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Time Trending/Adjusting for Changes in Market Conditions in Assessment

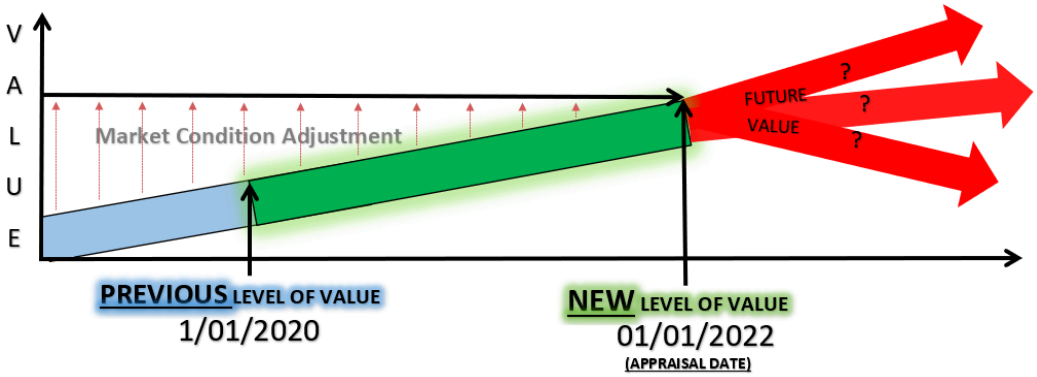
A vital key in the equitability of property assessments is to adequately address and adjust for changes in market conditions when they exist. Adjustments for market condition changes, commonly referred to as time trending, are the fluctuation in the price level of real estate due to factors such as economic conditions, interest rates, supply and buyer demand. Market conditions defined by the Appraisal Institutes Dictionary of Real Estate 6th Edition states: *"...comparable properties can be adjusted for differences in the points in the real estate cycle at which the transactions occur. Sometimes called a time adjustment because the differences in dates of sale are often compared, although that usage can be misleading because property values do not change merely as the result of the passage of time."*

In property valuation for assessment, one of the most important considerations is how the market changes over time. Time trending is one tool that assessors use to reflect the impact of time on property values. In this article we'll explore what time trending is, why it's important, applicable approaches, and how it helps ensure equitable assessments for property owners and taxing authorities alike.

Property owners depend on assessments that are fair and accurately reflect current market conditions. Time trending plays a crucial role in ensuring that assessments are a reflection of the real estate market, preventing inequities where recent sales might be overrepresented while older sales, though still valid, could distort results without adjustments.

When assessors use comparable properties (comps) to determine a property's value, these comps may have sold months or even years earlier. During that period, the real estate market may have shifted significantly. Time trending adjusts the sales prices of these comparable sales to align with current market conditions, resulting in a more accurate and equitable valuation.

The applicability of Time trending can be shown with a simple graphic as displayed:



Real Estate markets do not always move in a linear fashion, but the idea that markets fluctuate throughout a period of time studied and must be adjusted to the point of valuation or appraisal date. Time trending refers to this process of adjusting sale prices to account for changes in market conditions between the time when comparable properties were sold and the effective date of the appraisal. In other words, it's a method of ensuring that property values are consistent with the market at the time of appraisal, even if the sales data being used is from an earlier time period.

Assessors analyze market trends to understand how property values have changed over time. Factors such as economic growth, housing demand, interest rates, and inflation cause property values to rise or fall. To determine the impact of this involves studying historical sales data, market reports, and economic indicators to identify patterns of appreciation or depreciation. By calculating the rate at which property values have increased or decreased, assessors can apply that rate to older sales data. Though there are different techniques for deriving an adjustment for market conditions we will look at a few of the most commonly used; Resale Analysis, Sales Ratio Trend Analysis, Sales Unit Trend Analysis, and Multiple Regression Analysis.

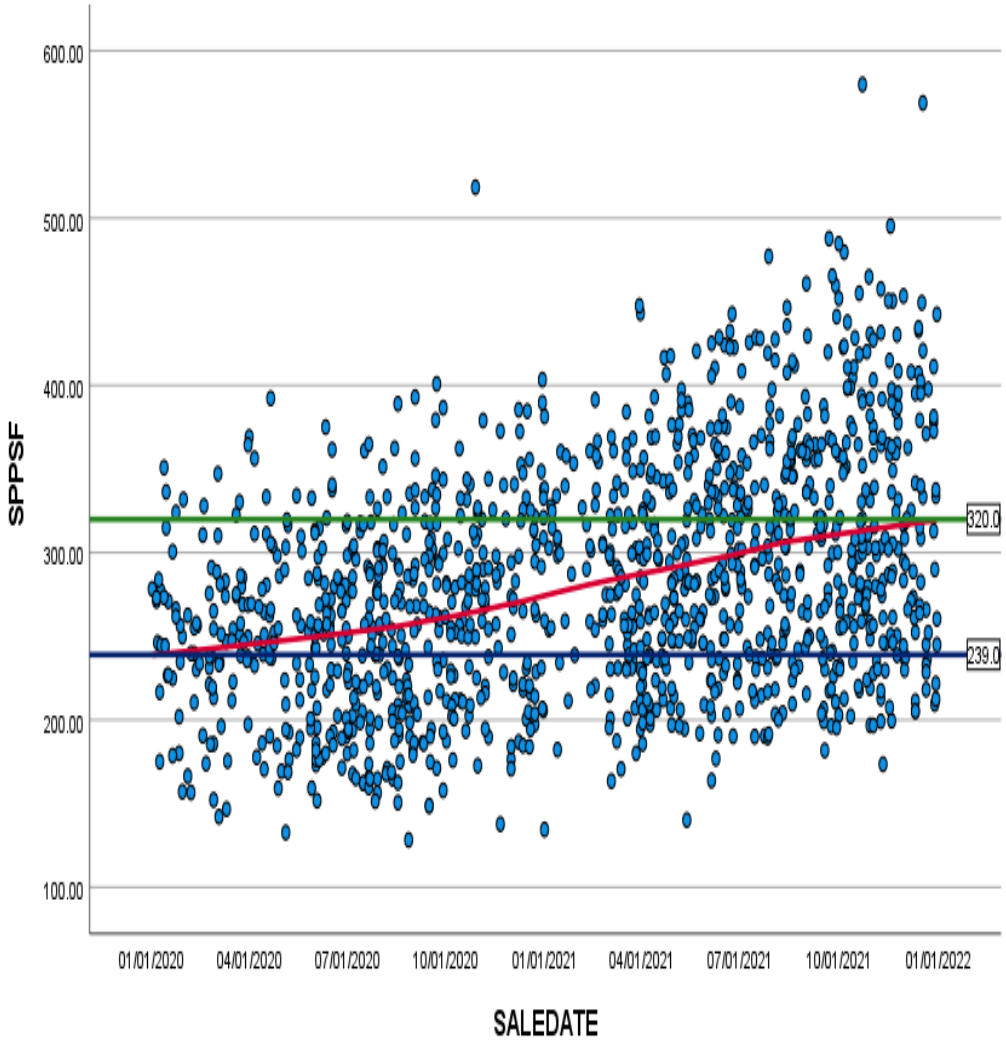
Resale Analysis:

Resale analysis aims to isolate price changes by examining the same property sold at different times. A key aspect of this approach is verifying each transaction to ensure the property was transferred at arm's length and received typical market exposure. During this verification, it's essential to confirm that the property's characteristics have not changed between the two sale points, ensuring that any price differences reflect market condition changes.

Parcel A: *Sold Date: March 2020 - $250,000*
Resale Date: April 2021 - $325,000

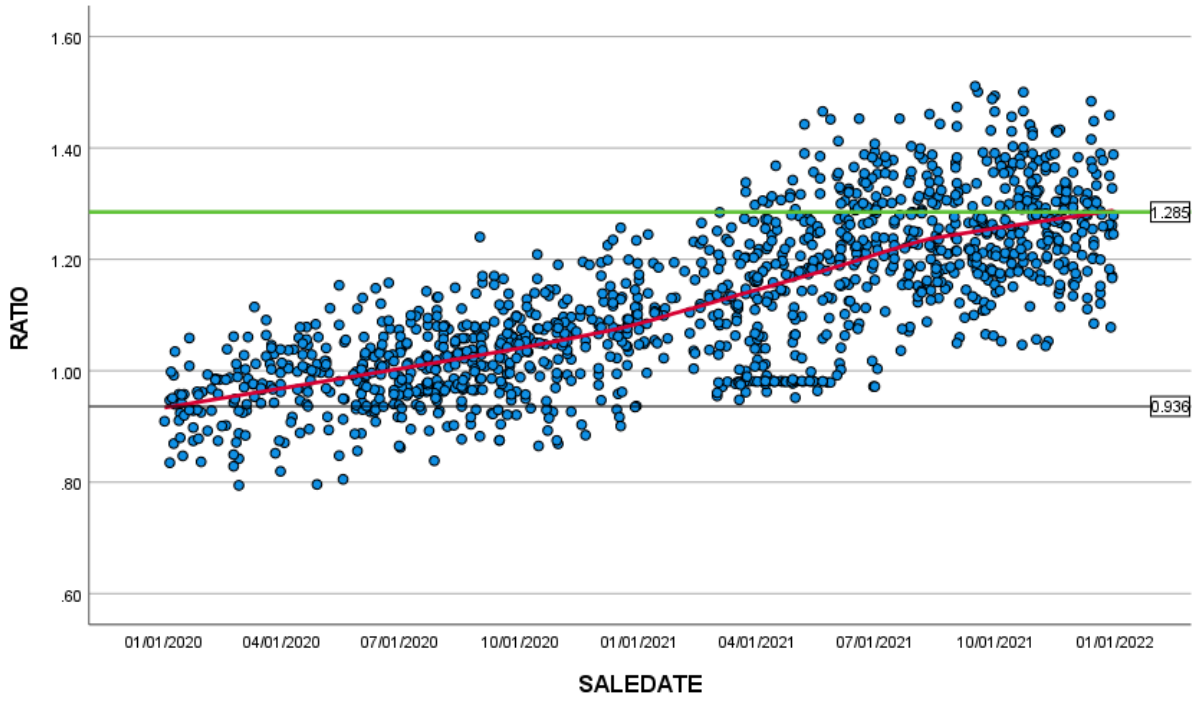
Sale Price Difference: $50,000
Month Difference: 13
Formula: (325000-275000)/275000/13 = (.013986)Monthly % Change
Trime Trend 1.3986% Per Month

Sales Unit Trend Analysis:
Sale trend analysis by unit is a straightforward tool for understanding the relationship between increasing or decreasing demand in the property market. The unit of measurement should correspond to the property type being studied, such as sales price per square foot, price per acre, or unit price. Plotting and analyzing the unit price at the beginning and end of the study period can provide a clear indication of whether a trend exists.



Utilizing a LOESS line (Locally Estimated Scatterplot Smoothing) to determine your start and end points you can identify the trend and compute this into a monthly rate of change.
Sale Price Per Square Foot Difference: $81.00
Months: 24
Formula: (320-239)/239/24 = (.014121)Monthly % Change
Trime Trend 1.4121% Per Month

Sales Ratio Trend Analysis:
Graphing ratio trends is an excellent way to visually identify potential patterns and explore how these trends can be derived. A simple approach to reviewing and analyzing ratio trends is similar to unit trend analysis. When using ratios to predict and assess trends, it is crucial to ensure that the ratio accurately represents the market value at the previous appraisal point to avoid skewed results. Here is the application of reviewing ratio patterns over a study period and extracting a monthly rate of change.



Sale Price Per Square Foot Difference: .349
Months: 24
Formula: (1.285-.936)/.936/24 = .015536 (Monthly % Change)
Trime Trend 1.5536% Per Month

To further validate and explore ratio trends, a simple linear regression can be used to regress the ratio against time (in months), providing a clear indication of any existing trends. This method also offers a statistical measure to determine whether the time variable significantly affects the change in ratios. By using an additive model, if the time coefficient is significant, you can divide it by the constant in the model to isolate the monthly trend rate.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.894732	.006		150.931	.000
	MONTHS	.016529	.000	.765	43.016	<.001

a. Dependent Variable: RATIO

Months Coefficient: .016529
Constant:.894732
Formula: .894732/.016529 = .018474 (Monthly % Change)
Time Trend: 1.8474% Per Month

Since markets don't always move in a linear fashion, modeling the natural log of the ratio helps account for non-linear trends. This is done by taking the natural log of the ratio variable and then exponentiating the time coefficient to calculate a monthly percentage change multiplier. This approach reflects the compounding rate of change and can often capture market fluctuations more accurately over time. When the market shifts significantly at different points during the study period, it may be useful to introduce spline points to model distinct rates of change across different time segments.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-.096113	.005		-18.497	<.001
	MONTHS	.014764	.000	.771	43.835	<.001

a. Dependent Variable: LNRATIO

Months

Coefficient: .014764
Formula: EXP(.014764)= 1.014764 (% Change Multiplier)
Time Trend: 1.4764% Per Month

Multiple Regression Analysis:
Time trending can also be applied through mathematical models that incorporate various factors, such as the sale date, location, and other key characteristics of the property. These models help automate and standardize the adjustment process, ensuring consistent application across all properties. By using a multiple regression model with the sale price as the dependent variable, you avoid skewing the results with prior reappraised values. Allowing the time variable to act independently from other attributes prevents overestimating the effect of time on price changes throughout the study period. Similar to the ratio example mentioned earlier, you can test different model structures and isolate the contribution of time (in months) to determine the rate of change.
Below is a sample regression output with time variables added independently alongside other variables that significantly explain sale price. The variables Months11_1 and Months11_2 represent two distinct time segments. Analysis showed that the rate of change in market conditions differed between these segments, which is reflected in the regression output below.

As with the sale ratio trend, we can take the antilog of the coefficient to derive the rate of change, applying it to each segment to calculate a new variable: Time-Adjusted Sale Price (TASP).

Months11_1 Coefficient: 0.013481
Formula: EXP(.014764)= 1.01357228
Time Trend: 1.357228% Per Month

Months11_1 Coefficient: 0.09788
Formula: EXP(.014764)= 1.01998508
Time Trend: 1.998508% Per Month

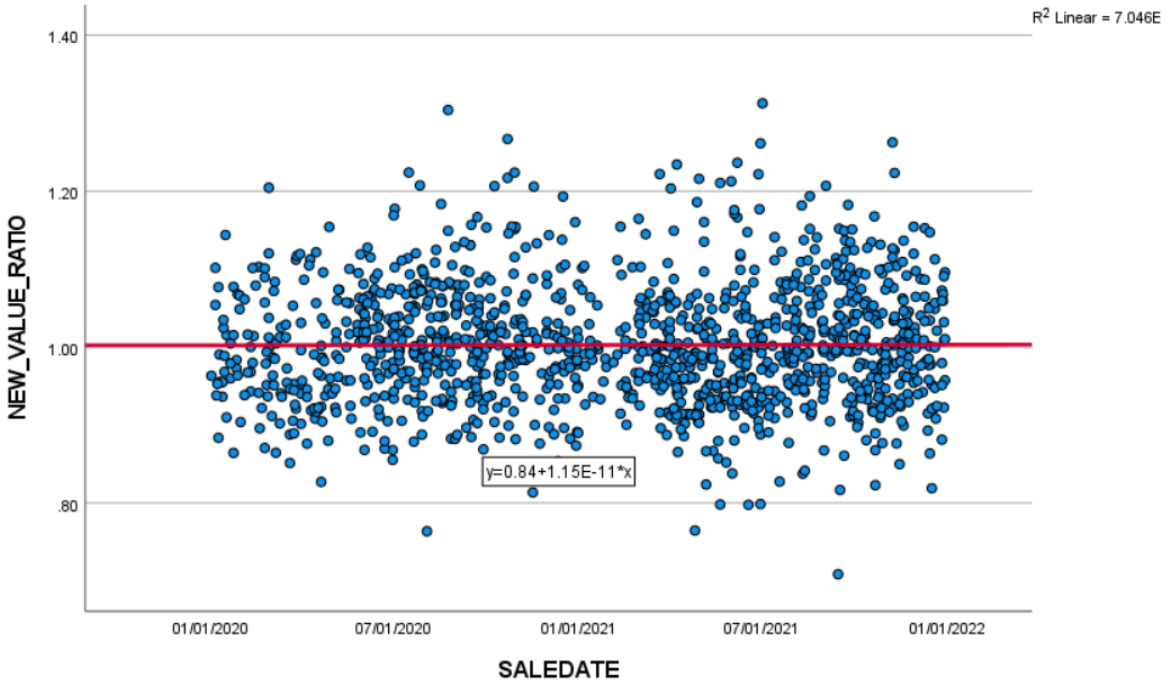
Once the TASP is calculated, a final check is essential to confirm that time adjustments have been appropriately applied before proceeding with the valuation process. One method for validation is to compute a ratio of prior values over TASP and generate a scatter plot to visually assess if time has been properly accounted for. Additionally, running a regression with TASP as the dependent variable and confirming that the time variable is insignificant can further validate the adjustments.

Coefficients[a]

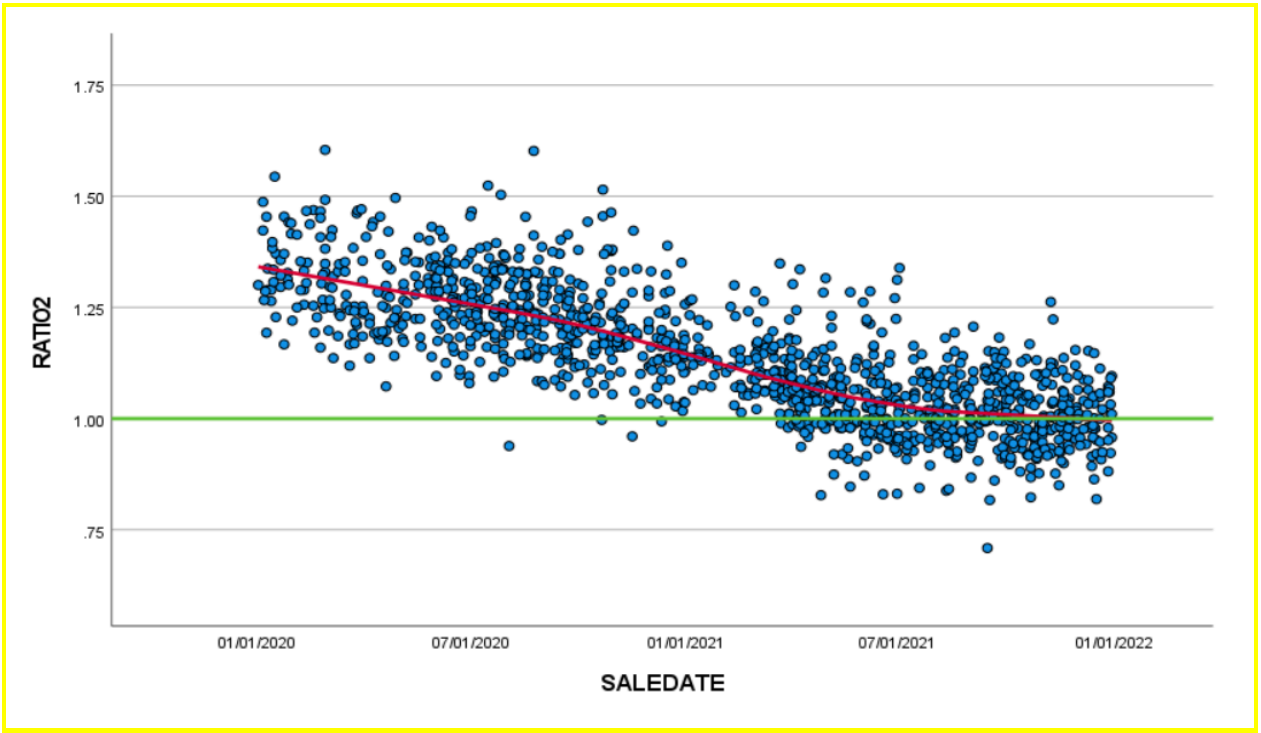
Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	95.0% Confidence Interval for B Upper Bound	Correlations Zero-order	Correlations Partial	Correlations Part
1	(Constant)	10.042	.080		124.767	.000	9.884	10.200			
	LNLANDSQFT11	.091	.009	.231	10.552	<.001	.074	.108	.398	.282	.126
	LNGLASQFT11	.243	.010	.405	25.205	<.001	.224	.262	.550	.574	.302
	LNFINBSMTSQFTratio11	.115	.008	.217	13.609	<.001	.098	.131	.141	.354	.163
	LNUNFINBSMTSQFT	.006	.001	.090	5.831	<.001	.004	.008	.132	.160	.070
	LNEFFAGE	-.048	.004	-.255	-13.288	<.001	-.055	-.041	-.092	-.347	-.159
	LNATTACHEDGARAGESQFT	.011	.003	.057	4.139	<.001	.006	.016	.152	.114	.050
	LNDETACHEDGARSQFT11	.006	.002	.039	2.721	.007	.002	.010	.098	.076	.033
	LNFIREPLACES	.025	.007	.049	3.772	<.001	.012	.038	.085	.104	.045
	WALKOUT	.053	.019	.036	2.760	.006	.015	.091	.232	.077	.033
	GARDENLEVEL	.028	.007	.058	3.743	<.001	.013	.042	-.038	.104	.045
	LNCOVEREDPORCH	.003	.001	.044	3.233	.001	.001	.006	.205	.090	.039
	LNWDBALC	.005	.001	.064	4.453	<.001	.003	.007	.238	.123	.053
	LNCOVWDBALC	.007	.002	.036	2.971	.003	.002	.011	.131	.082	.036
	LNTERRACESQFT	.003	.001	.034	2.644	.008	.001	.004	.078	.073	.032
	NBHDMKT66_1	.120	.026	.069	4.580	<.001	.068	.171	.273	.126	.055
	NBHDMKT83_1	.174	.019	.132	9.201	<.001	.137	.211	.294	.248	.110
	NBHDMKT83_2	-.104	.024	-.054	-4.366	<.001	-.151	-.057	-.110	-.121	-.052
	NBHDMKT84_1	.031	.011	.035	2.801	.005	.009	.052	.032	.078	.034
	NBHDMKT84_2	.059	.008	.093	7.258	<.001	.043	.074	.125	.198	.087
	MONTHS11_1	.013	.001	.270	15.989	<.001	.012	.015	.482	.407	.191
	MONTHS11_2	.020	.001	.338	20.164	<.001	.018	.022	.514	.490	.241

a. Dependent Variable: LNADJSALEPRICE

Each method provides strength and weakness in deriving a time trend. Weaknesses in the first few approaches is the linearity of the derived rate and markets do not always tend to trend in such a way. No matter the approach post valuation checks always help to ensure you have appropriately hit your target and have not under or overestimated time. Computing your new values into a ratio and using a scatterplot to see if you have hit your target across a time period is a validation that you have accounts for time. Twists of your fit line may indicate you have not hit your target thought out your time period and further work may still be needed. Regressing your new ratio on your time variables is an additional check to verify your time variables are insignificant and have been properly captured.



A final validation, known as an unadjusted ratio check, involves creating a ratio of your new values to the original, unadjusted sale prices. By graphing this ratio with a scatterplot, you aim for the ending loess line to align with the target value mark. If the loess line crosses above or below the target, it indicates that you may have over or underestimated the time adjustment. This crucial final check provides strong evidence that market conditions have been appropriately accounted for throughout the study period.



While time trending is an essential part of modern property assessment, it's not without its challenges. Key challenges that assessments face are data integrity, market segmentation, and public engagement.

Accurate and up-to-date market data is essential for assessors to apply time trending effectively. In volatile markets, property values can change quickly, making it challenging to track trends in real time. To keep up with these shifts, assessors rely on robust data analysis tools and comprehensive market reports. Ensuring that each market and submarket is adequately represented in the sample data is crucial for producing valid and trusted results. A poorly represented or low-quality sample can lead to misleading indications of trends that don't actually exist. This is why a well-vetted, high-quality sample is critical in time trend analysis, providing a reliable foundation for accurate assessments.

Within the same jurisdiction, different areas may experience varying rates of appreciation or depreciation. Time trends can differ significantly depending on neighborhood, property type, and local economic conditions, requiring assessors to apply adjustments with precision. Proper stratification of data is essential but challenging, as different market segments often move at different rates. Studying market trends carefully allows for accurate stratification, ensuring that each segment is appropriately represented. However, over-stratification can also be a concern, as dividing data into too many segments may dilute meaningful trends and complicate the analysis. Failure to accurately identify distinct markets and submarkets can result in over-adjustment, especially if certain locations are disproportionately influencing the overall trend.Time trending can be a complex concept for the general public to grasp. Property owners may question why older sales data is adjusted, especially if they are unaware of how the market has evolved over time or are actively participating in it. Clear communication from assessors is essential to address these concerns and foster understanding. Using visual aids and explaining the adjustments as simple reflections of market appreciation or depreciation over time can be helpful in these conversations.

A crucial part of these interactions is the training and education of assessment staff, equipping them to explain the purpose and rationale behind these adjustments. This practice is not only a fundamental principle of appraisal but, in many jurisdictions, a legal requirement to ensure assessments accurately reflect current market conditions.

Modern technology plays a crucial role in time trending, equipping assessors with advanced data analysis tools, automated valuation models (AVMs), and statistical software to track market trends and apply adjustments efficiently. These tools provide valuable insights into market dynamics, enabling assessors to apply time trends fairly and consistently. While this article has focused on extracting the monthly rate of change, identifying and extracting a trend is only the first step; effective data management software is then needed to apply this derived trend back to the studied sample. Most assessment software or CAMA systems include data entry points to apply these trends to sales data. Applying this rate accurately across different time periods is essential for consistent and correct adjustments.

At MAK Valuation Consultants, we specialize in providing advanced data and analytics tools to assist local assessors in making accurate, data-driven decisions. Our technology allows us to track market trends and apply time adjustments with precision, ensuring that property assessments reflect current conditions. We are committed to providing assessors with the tools and expertise they need to make informed, data-driven decisions. Time trending helps taxpayers understand how the market impacts their property values. When assessors can demonstrate that they've used market-based adjustments for time, it promotes transparency in the assessment process, leading to increased trust between property owners and assessors. Various knowledge in CAMA system products lends to ease of application of applying derived rates for the most accurate sales time trend adjustments. Time trending is an essential tool for modern assessors, allowing them to account for changes in market conditions over time. By adjusting for these trends, assessors can ensure fair and accurate property valuations that reflect the true value of properties in today's market.

Contact us today to learn more about how we can help your jurisdiction stay ahead of market changes and ensure equitable assessments for all property owners.