Looking for a Better Way

Estimating Projected Sales Tax Revenues for County Budgets

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SUNY NEW PALTZ
FOR PUBLIC POLICY INITIATIVES

Sales Tax Projections

Problems:

- Sales Tax returns from the state come in monthly estimates, and then reconciliations quarterly. (or so). Mid year data is helpful, but there are known unknowns.
- The past is not (always) a valid indicator of the future.
- Macro indicators and reporting tends to be measured at the national level, and even state indicators in New York are skewed by New York City's economy.
- Technical sophistication varies widely from one jurisdiction to another.

‘Typical’ Methodology

The typical methodology in the limited number of jurisdictions I’ve observed to is to do a basic linear trend analysis, and make adjustments based on the experience and insight of the administrator in charge of the projection.

It might also be argued that there are perverse incentives to both overestimate sales tax revenue and to underestimate sales tax revenue

Underestimate:

Underestimation of Sales tax revenue affords administrators and executives a known buffer for other areas of the budget, and a potential surplus to be leveraged for other purposes outside of the legislative process. It simultaneously serves to ‘rein in’ legislative appropriations for projects that fall outside the priorities of an executive

Overestimate:

Overestimation of Sales Tax revenues makes a budget appear balanced, and potentially under the tax cap. In the short term, covering the revenue shortfall with the General Fund Balance may be preferable to attempting to raise property taxes beyond the cap, or justify drawing down the fund balance in the budget process

Getting it Wrong

What are the effects of over or underestimating the sales tax revenues?

Overestimate:

Overestimation of Sales Tax revenues leads to diminishing fund balances. If the budget is overestimated for one time expenditure gaps or one time expenditures on programs then the effects are localized to one fiscal year. If, however, the overestimation is to cover recurring increases, or to expand programs, hire personnel, etc. in a way that is recurring, then the deficit becomes systemic.

Underestimate:

Underestimation of Sales tax revenue essentially amounts to knowingly overtaxing property owners. Since budgets are always presented as balanced, the underestimated portions of the sales tax will be made up for, typically through the property tax. Voters however may view a year end surplus as prudent management through containing expenditures.

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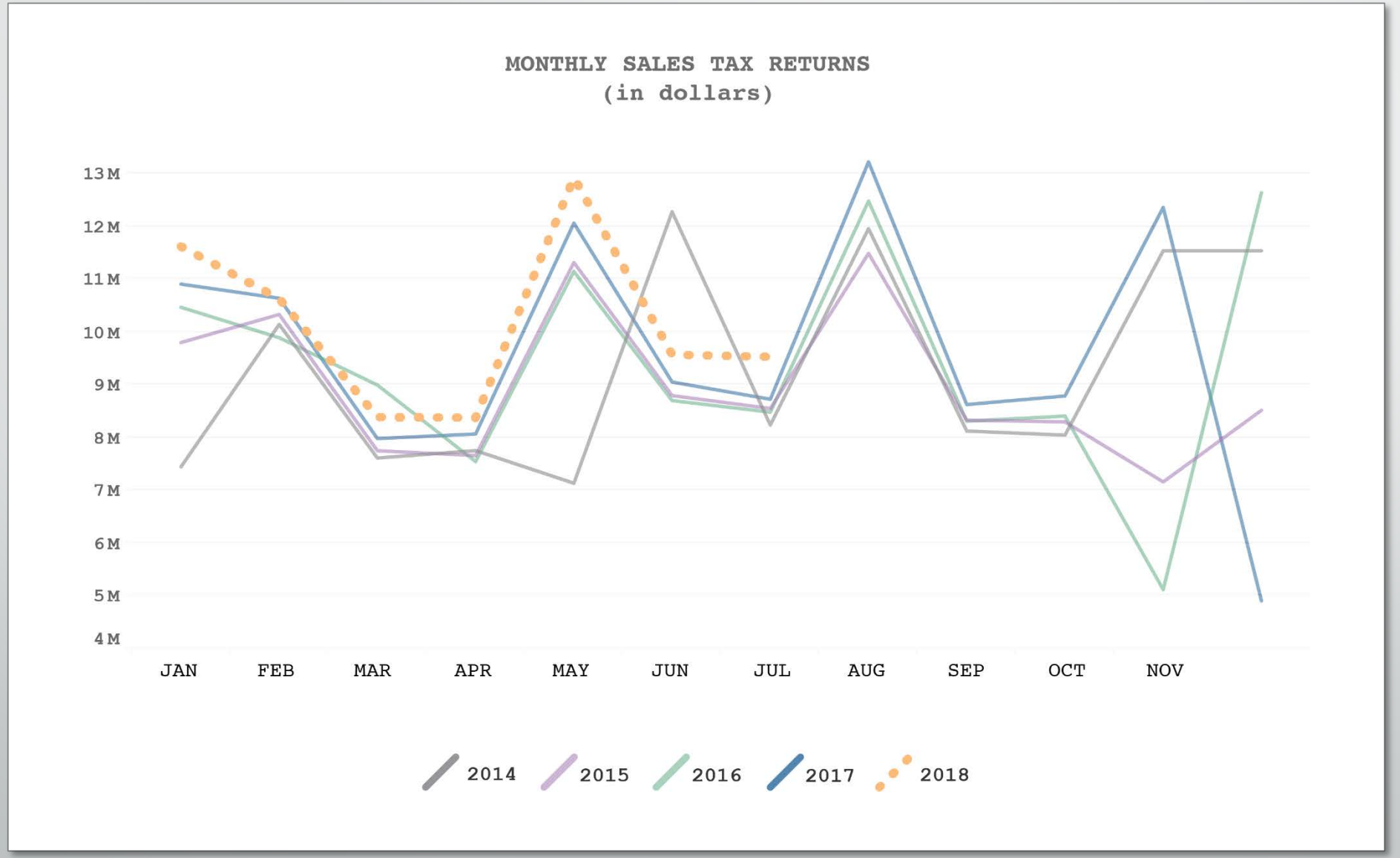
Sales Tax Projections



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Methodology

Rudimentary Methodology:

The general idea behind my methodology is to first create a range in which the actual sales tax return is almost certain to fall within. A series of projections using either statistical projections or percentage based projections based on trend data for the county, or tied to macro indicators are then made. The results of all of those indicators are then averaged resulting in a sales tax revenue projection. Recommendations are then made based on that figure (though not always exactly conforming to it).

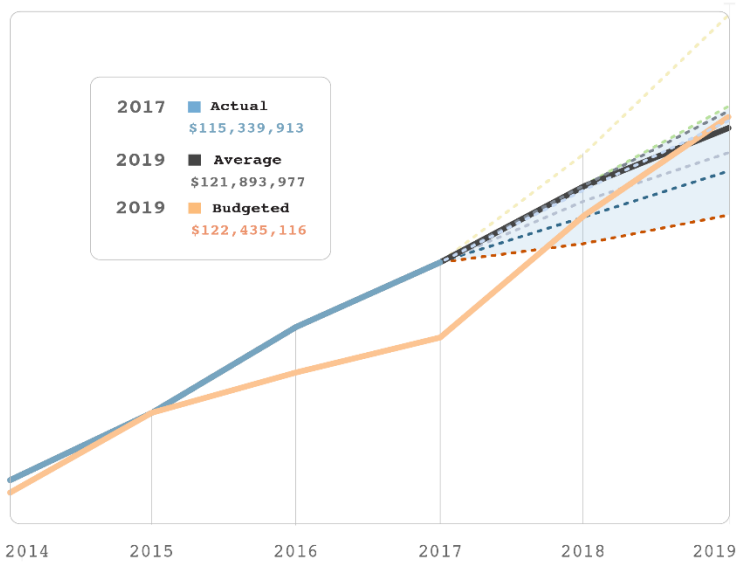
The methods or indicators used are:

- Linear, logarithmic, and polynomial projections of 5 years of data
- 4 and 10 year average growth
- 2018 US Consumer Spending Predicted Growth Percentage
- 2019 Governor's Sales and Use Tax Estimate Percentage

Sales Tax Projections

Based on 2017 Actuals

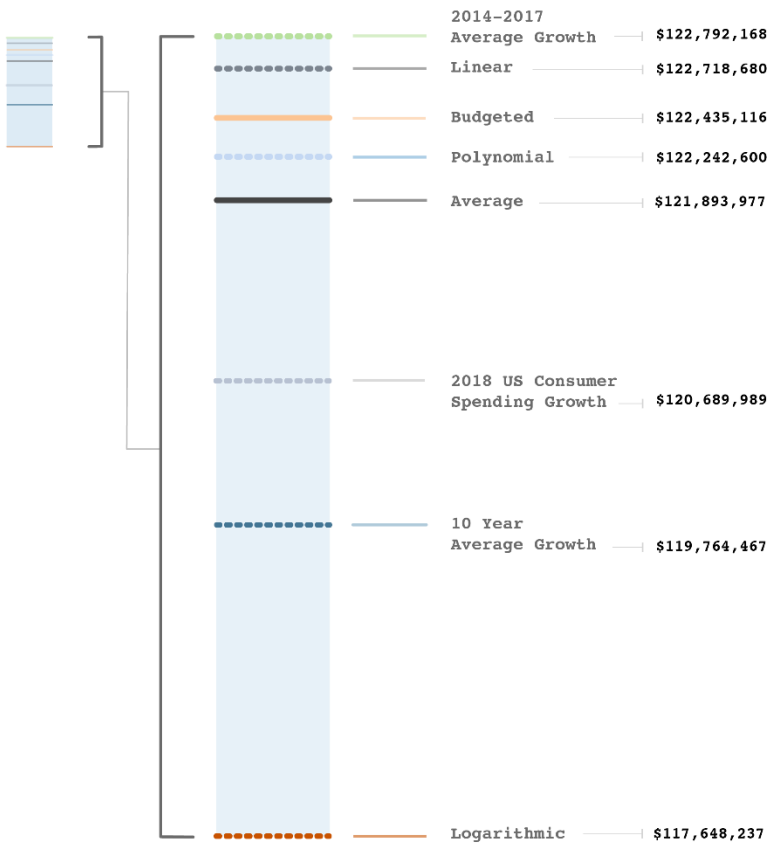
SALES TAX REVENUE PROJECTIONS



PROJECTION	2017	2018*
2019 Governor's State Estimate	$115,339,913	$120,645,549
2014-2017 AVG Growth	$115,339,913	$119,007,722
Linear	$115,339,913	$119,098,220
Budgeted	$111,672,331	$117,631,568
Polynomial	$115,339,913	$118,881,819
Average	$115,339,913	$119,061,548
2018 US Consumer Spending Growth	$115,339,913	$118,338,751
10 Year AVG Growth	$115,339,913	$117,531,371
Logarithmic	$115,339,913	$117,648,237

*estimates based on data from 2017

PROJECTION — 2019



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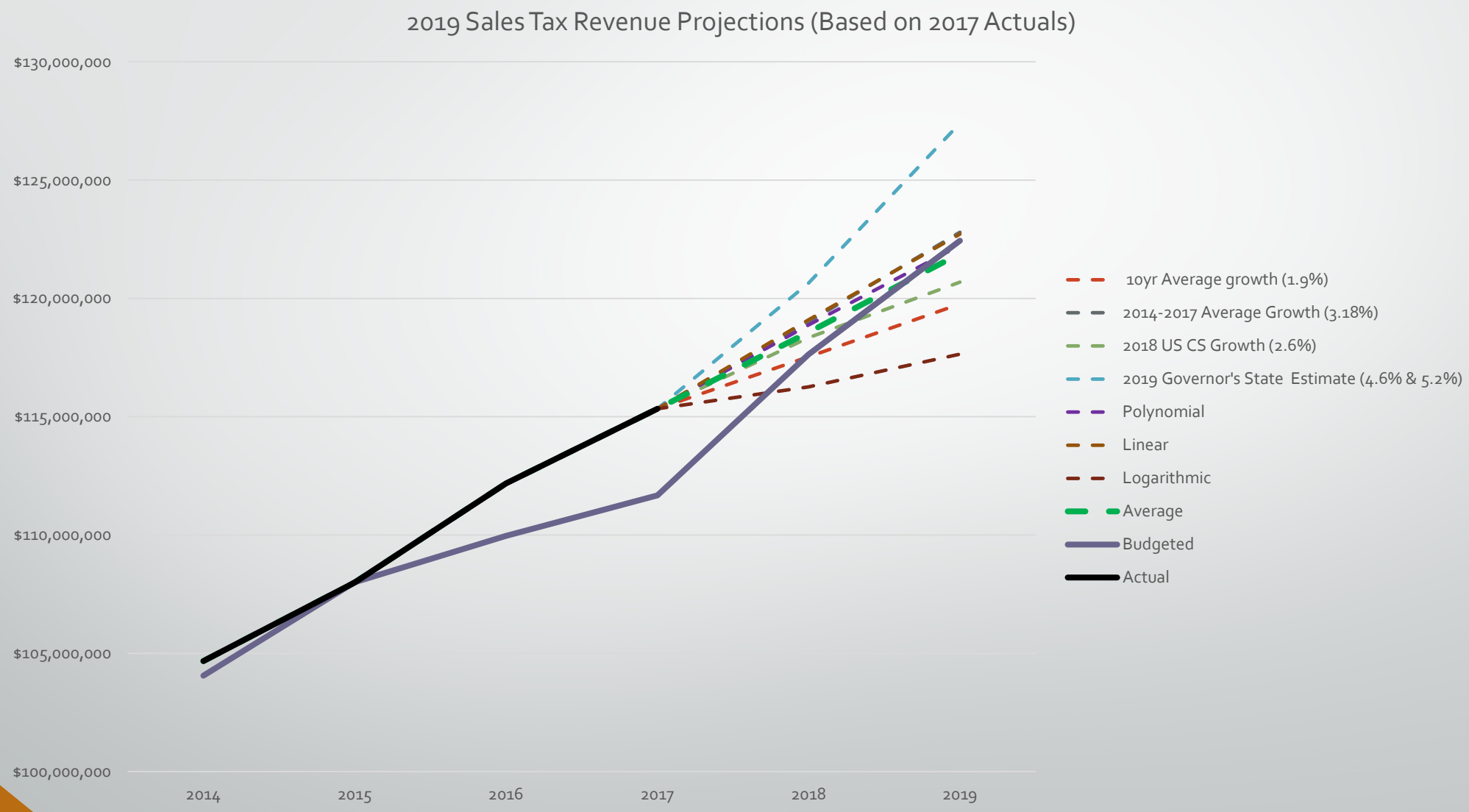
Sales Tax Projections



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Sales Tax Projections

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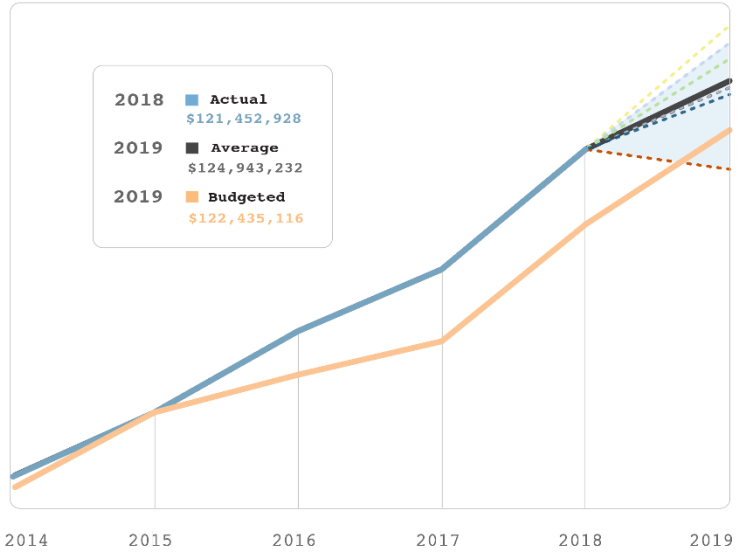
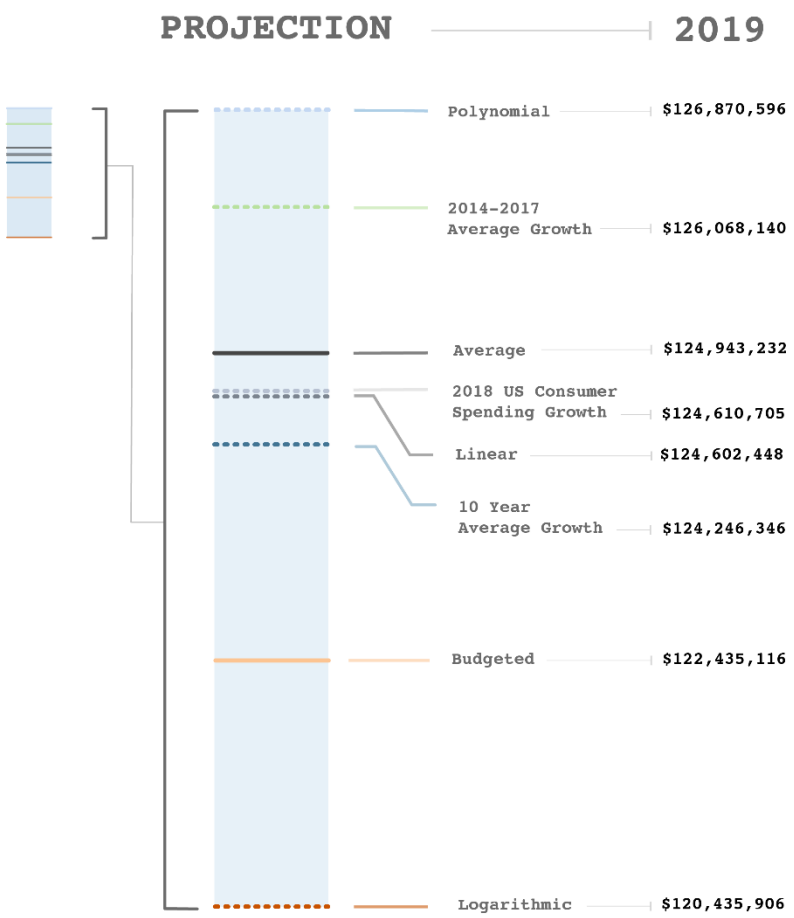


PROJECTION	2018	2019*
2019 Governor's State Estimate	$122,792,168	$126,870,596
2014-2017 AVG Growth	$122,792,168	$126,068,140
Linear	$122,792,168	$124,943,232
Budgeted	$117,631,568	$122,435,116
Polynomial	$122,792,168	$126,870,596
Average	$122,792,168	$124,246,346
2018 US Consumer Spending Growth	$122,792,168	$124,610,705
10 Year AVG Growth	$122,792,168	$124,246,346
Logarithmic	$122,792,168	$120,435,906

*estimates based on data from 2018



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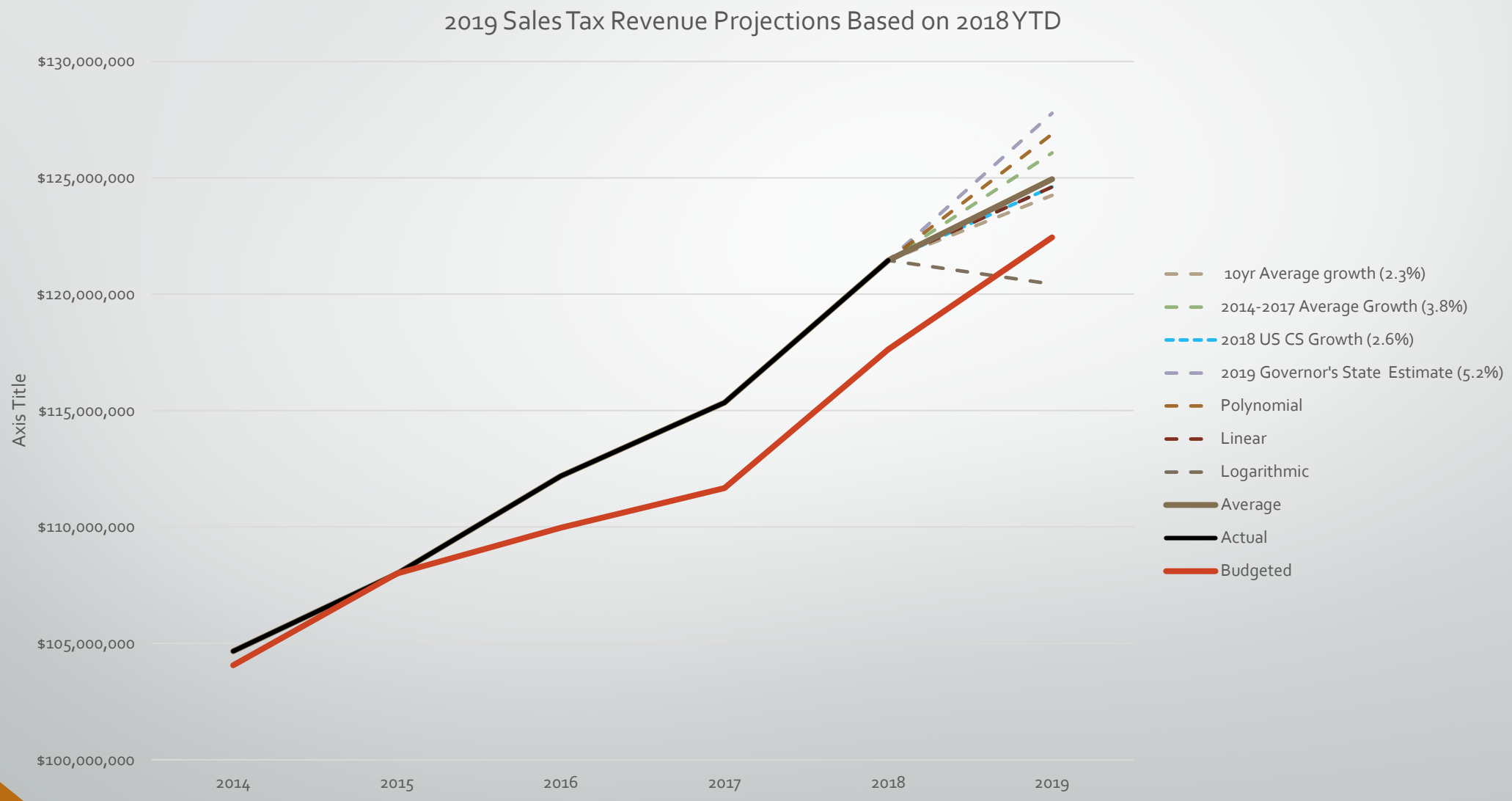

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Recommendations Based on the Projections

Our report to the Ulster County Legislature predicted that the 2018 Sales Tax revenues would total $120,000,000, and then projected the 2019 sales tax revenues to be roughly $124,000,000

This is in contrast to the County's budget of $117,631,568 for 2018, and $122,435,116 for 2019.

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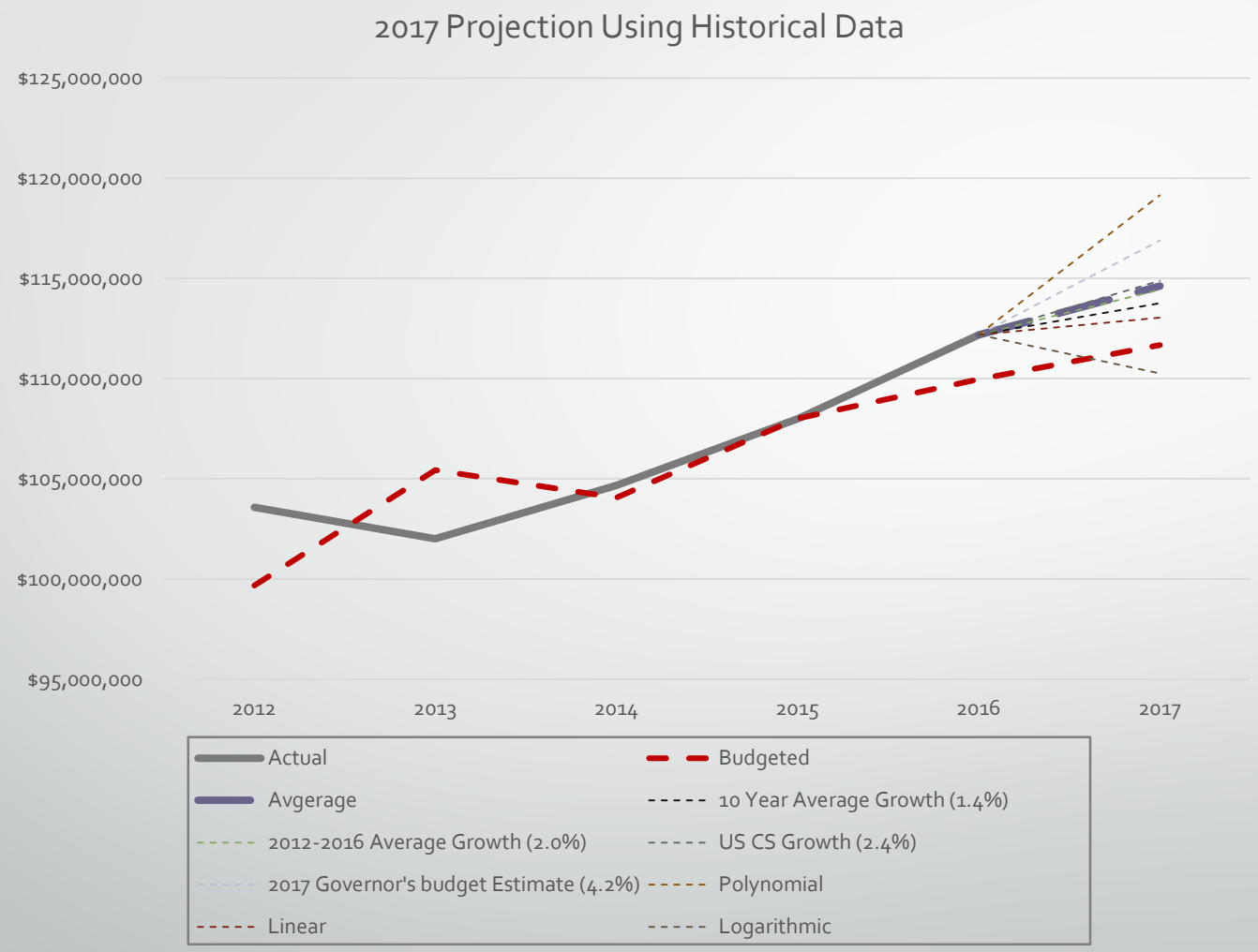
2017 Retroactive 'Projection' Using Historical Data



At the request of one legislator we created a "time travel" experiment using the model, and only the data that was available at the time for the 2017 projection.

The County Budget:
$111,672,331

Model Projection:
$114,628,150

Actual:
$115,339,913

The County was $3,667,582 under.
The Model was $711,763 under.

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Issues with this Methodology

Our report to the Ulster County Legislature predicted that the 2018 Sales Tax revenues would total $120,000,000. The official (unaudited) sales tax returns were $120,049,605. The 2018 budgeted sales tax revenues were $117,631,568. While the adopted budget underestimated the sales tax revenues by $2,418,037, our recommendation was under by $49,605, or 0.04% So what is the issue?

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We got lucky

The figure our model projected was $121,452,928 ($1.4 overestimate). It was revised downward conservatively because of uncertainty of returns in the last fiscal quarter. Our 2019 projection, however, was based on the $121 million figure, and not the actual, and while the $124 million 2019 recommendation was conservative, it amounts to a 3.9% increase over 2018. This would be in keeping with five year growth trends, but more recent uncertainty on the macro level may indicate a tightening of the market.

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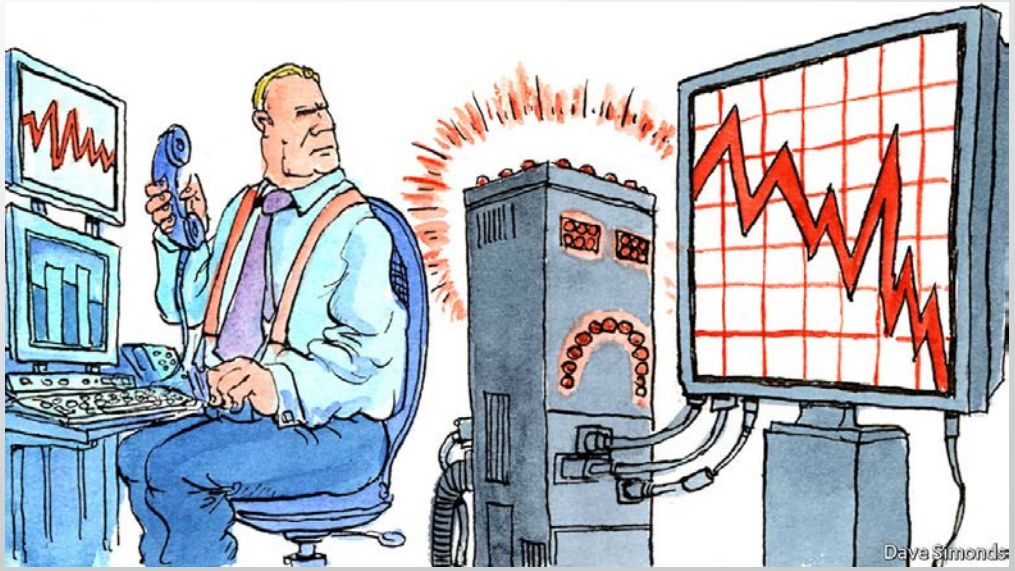
Next Steps

Machine Learning:

We will use data analytic tools to extract and clean historic and current county-level revenue and economic data, and then use machine learning to decipher trends in available data as well as to predict future revenues. We will use a deep-learning model to identify the micro-level and macro-level influence factors to continually refine the predictive process. The analytic process will involve supervised learning methodologies in conjunction with un-supervised and semi-supervised learning strategies.

The end goal here is to not only create accurate predictive models, but also to establish a system that can identify and alert administrators to trend reversals before they happen

Tools to be used: R, Tensorflow, pyTorch, Keras. DevOps and Cloud software strategies.



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Questions?

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