FORECASTING DURING A PANDEMIC THE KENTUCKY SALES TAX

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Current Trends in the Sales Tax

- FY21 growth was 12.0 percent; CAGR from FY10-FY21 4.1%

- Highest growth rate since FY91, when the sales tax rate was increased from 5 percent to 6 percent

- When the CFG met on December 4, 2021, sales tax growth through November was 6.3 percent in FY21

- After the meeting, sales taxes grew 16.4 percent from December to June in FY21 (missed forecast by 7.8% -- $328.2 million)

- Model did not correctly capture this growth

- Growth YTD through September in FY22 is 9.9 percent.

- Currently forecasting FY22 through FY24

Sales Tax Base in Kentucky

- Not in the base:
  - Car sales (motor vehicle usage tax)
  - Exempt property
    - Groceries
    - Prescription Drugs
    - Residential Utilities
    - New and Expanded industries
- In the base:
  - Online Retailers (2018), Marketplace Providers (2019)
  - Selected Services (usually associated with tangible sales) 2018

Taxation of Internet Sales

(Millions $, Source: Kentucky DOR)

	June 2021	June 2020
Marketplace Providers	$14.3	$15.4
Remote Retailers	$6.8	$5.4
Combined Sales Tax	**$21.0**	**$20.7**
	FY 2021	FY 2020
Marketplace Providers	$181.7	$110.4
Remote Retailers	$83.9	$56.0
Combined Sales Tax	**$265.6**	**$166.4**

Sales Tax Advancing Sectors, FY21

Sorted by NAICS code, Source: Kentucky DOR

NAICS Group	FY 2020	FY 2021	Difference	Growth
Nonstore Retailers	$216,567,062	$357,589,221	$141,022,159	65.1%
Building Material and Garden Equipment and Supplies Dealers	$287,442,512	$339,137,703	$51,695,192	18.0%
General Merchandise Stores	$461,460,309	$502,953,507	$41,493,199	9.0%
Merchant Wholesalers, Durable Goods	$256,310,733	$288,526,208	$32,215,474	12.6%
Motor Vehicle and Parts Dealers	$167,619,137	$192,809,875	$25,190,739	15.0%
Clothing and Clothing Accessories Stores	$111,158,329	$135,070,738	$23,912,409	21.5%
Food and Beverage Stores	$174,579,486	$198,237,040	$23,657,554	13.6%
Miscellaneous Store Retailers	$142,820,131	$161,899,599	$19,079,469	13.4%
Sporting Goods, Hobby, Musical Instrument, and Book Stores	$61,447,337	$77,753,071	$16,305,734	26.5%
Professional, Scientific, and Technical Services	$84,400,385	$98,902,915	$14,502,530	17.2%
Couriers and Messengers	$1,862,867	$15,579,062	$13,716,195	736.3%
Telecommunications	$133,796,864	$145,863,166	$12,066,303	9.0%
Gasoline Stations	$95,693,876	$105,598,111	$9,904,235	10.3%
Electronics and Appliance Stores	$79,464,957	$88,158,631	$8,693,674	10.9%
Furniture and Home Furnishings Stores	$58,037,485	$66,378,941	$8,341,455	14.4%
Utilities	$169,543,784	$177,052,303	$7,508,519	4.4%
Food Service and Drinking Places	$414,538,987	$421,239,709	$6,700,722	1.6%
Computer and Electronic Product Manufacturing	$34,390,396	$40,581,560	$6,191,164	18.0%
Other Information Services	$10,767,108	$16,613,863	$5,846,755	54.3%

Sales Tax Declining Sectors, FY21

Sorted by NAICS code, Source: Kentucky DOR

NAICS Group	FY 2020	FY 2021	Difference	Growth
Personal and Laundry Services	$69,617,381	$32,769,385	-$36,847,996	-52.9%
Accomodation	$67,572,629	$48,135,822	-$19,436,807	-28.8%
Motion Picture and Sound Recording Industries	$6,685,193	$1,414,997	-$5,270,196	-78.8%
Primary Metal Manufacturing	$31,283,130	$27,429,947	-$3,853,183	-12.3%
Transportation Equipment Manufacturing	$24,199,237	$20,465,904	-$3,733,333	-15.4%
Fabricated Metal Product Manufacturing	$24,650,637	$21,714,445	-$2,936,192	-11.9%
Performing Arts, Spectator Sports, and Related Industries	$6,641,246	$3,774,076	-$2,867,170	-43.2%
Heavy and Civil Engineering Construction	$16,837,669	$15,188,339	-$1,649,330	-9.8%
Machinery Manufacturing	$24,279,115	$23,032,779	-$1,246,335	-5.1%
Executive, Legislative, and Other General Government Support	$6,616,417	$5,430,553	-$1,185,864	-17.9%

Suspected Noise in the Sales Tax

- FY21 growth was 12.0 percent
  - Kentucky received considerable amounts of federal fiscal stimulus that sustained consumer spending
    - Direct stimulus checks
    - Unemployment insurance
    - Payroll protection from PPP Loans
    - Other exogenous spending related to federal aid (Child Tax Credit)
- Sales tax base has been expanding in recent years
  - Adding services, Base broadening
  - Enhanced ability to tax online sales
- The sales tax base broadening is structural and will persist. The federal fiscal stimulus is mostly transitory. Trying to separate these factors

Monthly Sales Tax Collections

(Millions $, Influenced by Federal Stimulus efforts from CARES, CAA, and ARP)
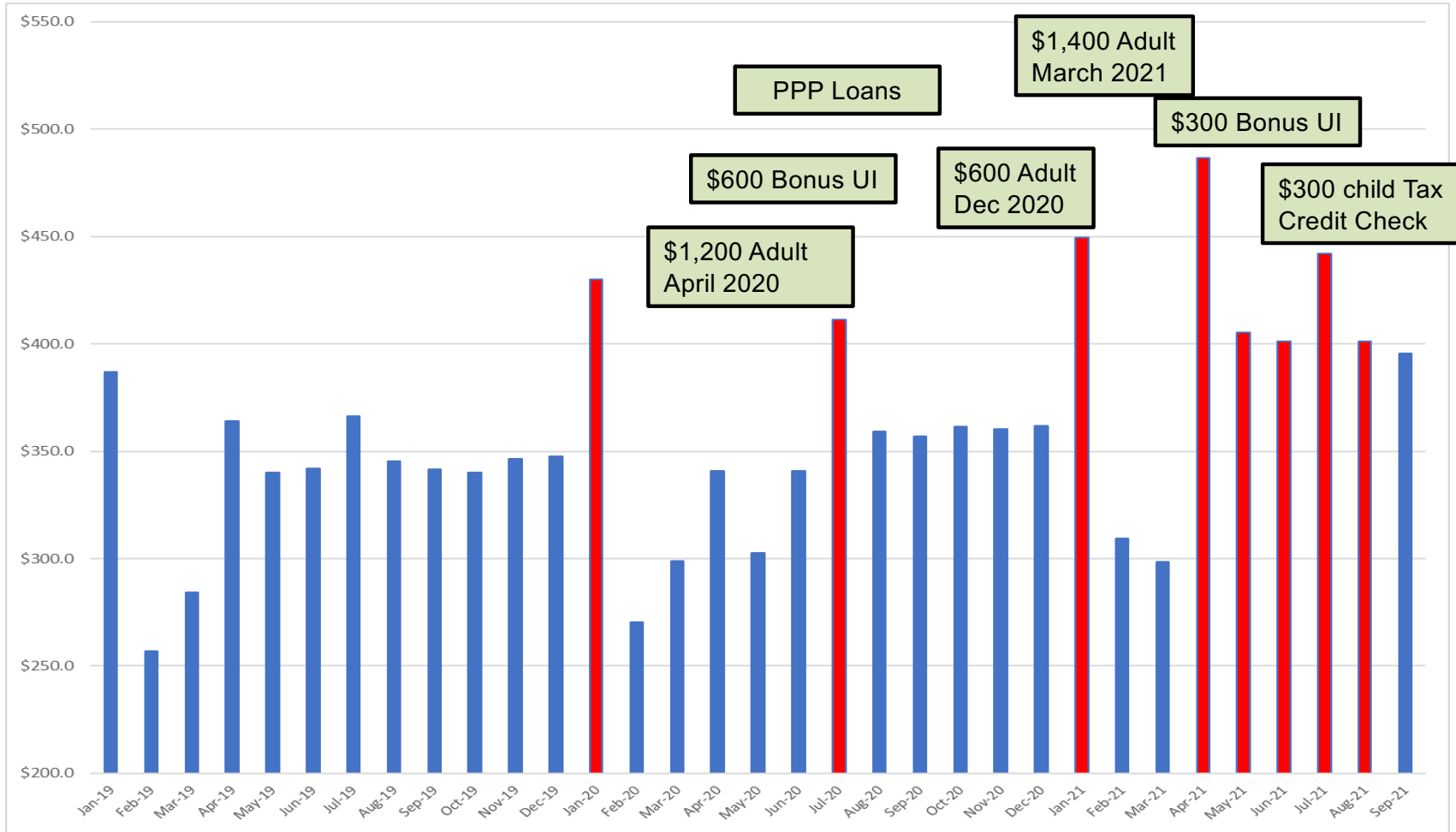
An Attempt to Create a Variable for Fiscal Stimulus

- Very difficult to turn these federal stimulus packages into specific dollar amounts of disposable income in Kentucky, both historically and into the future

- Use of Dummy Variables
  - How many dummy variables to create?
  - How to populate dummy variables for the forecasting period?
  - Dummy variables had explanatory power but consistently led to a lower forecast than the counterpart with no dummy
  - Potential for "Dummy Variable Paralysis"

Updating the Sales Tax Estimate

- Missed the blended first quarter August estimate by $18.0 million

- Re-ran the quarterly structural models, ARIMA, and VAR models

  - Tried to implement a KY transfers payment variable

    - Was not significant regardless of the sample size

  - Tried to "normalize" dependent variable (like we did after expanding the base in 2019), but lacked data to separate out the stimulus effect

  - Tried several structural variables (differenced data due to nonstationarity)

    - Income variables (KY wages, KY personal Income, US counterparts)

    - US State and Local Personal Taxes

    - Consumer spending – Durables, U.S. Retail sales

  - VAR has seasonally adjusted sales tax and KY personal income as dependent variables, several different exogenous or predetermined variables

- Ultimately adopted a weighted blend of 3 models, primarily using GARCH estimation of structural and time series models

ARCH and GARCH Models

- Suggested by Professor Oral Capps, Texas A&M

- There is a particular type of heteroscedasticity in which the variance of the regression error depends on the volatility of the errors in the most recent past.

- ARCH is Autoregressive Conditional Heteroskedasticity model that is meant to improve the efficiency of the parameter estimates.

- GARCH models simply open up the ARCH model to account for volatilities that go back a number of periods.

- Uses Maximum Likelihood Estimation techniques.

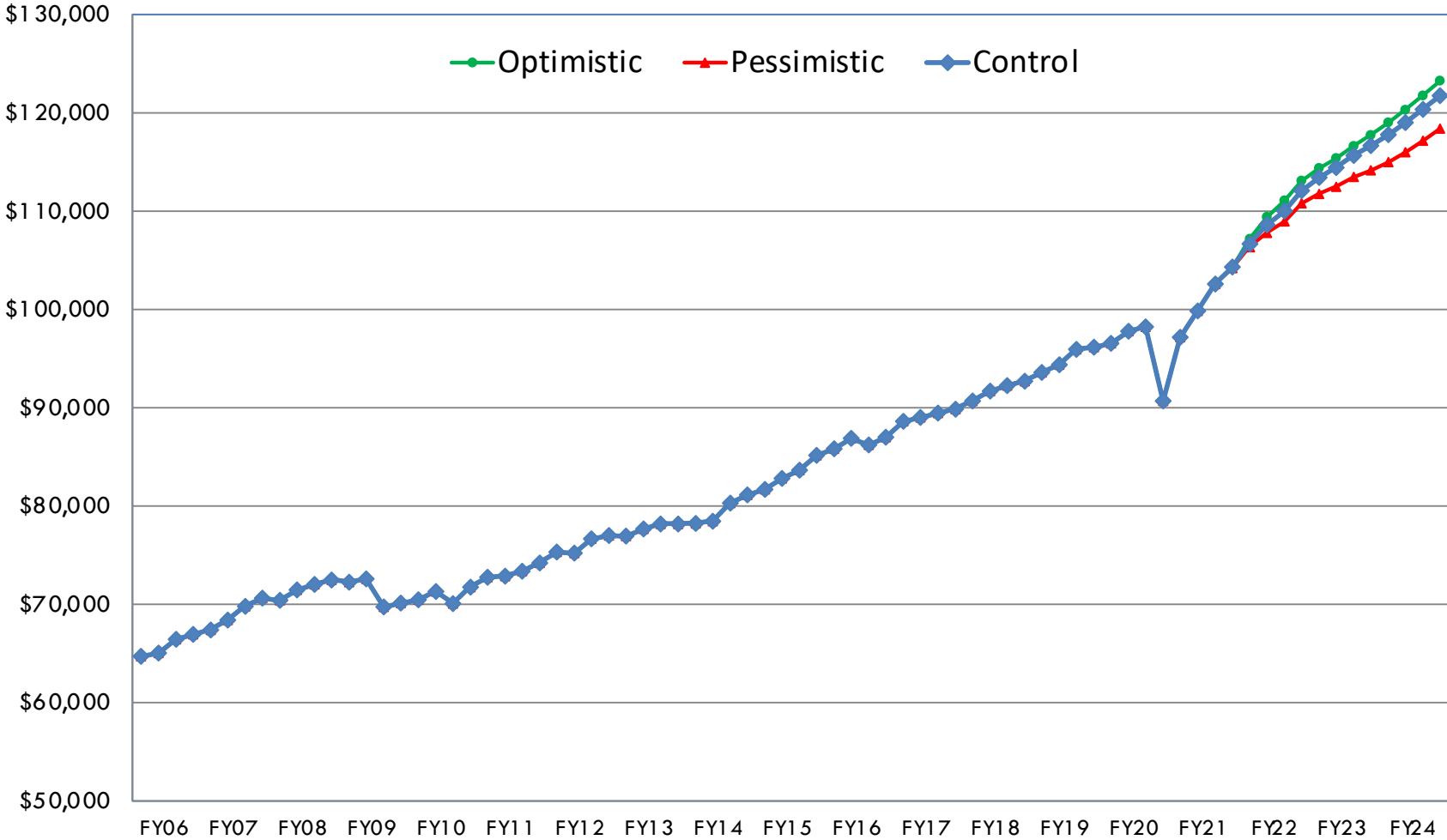- Easy to implement in modern software.

Kentucky Personal Income
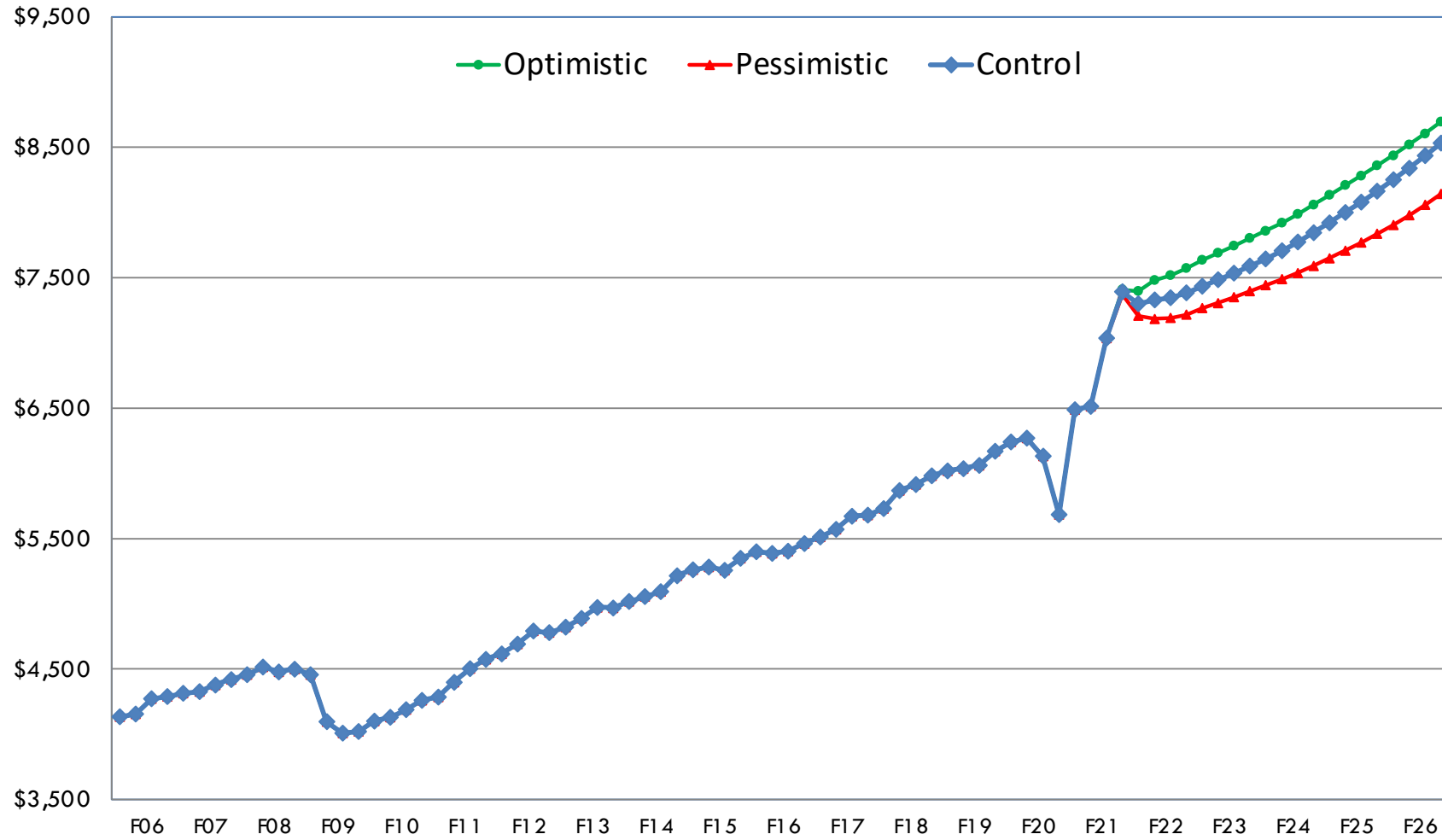## (Millions of Dollars, KY MAK Model)
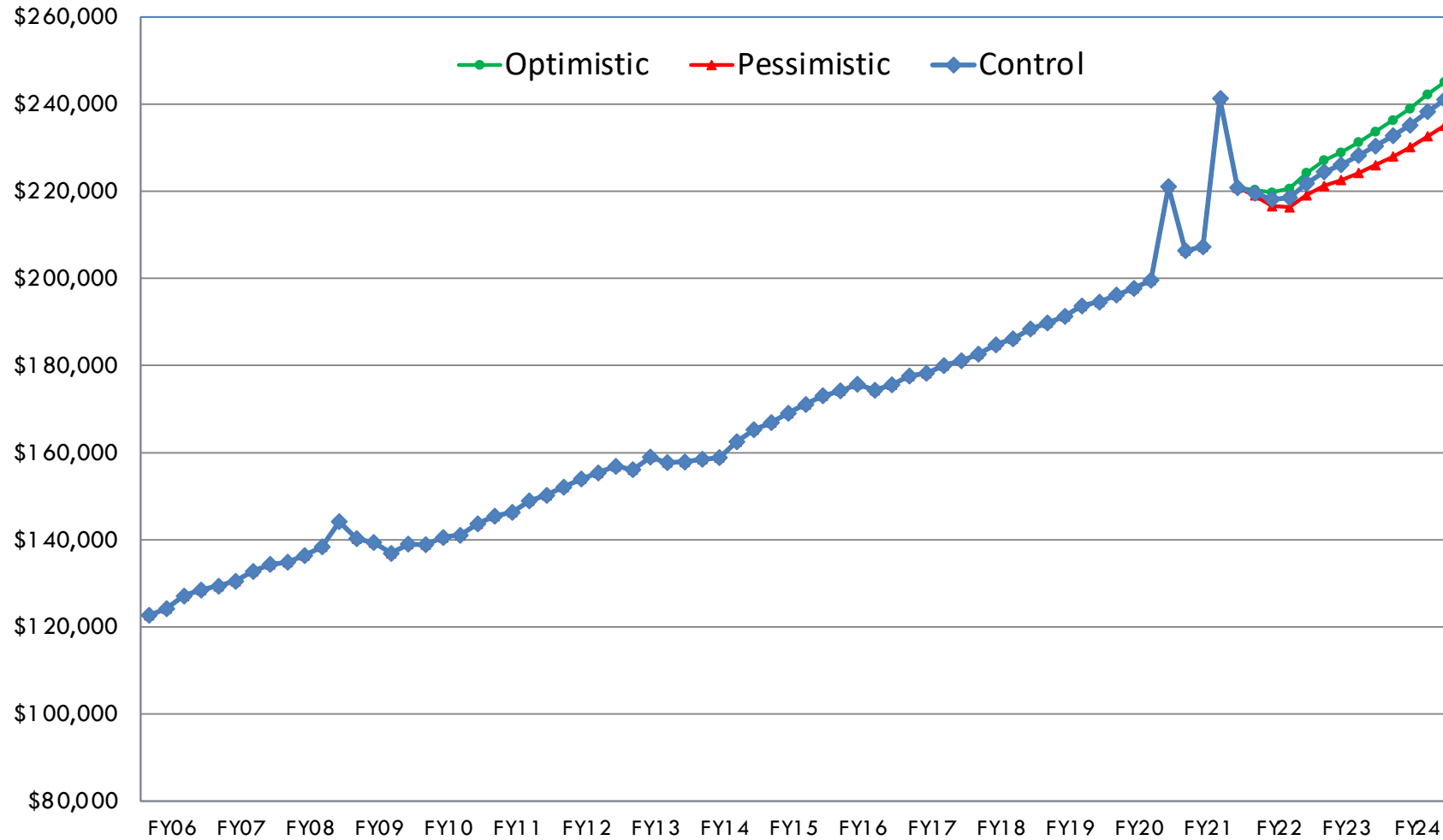
Kentucky Wages and Salaries Forecasts
(Millions of Dollars, KY MAK Model)
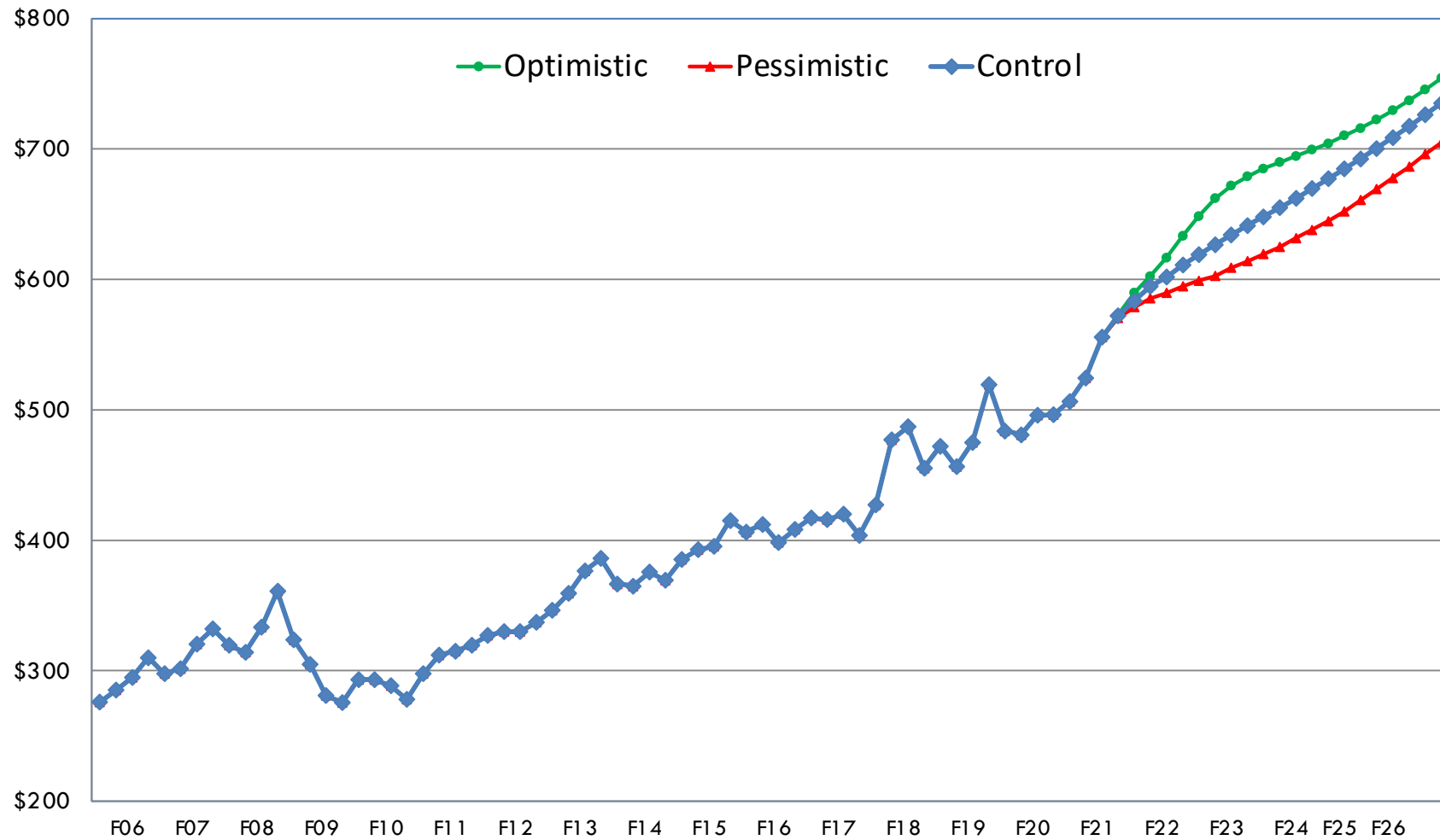
Retail Sales – Including Food Service

(Billions of Dollars, Annual Rate, Census)
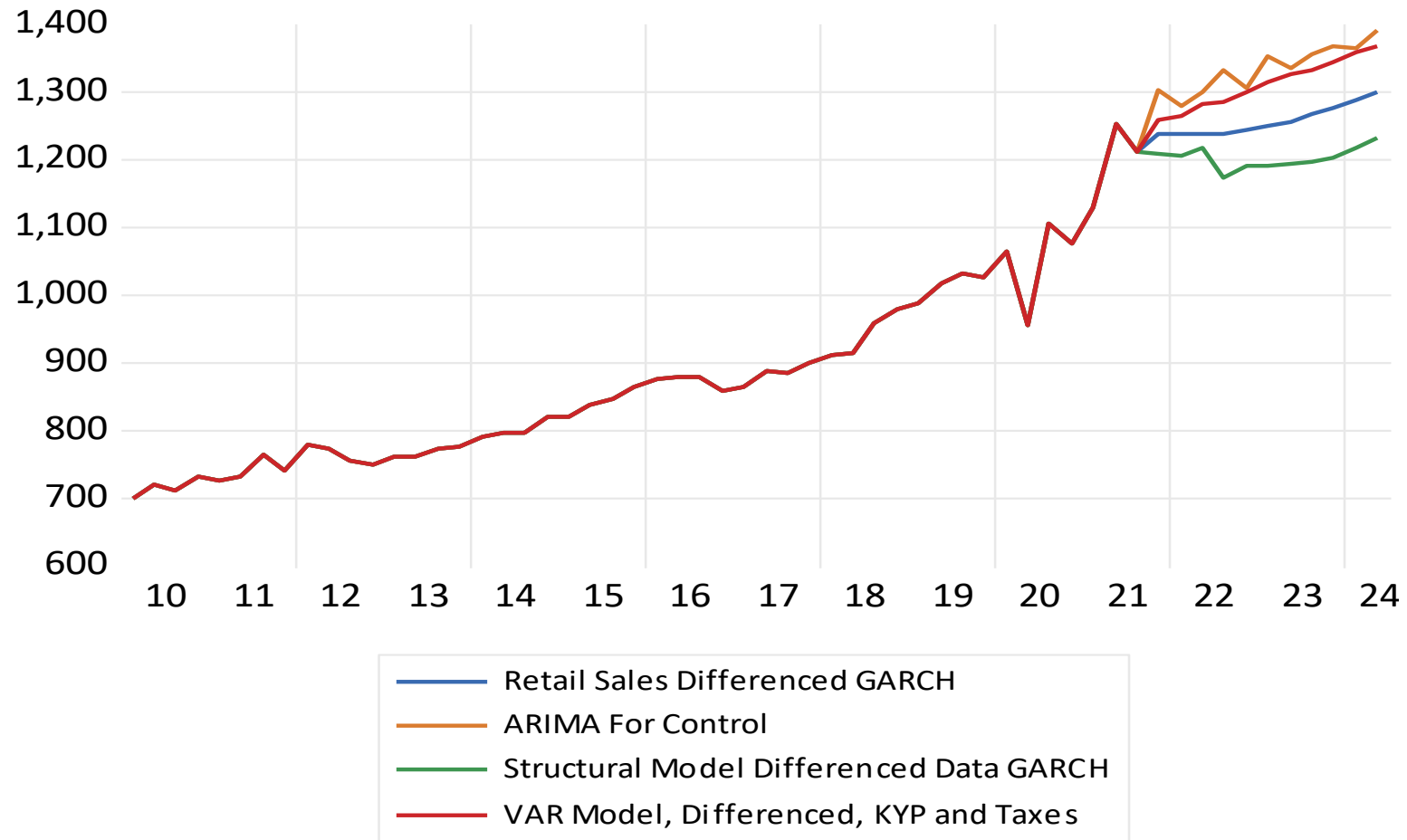
State & Local Government – Personal Tax Receipts

(Billions of Dollars, Annual Rate, BEA)
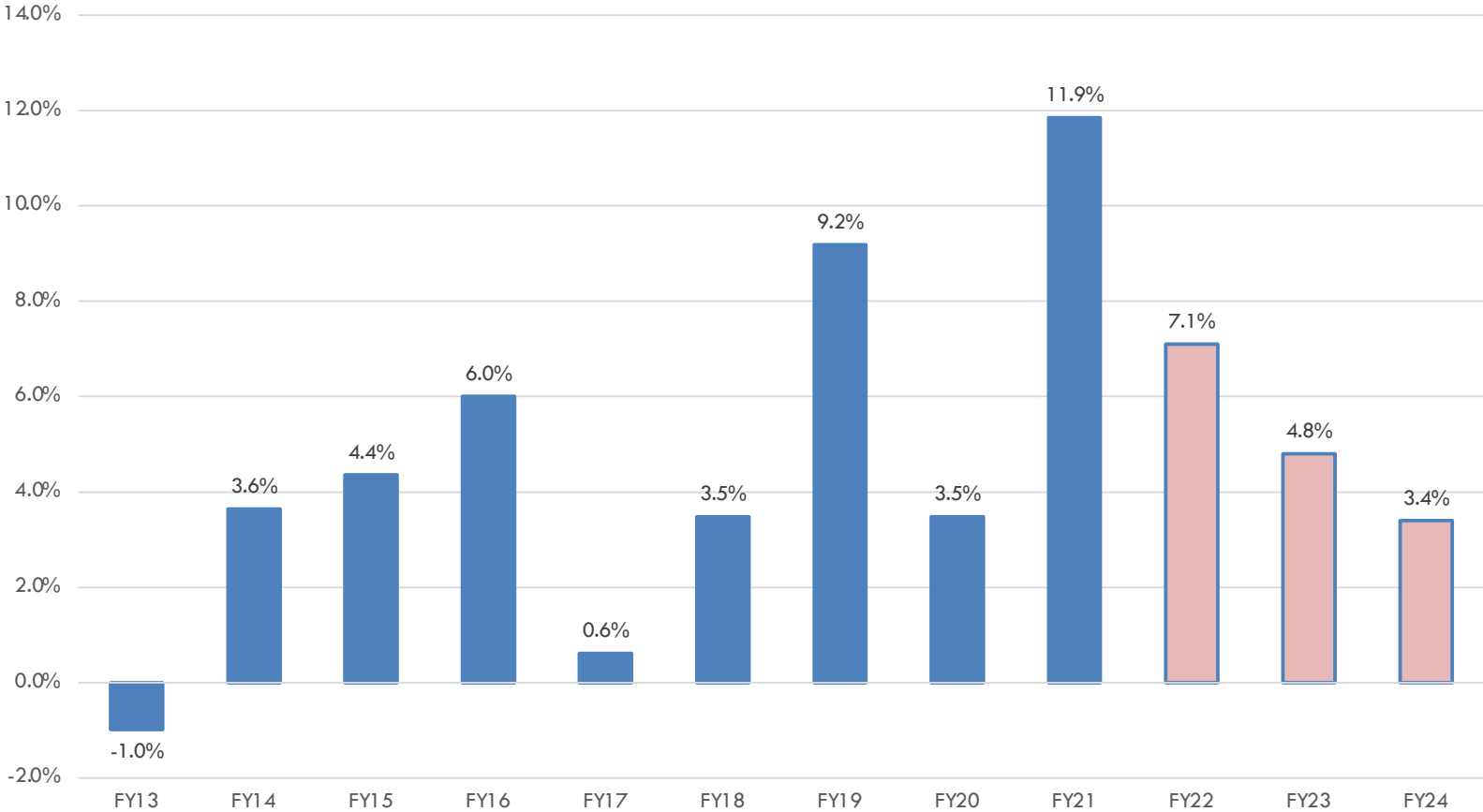
Blended Sales Tax Model

(Quarterly Data, Calendar Year, Seasonally Adjusted, Millions $)

Legend:
- Retail Sales Differenced GARCH
- ARIMA For Control
- Structural Model Differenced Data GARCH
- VAR Model, Differenced, KYP and Taxes

Sales Tax Control Forecast

(Fiscal Year growth rates)

Sales Tax Projections

(Millions $)

Fiscal Year	Control	Optimistic	Pessimistic
FY 2021	$4,561.0 12.0%	$4,561.0 12.0%	$4,561.0 12.0%
FY 2022	$4,884.3 7.1%	$4,935.8 8.2%	$4,770.9 4.6%
FY 2023	$5,118.8 4.8%	$5,207.7 5.5%	$4,861.3 1.9%
FY 2024	$5,294.8 3.4%	$5,470.1 5.0%	$5,043.2 3.7%

Sales Tax Forecast Needs for FY22

Percent Change

	Estimate	YTD	Needs
Control	7.1%	9.9%	6.2%
Optimistic	8.2%	9.9%	7.7%
Pessimistic	4.6%	9.9%	2.9%

The Art and Science of Forecasting

- Despite our efforts for science, art is sometimes indicated
- Model has been underestimating sales tax
- Creative ways to add art:
  - Obvious add factors
  - Model selection
    - Run several structural models
    - Several VAR models
  - Blending multiple models
  - Dummy variables
  - Alter the sample size