Nonrandom Thoughts on Revenue Forecasting

Do not look back. You are not going that way.

NCSL Fiscal Analysts Seminar
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Revenue Forecasting

![Revenue Forecasting Graph]
Forecasting Best Practices

- Know the tax
- Clean the data
- Plot the data
- Use an appropriate forecasting approach
- Disaggregate if you can
- Evaluate your model and its estimation results
- Revisit and refine your assumptions

“You need to reread the guidelines for disciplinary best practices.”
Know the Tax

- Understand the tax being forecast
  - Study the law
  - Study the regulations
  - Stay up-to-date with administrative and court rulings

- Understand the structure of the tax
  - The tax base – exclusion, exemptions and deductions
  - The net tax – tax rates and credits

- Understand collections procedures
  - These are what produce the revenue data
Clean the Data

Figure 3. Data Cleaning Process

By: Ramakant Soni, BKBIT
Plot the Data
Use an Appropriate Forecasting Approach

Naive
- Expert
- Judgmental

Extrapolative
- Trend
- Univariate

Associative
- Multivariate
- Econometric
Disaggregate If You Can
More Reason to Disaggregate
Disaggregating to Understand What Drives Growth and Volatility

Implied Sales Tax Base (in billions)

Annual Percent Change in Implied Sales Tax Base

Recession	Implied Base (in billions)

Recession	YOY Change in Implied Base	Median
## Growth and Volatility Estimates

<table>
<thead>
<tr>
<th>Tax Base</th>
<th>Long Run Change</th>
<th>Short Run Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implied Sales Tax Base (1978-2019)</td>
<td>0.853</td>
<td>1.094</td>
</tr>
<tr>
<td>Goods Net of Food for Off-Premises Consumption</td>
<td>0.784</td>
<td>1.105</td>
</tr>
<tr>
<td>Household Furnishings &amp; Equipment</td>
<td>0.562</td>
<td>1.153</td>
</tr>
<tr>
<td>Recreational Goods &amp; Vehicles</td>
<td>0.708</td>
<td>0.959</td>
</tr>
<tr>
<td>Gasoline &amp; Other Fuel Goods</td>
<td>1.353</td>
<td>3.746</td>
</tr>
<tr>
<td>Implied Personal Income Tax Base (1978-2019)</td>
<td>0.933</td>
<td>1.699</td>
</tr>
<tr>
<td>SOI State Tax Stats (1996 – 2016)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Taxable Income</td>
<td>0.770</td>
<td>1.542</td>
</tr>
<tr>
<td>Wages and Salaries</td>
<td>0.691</td>
<td>0.929</td>
</tr>
<tr>
<td>Capital Gains</td>
<td>0.234</td>
<td>7.741</td>
</tr>
</tbody>
</table>
Evaluation of the Revenue Model

\[ S = a + b_Y Y + b_T T \]

- \( S \) = Sales Tax Revenue
- \( Y \) = Personal Income
- \( T \) = Sales Tax Rate
In-Sample Evaluation of Model Results

Model Statistics
- R-square
- F-test
- Coefficients
- t-tests

Model Diagnostics
- Heteroskedascity
- Serial correlation
- Multicollinearity
Evaluating Potential Forecast Error

**In-Sample Testing**
- Use the entire sample
- Error = (Actual) - (Predicted)
- Mean Pct. Error
- Mean Absolute Pct. Error

**Out-of-Sample Testing**
- Use part of the sample
- Error = (Actual) - (Simulation)
- Mean Pct. Error
- Mean Absolute Pct. Error
Evaluating Actual Forecast Error

• Forecast Error
  • Error = (Actual) – (Forecast)

• Estimating Model Error and Variable Error
  • Forecast Simulation
  • Model error
  • Variable error
Refining Assumptions About Predictors

Predicted

Sales Tax Revenue

Predictors

Pers. Income*
Sales Tax Rate
Pct. Pop 65+
Housing Starts

\[ S = a + b_Y Y^* + b_T T + b_P P + b_H H \]

- \( S \) = Sales Tax Revenue
- \( Y^* \) = Personal Income Net of Transfer Payments
- \( T \) = Sales Tax Rate
- \( P \) = Population 65 and Older
- \( H \) = Single-Family Housing Starts
Thank You

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