

# **Forecast Accuracy: An Empirical Assessment**

**November 2, 2022**

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**Office of Economic and Revenue Forecasts**

# Presentation Outline

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**Part I: Scope and Approach of the Analysis**

**Part II: Summary of Fundings**

**Part III: Findings and Recommendations**



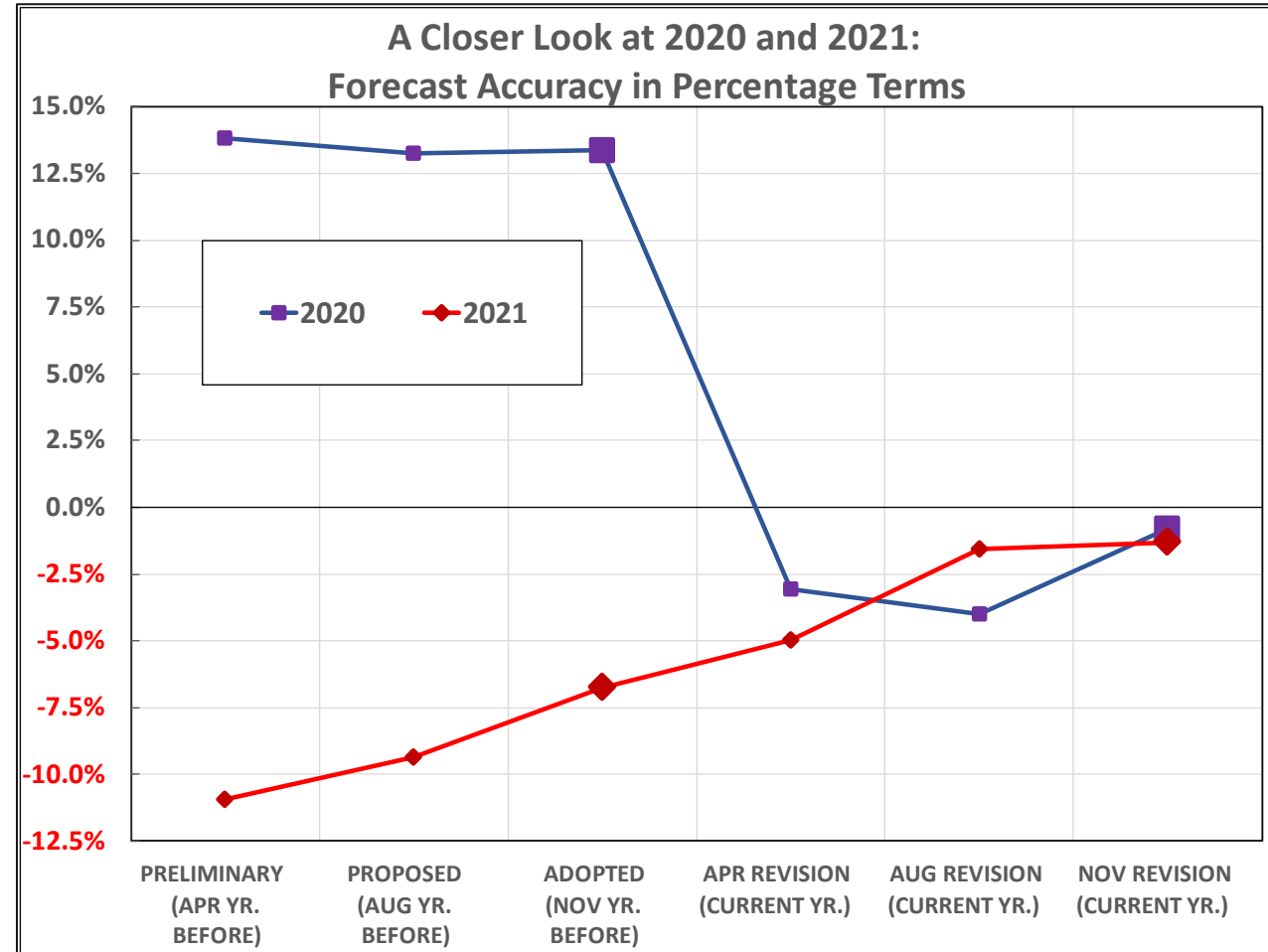
# Scope and Approach

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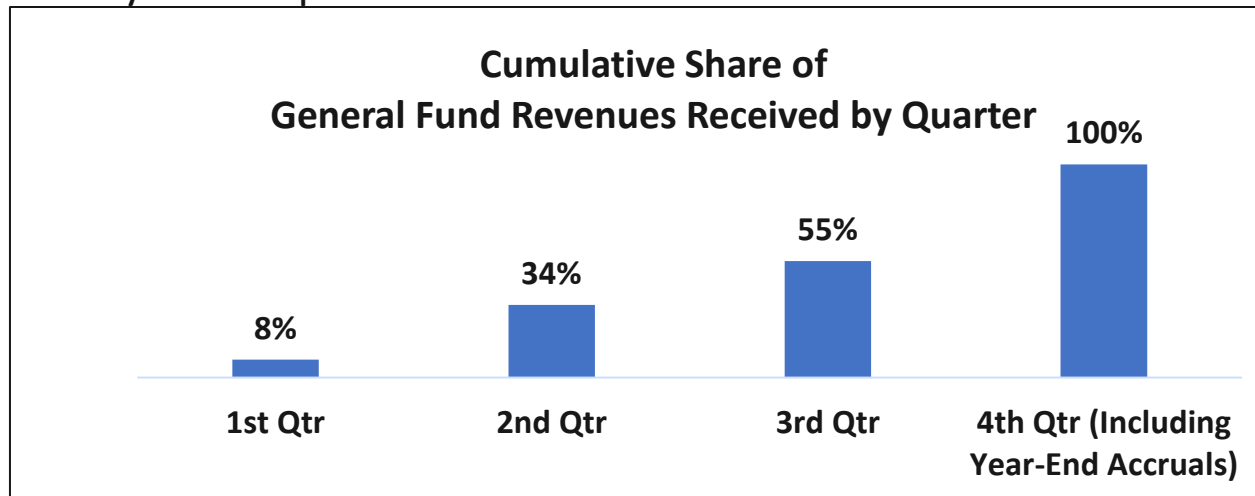
# What Motivated the Current Analysis of Forecast Accuracy?

- **Forecast Volatility:** During 2020 and 2021, the General Revenue (GF) revenue forecasts were unusually volatile, with significant changes seen in each of the revisions, as illustrated to the right.
- **Pattern of Under-forecasting:** Staff had observed a general pattern of modest under-forecasting in the years before the pandemic but had not had the opportunity to complete a detailed analysis of the underlying causes.
- **Dedicated Funding Sources:** Increased use of dedicated, undiversified funding sources, such as the JumpStart payroll expense tax, admission tax, sweetened beverage tax and short-term rental tax, means that forecast accuracy has greater potential operational impacts.
  - Revenue shortfalls have immediate impacts on service delivery for programs that rely on a single funding source.



# Background

- For revenue driven by economic conditions, forecasting is a two-step process:
  1. National forecast data are used as inputs to a model that forecasts key elements of the regional economy; and
  2. Then outputs from regional economic model are used together with the national forecast and actual revenue collection to date as inputs to forecast specific revenue streams.
- Total of six forecasts are developed over the course of two years:
  - “Year-ahead” Forecasts: Preliminary (April), Proposed (August), Adopted (November)
  - “Within-year” Forecasts: April Update, August Update, November Update
- Significant delay in receipt of revenues:



# Scope and Approach

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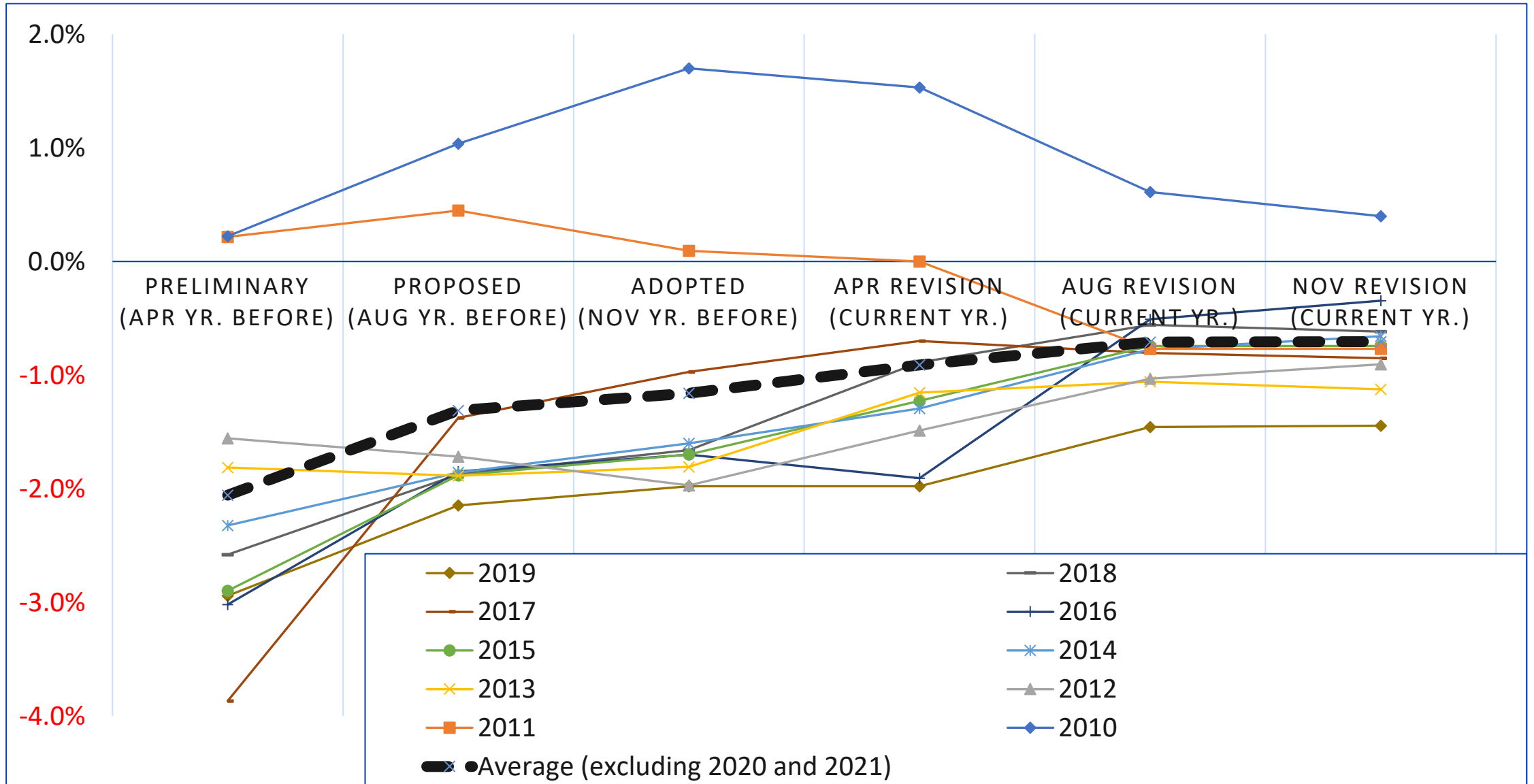
- Reviewed forecasts from the 2010 through 2021. The forecasting models used by the City have been evolving over time and given depth of changes, there is much less to be learned from forecasting results for year prior to this.
- Focused on major revenue streams and those that were most economically dependent.
  - Analyzed revenues represent ~85% of GF total
  - Excluded grants, transfer from other governments, and various department-specific fees and charges
  - Also conducted a review of REET forecasts
- Compared the final actual revenue receipts to forecasts developed at six separate stages of budget process
  - Three “Year ahead” forecasts – Preliminary (April), Proposed (August), and Adopted (November)
  - Three “Within year” forecasts – April revision, August revision, and November Revision
- Errors measured in percentage terms
  - “Under-forecasts”, where actual revenue exceeded projections, are expressed as a negative number
  - “Over-forecasts”, where actual revenue fell short of projections, are expressed as positive number

# Results

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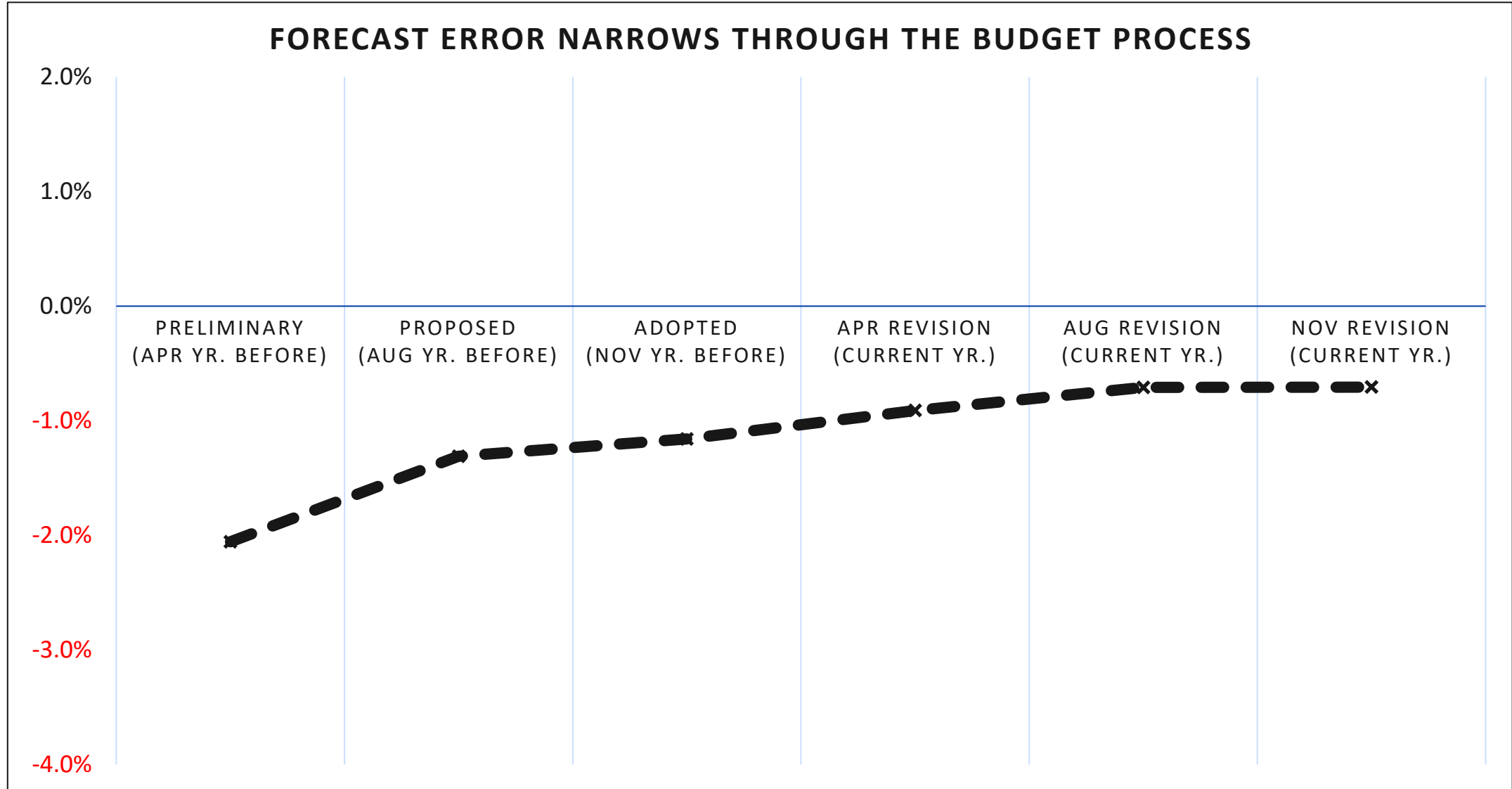


# Forecasts Quite Accurate and Accuracy Increases Through the Budget Process



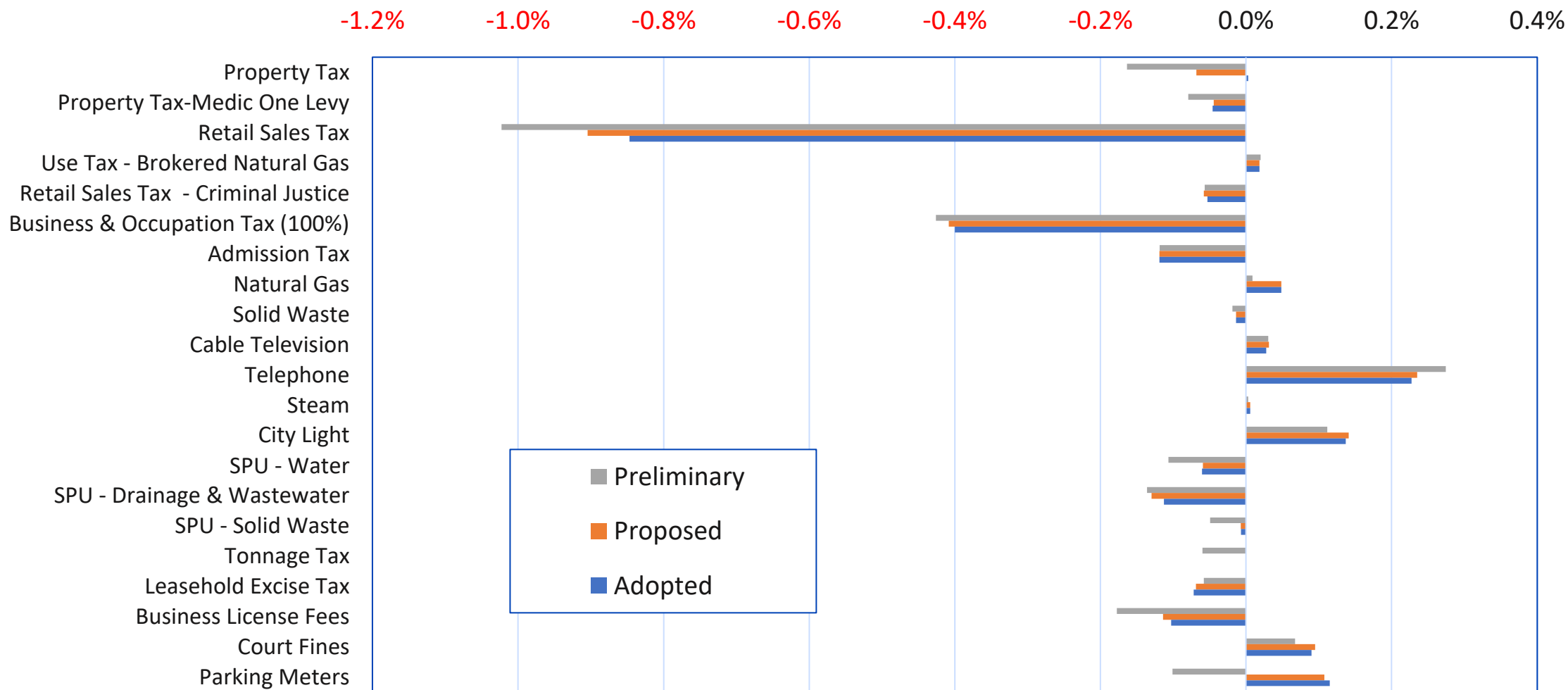


# On Average, Forecasts "Under-Predict" Actual Revenues by a Small Amount



# What is Driving the Systematic "Under-Forecast"?

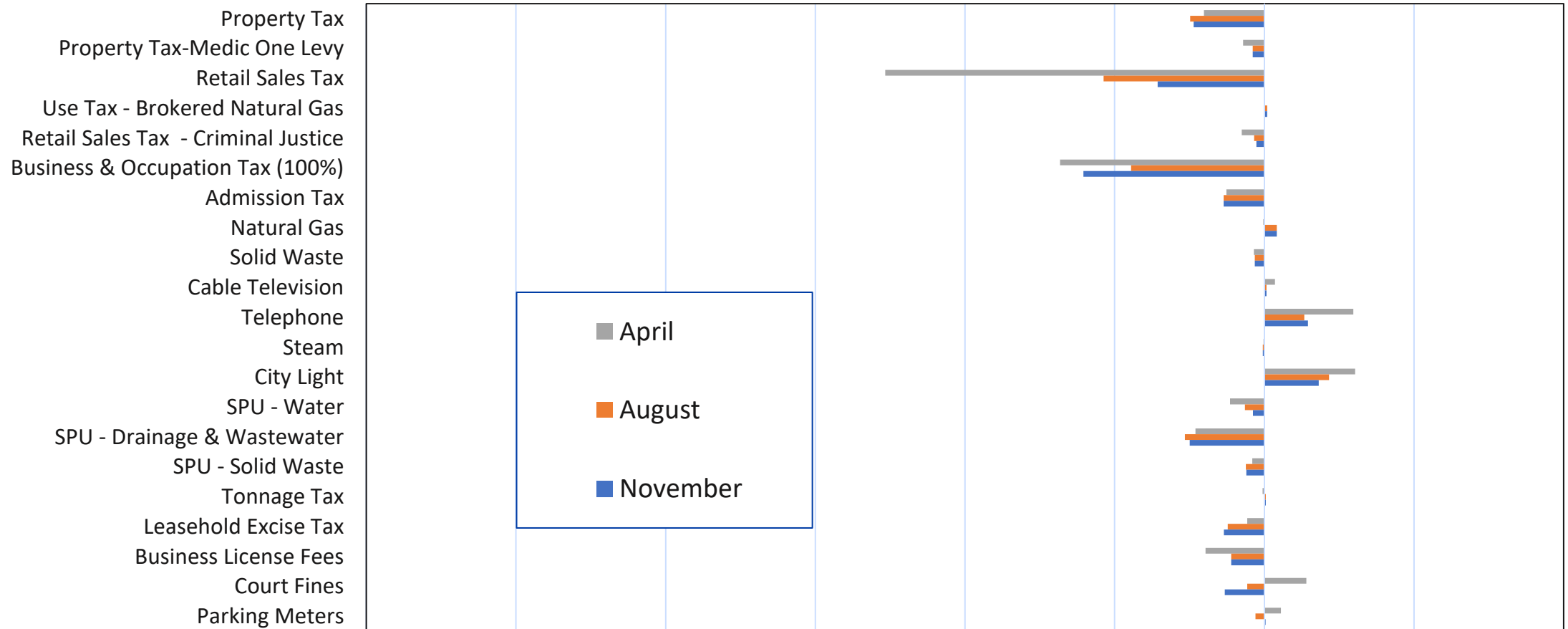
Relative Contribution of Individual Revenue Sources to the Overall GF Forecast Error in the Preliminary, Proposed, and Adopted Forecasts



# What is Driving the Systematic "Under-Forecast"? (cont.)

Relative Contribution of Individual Revenue Sources to the GF Forecast Error for "Within Year" April, August, and November Forecasts

-1.2%    -1.0%    -0.8%    -0.6%    -0.4%    -0.2%    0.0%    0.2%    0.4%



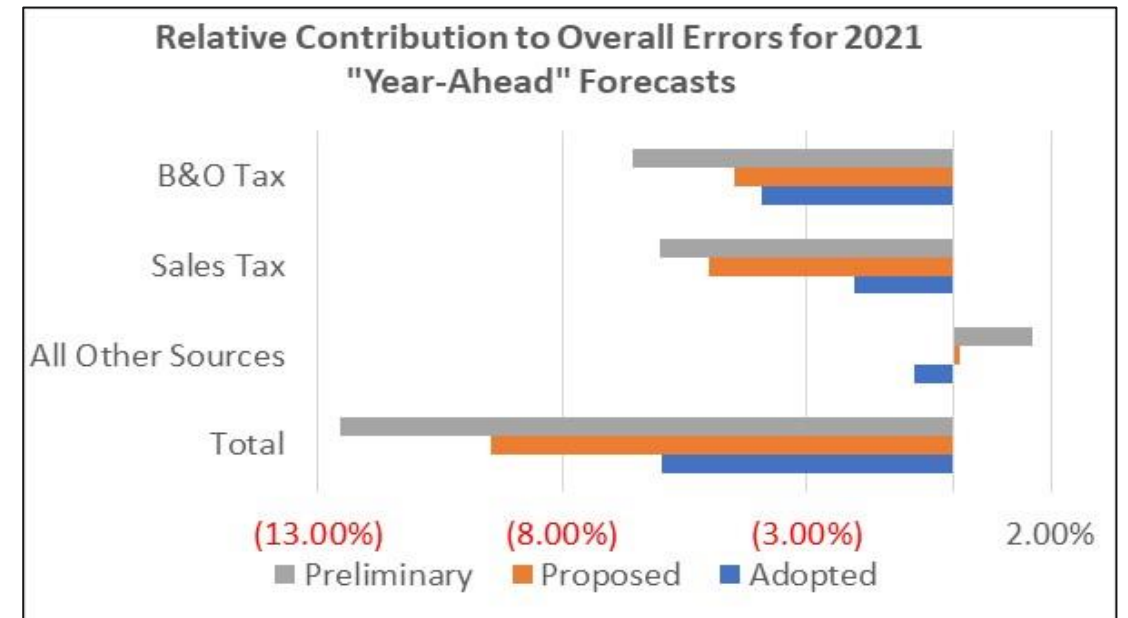
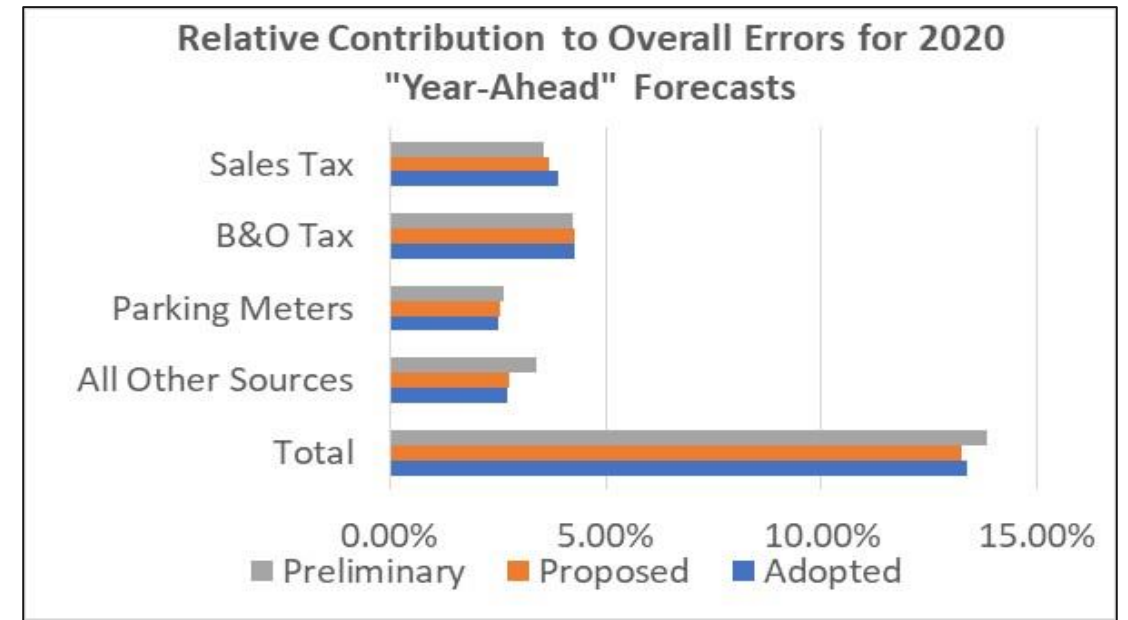
# Additional Analysis of Sales and B&O Tax

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- Retail Sales and B&O tax forecasts are heavily dependent on the national and regional economic forecast
- In turn, the regional economic forecast is highly dependent on:
  - Inputs from our national forecast firm (IHS Markit); and
  - Data from both state and federal agencies
- Detailed analyses of these two sources revealed that “errors” in these inputs drove more than half our observed revenue forecast variance.
  - The national economic forecasts by IHS Markit consistently underpredicted U.S. income and employment during the 2011 to 2019 period.
  - The regional-level salaries and income data used to capture the divergence from national patterns are reported infrequently, with significant lag (2021 income will only be available for April 2023 forecast), and have been subject to very large “after the fact” revisions.

# And what about 2020 and 2021?

- Our forecast errors in 2020 and 2021 were comparable to those seen in other jurisdictions
- Throughout 2020 and 2021, national forecasters struggled to accurately predict the evolving economic impacts of the pandemic. In general, the national modeling underestimated the pace and strength of the recovery.
- As a policy response to the pandemic, the state and City provided financial relief to businesses by delaying the due date for tax payments. This meant less current data for forecasting.
- B&O revenue data usefulness for forecasting was further impacted by a coincidental policy shift that changed which firms must pay on a quarterly vs. annual basis and when.



# Findings and Recommendations

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# Findings and Recommendations

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## Findings:

- The overall forecasts of GF revenues have been VERY accurate during 2010 to 2019 period
- Forecast errors narrow through the budget process, as more data becomes available.
- Despite the general accuracy, there as been a systematic pattern of modestly under-forecasting GF revenues.
- Retail sales and B&O tax predictions are the largest contributors to this pattern of under-forecasting and much of that pattern is driven by errors in the input data.
- REET revenues have been systematically and significantly under-forecast.

## Conclusions/Recommendations

1. Should not assume that pattern of under-forecasting will continue in new, highly uncertain economic environment.
2. Benchmark our current nation forecast service against alternatives; and consider expanding sources for national inputs.
3. Continue work to improve regional economic modeling; as well as forecast models for both retail sales and B&O tax.
4. Develop a more sophisticated econometric model for REET revenues.
5. Review/monitor forecasting approach for certain utility taxes, admissions tax, court fines and parking meters.

# Questions?

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