



# **December 2020 Revenue Forecast**

## **Methodology and Technical Documentation**

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## **Introduction**

This document provides an overview of the December 2020 state revenue forecast. The calculation instructions, model specifications, summary statistics, and forecasts are included.

For further information and assistance in the calculation of models, please contact the State Budget Agency's Tax and Revenue Division at 317-232-5610.

## **Revenue Forecast Committee**

The revenue forecast technical committee is comprised of members from both the executive and legislative branches. Staff from both the State Budget Agency and Legislative Services Agency have a vital role in the process by assisting with data analysis and modeling. Each forecast model and revenue estimate is agreed to by the technical committee on a consensus basis.

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## **Economic Forecast**

The forecast committee uses economic forecasts from IHS Markit, Inc. Forecasts cited in this document are provided by IHS, a leading economic consulting firm. IHS is routinely ranked among the leading economic forecasters in studies by The Wall Street Journal and Bloomberg Markets.

## Section I: Commentary on the Economic Forecast

IHS Markit projects U.S. real gross domestic product growth of 1.03% in FY 2021, 3.85% in FY 2022 and 2.95% in FY 2023. During the same period, Indiana's real gross state product is projected to grow by 1.91% in FY 2021, 2.42% in FY 2022 and 1.56% in FY 2023. Additionally, Indiana nominal wages and salaries is projected to grow by 4.07% in FY 2021, 4.09% in FY 2022 and 2.66% in FY2023.

FY 2021 to FY 2023 is projected to see the gradual recovery of the economy from the economic shock experienced in the first half of CY 2020 since the onset of the COVID-19 pandemic. As the economy transitions out of shelter in place orders, the impact of federal policy actions on employment, consumer spending and financial markets is one of the main aspects to watch.

Wages and personal income in general are two of the most important economic variables for the General Fund revenue forecast. While income growth was projected to accelerate post CY 2020 in the December 2019 Forecast, the economic disruptions related to the pandemic have negatively impacted the positive trend in total employment seen since the 2008-2009 recession. However, unprecedented levels of federal policy actions such as direct payments to individuals and businesses, low interest rates and enhanced unemployment benefits have introduced additional, fast-changing dynamics.

While the employment and wages picture is challenged, the wave of federal policy actions has coincided with a rise in financial markets, proprietors' income and homeowners' equity since the second quarter of CY 2020. During this same period, investment income and consumer spending on goods such as housing related purchases have recovered while spending on services and leisure and hospitality continue to be at subdued levels. These various dynamics are likely to have had varying impacts on different business industries and household groups.

With uncertainty on additional federal fiscal stimulus and continued phased reopening of the economy, the momentum seen across economic metrics such as personal consumption expenditures on goods is projected to slow down in first half of CY 2021 before transitioning from recovery to expansion in the third quarter of CY 2021. Thereafter, the economy is projected to regain full employment in mid-2023.

Below are some of main assumptions in the December 2020 economic forecast from IHS Markit:

### **Assumed stimulus and better-than-expected news on vaccines result in upward revisions to GDP forecast**

- Real GDP grew 33.1% in the third quarter according to BEA's second estimate, which was unrevised from the advance estimate. It was easily the sharpest rise on record but one that left GDP still 3.5% below the previous peak.
- We have revised up our projection for real GDP growth in 2021 from 3.1% to 4.3%, reflecting three developments:
  1. Recent data led us to revise upward our estimate of fourth-quarter GDP growth from 3.7% to 5.6%, raising the level of GDP 0.35% heading into the new year.
  2. News on the efficacy of COVID-19 vaccines has been surprisingly good, and we now expect much of the population to be inoculated by the summer of 2021, pushing real GDP growth to 4.5% in the second half.
  3. At the time of our December forecast, stimulus negotiations looked promising enough that we included in the forecast an assumed extension of the PUA and PEUC unemployment benefit programs as well as enhanced unemployment payments of \$300/month for five months.
- With projected growth of 3.6% in 2022, GDP crosses its previous peak in the third quarter of 2021 and the economy regains full employment in mid-2023, both earlier than in last month's forecast.

## Policy assumptions in the December forecast

- This month, extension of certain unemployment programs and enhanced unemployment benefits are included in the forecast. Specifically, we assume that the PUA and PEUC unemployment programs are extended through April, followed by a 2-month phase out, and an enhanced unemployment benefit of \$300/week is instated from January through May.
- The short-term spending bill that funds federal agencies through mid-December is extended as necessary to prevent a government shutdown. In addition, the debt ceiling is suspended again in March.
- State and local governments restrain spending heading into their new fiscal years.
- The Fed maintains the federal funds rate near 0% until late 2026 when the economy is again beyond full employment. The Fed encourages inflation above 2%, which in the forecast happens in 2026. The Fed expands its holding of term Treasuries by nearly \$2 trillion.

## Section II: Economic Indicators for Indiana

### Fiscal Year Amounts

<b>Indiana Economic Indicators</b>	<b>FY 2020 Actual</b>	<b>FY 2021 Forecast</b>	<b>FY 2022 Forecast</b>	<b>FY 2023 Forecast</b>
Personal Income (millions \$)	337,368.08	350,177.26	352,415.09	364,517.05
Adjusted Personal Income (less Transfers Payments) per Household (millions \$)	99.88	102.22	104.10	106.57
Nominal Wages and Salaries (millions \$)	159,476.27	165,964.49	172,749.88	177,346.77
Home Sales	110.48	127.90	123.69	120.37
Real GSP, Retail Trade (Millions 2012\$)	19,401.63	20,114.34	20,292.42	19,287.02

<b>US Economy</b>				
Household financial obligations ratio	14.73	15.78	15.40	15.31
Retail Price on All Grades of Gasoline (cents \$)	248.78	221.10	245.33	263.38
Before Tax Corporate Profits (billions \$)	2,104.73	2,109.40	2,082.79	2,195.32
Industrial Production Index, Transportation Equipment (2012 = 100)	98.77	106.63	108.12	109.90
Dividend payments to Individuals and Personal Interest Income (billions \$)	2,961.27	2,876.37	2,883.03	2,932.05
S&P 500 Index	3,010.77	3,583.78	3,803.90	3,941.36
Market value of household holdings of corporate equities (billions \$)	28,433.01	35,060.01	36,836.62	37,402.67

### Year-Over-Year Percentage Change

<b>Indiana Economic Indicators</b>	<b>FY 2020 Actual</b>	<b>FY 2021 Forecast</b>	<b>FY 2022 Forecast</b>	<b>FY 2023 Forecast</b>
Personal Income (millions \$)	4.59%	3.80%	0.64%	3.43%
Adjusted Personal Income (less Transfers Payments less Proprietors Income) per Household (millions \$)	0.59%	2.35%	1.84%	2.37%
Nominal Wages and Salaries (millions \$)	0.58%	4.07%	4.09%	2.66%
Home Sales	-0.36%	15.77%	-3.29%	-2.69%
Real GSP, Retail Trade (Millions 2012\$)	-1.07%	3.67%	0.89%	-4.95%

<b>US Economy</b>				
Household financial obligations ratio	-2.00%	7.11%	-2.37%	-0.62%
Retail Price on All Grades of Gasoline (cents \$)	-9.51%	-11.13%	10.96%	7.36%
Before Tax Corporate Profits (billions \$)	-6.30%	0.22%	-1.26%	5.40%
Industrial Production Index, Transportation Equipment (2012 = 100)	-14.55%	7.95%	1.40%	1.65%
Dividend payments to Individuals and Personal Interest Income (billions \$)	-0.45%	-2.87%	0.23%	1.70%
S&P 500 Index	8.03%	19.03%	6.14%	3.61%
Market value of household holdings of corporate equities (billions \$)	3.17%	23.31%	5.07%	1.54%

## Section III: Models Used in the Forecast

### Sales & Use Taxes

The forecast for sales and use tax is composed of (1) a sales net of gasoline use tax model (“sales net of GUT”), and (2) a gasoline use tax model (“GUT”). The reason for developing the two models was to better account for the impact that volatile gasoline prices have on total sales and use tax. The sales net of GUT and GUT models has been adjusted, as part of the December 2019 Forecast, to better address specific dynamics that are affecting sales and use tax revenues.

The tax base for sales tax net of GUT was calculated by subtracting the historical series of gasoline use tax revenue from the historical series of total sales tax revenue then dividing the result by the prevailing sales tax rate in each period to generate the new historical series for sales tax net of GUT. Additionally, an estimate of revenues attributable to enforcement of remote sales tax compliance attributable to post-Wayfair and marketplace facilitator legislative changes (“remote sales”), based on best data available from the Indiana Department of Revenue, is subtracted from the historical series for sales tax net of GUT. Effectively, the regression model for sales tax net of GUT seeks to forecast sales net of GUT collections excluding remote sales and an additional analysis is done to forecast the net revenue impact of remote sales.

The tax base for the gasoline use tax has been changed since the December 2017 Forecast and uses the gallons reported by the Indiana Department of Revenue to the Federal Highway Administration. The use of actual gallons reported for net taxable gallons in Indiana can help improve the quality of the forecast.

Historical sales and use tax collections are also adjusted to account for legislative changes and tax holidays that have altered tax collections over the course of the two-time series. Consequently, the same adjustments must be made in the opposite direction to the forecast values in order to maintain consistency in each of the time series.

Notably, the sales net of GUT model uses (1) Indiana adjusted personal income (less transfers payments) per household to potentially capture a measure of income that would better reflect the ability to spend, (2) U.S household obligations ratio as a percent of disposable income to potentially capture the impact of credit on the ability and willingness to spend, (3) prior year home sales to potentially reflect the impact of home sales on the ability and willingness to spend on taxable purchases.

The GUT model, which seeks to forecast taxable gallons of gasoline consumed in Indiana, uses (1) Indiana real gross state product, retail trade, as most gasoline consumption is from passenger vehicles and, in a State like Indiana, the purchase or delivery of goods to the end consumer is done using gasoline as a fuel to drive, (2) demand for petroleum as a percentage of total demand for all fuels to potentially capture the shift away from gasoline driven cars, and (3) the product of summer retail gas prices and fuel efficiency to potentially capture the impact of the cost of driving on gasoline consumption.

The forecast of gallons is (1) multiplied by an estimate of the average gasoline use tax rate (based on gasoline retail prices) to arrive at the forecast for total gasoline use tax revenue collections, then (2) the forecast for total gasoline use tax revenue collections is multiplied by the share of revenues to be distributed to the General Fund, based on the Indiana Code. The General Fund share of total gasoline use tax collections has been decreasing every Fiscal Year and is set to decrease from 42.865% in FY 2021 to 21.445% in FY 2023.

Total State Sales Tax Forecast = Sales Net of Gasoline Use Tax (Sales net of GUT) + Gasoline Use Tax (GUT)

## Sales & Use Taxes: Sales Net of Gasoline Use Tax

$$\text{Log (Sales Net of GUT Tax Base)} = \beta_0 + (\beta_1 * \text{Log (Indiana Adjusted Personal Income (Less Transfer Payments) Per Household)}) + (\beta_2 * \text{U.S Household financial obligations ratio}) + (\beta_3 * \text{Prior Fiscal Year Home Sales})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	6.543***
$\beta_1$	0.960***
$\beta_2$	0.022***
$\beta_3$	0.063***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.995
Predicted R <sup>2</sup>	0.994
F –Statistic	1547.016***
DW Statistic	1.457
Sample Size (n)	24

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

<b>Historical Revenue Data</b>				
Fiscal Year	Adjusted General Fund Revenue (Millions \$)	Growth Rate	Commuter Rail Service Fund	Industrial Rail Service Fund
2017	7,158.55	4.5%	9.39	2.22
2018	7,359.83	2.8%	9.66	2.29
2019	7,626.14	3.6%	10.01	2.37
2020	7,835.81	2.7%	10.28	2.43

<b>Forecast Revenue Data</b>				
Fiscal Year	Adjusted General Fund Revenue (Millions \$)	Growth Rate	Commuter Rail Service Fund	Industrial Rail Service Fund
2021	8,330.61	6.3%	10.91	2.58
2022	8,530.55	2.4%	11.18	2.64
2023	8,721.87	2.2%	11.43	2.70

Forecasted revenue shown above also include adjustments related to legislative acts and remote sales as a result of the Wayfair ruling in 2018.

## Sales & Use Taxes: Gasoline Use Tax (GUT)

$$\text{Log (GUT Base)} = \beta_0 + (\beta_1 * \text{Log (Real GSP, Retail Trade)}) + (\beta_2 * \text{Demand for petroleum as \% of Total demand for all fuels}) + (\beta_3 * \text{Summer Gas Price x Fuel Efficiency})$$

### Coefficient Statistics:

Coefficient	Estimated Coefficient
$\beta_0$	19.763***
$\beta_1$	0.170***
$\beta_2$	1.214***
$\beta_3$	0.000***

### Model Statistics:

Adjusted R <sup>2</sup>	0.703
Predicted R <sup>2</sup>	0.600
F –Statistic	18.395***
DW Statistic	1.014
Sample Size (n)	23

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

*Note that revenue data below reflects revenues and therefore is influenced by factors such as changes in the distribution formula of the gross revenue collections across different funds for each fiscal year.*

Historical Revenue Data						
Fiscal Year	Adjusted General Fund Revenue (Millions \$)	Growth Rate	Local Road & Bridge	MVHA	STFF	State Highway
2017	331.08	-11.7%	-	55.18	-	-
2018	302.72	-8.6%	60.55	60.55	-	-
2019	288.87	-4.6%	96.29	64.20	-	-
2020	206.20	-28.6%	82.47	54.98	32.98	8.24

Forecast Revenue Data						
Fiscal Year	Adjusted General Fund Revenue (Millions \$)	Growth Rate	Local Road & Bridge	MVHA	STFF	State Highway
2021	139.56	-32.3%	29.91	19.94	17.94	11.96
2022	122.33	-12.3%	26.21	17.48	15.72	23.58
2023	88.37	-27.8%	18.94	12.62	7.57	30.29



## Individual Income Tax

The individual income tax forecast is based on (1) a model of state and local withholding payment activity, (2) a model of state and local estimated payments and other non-withholding payment activity combined with a separate estimate of individual income tax refunds, and (3) a separate estimate of local income tax revenues. The selected equations use fiscal year data rather than quarterly data. A fiscal year methodology reduces the risk of factors involving atypical timing delays affecting the model output.

The withholding payments model seeks to capture payments received for both state and local withholding on income tax, excluding non-resident partnership withholdings. The non-resident partnership withholdings attributable to individual income taxpayers are estimated separately based on historical data over the last two years.

The estimated payments & other non-withholding model seeks to capture non-withholding individual income tax payment activity. Refunds are estimated separately to arrive to the net forecast.

Lastly, an estimate for local income tax revenues is generated and subtracted from the sum of state and local individual income tax collections to arrive at the net state individual income tax revenue forecast. The local income tax forecast is based on a calculation of the statewide weighted average local income tax rate relative to the state rate. In essence, it seeks to capture the share of payments that is attributable to local income taxes.

In FY19 and thereafter, a notable adjustment to the forecast is the estimated impact of Indiana's tax changes relative to the state's conformity to the 2017 Federal Tax Cuts & Jobs Act.

$\text{Total State Income Tax Forecast} = \text{Total State and Local Withholding Payments} + \text{Total State and Local Estimated Payments \& Other Non-Withholding Payments Net of Refunds} - \text{Local Income Tax Payments}$
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## Individual Income Tax: Withholdings

The withholding forecast is based on a methodology that seeks to capture the overall state and local withholding payment liability. This methodology reflects the actual cash flow process as both state and local withholding income tax payments are grouped together as withholding collections. The model is therefore able to use actual data of withholding payments for its forecast.

While Indiana’s salary and wage disbursements is the major driver of withholding, adjustments relative to personal contribution to social insurance and residence adjustment add value by accounting for factors that impact the taxable income based on which the Indiana withholding tax is applied. On the same note, a variable for Indiana prior year births is added to address significant events (newborn children etc.) that would affect a taxpayer’s withholding. The ‘prior year’ nature of the Indiana births variable also seeks to address the timing of when taxpayers would actually change their withholding details.

The forecast generated by the model is (1) adjusted to account for the combined state income tax rate and statewide average local income tax rate, (2) added to an estimate of individual income tax revenues related to nonresident partnership withholdings, based on a percentage of corporate tax payments, and (3) a separate estimate of additional impacts from legislative changes is factored in to arrive to the net withholding revenue forecast.

$$\text{Log (Withholdings Payment Liability)} = \beta_0 + (\beta_1 * \text{Log (Indiana Wage Disbursements Less Personal Contribution to Social Insurance + Residence Adjustment)}) + (\beta_2 * \text{AR (1)}) + (\beta_3 * \text{Log (Indiana Prior Year Births)})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	0.143
$\beta_1$	0.851***
$\beta_2$	0.177***
$\beta_3$	-0.123**

**Model Statistics:**

Adjusted R <sup>2</sup>	0.999
Predicted R <sup>2</sup>	0.999
F -Statistic	7915.702***
DW Statistic	1.714
Sample Size (n)	23

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

Historical Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	6,916.68	4.8%
2018	7,497.55	8.4%
2019	7,786.06	3.8%
2020	7,827.57	0.5%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	8,268.21	5.6%
2022	8,529.96	3.2%
2023	8,798.03	3.1%

## Individual Income Tax: Estimated Payments and Other Non-Withholding

Similar to the withholding forecast, the estimated payments & other non-withholding payment forecast is based on a methodology that seeks to capture the overall state and local non-withholding payment liability.

In terms of variables, the model uses U.S dividend and personal interest income as well as U.S market value of household holdings of corporate equities. These variables seek to capture income from investments and other sources that are not captured in withholdings but affect the estimated payment and final payment liability.

The forecast generated by the model is then combined with an estimate of individual income tax refunds, based on historical data of refunds as a percentage of total payments, to arrive to the net revenue forecast for estimated payments and other non-withholding.

$$\text{Log (Estimated Payments \& Other Non-Withholding Payment Liability)} = \beta_0 + (\beta_1 * \text{Log (U.S Dividend payments to Individuals + Personal Interest Income)}) + (\beta_2 * \text{Log (U.S Market value of household holdings of corporate equities)})$$

### Coefficient Statistics:

Coefficient	Estimated Coefficient
$\beta_0$	4.695***
$\beta_1$	0.478***
$\beta_2$	0.242***

### Model Statistics:

Adjusted R <sup>2</sup>	0.964
Predicted R <sup>2</sup>	0.958
F –Statistic	297.244***
DW Statistic	1.543
Sample Size (n)	23

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

Historical Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	916.41	2.9%
2018	977.37	6.7%
2019	1,114.15	14.0%
2020	475.86	-57.3%

Forecast Data		
Fiscal Year	Adjusted Revenue	Growth
2021	1,679.44	252.9%
2022	979.97	-41.6%
2023	1,058.01	8.0%

## Individual Income Tax: Local Income Tax

The estimate for local income tax revenues is based on a calculation of the statewide weighted average local income tax rate relative to the state rate. In essence, it seeks to capture the share of payments that is attributable to local income taxes.

<b>Historical Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	2,397.79	5.9%
2018	2,637.02	10.0%
2019	2,843.25	7.8%
2020	3,031.61	6.6%

<b>Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	2,974.71	-1.9%
2022	3,140.63	5.6%
2023	3,254.93	3.6%

## Corporate Taxes: Corporate AGI

The corporate adjusted gross income (“AGI”) model is based on a methodology that seeks to capture the corporate AGI tax payment liability. Notably, the model looks to address not only the (1) overall trend in corporate profitability and size of the corporate sector but also (2) the specific dynamics that Indiana’s corporate tax base is exposed to relative to its industry composition, (3) recognition of income in U.S versus abroad, (4) evolving Indiana corporate taxation framework, and (5) tax planning and payment behavior.

The model uses variables such as the moving average of the last two fiscal year’s value of a measure of U.S before-tax corporate profits, the moving average of the last two fiscal year’s value of U.S Industrial Production of transportation equipment, the U.S net international investment position, and the year over year change in Indiana’s corporate AGI statutory tax rate.

The forecast generated by the model is (1) adjusted to account for the corporate tax rate; then (2) separate estimates of additional corporate credits and legislative changes are factor in to arrive to the payments made by corporations, and (3) separate estimates of refunds and corporate payments transferred to individual income for pass through nonresident withholding are subtracted to arrive to the net corporate AGI revenue forecast. The corporate tax rate is scheduled to gradually decrease until FY 2022. Over the biennium, rates will range from 5.25% in FY 2021 to 4.90% in FY 2023.

$$\text{Log (Corporate Payments Liability)} = \beta_0 + (\beta_1 * \text{Log (Last 2 Fiscal Year Moving Average of U.S Before-tax corporate profits with IVA \& capital consumption adjustment)}) + (\beta_2 * \text{Log (Last 2 Fiscal Year Moving Average of U.S Industrial Production Index, Transportation Equipment)}) + (\beta_3 * \text{Net U.S. international investment position, billions of dollars}) + (\beta_4 * \text{Tax Rate Change})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	-0.704
$\beta_1$	0.505***
$\beta_2$	1.368***
$\beta_3$	0.000***
$\beta_4$	36.158***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.987
Predicted R <sup>2</sup>	0.976
F -Statistic	273.277***
DW Statistic	2.496
Sample Size (n)	15

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

Historical Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	730.92	1.9%
2018	390.63	-46.6%
2019	603.02	54.4%
2020	437.55	-27.4%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	598.77	36.8%
2022	493.85	-17.5%
2023	609.62	23.4%

## Corporate Taxes: Other Corporate Taxes

In addition to the corporate AGI forecast, revenues from the utility receipts tax, the utility services use tax, and the financial institutions tax are estimated separately using historical compounded annual growth rates. These forecasts are then added together to get a total corporate tax forecast.

### *Utility Receipts Tax*

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	209.01	14.1%
2022	202.44	-3.1%
2023	209.60	3.5%

### *Utility Services Use Tax*

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	4.27	-8.4%
2022	4.02	-5.8%
2023	4.13	2.8%

### *Financial Institutions Tax*

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	69.58	6.4%
2022	64.75	-6.9%
2023	64.92	0.3%

## Cigarette & Other Tobacco Products Tax

The committee estimates cigarette tax and tobacco products tax separately. Cigarette sales, measured in packs of 20, depends upon fiscal year real Indiana personal income, an estimate of the sum of the four surrounding states' real prices, the real Indiana price, and a trend variable. Other tobacco product sales are estimated based on an annual fiscal year trend.

$$\text{Log (Packets Sold)} = \beta_0 + (\beta_1 * \text{Log (Real FY Indiana Personal Income)}) + (\beta_2 * \text{Log (Real Indiana Cigarette Price)}) + (\beta_3 * \text{Log (Real All Neighbor's Price)}) + (\beta_4 * \text{Trend})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	-7.9334***
$\beta_1$	1.3520***
$\beta_2$	-0.8621***
$\beta_3$	0.8376***
$\beta_4$	-0.0813***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.978
F -Statistic	337.844***
Sample Size (n)	36

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

Historical Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	400.00	-2.3%
2018	383.40	-4.2%
2019	368.70	-3.8%
2020	373.60	1.33%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	390.40	4.5%
2022	392.90	0.6%
2023	377.80	-3.8%

Note: The state General Fund receives 56.2% of the cigarette and tobacco products taxes. The historical and forecasted revenues reflect cigarette tax (net of collection allowance) to state funds.

## Alcoholic Beverage Taxes

The alcoholic beverage tax model includes three equations: one for beer, one for liquor, and one for wine. All three equations include fiscal year real Indiana personal income and the real beverage price. The beer equation includes dummy variables for 1979 and after, 1993 and after, and 2012 and after. The liquor equation includes a dummy variable for 1999 and after. The wine equation includes a dummy variable for 1987 and after. The sales and income variables are expressed in terms of natural logarithms. The price variables are not in natural logarithms.

### Alcoholic Beverage Taxes: Beer

$$\text{Log(Thousands of Gallons of Beer Sold in Indiana)} = \beta_0 + (\beta_1 * \text{Log(FY Real Indiana Personal Income)}) + (\beta_2 * \text{Log(Real Price of Beer)}) + (\beta_3 * \text{Slope Dummy (pre 1979=0, 1979 and after=log(real IPI)}) + (\beta_4 * \text{Slope Dummy (pre 1993=0, 1979 and after=log(real IPI)}) + (\beta_5 * \text{Dummy Variable for FY 1979 and after}) + (\beta_6 * \text{Dummy Variable for FY 1993 and after}) + (\beta_7 * \text{Dummy Variable for FY 2012 and after})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	3.124**
$\beta_1$	0.7593***
$\beta_2$	-0.1918
$\beta_3$	-0.7254***
$\beta_4$	0.2012**
$\beta_5$	8.5915***
$\beta_6$	-2.4556***
$\beta_7$	-0.0883***

**Model Statistics:**

Adjusted R <sup>2</sup>	.9765
F-statistic	327.8
Sample Size (n)	55

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

<b>BEER</b>	<b>Actual*</b>	<b>Actual*</b>	<b>Forecast</b>	<b>Forecast</b>	<b>Forecast</b>
	<b><u>FY 2019</u></b>	<b><u>FY 2020</u></b>	<b><u>FY 2021</u></b>	<b><u>FY 2022</u></b>	<b><u>FY 2023</u></b>
GENERAL FUND	4.7	4.7	4.7	4.7	4.7
PWCF	0.0	0.0	0.0	0.0	0.0
STATE CONSTRUCTION FUND	4.4	4.4	4.4	4.4	4.4
ENFORCEMENT & ADMIN	2.1	2.1	2.1	2.1	2.1
ADDICTION SERVICES	2.4	2.4	2.4	2.4	2.4
PENSION RELIEF FUND	0.0	0.0	0.0	0.0	0.0
WINE GRAPE	0.0	0.0	0.0	0.0	0.0
<b>TOTAL</b>	<b>13.6</b>	<b>13.6</b>	<b>13.6</b>	<b>13.6</b>	<b>13.6</b>

\*Actuals are calculated based on reported gallons sold, not actual revenue.



## Alcoholic Beverage Taxes: Liquor

Thousands of Gallons of Liquor Sold in Indiana =  $\beta_0 + (\beta_1 * \text{Real Indiana Per Capita Personal Income}) + (\beta_2 * \text{Indiana Population Ages 20 - 29})$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	-28,551.2320***
$\beta_1$	211.2210***
$\beta_2$	32.8280***

**Model Statistics:**

Adjusted R <sup>2</sup>	.972
F-statistic	521.9
Sample Size (n)	30

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

<b>LIQUOR</b>	<b>Actual*</b>	<b>Actual*</b>	<b>Forecast</b>	<b>Forecast</b>	<b>Forecast</b>
	<b><u>FY 2019</u></b>	<b><u>FY 2020</u></b>	<b><u>FY 2021</u></b>	<b><u>FY 2022</u></b>	<b><u>FY 2023</u></b>
GENERAL FUND	12.4	12.7	12.8	12.5	12.5
PWCF	0.0	0.0	0.0	0.0	0.0
STATE CONSTRUCTION FUND	14.6	14.9	15.0	14.7	14.7
ENFORCEMENT & ADMIN	1.4	1.4	1.4	1.4	1.4
ADDICTION SERVICES	0.7	0.8	0.8	0.8	0.8
PENSION RELIEF FUND	4.2	4.3	4.4	4.3	4.3
WINE GRAPE	0.0	0.0	0.0	0.0	0.0
<b>TOTAL</b>	<b>33.3</b>	<b>34.2</b>	<b>34.4</b>	<b>33.6</b>	<b>33.6</b>

\*Actuals are calculated based on reported gallons sold, not actual revenue.

## Alcoholic Beverage Taxes: Wine

Compound Annual Growth Rate from 2010-2020 to trend wine consumption.

<u>WINE</u>	<u>Actual*</u> <u>FY 2019</u>	<u>Actual*</u> <u>FY 2020</u>	<u>Forecast</u> <u>FY 2021</u>	<u>Forecast</u> <u>FY 2022</u>	<u>Forecast</u> <u>FY 2023</u>
GENERAL FUND	2.5	2.6	2.7	2.8	2.8
PWCF	0.0	0.0	0.0	0.0	0.0
STATE CONSTRUCTION FUND	2.0	2.1	2.1	2.2	2.3
ENFORCEMENT & ADMIN	0.5	0.5	0.5	0.6	0.6
ADDICTION SERVICES	0.2	0.3	0.3	0.3	0.3
PENSION RELIEF FUND	0.0	0.0	0.0	0.0	0.0
WINE GRAPE	0.6	0.7	0.7	0.7	0.7
TOTAL	5.8	6.1	6.3	6.5	6.7

\*Actuals are calculated based on reported gallons sold, not actual revenue.

## Riverboat and Racino Wagering

The committee uses an equation to estimate the total adjusted gross wagering receipts of the state's eleven riverboat casinos and two racinos. Adjusted gross wagering receipts serve as the tax base for both wagering taxes. These estimates are then adjusted to compute the estimated fiscal year riverboat wagering tax collections and racino slot machine wagering tax collections. The equation estimates the quarterly total adjusted gross wagering receipts with nominal Indiana personal income, a set of dummy variables for market and seasonal changes, and an interaction variable that accounts for other economic and market circumstances.

The baseline adjusted gross wagering receipts forecast is then adjusted to account for: (1) potential competitive impacts from new casino operations in neighboring states, (2) changes in Indiana laws, (3) court decisions impacting taxation of gaming revenues, and (4) the competitive effects of a new casino in South Bend Indiana.

$$\text{Total Adjusted Gross Wagering Receipts} = \beta_0 + (\beta_1 * \text{Indiana Personal Income}) + (\beta_2 * \text{CY Q4 Dummy}) + (\beta_3 * \text{Four Winds Dummy}) + (\beta_4 * \text{Racinos Dummy}) + (\beta_5 * \text{Ohio Competition AGR}) + (\beta_6 * \text{Indiana Personal Income} * \text{Four Winds Dummy})$$

### Coefficient Statistics:

Coefficient	Estimated Coefficient
$\beta_0$	-43,066,907
$\beta_1$	3,327***
$\beta_2$	-31,500,837***
$\beta_3$	645,149,368***
$\beta_4$	59,924,054***
$\beta_5$	-0.55***
$\beta_6$	-3,152***

### Model Statistics:

Adjusted R <sup>2</sup>	0.943
F -Statistic	191.484***
Sample Size (n)	70

*Significance: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01*

## Riverboat and Racino Wagering

<b>Riverboat Wagering Historical Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	317.60	-3.8%
2018	317.32	-0.1%
2019	311.60	-1.8%
2020	200.28	-35.7%

<b>Riverboat Wagering Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	269.70	34.7%
2022	286.03	6.1%
2023	293.17	2.5%

<b>Racino Wagering Historical Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	114.03	2.8%
2018	114.84	0.7%
2019	119.38	3.9%
2020	90.42	-24.3%

<b>Racino Wagering Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2021	104.20	15.2%
2022	117.84	13.1%
2023	118.39	0.5%

## Section IV: Technical Explanations

### General Note on the Statistical Forecast Methodology

Models from this forecast are estimated using ordinary least squares regression (“OLS”). The OLS equation estimates the relationship between the explanatory variables ( $x$ ) and the response variable ( $y$ ). The multiple regression function is described by the equation below:

$$y = \hat{\beta}_0 + \hat{\beta}_1x_1 + \dots + \hat{\beta}_nx_n$$

In this equation  $\hat{\beta}_1$  represents the relationship between the explanatory variable  $x_1$  and the response variable  $y$ , while  $\hat{\beta}_0$  equals the point at which the regression line intercepts with the  $y$  axis. The models used to estimate the state revenue forecast use this functional form. Certain models use the natural logarithmic form of the explanatory and response variables.

In order to calculate the forecast values of state revenue ( $y$  in the equation above) the committee uses forecast values of the explanatory variables ( $x$ ) from IHS Markit. Data from December 2019 was used to create the models. Forecasts were then created using December 2019 data. By substituting the forecast values of  $x$  into the equation, a future value of  $y$  can be estimated.

### Explanations of summary statistics

Standard summary statistics for each model are included with the model specifications.

The Adjusted  $R^2$  listed in the model summaries describes the total variation in the response variable ( $y$ ) explained by the explanatory variables ( $x$ ). An Adjusted  $R^2$  equal to 0.90 means that 90% of the change in the dependent variable was explained by the change in the explanatory variables.

Predicted  $R^2$  is calculated by systematically removing each observation from the data set, estimating the regression equation, and determining how well the model predicts the removed observation. It describes the total variation found in this way and determines how well the model explains new data.

The number of observations, or sample size, used to estimate the model is also listed as “ $n$ ”. Most of the forecast models are based on annual data, meaning that a model with an “ $n$ ” equal to thirty is using thirty years of data. Certain models are based on quarterly data and in this case the statistic refers to the number of quarters used to estimate the model.

The F-statistic measures the overall statistical significance of the model and allows for an assessment of the probability that the coefficients estimated by the model do not equal zero. The relationship observed in the model is likely representative of reality if the F-statistic is significant.

The Durbin Watson Statistic (DW Statistic) is a statistic that tests for first order autocorrelation in the residuals of a model. The presence of first order autocorrelation violates assumptions in regression theory thus harming model integrity.

The p-value measures the significance of the relationship between a particular explanatory variable and the response variable in the model. While the F-statistic and the associated p-value evaluate the entire model simultaneously, the p-values associated with the coefficients examine each relationship independently.