# Seasonality in Home Prices – Evidence from CBSAs

**By**

Norm Miller*

Vivek Sah**

Michael Sklarz***

Stefan Pampulov****

*V.P. Analytics, CoStar, and Distinguished Research Professor at the University of San Diego, San Diego, CA, nmiller@costar.com or nmiller@sandiego.edu

**Primary contact author: Assistant Professor, Burnham-Moores Center for Real Estate, University of San Diego, 5998 Alcala West, San Diego, CA 92110, Ph: 619-260-7832, Fax: 619-260-2760, viveksah@sandiego.edu

***President and CEO, Collateral Analytics, 3465 Waialae Avenue, Suite 330, Honolulu, HI 96816, msklarz@collateralanalytics.com

****Director of Research, Collateral Analytics, 3465 Waialae Avenue, Suite 330, Honolulu, HI 96816, Spampulov@collateralanalytics.com

**Abstract**

This study attempts to detect seasonality in home prices at the Core Base Statistical Area (CBSA) level. Using a unique database of home sales from over 270 CBSAs over the last ten years, we study if monthly home prices vary significantly during the year. Using a hedonic pricing model to account for housing characteristics and dummy variables for months, our findings indicate significant price variations during the year for most CBSAs around the country. At the aggregate level, the monthly price changes vary from an average of -6.13% on the downside to 1.55% on the upside. This study finds two factors affecting price changes: one if the CBSA is a tourist destination or not; the other the geographic region.

**Key words:** Seasonality, home prices, price changes, appraisal.

## I. Introduction

Sales of homes in the United States take place all around the year although at vastly different volumes. Sellers wait for the best offer on their houses, and when an offer meets their reservation price, they enter into a contract with the buyer. However, the decision as to when to attempt a sale is more often a need or consumption-driven decision rather than an investment-maximizing decision. Sellers may surmise that the price fetched by their property is independent of the time of year it is offered. This is not true and it appears that both consumers and appraisers have largely ignored seasonal price effects. There is already evidence of inefficiency in the housing market with respect to the volume of single-family homes.[1] Sales of homes peak at different times of the year across the country. While it is a common knowledge among real estate agents, Goodman (1993) established the pattern of home sales peaking during the Spring-Summer season. With respect to new homes, the author explains that sales peak earlier because of recording differences as most new homes are sold before they are ready for occupancy. Having seen inefficiency with respect to home volumes, it is reasonable to question the existence of informational inefficiency with respect to seasonality in home prices.

Studies in the past have looked at pricing changes over years. Case and Shiller (1989, 1990) find that the single homes market is inefficient across years. Using data from 1970 to 1986 for Atlanta, Chicago, Dallas and San Francisco, the study finds that price changes in one year tend to continue for more than one year in the same direction. In a recent study of home prices, Kaplanski and Levi (2009) find a significant and persistent seasonality effect. Their study examines price changes within each year during the period of 1987 to 2007. They use two

[1] See Goodman (1993) and Figure 1.

indices, the Case-Shiller Index and the House Price Index, to find evidence of price seasonality. Specifically, the study finds that the real rates of return on real estate are very low and even negative during the fall and early winter and positive and relatively high during the spring and early summer. Depending on the real estate price index employed, the prices are higher, on average, in the summer by 0.86% to 3.75%. However, the study uses indices to proxy for residential real estate prices. By using the Case-Shiller index, the study is restricted to only 20 major metropolitan statistical areas, a small set of major markets. (The other index used in the study is the House Price Index which is restricted to 9 divisions)

This study adds to the work by Kaplanski and Levi (2009) by greatly expanding the sample size, exploring new theories and analyzing the seasonality effect in home prices at the Core Base Statistical Area (CBSA) level. Using a unique database of home sales from over 270 CBSAs over the last 10 years, we study the variation in monthly home prices. Our results indicate significant price variation over the year for almost all CBSAs analyzed in this study, providing further evidence of significant market frictions based on households' mobility needs. If homeowners wished to maximize investment gains, they would certainly sell during the peak months and purchase during the troughs. Unfortunately for most homeowners, the decision to move often creates the need for both selling and buying, lest the homeowners decide to temporarily rent and move twice, adding significant transactions costs to the move and negating much of the benefits from timing the purchase and sale. To the extent these moving costs are significant, the variations in price observed here over the course of the year is rational and explainable. Still, it does allow for some exploitation by first-time buyers or last-time sellers as well as speculators in the housing market.

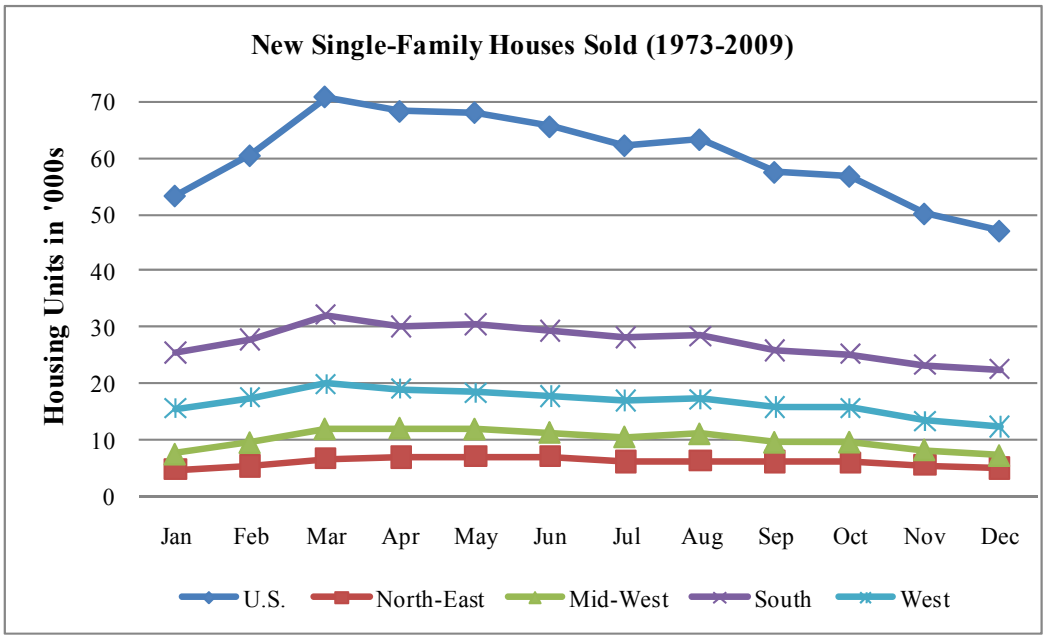
## II. Literature Review

Previous studies have addressed the topic of inefficiencies in the housing market in various forms. With regard to knowledge of local markets, Lambson, McQueen and Slade (2004) detect the presence of a home bias amongst buyers of property in Phoenix. In a study of homes bought by out-of-state buyers and in-state buyers in Phoenix, the study finds that out-of-state buyers pay an average 5% higher price than in-state buyers.[2] The authors argue that this premium is a compensation for the information disadvantage that these out-of-state buyers have over their in-state counter parts.

[2] A similar but smaller effect is found in, "The Effects of Housing Transaction Phenomena on the Housing Market", Norman G. Miller dissertation, Ohio State University, 1977.

With regards to volumes of home sales, Figure 1 shows the average monthly pattern in new home sales in the United Sates for a period of 37 years (1973-2009).

**Figure 1**




***Source: census.gov***

As seen in Figure 1, the months March to June lead the volume tally for home sales. This is consistent at the regional level as well. In a study to understand the mobility patterns of people around the country, Goodman (1991) finds evidence of transaction volume seasonality. Using data from the American Housing Survey, the study finds that moves are two times as likely to occur during the summer months than during the winter months. The study also finds that this effect is similar for all the reasons that people move and not necessarily because of summer weddings and school calendars (they are part but not all of the factors driving seasonal volume). Also the seasonality is similar for all regions and climate zones. The author explains that new home developers take advantage of this seasonality in order to shorten their marketing period and secure higher premiums from consumers. With respect to the pricing of homes, Case and Shiller (1989, 1990) find that the market for single-family homes is not efficient. Using quarterly data of

single-family homes for four cities, they find momentum in price changes in one direction for over a year. However, the Case Shiller studies did not look at monthly seasonality effects in home prices.

In a recent study, Kaplanski and Levy (2009) try to explain seasonality in home prices by two local factors: the monthly change in the number of daylight hours and the latitude, which should capture most of the climate impact. Using the Case-Shiller Index for 20 MSAs in the United States and the House Price Index for nine divisions, their study finds evidence of inefficiency in monthly home prices during the year. Specifically, the study finds that the real rates of return on real estate are very low and even negative during the fall and early winter and are positive and relatively high during the spring and early summer. The prices are higher, on average, in the summer by 0.86% to 3.75%, depending on the real estate price index employed. The authors attribute this seasonality to Seasonal Affective Disorder (SAD). Our study looks at a much larger sample to get a broader representation of the U.S. market and to explore additional factors that may drive seasonal price variation. We hypothesize that the population of the CBSA, whether the CBSA is a tourist destination or not, cold weather, geographic region and whether the city is a capital city or not may explain price variation during the year.

## III. Data and Methodology

The data for this study is from Collateral Analytics. All types of information on home sales, including home characteristics such as the area of the living room, the number of bedrooms, bathrooms and age is obtained for over 300 CBSAs from 2000 to 2009. This data is one of the

most comprehensive sets of home sales data available. Housing prices are explained by a hedonic pricing regression model, which account for housing size and quality characteristics. Dummy variables for months are used to detect seasonality in prices. Dummy variables for each year are used to control for and separate our long-term price trends. The regression run is shown in Equation 1.

$$Ln(P) = \alpha + \beta_1 L + \beta_2 B + \beta_3 Ba + \beta_4 Age + \beta_5 D_Y + \beta_6 D_M + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where P is the price of the house sold, L is the area of the living room, B is the total number of the bedrooms, Ba is the number of bedrooms, Age is the physical age of the home, $D_y$ is a dummy variable for the year, $D_m$ is a dummy variable for each month of the year and $\varepsilon$ is the error term which is assumed to be normally distributed.

For the monthly dummy variable, the base category used is December. Thus, the coefficient for any month is the change (increase or decrease in percentage) in the home prices relative to December.

The regression shown in Equation 1 is run for each CBSA using the home price data for that CBSA. Once we have the coefficients for the entire sample, we calculate an average of all the months for each CBSA. This average monthly price variation for each CBSA is then regressed on variables, which may help explain seasonality.

$$AvgM_i = \alpha + \gamma_1 Pop_i + \gamma_2 D_{iTcap} + \gamma_3 D_{iTou} + \gamma_4 D_{iRegn} + \gamma_5 D_{iTemp} + \mu \quad \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where $AvgM_i$ is the average monthly change for the $i^{th}$ CBSA, $Pop_i$ is the estimated population for the $i^{th}$ CBSA for the latest quarter (2010), $D_{iTcap}$ is a dummy variable if the CBSA is a capital city or not, $D_{iTou}$ is a dummy if the CBSA is a tourist city or not, $D_{iReg}$ is a dummy for the four regions (West, Midwest, South and East) as classified by the U.S. Census Bureau, $D_{iTemp}$ is a dummy if the CBSA is in the Top 15 coldest states of the country and $\mu_i$ is the error term, which is assumed to be normally distributed. Population estimates for the latest quarter for 2010 are from the U.S. Census Bureau.

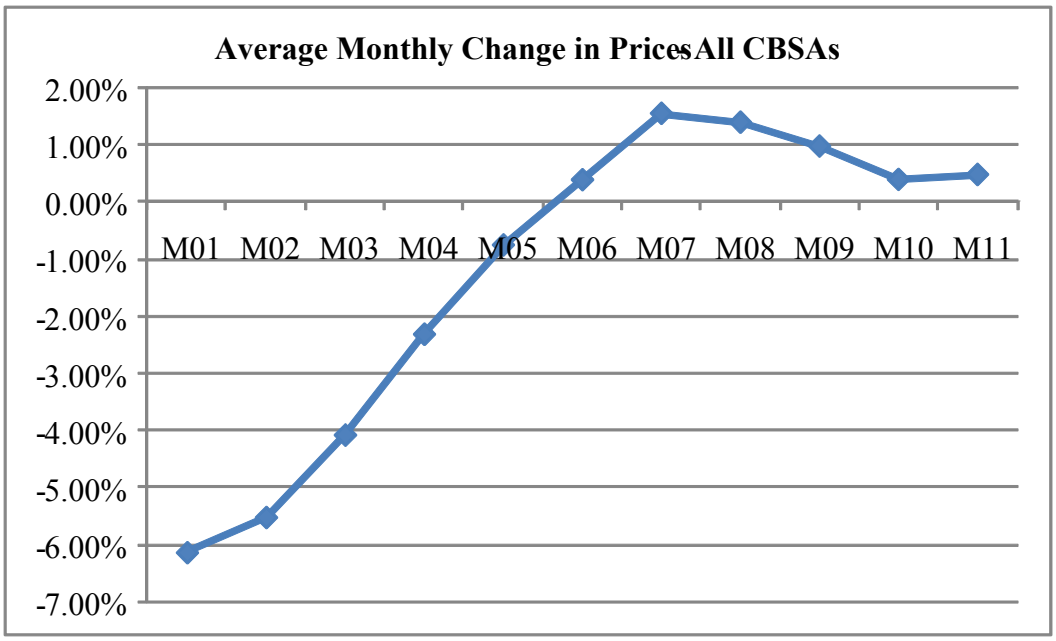
## IV. Results

The results from the first regression give us the coefficients for the monthly dummies. Most of the dummies in all the CBSAs are significant[3]. The initial data on home prices represented a total of 307 CBSAs. However, upon a detailed examination of the coefficients for all the CBSAs, it was found that some of the CBSAs had very high monthly changes (both positive and negative). Thus, to filter these more extreme CBSAs, all of those that had an average monthly change greater than or equal to 10%, or smaller than or equal to -10%, were removed from the sample. We feel that this will reduce the noise within the sample, although it may also dampen our results. Further, those CBSAs that had more than three coefficients of the monthly dummies as zero were also removed from the sample. After removing these outliers, we were left with 272 CBSAs.

[3] The complete list of coefficients for the CBSAs can be obtained from the author on request.

Figure 2 shows the price variation over the year for our filtered sample. As mentioned in the previous section, the change in price (increase or decrease) for any month is relative to the month of December. As seen in the figure, prices are higher in months after June. The prices are low in January through May, after which they start to rise. The price variation is sizable with the lowest being -6.13%, and the highest being 1.55%. Note that the results shown here are based on closing months as opposed to contract months. As such, the contracts were typically signed 30 to 60 days prior to closing. One should keep this in mind when analyzing the results.

**Figure 2**

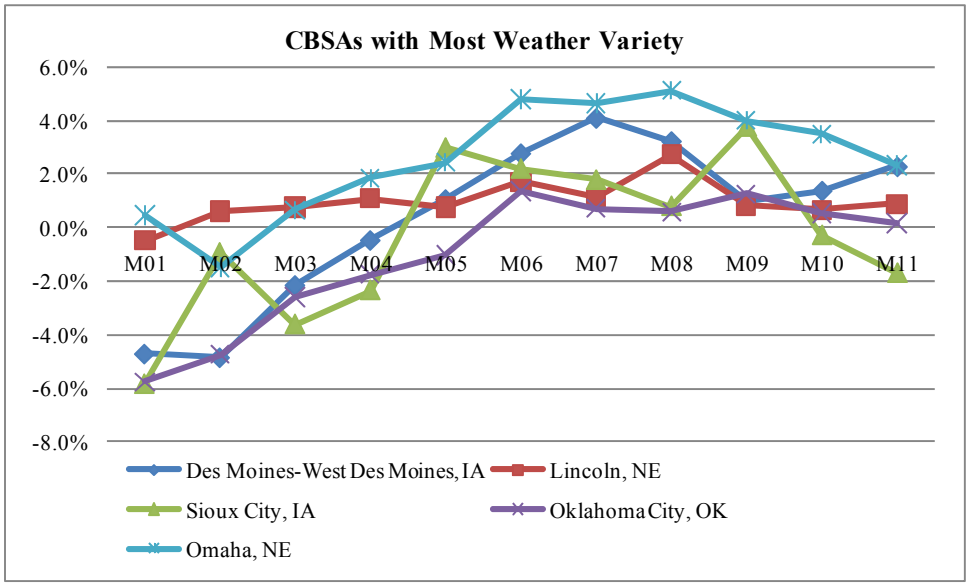



The results of the first regression (monthly price changes) of the filtered sample are shown in Table 1. Because of a very large sample of 272 CBSAs, Table 1 first shows four CBSAs, two with the highest average monthly change and two with the lowest average monthly. It then shows some of the five of the largest markets in the country. As seen from the table, most of the monthly price changes are significant at the 1% levels.

Next, we plot graphs to see if there exists any commonality amongst various CBSAs. We graph cities on various parameters. We plot cities with the least weather variety, the most weather variety, the lowest average monthly change, the highest average monthly change, the tourist cities, and cities with the least price variation as measured by the standard deviation of monthly prices. Last, we examine cities with the most price variation and cities in the 15 coldest states in the nation.

Figure 3 and Figure 4 show the monthly variation in prices for CBSAs with the most and least weather variety in the nation respectively.

## Figure 3


CBSAs with Most Weather Variety
6.0%
4.0%
2.0%
0.0%
-2.0%
-4.0%
-6.0%
-8.0%
M01
M02
M03
M04
M05
M06
M07
M08
M09
M10
M11
Des Moines-West Des Moines, IA
Lincoln, NE
Sioux City, IA
Oklahoma City, OK
Omaha, NE

## Table 1

| | Coefficients | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CBSA** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Avg.** |
| Port St. Lucie, FL | -18.8% | -13.7% | -11.7% | -11.3% | -12.7% | -8.6% | -7.8% | -5.4% | -5.3% | -5.0% | -1.6%* | **-9.3%** |
| Fernley, NV | -16.2% | -12.8% | -13.9% | -10.7% | -7.4% | -8.8% | -7.0% | -7.0% | -6.9% | -3.3%* | -2.1%# | **-8.7%** |
| Atlanta-Sandy Springs-Marietta, GA | 9.1% | 8.8% | 10.0% | 10.5% | 11.4% | 11.1% | 10.7% | 7.2% | 5.8% | 3.8% | 0.7%# | **8.1%** |
| Youngstown-Warren-Boardman, OH-PA | 3.2%# | 3.1%# | 3.1%# | 4.8%* | 7.6% | 8.6% | 6.7% | 8.5% | 6.3% | 5.3%* | 4.8%* | **5.6%** |
| New York-White Plains-Wayne, NY-NJ | -6.6% | -7.2% | -5.6% | -4.5% | -4.3% | -3.4% | -0.8%* | 0.8%* | 1.5% | 0.9%* | -0.6%** | **-2.7%** |
| Los Angeles-Long Beach-Glendale, CA | -9.0% | -8.2% | -5.5% | -4.2% | -3.2% | -1.0% | -0.9% | 0.0%# | -0.4%* | -0.7% | 0.4%# | **-3.0%** |
| San Francisco-San Mateo-Redwood City, CA | -6.4% | -3.4% | -0.9%* | 1.3% | 1.0%* | 2.5% | 1.5% | 1.0%* | 0.2%# | 1.2% | 1.8% | **-0.01%** |
| Phoenix-Mesa-Scottsdale, AZ | -5.1% | -4.6% | -4.0% | -2.9% | -2.5% | -1.8% | -1.6% | -0.8% | -0.8% | -0.4% | 0.3%** | **-2.2%** |
| Chicago-Naperville-Joliet, IL | -6.5% | -7.6% | -5.3% | -2.1% | -0.5%# | 3.4% | 3.7% | 3.5% | 2.2% | 1.2% | 0.1%# | **-0.7%** |

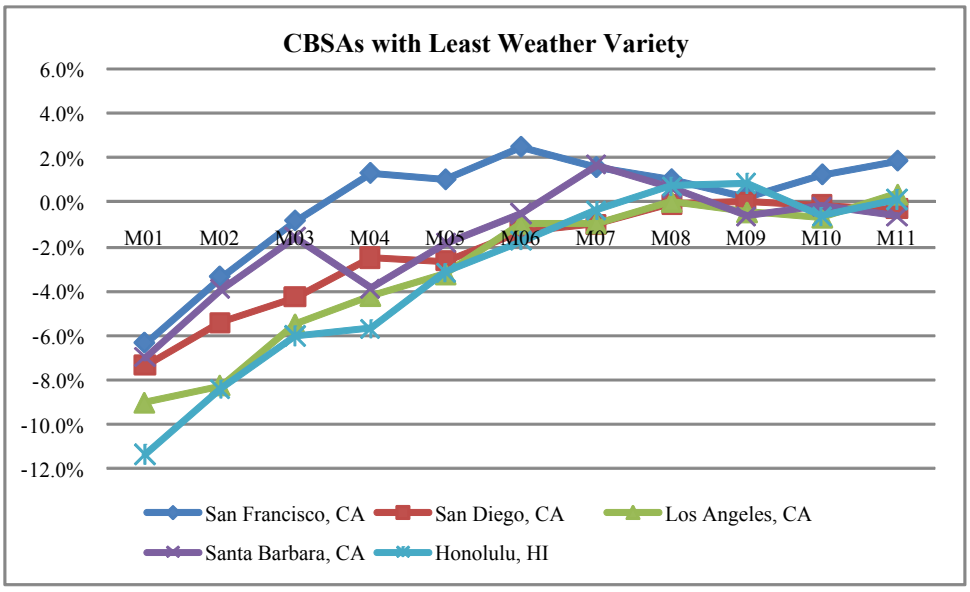
***Significant at 5% level**

****Significant at 10% level**

***#Not significant All others that are not marked are significant at the 1% level.**

***Note: The complete list of coefficients for the CBSAs can be obtained from the author on request.**

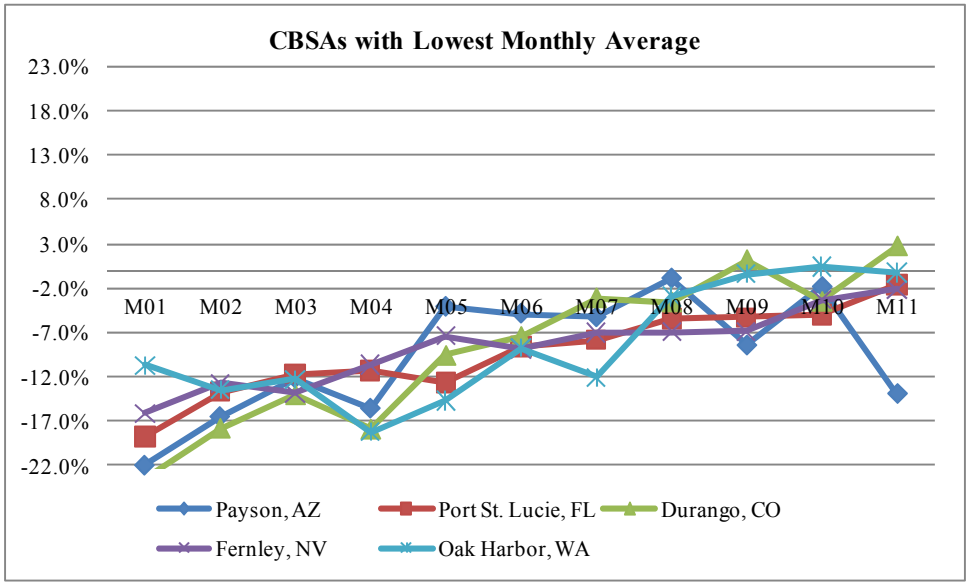
**Figure 4**




As seen from Figures 3 and 4, with respect to monthly price variation cities with the least weather variety are more consistent in pattern than cities with the most intense weather variety. However, one thing is common to both groups: Most cities in both groups have a lesser price change during the first half of the year than the second half. Note that the seasonal price effects shown need not balance out as the volumes are different by month, so the reader should not assume symmetry. We see that cities with more intensive weather show more positive and negative swings while those with less weather variation show more negative, but not as many positive swings.

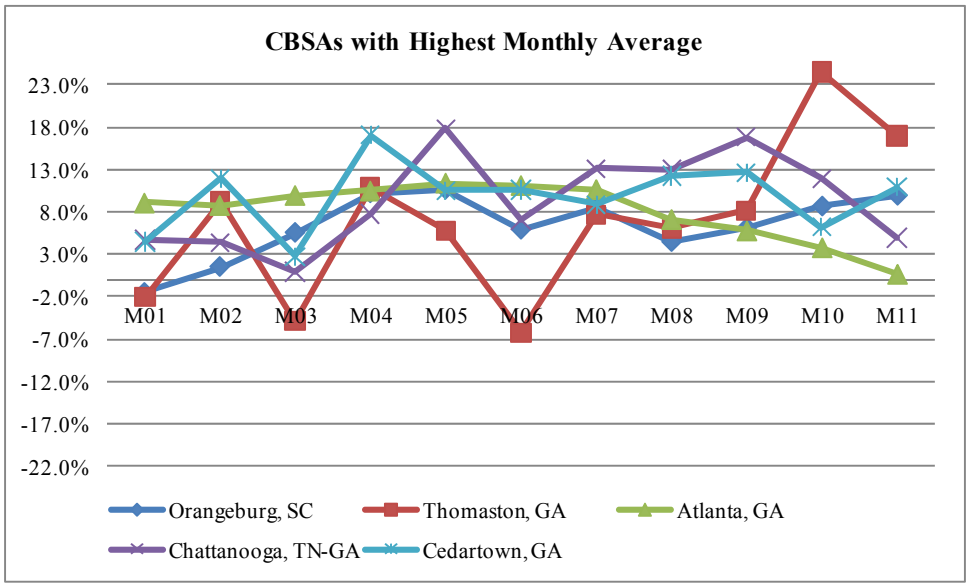
Figure 5 and Figure 6 show the cities with the lowest and highest average monthly change respectively.

**Figure 5**



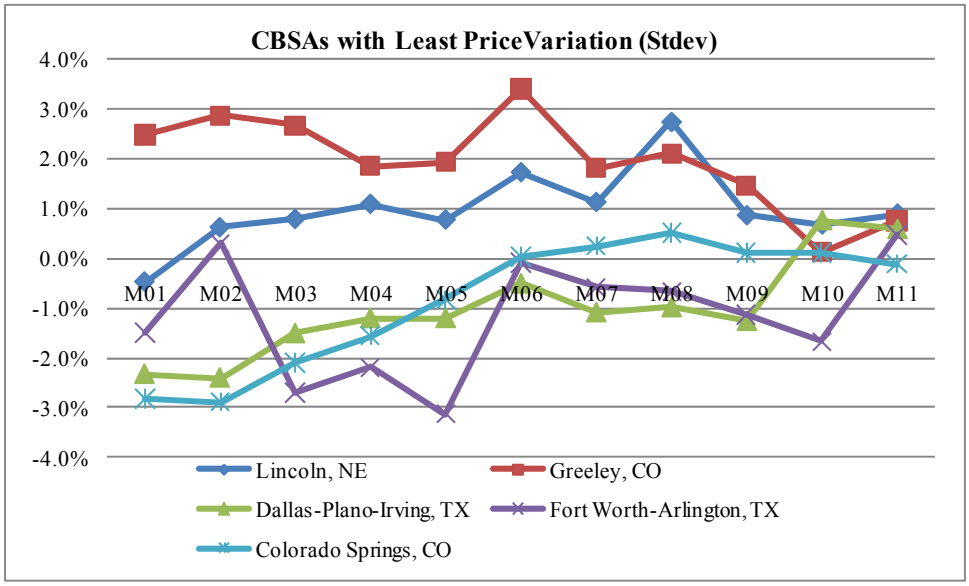

What can be observed from Figures 5 and 6 is that the CBSAs with the lowest monthly average positive change in prices overall still show large negatives. The winter swings, which show some large negatives, are much thinner with fewer transactions and which is why these large negatives do not balance out with the positives. What can also be observed is that the CBSAs with the lowest monthly average price variation are from the western region of the country. When you look at the CBSAs with the highest monthly average swings, they tend to belong to the south/south-eastern region of the country. Weather likely dominates these general regional observed price effects.

**Figure 6**

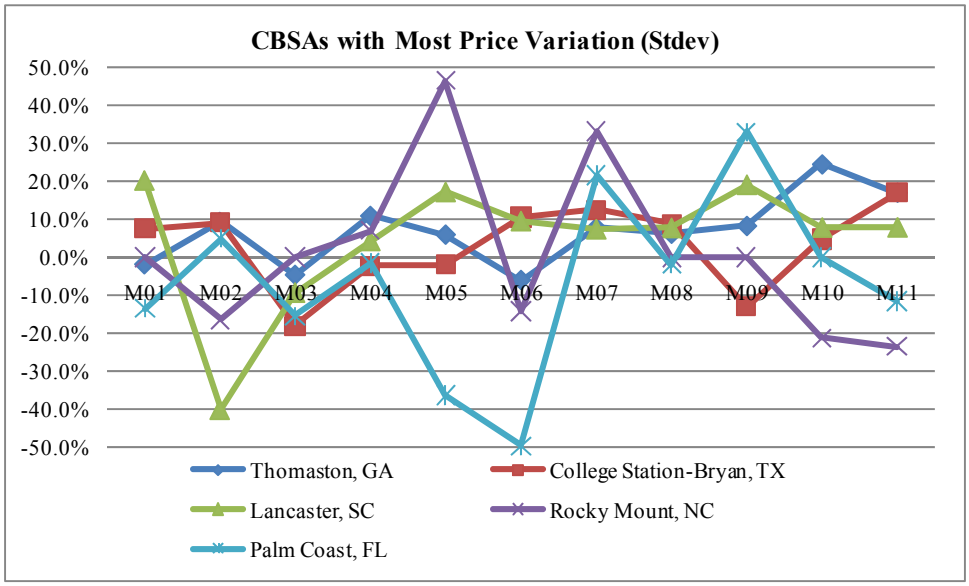



Next we look at CBSAs with the least and most price variation during the year as measured by standard deviation. Figure 7 and Figure 8 show this difference in terms of annual price variation. Looking at these graphs, we may be able to somewhat confirm our belief that CBSAs with the most price variation during the year tend to be the ones that experience different seasons throughout the year. As we can see from Figure 8, all of the CBSAs with the most price variation are from the south/south eastern region of the country.

## Figure 7

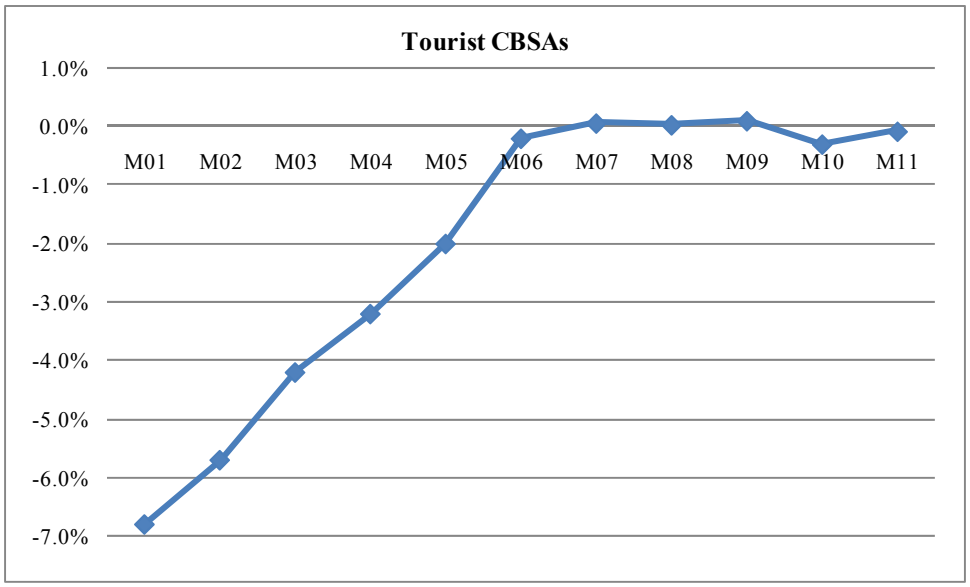



## Figure 8



Finally, we look at some cities in our sample that are tourist destinations and see their pattern of price changes. Figure 9 shows the price variation of 59 such cities in our sample. As seen from the graph, tourist cities have mostly negative price changes during the year and very minor positive changes. The graph also shows that prices in tourist cities consistently increase as the year progresses, with the lowest price realized in the month of January.

**Figure 9**




Lastly, Table 2 summarizes the results for the second regression. When we look at these results, we find the dummy for region and tourist city to be significant. The base category for the regional dummy is the eastern region. G1, G2 and G3 are the dummies for the West, Midwest and South regions respectively. The Western region and the midwestern region variables are significant at the 5% levels. As mentioned in the previous section, the dependent variable in the second regression is the average of the price variation for all months (January to November, with December as the base dummy). The standardized coefficient for the Western region suggests that this average monthly price variation for the Western region is 15.6% less than that of the Eastern

region. At the same time, the standardized coefficient for the Midwestern region suggests that the average monthly price for the Midwestern region is 17.1% more than that of the Eastern region.

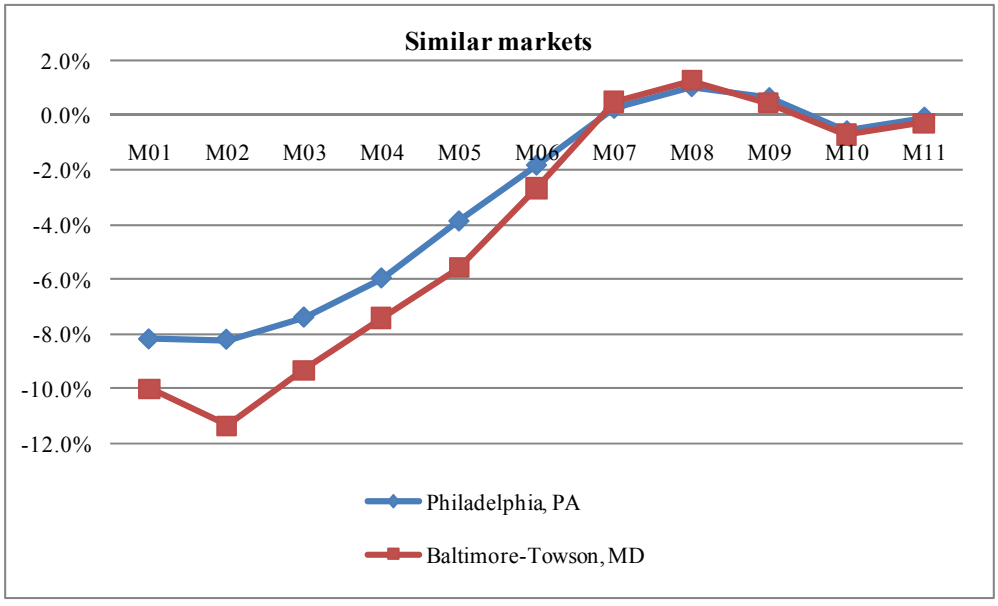
**Table 2**

| | Standardized coefficients | P value |
|---|---|---|
| **Constant** | | 0.002 |
| **Pop_2010** | 0.068 | 0.315 |
| **D_Cap** | 0.038 | 0.522 |
| **D_Tou** | -0.141 | 0.038* |
| **G1** | -0.156 | 0.031* |
| **G2** | 0.171 | 0.014* |
| **G3** | 0.025 | 0.719 |
| **Temp** | 0.020 | 0.748 |

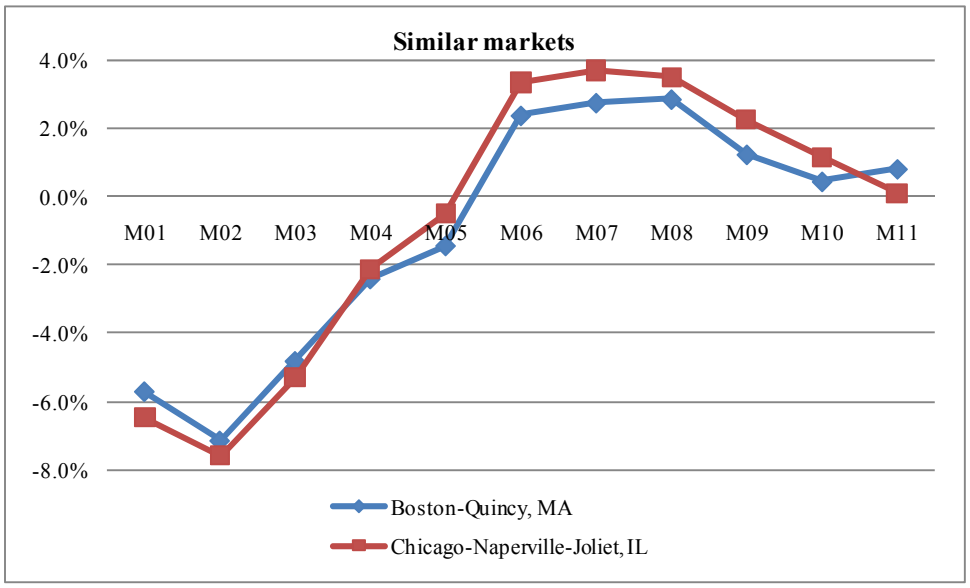
***Significant at the 5% levels***
***Dependent variable: Average Monthly Price Variation***

Since we have a large sample, we also look at cities with similar monthly price variations. For that, we look at the correlations between cities. Figures 10, 11, 12, 13 and 14 show some of these markets, which are very highly correlated with each other.

**Figure 10**



## Figure 11




## Figure 12

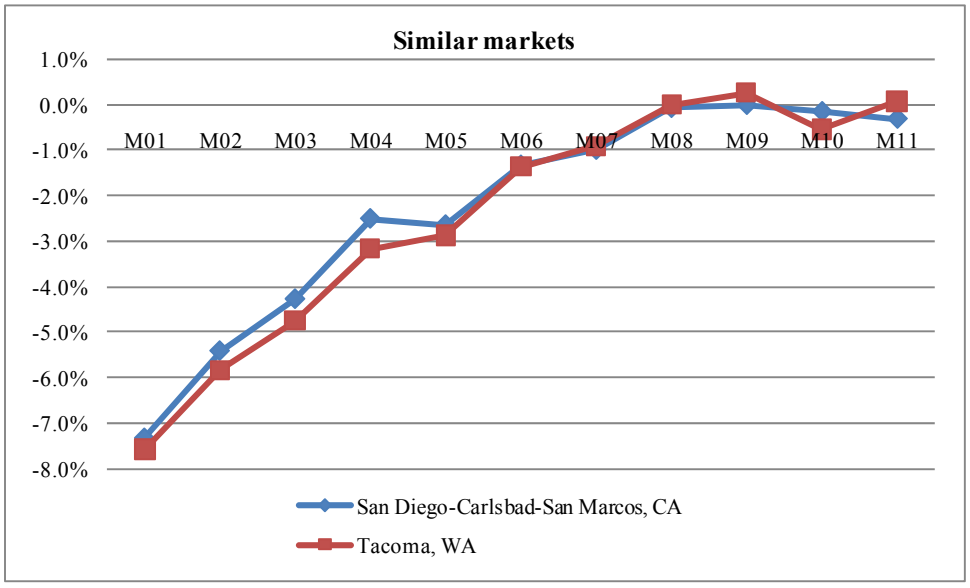


**Figure 13**

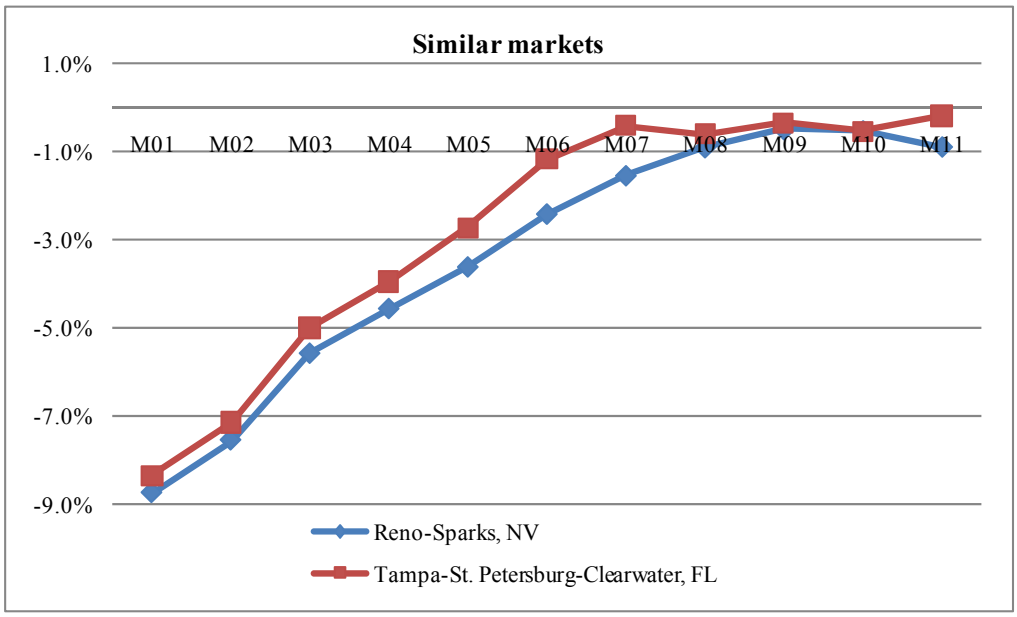
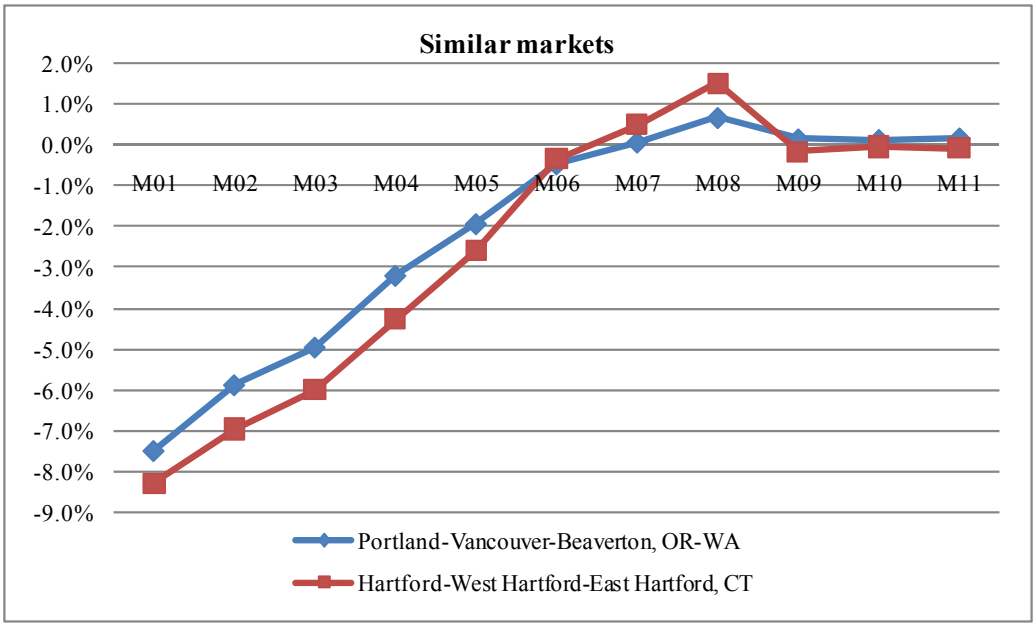



**Figure 14**



Besides the fact that most of these cities are large commercial markets, there does not seem to be any other common factor in these pairs that may help explain the high correlation in price movements.

## V. Implications and Conclusions

This study explores the drivers of seasonality in home prices at the Core Base Statistical Area (CBSA) level. Using a unique database of home sales from over 270 CBSAs over the last 10 years, we study monthly home prices variations during the year. Using a hedonic pricing model to account for housing characteristics and dummy variables for months, our findings indicate significant price variations during the year for most CBSAs. At the aggregate level, the monthly price changes vary from an average of -6.13% on the downside to 1.55% on the upside. Additionally, this study finds two factors affecting price changes: One is if the CBSA is a tourist destination or not; the other being the geographic region it is located in. Our data is based on closings and since it typically takes 30 to 60 days to close a transaction, the negotiated contracts occurred prior to the peaks and troughs shown here. Summer time peaks are generally based on mid to late spring time contracting. January closings, when the market is slower typically are generated from late November and December contracting.

The results from this study have significant implications for consumers, appraisers, lenders and policymakers. Appraisers could easily be off of true values by several percent when ignoring seasonal price effects. Because appraisers use historical transactions, often from sales up to 12 months ago in attempts to find good comps, existence of significant seasonal variations in home prices within local markets should require adjustments to the comparable property data. One exception would be if the comparable property entered into contract exactly one year before it is

being used to value a subject property[4]. Then, the appraiser need only consider the longer-term price trend. Because seasonality exists in markets, incorporating these effects while valuing properties is essential to reduce appraisal errors that otherwise appear to be noise, but are not. The valuation errors will depend upon both the time of year and the magnitude of price changes within that local market. Markets that have higher price seasonality will obviously have more appraisal error when price seasonality is not factored into adjustments.

From a tax assessment point of view in counties, the timing of property valuation could have a significant financial impact on a county's revenues. The timing of appraisal by the assessor's office may either increase or decrease revenues. If the appraisal is conducted in months in which prices are higher, it will lead to higher property values and, hence, increased property taxes. This may well benefit the given county. On the other hand, from the property owner's perspective, appraisal appeals based on comparable properties selected from months of lower prices will benefit the owner. So we do see the possibility for the strategic use of the seasonal price effects found here. Finally, from an investor's perspective, our results show that if one can buy in the down seasons, one can significantly benefit from the seasonal price variations. There is clearly an arbitrage opportunity in the housing market for time-flexible buyers and sellers.

[4] This means the sale probably closed about 10 to 10.5 months before the date of the appraisal.

**References**


- Case, K.E. and R.J. Shiller, The Efficiency of the Market for Single Family Homes, American Economic review, 1989, 79, 125-137.
- Case, K.E. and R.J. Shiller, Forecasting Prices and Excess Returns in the Housing Market, Journal of the American Real Estate & Urban Economics Association, 1990, 18, 253-273.
- Goodman, J., A Housing Market Matching Model of the Seasonality in Geographic Mobility. The Journal of Real Estate Research, 1993, 8, 1, 117-138.
- Kaplanski G and H Levy, Real Estate Prices: Seasonality's Sentiment Effect, 2009, Working Paper. Available at SSRN: http://ssrn.com/abstract=1438826
- Lambson V, G McQueen and B Slade, Do Out-of-State Buyers Pay More for Real Estate? An Examination of Anchoring-Induced Bias and Search Costs. Real Estate Economics, 2004, 32, 1, 85–126.