501	20,668	23,056	-
Mean	-	19,841	19,101	19,336	19,083	20,265	20,849	22,013	22,285	21,890
Standard Deviation	-	1,098	1,057	642	1,487	987	744	720	836	918
Std Dev/Mean		5.5	5.5	3.3	7.8	4.9	3.6	3.3	3.8	4.2

in that year 10 were incorrect. In reviewing the raw data it appears that the volume of sales during that period increased significantly. It might be that the city experienced a boom in the market that acted to distort the seasonal pattern. For example a new local industry might have been responsible.

Additionally, 40 percent of the wrong adjustments occurred during February, March, and April. Again, looking at the raw data, it appears that Charlotte may experience an earlier upturn in annual sales than does the rest of the nation. A slight adjustment of the index for this local market aberration could eliminate most of that problem.

The real test of the index is whether it reduces the total variance. In this case it does in all but two years. Those two years were 1967 and 1968. Again, it might be that a local event distorted the seasonal pattern. The index has acted to flatten the seasonal pattern in all the other years.

As with the United States data, the coefficient of variation (standard deviation divided by the mean) was reduced on the average for the nine years. However the percentage reduction was not as great, falling only about 7.5 percent from 5.05 percent to 4.67 percent.

Because of the consistancy with which the index reduced the differences (in effect acted to eliminate the seasonal changes), I feel that the model is a reasonably good estimate

of the seasonal index for the Charlotte market. A different index based entirely on the Charlotte market data could be constructed. But the Charlotte data have errors which are more pronounced than similar errors in the national data, and local temporary factors introduce nonrecurring fluctuations in the local data. Thus, the national index is probably as good, if not a better index, than one derived from the local data. Certainly it appears that using the national seasonal index is better than using no index in the Charlotte market.

Sales in Gainesville, Florida

As with the Charlotte sales data, the Gainesville data were collected from the local MLS. There are several important differences between the two sets of data. First, the Gainesville volume is less than one-half that of the Charlotte volume. This will allow the errors to show through more clearly. Since the sample is smaller, the results are not as reliable.

The second difference is that the Gainesville MLS only kept records for total sales. Total sales include vacant lots, apartment complexes, acreage, and warehouses, as well as single-family homes. This is a serious deviation from the national data. However, probably 90 percent of the reported sales in Gainesville were of single-family houses. Additionally, monthly summaries showing individual office sales were available. In an effort to reduce some of the

greater distortions, I reviewed all of the monthly summaries and eliminated those sales which appeared to be distorted. For example, in July 1968, office 15 reported a sale of $1,600. The average sale price for the month was $22,745. I eliminated the $1,600 sale from the data as probably being a vacant lot sale. This action has introduced some personal bias into the data, but hopefully this bias has made the data more representative of the housing market and is the type of adjustment which might be used on the local level by an analyst attempting to establish a local index.

The Gainesville volume data are listed in Table 15. The average sale price is listed in Table 16 and the average price adjusted for the HPI is listed in Table 17. Again the seasonal pattern appears very distinct. Volume is low in the winter. It increases through the spring, reaching a high in the summer, before falling through September to the low winter months.

The prices appear to exhibit the same seasonal variations as seen in the national and Charlotte data. The HPI adjusted prices have been graphed in Figure 6. While this graph is not as smooth as the Charlotte graphed data, neither were the Charlotte graphed data as smooth as the national data. It would appear that the larger fluctuations are a reflection of the smaller number of observations and the inclusion of nonsingle-family home sales in the data.

The same process used to analyze the Charlotte data was used on the Gainesville data. The seasonally adjusted and

Table 15
Total Number of Sales, All Properties, Reported to
Multiple Listing Service, Gainesville, Florida

Month	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	32	37	49	42	81	88	117	150	130	124	150	232
February	33	39	60	63	82	111	128	153	129	145	196	210
March	50	52	65	77	100	136	167	140	152	170	245	300
April	36	37	80	66	104	110	164	212	160	228	150	333
May	50	75	89	89	106	151	177	197	197	195	231	337
June	50	66	88	81	121	174	168	167	185	210	262	323
July	75	62	83	90	122	145	172	203	198	216	251	313
August	59	85	81	107	112	188	156	170	195	218	234	309
September	45	56	69	65	86	101	98	133	175	128	197	246
October	43	42	42	51	78	105	136	143	120	147	232	294
November	34	39	38	57	95	104	145	100	104	124	171	217
December	47	41	53	59	87	94	90	59	127	130	159	188

Table 16
Average Sales Price of All Sales Reported to
Multiple Listing Service, Gainesville, Florida

Month	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	$21,500	$18,673	$21,256	$19,538	$20,244	$22,075	$28,057	$29,512	$32,309	$33,265	$32,281	$39,605
February	16,656	20,414	21,495	20,733	21,143	24,935	26,768	32,239	33,803	36,713	25,429	36,216
March	18,091	18,935	20,049	19,774	22,463	24,901	26,198	32,084	31,980	32,656	38,636	38,298
April	19,002	21,188	20,928	21,400	28,830	24,085	29,765	32,962	38,604	32,032	36,077	34,354
May	19,832	21,987	20,510	22,113	23,725	26,026	29,537	30,769	33,311	34,720	36,677	41,584
June	19,040	21,003	23,395	25,619	25,006	27,134	28,872	32,367	34,271	38,642	36,619	45,401
July	21,314	22,745	22,261	22,994	23,578	26,437	27,808	33,041	36,315	36,362	36,871	42,222
August	20,111	21,760	21,431	22,735	22,357	25,587	32,563	33,019	47,100	34,825	35,612	40,649
September	16,277	21,714	20,639	25,817	21,887	27,582	26,689	21,794	41,855	42,915	41,651	41,232
October	16,201	17,896	18,478	21,200	21,335	23,188	29,541	30,657	39,058	30,843	32,853	38,933
November	19,600	17,085	23,028	18,366	23,480	23,289	30,185	32,809	34,043	37,943	36,787	42,986
December	17,962	17,535	20,417	18,098	23,245	24,603	30,941	37,646	32,199	36,201	37,397	50,850

Table 17
Average Sales Price of All Sales
Reported to MLS, Adjusted for Inflation, Gainesville, Florida

Month	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	$21,717	$18,343	$19,791	$17,034	$16,499	$17,341	$21,352	$20,754	$20,030	$19,206	$17,630	$20,104
February	16,790	19,955	19,921	17,920	17,246	19,542	20,279	22,482	20,764	21,124	19,224	18,272
March	18,255	18,455	18,410	16,915	18,352	19,469	19,787	22,142	19,548	18,714	20,828	19,159
April	19,117	20,611	19,095	18,197	23,535	18,787	22,413	22,577	23,439	18,314	19,324	17,041
May	19,892	21,326	18,629	18,708	19,257	20,254	22,158	20,846	20,152	19,772	19,551	20,465
June	19,078	20,234	21,172	21,601	20,166	21,034	21,562	21,694	20,596	21,893	19,375	22,114
July	21,314	21,745	20,037	19,290	18,938	20,415	20,721	21,896	21,732	20,486	19,355	20,387
August	20,031	20,704	19,169	18,962	17,871	19,697	24,085	21,609	28,086	19,521	18,606	19,487
September	16,180	20,602	18,346	21,407	17,440	21,184	19,538	20,526	24,781	23,908	21,614	19,550
October	16,056	16,915	16,338	17,492	16,946	17,782	21,391	19,564	23,002	17,125	16,970	18,471
November	19,387	16,042	20,271	15,066	18,578	17,805	21,654	20,726	19,873	20,998	18,904	20,075
December	17,697	16,388	17,878	14,762	18,332	18,752	22,006	23,543	18,699	19,934	19,119	23,651
Mean	-	19,224	18,848	18,455	18,383	18,986	20,657	21,549	21,559	20,449	19,655	19,410
Standard Deviation	-	1,894	1,651	1,470	2,522	1,307	1,897	844	2,433	1,946	1,743	1,594
Std Dev/Mean	-	9.9	8.8	8.0	13.7	6.9	9.2	3.9	11.3	9.5	8.9	8.2

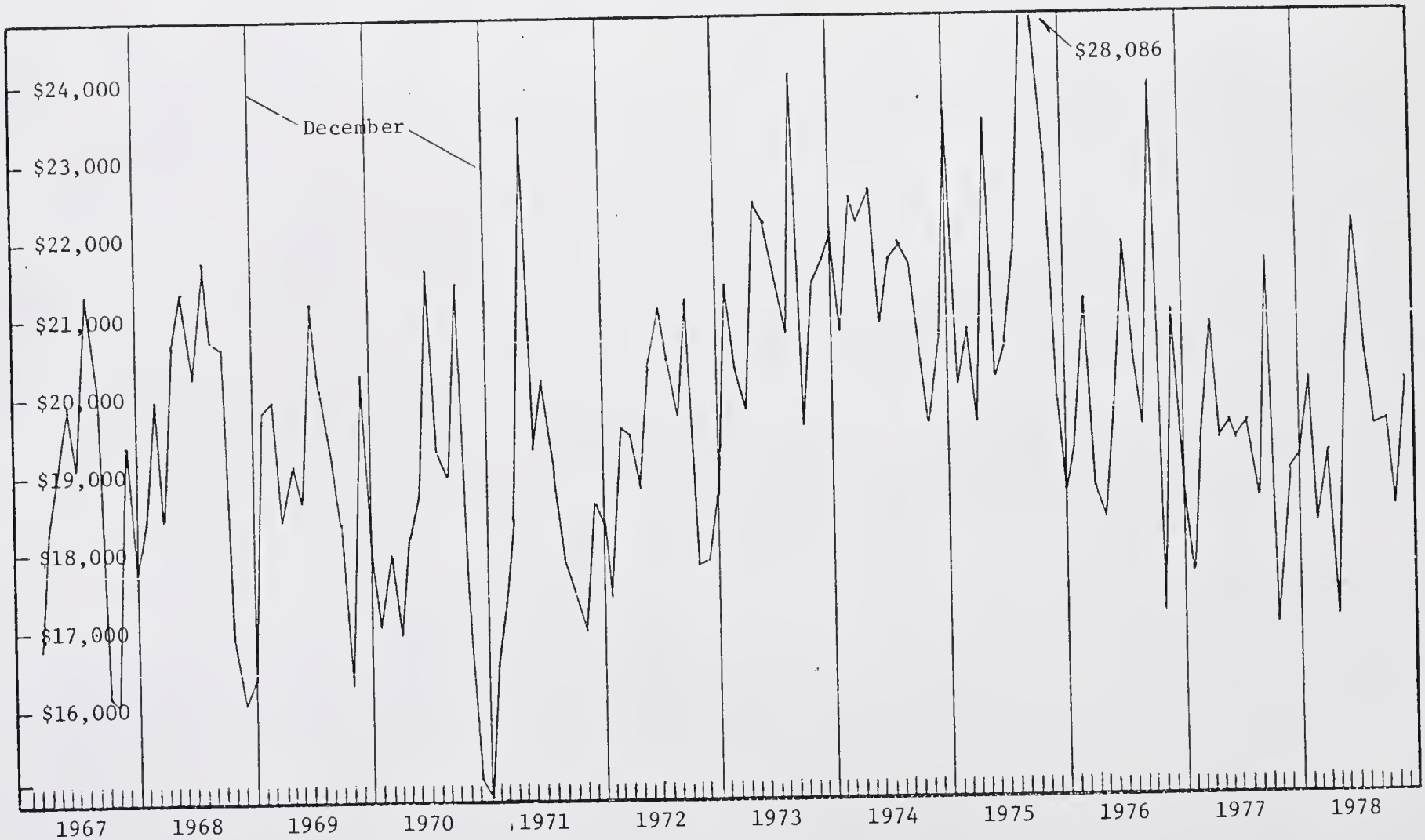

Figure 6
Average Sales Price of Properties
Reported to Gainesville, Florida MLS
Adjusted for Inflation

HPI adjusted prices are reported in Table 18. The result was that of the 132 observations, 85, or 64.4 percent, of the monthly differences were reduced by the seasonal index. In addition, eight of the eleven years had reduced variances. 15 percent of the wrong adjustments occurred in the month of September.

A look at the raw data shows that September is still a transition month, but the amount of the decline from the summer months to September appears not to be as sharp as the national average. This could relate somehow to the strong influence on the area by the University of Florida. While normal school years begin in late August or early September, the university school year began in late September; thus, buying and selling probably continued into September, keeping prices slightly higher than the national average.

As with the national data and the Charlotte data, the coefficient of variation (standard deviation divided by the mean) was reduced on the average for the 11 years. The reduction from 8.94 percent to 8.27 percent is about 7.5 percent or approximately the same percentage reduction experienced by the Charlotte data.

The index again reduced the total annual errors and did better than average on the monthly adjustments. It appears that the index reflects some seasonal pattern in the Gainesville market. Additionally, since the national model represents all the local markets, and the local markets represent all

Table 18
Average Sales Price of All Sales
Reported to MLS, Adjusted for Inflation and Seasonality
Gainesville, Florida

Month	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
January	-	$18,533	$20,018	$17,229	$16,687	$17,539	$21,597	$20,991	$20,259	$19,426	$17,832	$20,334
February	-	20,089	20,055	18,040	17,361	19,673	20,415	22,633	20,903	21,266	19,353	18,395
March	-	18,452	18,407	16,912	18,349	19,466	19,784	22,138	19,544	18,711	20,824	19,155
April	-	20,358	18,861	17,974	23,246	18,557	22,139	22,300	23,152	18,090	19,087	16,832
May	-	20,907	18,262	18,340	18,879	19,856	21,723	20,436	19,756	19,384	19,166	20,062
June	-	19,753	20,668	21,087	19,686	20,533	21,049	21,177	20,105	21,372	18,914	21,588
July	-	21,101	19,444	18,720	18,378	19,811	20,108	21,248	21,090	19,880	18,782	19,784
August	-	20,126	18,633	18,432	17,372	19,147	23,412	21,005	27,301	18,975	18,096	18,942
September	$16,476	20,978	18,681	21,799	17,759	21,572	19,895	20,901	25,234	24,345	22,010	-
October	16,564	17,450	16,855	18,045	17,482	18,345	22,068	20,183	23,730	17,667	17,506	-
November	19,867	16,439	20,773	15,439	19,036	18,246	22,190	21,239	20,365	21,518	19,372	-
December	18,224	16,876	18,411	15,201	18,878	19,311	22,662	24,245	19,255	20,528	19,688	-
Mean	-	19,206	18,841	18,454	18,370	18,978	20,642	21,562	21,556	20,474	19,675	19,472
Standard Deviation	-	1,554	1,454	1,324	2,357	982	1,563	895	2,275	2,129	1,890	1,494
Std Dev/Mean	-	8.1	7.7	7.2	12.8	5.2	7.6	4.2	10.6	10.4	9.6	7.7

sales, it is reasonable to say that on the average the national model should represent the sale of the average house within the local market.

Some Observations on Volume

The volume of sales activity has been used throughout this study as an indication of the expected change in prices. Table 19 lists the average monthly ranking for the nation, Charlotte, Gainesville and Los Angeles. There are differences in monthly rankings from location to location. For example, June ranks as the month with the second highest volume of sales for the nation on the average, Charlotte ranks June as third, and Gainesville ranks the month as fourth. What is important to note is that the same relative volume is experienced in all locations for all months. Thus it appears that the volume builds to the summer months and then falls to the winter months.

This pattern is based on gross sales. There has been no adjustment for the number of days in the month, the number of weekends, or specific days of the week. These "trading-day" variations have been found to have a significant influence on the data.[1]

The most obvious misrepresentation is for the month of February. That month generally has only 28 days. When compared with the month before and the month after which have 31 days each, the true demand will be slightly distorted. For example, if February reports eight sales a day the total

Table 19
Monthly Sales Volume Ranking[a]

	Nation 1966-1979[b]	Charlotte, NC 1966-1976	Gainesville, FL 1967-1978	Los Angeles, CA 1953-1960[c]	Los Angeles Estimated[d]
January	11	10	12	8	12
February	9	8	9	8	8
March	5	6	5	8	4
April	6	5	6	4.5	6
May	4	1	2	4.5	5
June	2	3	4	4.5	2
July	3	3	1	4.2	3
August	1	2	2	4.2	1
September	7	7	7	4.2	9
October	8	9	8	9.3	7
November	10	11	10	9.3	10
December	12	12	11	9.3	11

Notes:

a. This information was provided by listing the gross sales volume for each area by year. The ranking was assigned to each month within the year indicating its volume relating to the other months. 12 was assigned to the lowest volume and one was assigned to the highest volume with all others ranked in between. Then the yearly rankings were added together and ranked again to determine the average ranking over the period indicated.

b. Data for the nation were not available for 1975 and 1976.

c. The California data were reported quarterly. This volume represents the average ranking for the 3 months within the quarter.

d. This volume was derived by totaling the 3 months contained in each quarter (8+8+8=24) then estimating the monthly ranking which could sum to that figure (12+8+4=24).

e. Actual monthly volume depends greatly on the number of days and weekends in each month.

would be 224 sales for the month. January could report daily sales of only 7.4 and still be rated higher than February (7.4 x 31 = 229).

Therefore, any attempt to compare prices directly with monthly volume should be adjusted for the number of trading days in the month. However, this problem does not affect this study's model, since it is concerned only with price changes; and sale prices are not necessarily affected by "trading-day" variations.

Test Conclusions

The initial test for the model determined that the means developed from the national data appeared to represent the true mean of the data and therefore could reasonably be used as a seasonal adjustment of national sale prices. The next two tests applied the seasonal index to two local markets, Charlotte, North Carolina, and Gainesville, Florida. The seasonal index reduced the variations in prices which are believed to be caused by seasonal demand changes in those markets. The Gainesville test results were significant by themselves, reducing the monthly price differences for 64.4 percent of the months observed and reducing the monthly variance in eight out of eleven years. Charlotte's data produced very similar results with 59.3 percent of the months showing a reduction in the difference from the average price. Additionally, in all but two years there was a reduction in the monthly variance.

The graphed data from both cities also show a close resemblance to the national data. There are a few months which vary from the national trend, but those specific variations are probably caused by errors in reporting the data. The overall trend of the city data matches that of the national data.

The model appears to represent a reasonable index with which to adjust selling prices of the existing single family house throughout the United States, where those markets display similar seasonal characteristics. These characteristics can be found fairly easily by looking at the MLS sales data for the local market.

The monthly sales volume ranking from the two cities (Table 19) appears to follow very closely the ranking of the national data for the same period of time. Quarterly sales data from Los Angeles from a period 10 to 15 years earlier than the period covered by this study appear to share similar characteristics with the national and city data. A monthly sales volume ranking (Table 19) developed from the California data and adjusted from the national data, shows that the California sales volume could have experienced the same relative volume changes as does the national volume figures. The implication is that not only does the model represent the market during the test period but also back to the beginning of the California study, a span of approximately 25 years.[2] Thus, where the sales volume characteristics are

similar, house sales occurring in different months can be adjusted using this study's index, to obtain an estimate of the prices that occur during other months.

Notes

1. NATIONAL ASSOCIATION OF REALTORS®, Economics and Research Division, Existing Home Sales, Annual Report (1978), p. 46.

2. An additional test was conducted on the California data. The average quarterly sale prices reported in that study were grouped into the seasonal years beginning in the fouth quarter and ending with the third quarter for 1953 through 1960. This produced six seasonal years to adjust.

   The seasonal index from this study was then grouped into quarters and averaged for each quarter. This quarterly index was then applied to the California seasonal year's data.

   Of the 24 quarters, 21 were adjusted so that the error or difference from that year's average price, was reduced. It appears that the index might be applicable to the earlier California data also.

   However, it should be noted that the California data had not been adjusted for inflation (about 5.4 percent annualized for the period). Because of the way the index and the seasonal year were derived, these results cannot be used except to note the results with interest and suggest that further study is needed.

CHAPTER X
WORKING WITH THE MODEL

The Formula

The most obvious use for the model will be to adjust an observed sale price from one month to equate it to a sale price in another month. This will be useful in appraisal work and in removing the seasonal variation from research data. The formula for the model to accomplish this adjustment is

$$P_{m+i} = (P_m)\ (\frac{HPI_{m+i}}{HPI_m})\ (BMA_m)\ (1/BMA_{m+i})$$

where

Pm = the observed monthly sale price

m+i = the monthly price to be estimated from P_m

An appraisal example would be to adjust comparable sales, for the appraiser's estimate of value. Assume a sale took place in January 1975. That sale is to be used to determine the value of a subject property being appraised in April 1975. Inflation increased .021079 from January to April (1.613 to 1.647 from the HPI). The sale price observed in January was $36,900. What is April's expected price?

$$P_{Apr} = (\$36,900)\ (\frac{1.647}{1.613})\ (1.011438)\ (1/.98034)$$

$$P_{Apr} = (\$37,677.82)\ (1.031722)$$

$$P_{Apr} = \$38,873.02$$

The actual price for April, from the NAR Table 3, turned out to be $38,800. Using the model, the price was missed by $73 or only .188 percent. Had the price been

adjusted only for inflation, the estimated price, $37,677.82, would have been off by $1,122 or 2.892 percent. Had no adjustment been made in the price, the error would have been about 5 percent ($36,900 - $38,800 = $1,900).

Various comparisons are made using house sales data. If the analyst is using anything other than annual data, the information will contain a seasonal bias. By using the seasonal index, the analyst can reduce the seasonal bias, creating seasonally adjusted prices with which to work. This adjustment is simply

$$P_{SA} = P_m \ (BMA_m)$$

where P_{SA} is equal to the seasonally adjusted price.

An example would be where a researcher is comparing first quarter 1975 sale prices with third quarter 1980 prices. The first and third quarter prices would be multiplied by the seasonal index for that period to obtain the seasonally adjusted price. (A quarterly index can be determined at this point by averaging the three monthly index figures, but this introduces an error factor. This error will be compounded when a transition month like September is averaged with July and August, traditionally peak price months).

Impact on the Appraisal Process

Appraisals of single-family houses, where there are a reasonable number of recent sales, will use comparable sales as the most important method of determining the value or

expected selling price of a house. Depending on the availability of comparable sales, the appraiser will generally not use sales more than six months old. The appraiser will generally select from three to six of the more recent sales felt to best represent the subject property.

Not making a seasonal adjustment in the comparable house sales may result in a biased value estimate. During some parts of the year the appraisal accuracy will be greatly distorted by seasonal price changes. An appraisal based on four comparable sales with the appraisal work being done in April (using comparables one to six months old) for a May 1st appraisal date could have been as indicated in Table 20.

It is not uncommon to find appraisals which make no adjustment for time, especially when the comparable sale takes place within a very few months of the appraisal date. Had the appraiser made no adjustment for time in the three examples given in the chart, the appraisal errors would run from a low of 6.2 percent to a high of 10.5 percent. Obviously some adjustment, even in the very short term is required. A professional appraisal error of 10 percent on a single-family house can hardly be called professional.

Inflation has aggravated the error between comparable sales and the expected selling price of the existing single-family house. Many appraisers attempt to adjust for inflation by estimating the amount of inflation which has and will take place between the time of the comparable sale and

Table 20
Examples of Appraisal Errors

Comparable Sale Date	Average Price 1971/72	Average Price 1975/76	Average Price 1977/78
Sale 1 in November	$27,900	$39,300	$48,500
Sale 2 in December	27,600	39,400	48,300
Sale 3 in January	28,000	40,200	50,300
Sale 4 in February	28,000	40,100	51,300
Appraised Value (Average)	$27,875	$39,750	$49,600
Actual May Price	$29,600	$42,900	$54,800
Appraisal Error	$ 1,725	$ 3,150	$ 5,200
Error/Appraisal	6.2%	7.9%	10.5%
Value Adj. for Inflation	$28,191	$40,376	$51,530
Appraisal Error	$ 1,404	$ 2,524	$ 3,270
Error/Appraisal	5.0%	6.3%	6.3%
Value Seasonally Adj.	$29,286	$41,932	$53,508
Appraisal Error	$ 314	$ 986	$ 1,292
Error/Appraisal	1.1%	2.3%	2.4%

the expected selling date of the subject house. Since the Housing Price Index is more a measure of the housing market at the margin (at the time of the sale), that index is probably the best inflation estimate of the many available.

Unfortunately, adjustments upward for inflation between the summer sales and the following winter sales only result in larger errors because of the actual decline in prices experienced in the winter months. While the appraiser is adding one-half to one or more percent per month to the selling price of the comparable house, by October or November the price may actually decline one to five percent.

The second part of the chart shows comparable sales adjusted for inflation using the actual inflation figures for the time period. While the appraisal error was reduced, it still ranged from 5 percent to 6.3 percent, a very material amount of dollar error.

The results of an appraisal during the transition months without a seasonal adjustment may cause the property owner either to overprice the house in the winter, causing it to remain on the market for an extended period of time, or to underprice the property in the spring. Either way the property owner has not received his money's worth by having a professionally accurate appraisal of the property.

The last three lines of the chart show the comparable sales adjusted not only for inflation but also seasonally adjusted using this study's seasonal index. In one case the

error was reduced to less than 1.1 percent. The worst the error was 2.4 percent. This still does not produce results that are completely accurate, but the results are exceptionally close when both the inefficiencies in the market are considered along with the shortcomings of the index previously discussed. A random sampling of similar seasonal adjustments produced seasonally adjusted appraisals with errors from as low as .25 percent up to three percent, with most lying in the one to two percent range.

Note that the index as designed is a weighted average between recession data and expansion data. The periods covered in the chart are expansion periods. The index is more conservative for expansion periods because of the inclusion of the recession data. Therefore, the "under" estimating as experienced in the three examples is to be expected. Had the example included comparable sales during a recessionary period, the adjustments would probably over estimate the subject property. The over estimation should still not exceed the one to two percent range.

A Counseling Tool

The seasonal index is also a counseling tool for use by the appraiser. It can be used to show the property owner that during different periods of the year more or fewer people are in the market to buy and sell houses, increasing or decreasing the probablity of a sale.

With complete information the buyer (or seller) may decide to postpone a transaction until market conditions

change. The seasonal index is proof that the change will occur and of the direction it will take.

The appraiser's information about the seasonal change could also help a client decide to accept an offer, say in August, at a lower than desired price, instead of "waiting to see whether something better comes along". With knowledge of the seasonal change the client would know that because of the drop in the number of buyers in the market and the expected drop in the average selling price, the probability of selling the property at the current market value decreases.

Failing to advise a client of these changing market conditions could cost that client considerable money and grief. A seller may not be able to hold off selling for several months (like over the slow winter months). The seller might be better off delaying moving or reducing the price rather than risk holding the property for four to six months in the winter. Knowledge of the seasonal patterns will help the client to reduce the risks of home ownership.

Future Regional Indexes

Just as there are now books published with building costs and standard expense estimates for various regions and locals, the seasonal index could be further refined not only to include the obvious adjustments for the business cycle and quality trends, but also for regional variations in the seasonal demand.

The NAR publishes its data on a regional basis making a regional index a reasonable next step. Additionally, locations with seasonal variations at odds with the national information could develop their own local index through correlation of local MLS data of volume and sale prices. This type of refinement should ultimately lead to a better, more accurate appraisal for the home owner.

Abnormal Profits

Any time there are predictable changes in prices great enough to cover transaction costs or holding period losses, and these price changes are not justified in the long run, there are abnormal profits available in that market. As this study has pointed out, there are predictable fluctuations in the existing single-family house prices which are relatively short term in duration and certainly not justified in the long run. People with information on these seasonal changes theoretically could reap abnormal profits by arbitraging these price differences. It is possible for a person to option property at the market value in December, pending the owner's planned move in the summer. The optionee could then resell the property at the predicted higher price, thereby obtaining an abnormal profit on the transaction.

However, as more and more people become aware of the exact nature of the observed monthly price changes, more and more people should act to eliminate the abnormal profits in the system, first by offering to pay more for options and

second by adjusting ask and bid prices to account for the expected seasonal changes. The appraiser's role will be to evaluate properly the seasonal effect on the property and advise the buyer/seller of the expected market conditions under which the property is expected to sell.

APPENDIX
BUSINESS CYCLE INDEX

One of the major drawbacks of the index contained in this study is its failure to deal with the business cycle. The monthly price fluctuations appear to differ to a material degree when comparing a recessionary year to a year of expansion.

This study began the "seasonal year" in September and thus was able to minimize the effects of the business cycle. The net result was a useable model capable of a more accurate forecast of prices than is currently available. However, the induced error from the business cycle is not eliminated by the model. If it were eliminated, the model should provide an even better estimate of the market.

Based on the average HPI adjusted national sale prices, the following indexes were developed for calendar years for the various business phases

Month	Expansion	Recession	Level
January	1.02757	0.99491	1.01314
February	1.02135	0.99021	1.00454
March	1.00989	0.98379	1.00868
April	0.99712	0.99107	1.00081
May	0.99455	0.98641	0.99369
June	0.98266	0.98141	0.98417
July	0.97855	0.97508	0.97102
August	0.97439	0.99006	0.98405
September	0.99658	1.01571	1.00543
October	1.00666	1.03368	1.01622
November	1.00070	1.02820	1.00872
December	1.00557	1.03529	1.01253

The major problem with these indexes is their variance. The Recession and Level indexes were derived from two

observations for each month. The Expansion index is better but still has only eight observations per month. Obviously with any variance at all, one degree of freedom is not sufficient to allow use of the business cycle index with any reasonable degree of certainty.

This study's index, while being offset by four months, is generally a weighted average of the above three indexes. Note that the Business Cycle Expansion index is substantially (at least for these figures) above the value 1.0 for January and February during periods of expansion while being slightly below 1.0 during recessions. The study's index for the same two months falls between these two positions. By having to, in effect, combine the two indexes, the study's index does not allow for the full adjustment warranted by real world conditions.

With additional observations, I believe indexes for the various business cycles can be derived with reasonable confidence levels. The new indexes could increase the accuracy of all price move predictions to within .5 percent per month, while substantually decreasing the variance of the index.

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BIOGRAPHICAL SKETCH

The author is active in many fields of real estate as a broker, developer, and state certified contractor. He currently owns or controls over $9,000,000 in real estate related assets. His recent activities in the community have included serving as chairman of the Gainesville Development Authority and president of the Gainesville Real Estate Exchangors.

The author was born in Missouri, but considers Florida his home, having moved there at the age of two.

He skipped a year of high school and entered college at age 16. A year later he dropped out to join the army and spent 1965 in Vietnam. He achieved the rank of Captain at the tender age of 22 through rapid promotion. He received extensive training as a paratrooper, jungle expert, cryptographer, and spy. His last assignment was as commander of a state-of-the-art covert spy plane in Europe. He traveled extensively overseas to more than 40 contries including Egypt, China, Syria, Northern Ireland, Panama, and Israel.

Upon leaving the service in late 1970, he returned to college and received a B.S.B.A. with honors in management in 1972. A year later he received a M.A. majoring in real estate with a minor in finance.

While working on his Phd, he worked for himself, developing over 500 building lots, platting eight subdivisions, building over 10 miles of roads, and renovating or building new, over 65,000 square feet of office space.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Clayton Curtis, Chairman
Associate Professor of Real Estate

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Halbert C. Smith, Jr.
Professor of Real Estate

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a disseration for the degree of Doctor of Philosophy.

Roger Blair
Professor of Economics

This dissertation was submitted to the Graduate Faculty of the Department of Real Estate in the College of Business Administration and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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