



Time Adjustment Analysis

The Auditors' Way of Defining the Overall Market Trend

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Main Topics Today



- **Who am I ?**
- **What is and Why do we need Time Adjustment ?**
- **What Approaches are available for Time Adjustment Analysis ?**
- **How Deep are we landing on the Time Adjustment Analysis ?**
- **What Tool(s) do Auditors use for Time Adjustment Analysis ?**



About Me

2006

Moved to Edmonton, Year 1 in Canada

- Lakeland College, Appraisal and Assessment Program

2008

City of Edmonton, Assessment and Taxation

- Assessor in multiple sections
- Modelling as main job responsibility

2012

City of Edmonton, Assessment and Taxation

- Earned AMAA designation
- Earned AACI designation

2014

Municipal Affairs, Assessment Audit

- Auditor
- Senior Auditor
- Acting Audit Manager

2042

36 Years of being a Canadian

- Earning Time Adjusted OAS



Time Adjustment

What is Time Adjustment?

- an **adjustment** is done to account for **changes** in market prices since the date of the sale. (Source: UBC, “Foundations of Real Estate Appraisal”)

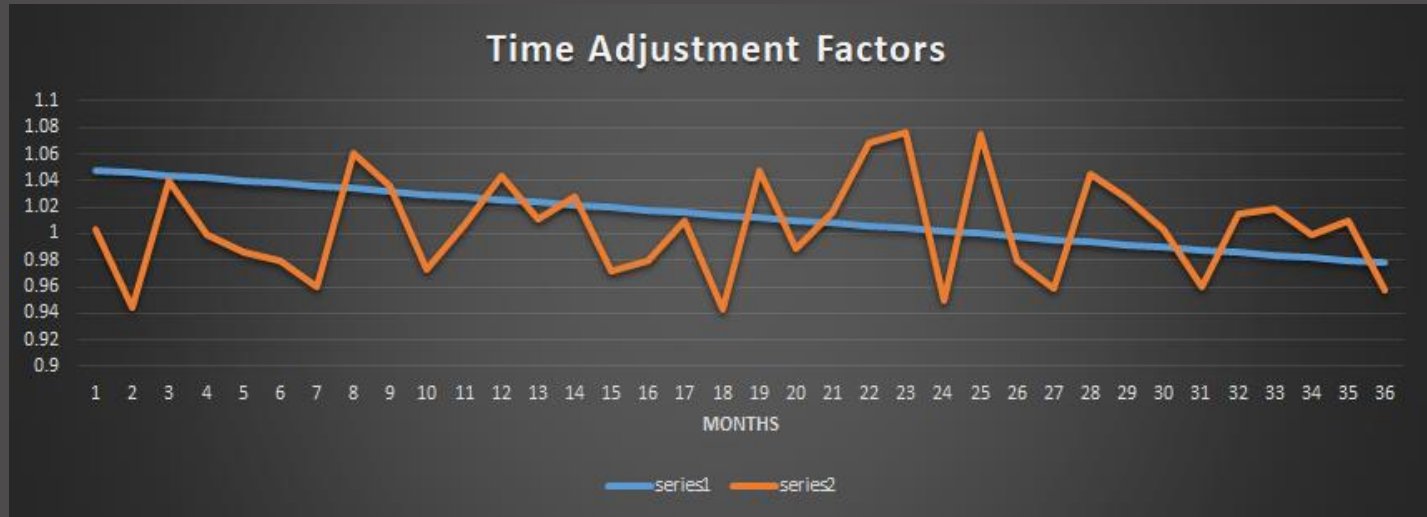
Why do we need Time Adjustment ?

- Legislation required
- Best practice required

What is Time Adjustment Analysis ?

- Identify individual **changes** – differs from approaches applied
- **Changes** have to be **processed** using available tools and programs to produce output
- Output – Monthly Time Adj Factors: **Meaningful Overall Market Trend** for Mass Appraisal

Meaningful means...



- Make sense to majority of your audiences
- Can be easily used to predict the future market

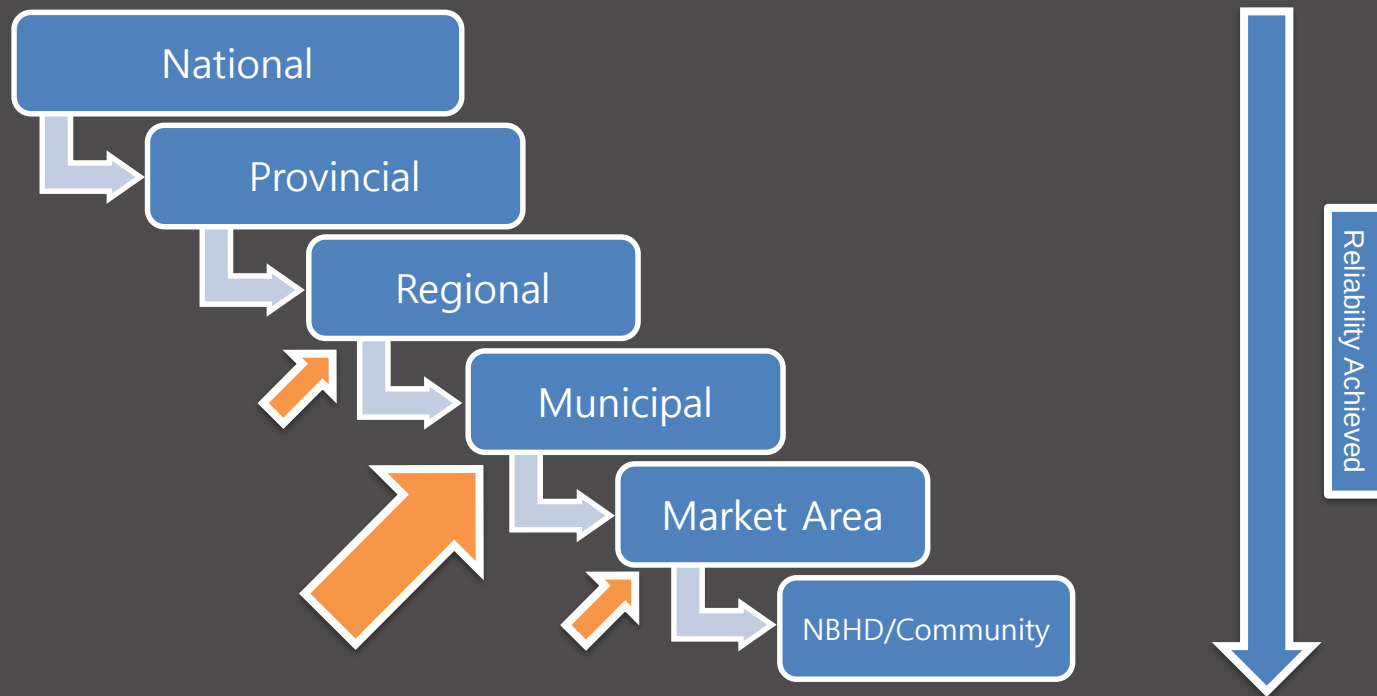


Approaches Used in Time Adjustment Analysis

- ~~Resales / Paired Sales~~
- ~~Multiple Regression Analysis~~
- Sales to Assessment Ratio Analysis / Unit Value Analysis ✓

Depth of Time Adjustment Analysis

Depends on the purpose of the analysis, for each property group:



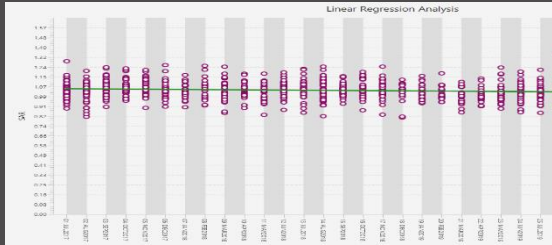


Demo – Auditor's Program

- Data used: Fort Saskatchewan 2020 assessment year
- This dataset is not the final ASSET submission, used for this presentation only
- The program is named Annual Audit Application, acronymed as **AAA**
- It was developed using JavaFX platform and Apache Derby database. It is currently a standalone application which doesn't support database sharing
- A web based version of this program is under development, hopefully put on test in 2 or 3 years from now

No Post Facto Sales

Added Post Facto Sales



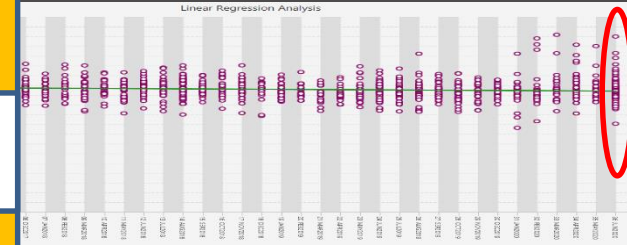
Significant

↑ T-Test: 1.96

Insignificant

↓ T-Test: -1.96

Significant



Model Summary

Formular of current analysis: $y = 1.056 + -.001 * x$

R-Square of this model: .020

Order	Coefficients	T-Test Values
1	1.056	279.565
2	-.001	-5.529

Choose the Coefs to apply: ☒ 1 ☒ 2

Apply Chosen Coefficients

Close

Model Summary

Formular of current analysis: $y = 1.054 + -.001 * x$

R-Square of this model: .014

Order	Coefficients	T-Test Values
1	1.054	278.679
2	-.001	-4.661

Choose the Coefs to apply: ☒ 1 ☒ 2

Apply Chosen Coefficients

Close

OVERALL RATIO STATS of Assessor's Analysis :

	Counts	Median ASR	AbsDevMedA...	PRD	COD
OVERALL	1500	.982	5.045	1.01	5.18

OVERALL RATIO STATS of Auditor's Analysis :

	Counts	Median ASR	AbsDevMedA...	PRD	COD
OVERALL	1500	.986	5.064	1.01	5.24

OVERALL RATIO STATS of Assessor's Analysis :

	Counts	Median ASR	AbsDevMedA...	PRD	COD
OVERALL	1590	.981	5.032	1.01	5.20

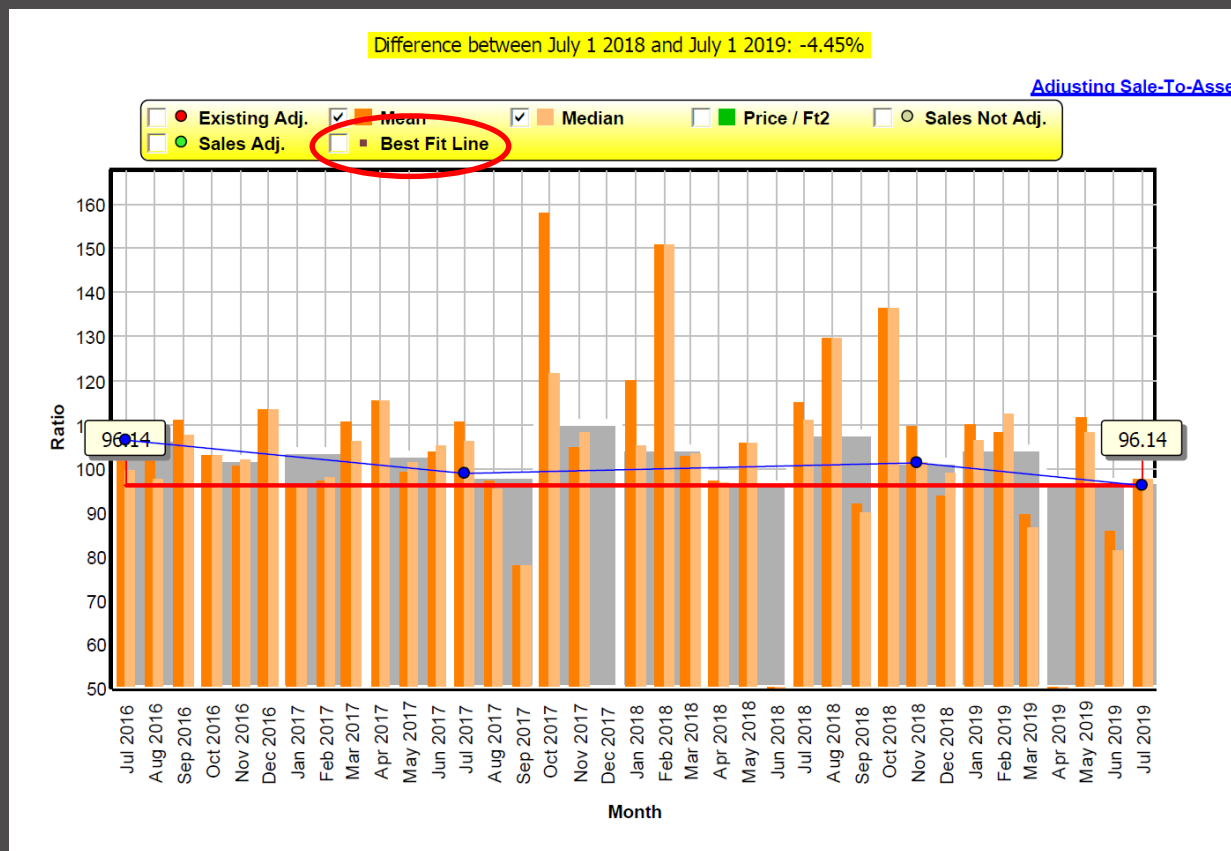
OVERALL RATIO STATS of Auditor's Analysis :

	Counts	Median ASR	AbsDevMedA...	PRD	COD
OVERALL	1590	.980	5.052	-.34	5.32

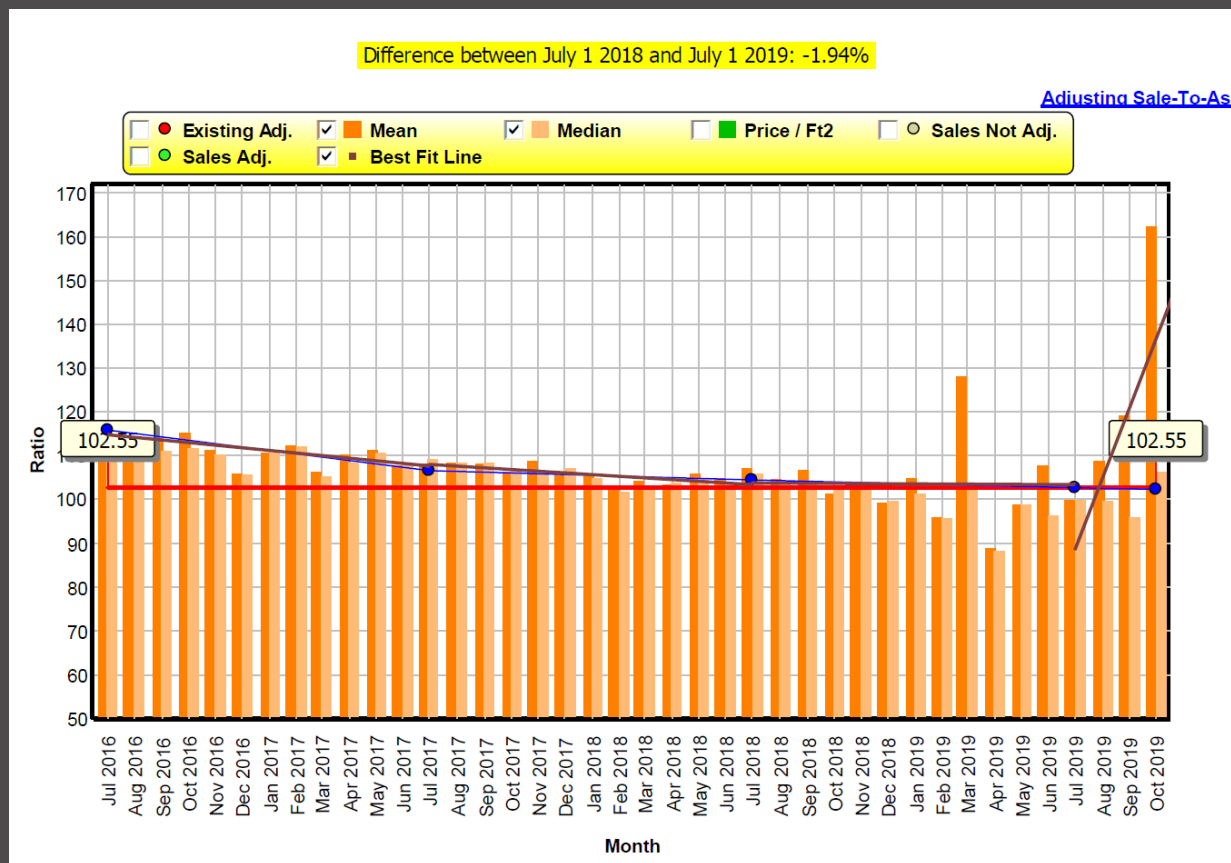
TimeAdjFactor @ Jul 1,2017 : -3.550%

TimeAdjFactor @ Jul 1,2017 : -2.868%

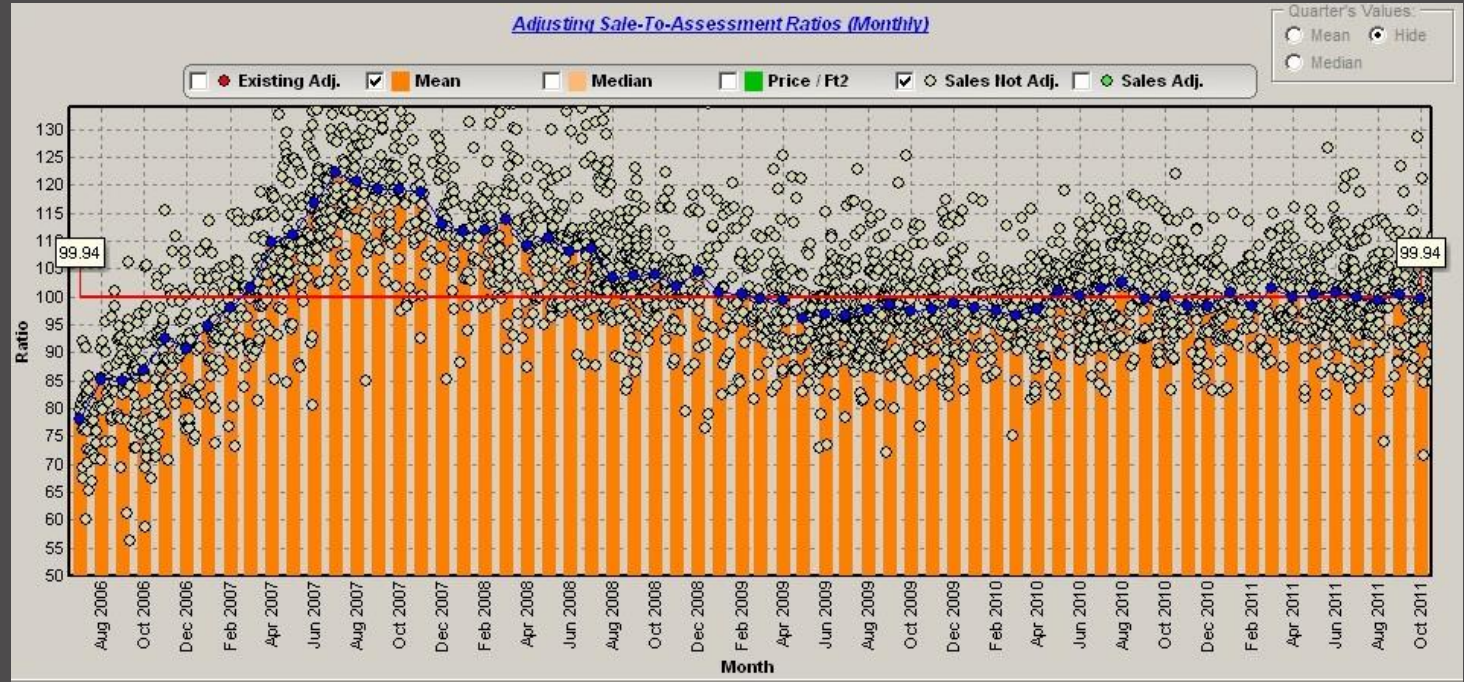
Example of Time Adjustment Plot **without** Best Fit Line applied.



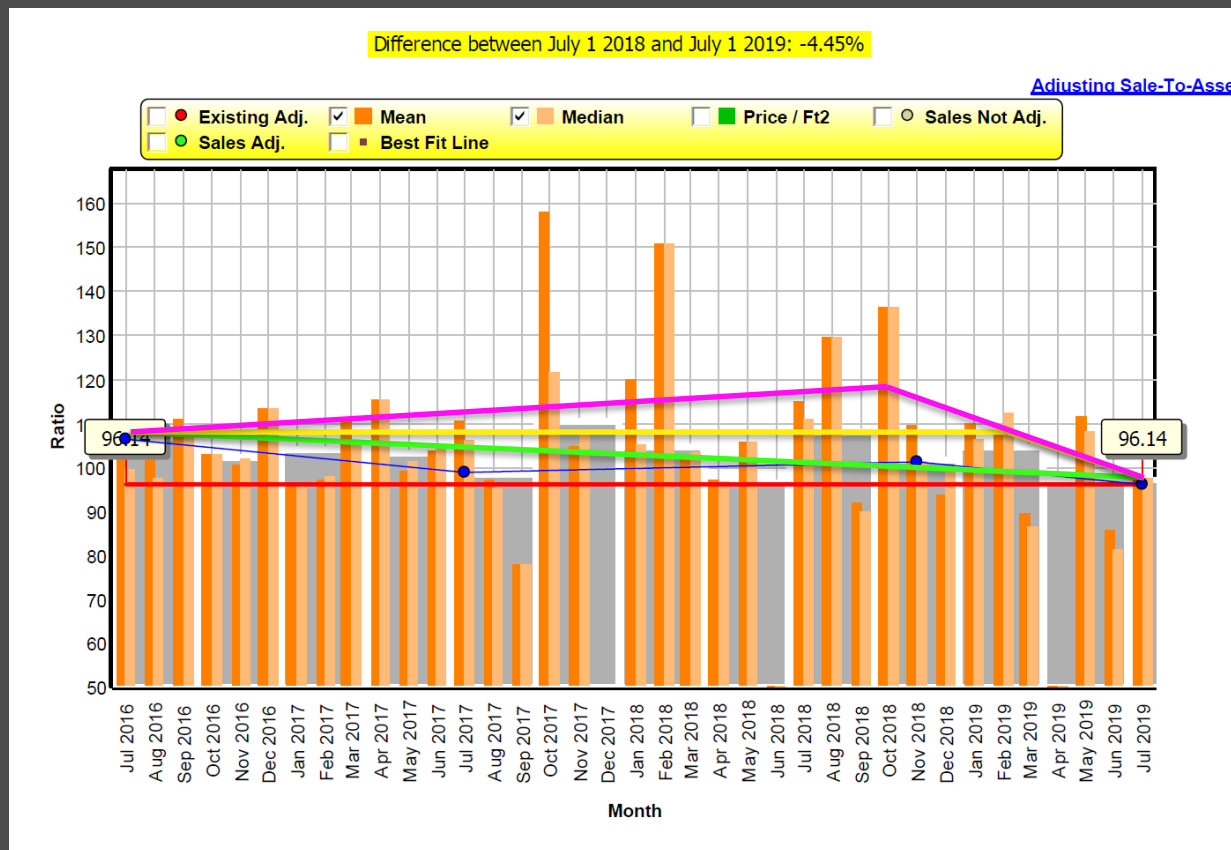
Example of Time Adjustment Plot **with** Best Fit Line applied.



Example of Multi-trend Analysis

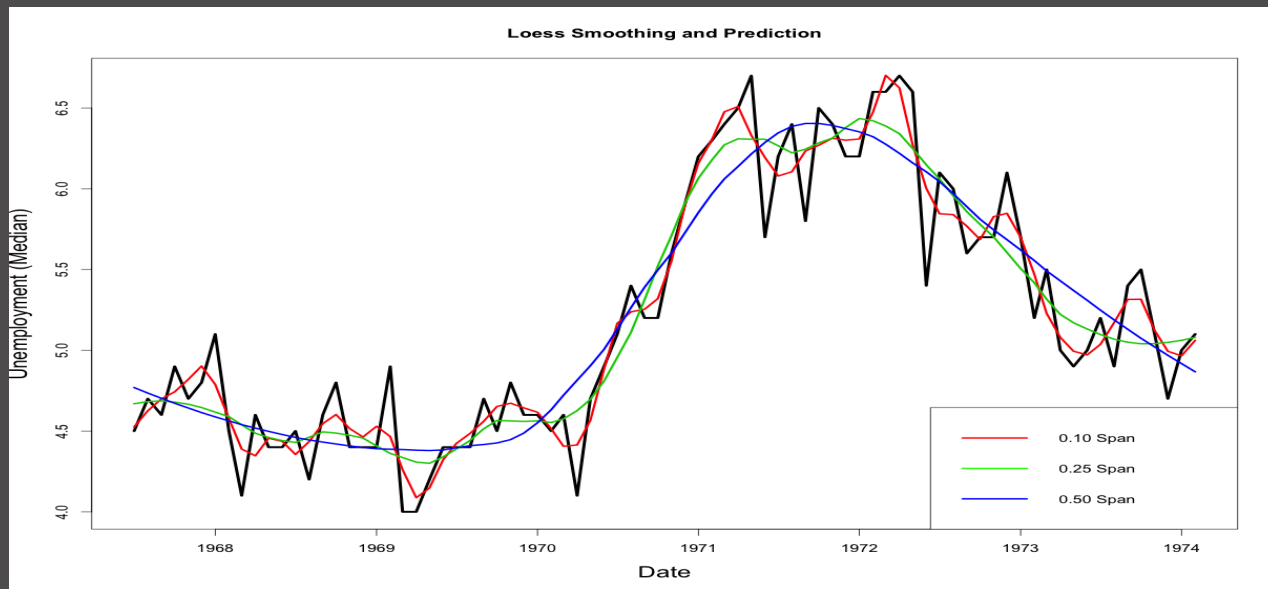


Example of Time Adjustment Plot **without** Best Fit Line applied.



LOESS Smoothing Curve

Loess Regression is the most common method used to smoothen a volatile time series. It is a non-parametric methods where least squares regression is performed in localized subsets, which makes it a suitable candidate for smoothing any numerical vector. The **span** value ranges from 0 to 1, controls the degree of smoothing. So, the greater the value of span, more smooth is the fitted curve.





Take-aways Today...

- Conduct Time Adjustment Analysis on the **MUNICIPAL** level by property groups,
- Apply filters for outliers before diving into time analysis,
- For those munis require only ONE year of SFD sales, use **THREE** years of sales instead to curtail the impact from two months of sales loss caused by COVID,
- Rely on the **Best Fit Line** in **linear regression analysis**, or
- Using **LOESS curve** in **Multi-trend analysis** to determine **turning points** if needed, and
- **DON'T** try to move the turning points up and down **AS YOU WISH** – you will definitely lose the statistical reliability to your results.

