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# **December 2021 Revenue Forecast**

## **Methodology and Technical Documentation**

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## **Introduction**

This document provides an overview of the December 2021 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 are agreed to by the technical committee on a consensus basis.

### **Technical Committee:**

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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 4.87% in FY 2022, and 3.44% in FY 2023. During the same period, Indiana's real gross state product is projected to grow by 4.01% in FY 2022, and 2.21% in FY 2023. Additionally, Indiana nominal wages and salaries is projected to grow by 8.81% in FY 2022, and 6.40% in FY 2023.

FY 2022 and FY 2023 are projected to see the continued recovery of the economy from the economic shock experienced in the first half of CY 2020 following the onset of the COVID-19 pandemic. In particular, FY 2022 is on track to build on the momentum seen in the second half of FY 2021 with high growth rates across all tax categories and economic metrics. FY 2023 is projected to be driven by wage growth, but more challenges will arise related to continued growth in employment, financial markets and spending on goods. With income tax deadlines being pushed from FY 2020 to FY 2021 due to the alignment of Indiana's tax filing and payment due dates with the federal deferral to July 15, 2020, tax collection trends from FY 2021 to FY 2022 are to be analyzed after adjusting for this timing factor.

Related to the combined developments associated with the pandemic, federal policy actions and underlying economic momentum, the most important economic metrics driving this forecast include the growth in Indiana wages and personal income, household savings and debt obligations, personal consumption expenditures on goods, financial markets and gross state product.

Following the December 2020 Forecast and April 2021 Forecast which were both subdued and weighed down by disruptions related to the pandemic, the combination of additional federal policy actions, phasing out of shelter in place restrictions and vaccine rollout, remote sales compliance (i.e sales tax related compliance following Wayfair ruling and marketplace facilitator), better than expected performance in goods production and goods related industries, strong financial markets and rapidly recovering employment and wage growth has led to the rapid recovery of tax collections in FY 2021 and the improved outlook heading into FY 2022 and FY 2023.

Below are some of main assumptions in the December 2021 economic forecast from IHS Markit:

### **GDP accelerates in the fourth quarter, pulling growth from 2022; Omicron a wild card**

- Our forecast of real GDP growth for 2021 is revised up from 5.5% to 5.7%; the forecast for 2022 remains 4.3%.
- The upward revision for 2021 arose from unexpected surges in October of exports and inventory investment that, even assuming partial reversals in November, encouraged us to revise up our projection of Q4 growth from 4.4% last month to 7.1% this month.
- We revised up our forecast of CPI inflation for 2021 from 4.5% to 4.6%, and for 2022 from 3.3% to 3.7%, the result of an unexpectedly sharp jump in prices in October.
- As supply disruptions wane, and with long-run inflation expectations anchored near the Fed's 2% objective, we expect core PCE inflation to subside to moderately above 2% by 2023.
- Given persistent inflation pressures, a sharp jump in the employment ratio in November, and considering recent Fed communications, we now expect the Fed to quicken the pace of the "taper", completing it in March.

## Policy assumptions in the December forecast

- The forecast reflects all pandemic relief measures of 2020 and the \$1.9 trillion American Recovery Plan (ARP) enacted in March. The support to incomes, which averaged \$2.7 trillion (annual rate) over the first half of 2021, will drop sharply to less than \$0.5 trillion by the fourth quarter of the year, and even less in 2022.
- The forecast also includes the Infrastructure Investment and Jobs Act (IIJA) enacted by President Biden on 15 November; it does not yet include the “Build Back Better” reconciliation bill, the size, scope, and timing of which remain uncertain.
- Strong revenues limit the usual cyclical state and local fiscal contraction. States and localities receive unrestricted ARP funding in two tranches: the first in the second quarter of 2021, and the second in the second quarter of 2022.
- The Fed tapers its purchases of Treasury and mortgage-backed securities to zero by March 2022; begins raising its policy rate in September of 2022; and tolerates inflation modestly above 2% after 2023 to affirm its long-run 2% objective is an average, not a ceiling.

## The Indiana economy has largely rebounded from pandemic, but faces same hurdles as most of the nation

- Indiana is having a relatively quick rebound from the sharp downturn of spring 2020
  - Overall economic output regained pre-downturn level by early 2021
  - Manufacturing bounced back much more quickly than usual from the downturn
  - Recent surge in virus cases may alter some behavior, but not expected to be a major economic factor
- Manufacturers enjoying robust demand for products, but activity is being held back
  - Lack of semiconductors probably the single biggest limiting factor for makers of autos, other equipment
  - Labor shortages an ongoing concern; some of this predates 2020
    - Aging population, slowdown in immigration, lack of needed skills
- Job recovery has resumed after a slowdown, but lower-wage service jobs will be difficult to restore or replace.
  - State payroll employment will return to pre-pandemic peak by late 2022
  - Return to offices is underway, but pace appears to be slow
- Much travel and leisure activity is returning; sporting events leading the way
  - Business travel and convention activity is still reduced

## Section II: Economic Indicators for Indiana

### Fiscal Year Amounts

<b>Indiana Economic Indicators</b>	<b>FY 2020 Actual</b>	<b>FY 2021 Actual</b>	<b>FY 2022 Forecast</b>	<b>FY 2023 Forecast</b>
Personal Income (Millions \$)	341,808.37	367,716.66	373,027.10	388,407.30
Adjusted Personal Income (less Transfers Payments) per Household (Millions \$)	99.74	103.30	108.63	113.42
Nominal Wages and Salaries (Millions \$)	161,301.92	168,592.84	183,440.29	195,186.01
Personal Savings (Millions \$)	39,907.32	50,952.55	23,130.25	21,339.26
Existing, Single-Family Home Sales (Thousands)	111.30	126.82	125.47	120.61
Real GSP, Retail Trade (Millions 2012\$)	19,156.15	19,957.90	19,803.63	18,822.48
Gross State Product (Millions \$)	375,417.03	396,440.93	433,847.53	455,033.72

<b>US Economy</b>				
Household Financial Obligations Ratio	14.48	13.64	15.21	15.28
Retail Price on All Grades of Gasoline (cents \$)	248.78	253.08	320.01	309.01
GSP / GDP	0.0179	0.0180	0.0181	0.0179
Personal Interest Income (Billions \$)	1,637.44	1,619.36	1,654.47	1,692.45
S&P 500 Index	3,010.77	3,730.25	4,555.00	4,652.27
Wilshire 5000 Common Stock Index	30,637.77	38,911.15	47,389.20	48,401.16

### Year-Over-Year Percentage Change

<b>Indiana Economic Indicators</b>	<b>FY 2020 Actual</b>	<b>FY 2021 Actual</b>	<b>FY 2022 Forecast</b>	<b>FY 2023 Forecast</b>
Personal Income (Millions \$)	5.59%	7.58%	1.44%	4.12%
Adjusted Personal Income (less Transfers Payments less Proprietors Income) per Household (Millions \$)	1.57%	3.57%	5.16%	4.41%
Nominal Wages and Salaries (Millions \$)	1.45%	4.52%	8.81%	6.40%
Personal Savings (Millions \$)	73.20%	27.68%	-54.60%	-7.74%
Existing, Single-Family Home Sales (Thousands)	0.33%	13.94%	-1.07%	-3.87%
Real GSP, Retail Trade (Millions 2012\$)	-1.26%	4.19%	-0.77%	-4.95%
Gross State Product (Millions \$)	-0.54%	5.60%	9.44%	4.88%

<b>US Economy</b>				
Household Financial Obligations Ratio	-2.06%	-5.78%	11.48%	0.50%
Retail Price on All Grades of Gasoline (cents \$)	-9.51%	1.73%	26.45%	-3.44%
GSP / GDP	-0.89%	0.35%	0.55%	-0.82%
Personal Interest Income (Billions \$)	-0.47%	-1.10%	2.17%	2.30%
S&P 500 Index	8.03%	23.90%	22.11%	2.14%
Wilshire 5000 Common Stock Index	-0.92%	1.65%	4.87%	3.44%

## 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 fiscal year savings to capture the potential impact on current year spending from the rising levels of savings and household net worth seen over the past year related to federal policy actions and rising financial markets (4) Prior fiscal year home sales to potentially capture spending on taxable purchases that drive most of Indiana’s sales tax base changes.

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 32.155% in FY 2022 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)
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## Sales & Use Taxes: Sales Net of Gasoline Use Tax

$$\text{Log (Sales Net of GUT Tax Base)} = \beta_0 + (\beta_1 * \text{Log (Indiana Adjusted Personal Income (Less Transfer Payments) Per Household)}) + (\beta_2 * \text{U.S. Household financial obligations ratio}) + (\beta_3 * \text{Log (Prior Fiscal Year Savings)}) + (\beta_4 * \text{Log (Prior Fiscal Year Home Sales)})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	5.829***
$\beta_1$	0.893***
$\beta_2$	0.031***
$\beta_3$	0.071**
$B_4$	0.106***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.993
Predicted R <sup>2</sup>	0.989
F –Statistic	860.511***
DW Statistic	2.169
Sample Size (n)	25

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

Historical Revenue Data				
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	7,359.86	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
2021	8,925.60	13.9%	11.69	2.77

Forecast Revenue Data				
Fiscal Year	Adjusted General Fund Revenue (Millions \$)	Growth Rate	Commuter Rail Service Fund	Industrial Rail Service Fund
2022	9,842.82	10.3%	12.92	3.06
2023	9,831.94	-0.1%	12.90	3.05

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

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

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

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	19.821***
$\beta_1$	0.159***
$\beta_2$	1.321***
$\beta_3$	0.000***

**Model Statistics:**

Adjusted R2	0.711
Predicted R2	0.644
F-Statistic	19.829***
DW Statistic	1.267
Sample Size (n)	24

*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
2021	146.96	-28.7%	73.47	48.98	44.06	29.38

Forecast Revenue Data						
Fiscal Year	Adjusted General Fund Revenue (Millions \$)	Growth Rate	Local Road & Bridge	MVHA	STFF	State Highway
2022	171.12	16.4%	114.04	76.03	68.39	102.59
2023	108.39	-36.7%	108.31	72.21	43.31	173.23



## 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
$\beta_0$	0.163
$\beta_1$	0.851***
$\beta_2$	0.177***
$\beta_3$	-0.129**

**Model Statistics:**

Adjusted R <sup>2</sup>	0.999
Predicted R <sup>2</sup>	0.999
F -Statistic	9416.737***
DW Statistic	1.820
Sample Size (n)	24

*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%
2021	8,555.06	9.3%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	9,242.44	8.0%
2023	9,937.91	7.5%

## 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 personal interest income and Wilshire 5000 common stock index. These variables seek to capture income from investments, businesses 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.

$$\text{Log (Estimated Payments \& Other Non-Withholding Payment Liability)} = \beta_0 + (\beta_1 * \text{Personal Interest Income}) + (\beta_2 * \text{Wilshire 5000 common stock index})$$

### Coefficient Statistics:

Coefficient	Estimated Coefficient
$\beta_0$	238.177
$\beta_1$	21.912***
$\beta_2$	0.890***

### Model Statistics:

Adjusted R <sup>2</sup>	0.977
Predicted R <sup>2</sup>	0.968
F –Statistic	439.159***
DW Statistic	1.666
Sample Size (n)	24

*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	475.71	-57.3%
2021	2,023.87	325.4%

Forecast Data		
Fiscal Year	Adjusted Revenue	Growth
2022	1,463.49	-27.7%
2023	1,445.90	-1.2%

## 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%
2021	3,047.40	0.5%

<b>Forecast Data</b>		
Fiscal Year	Adjusted Revenue	Growth
2022	3,567.88	17.1%
2023	3,804.92	6.6%

## 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 (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 attributable to Indiana.

The model uses variables such as the Indiana gross state product, Indiana GSP/US GDP, and the S&P 500 index of common stocks.

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, corporate tax rate will be 4.90%.

$$\text{Log (Corporate Payments Liability)} = \beta_0 + (\beta_1 * \text{Log (Indiana Gross State Product)}) + (\beta_2 * (\text{Indiana GSP/US GDP})) + (\beta_3 * \text{S\&P 500 Index of Common Stocks})$$

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	-12.350*
$\beta_1$	1.224***
$\beta_2$	316.271***
$\beta_3$	0.000***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.956
Predicted R <sup>2</sup>	0.932
F -Statistic	109.846***
DW Statistic	2.372
Sample Size (n)	16

*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%
2021	994.94	127.4%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	1,091.97	9.8%
2023	991.48	-9.2%

## 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*

<b>Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	203.15	0.2%
2023	208.21	2.5%

### *Utility Services Use Tax*

<b>Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	4.88	-4.6%
2023	4.55	-6.9%

### *Financial Institutions Tax*

<b>Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	43.69	-76.0%
2023	77.49	77.4%

## Cigarette & Other Tobacco Products Tax

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

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

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	-8.007***
$\beta_1$	1.349***
$\beta_2$	-0.863***
$\beta_3$	0.864***
$\beta_4$	-0.083***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.974
F -Statistic	339.260***
Sample Size (n)	37

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

Historical Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2017	400.00	-2.3%
2018	383.44	-4.1%
2019	368.67	-3.9%
2020	373.65	1.4%
2021	368.70	-1.3%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	\$351.06	-4.8%
2023	\$340.12	-3.1%

Note: The state General Fund receives 56.24% 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. The beer and liquor 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. In the beer equation, the price and income variables are expressed in terms of natural logarithms, and in the liquor equation the income variable is expressed in terms of a natural logarithm.

### Alcoholic Beverage Taxes: Beer

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

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	3.064**
$\beta_1$	0.763***
$\beta_2$	-0.185
$\beta_3$	-0.730***
$\beta_4$	0.199**
$\beta_5$	8.642***
$\beta_6$	-2.429***
$\beta_7$	-0.088***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.976
F -Statistic	332.3***
Sample Size (n)	57

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

<b>BEER</b>	<b>Actual*</b> <b>FY 2019</b>	<b>Actual*</b> <b>FY 2020</b>	<b>Actual*</b> <b>FY 2021</b>	<b>Forecast</b> <b>FY 2022</b>	<b>Forecast</b> <b>FY 2023</b>
GENERAL FUND	4.7	4.5	4.8	4.8	4.8
PWCF	4.4	0.0	0.0	0.0	0.0
STATE CONSTRUCTION FUND	0.0	4.2	4.5	4.5	4.5
ENFORCEMENT & ADMIN	2.1	2.0	2.1	2.1	2.1
ADDICTION SERVICES	2.3	2.2	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>13.5</b>	<b>12.9</b>	<b>13.9</b>	<b>13.7</b>	<b>13.7</b>

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



## Alcoholic Beverage Taxes: Liquor

Log(Thousands of Gallons of Liquor Sold in Indiana) =  $\beta_0$  + ( $\beta_1$  \* Log (Real Indiana Personal Income)) + ( $\beta_2$  \* Real Price of Liquor)

**Coefficient Statistics:**

Coefficient	Estimated Coefficient
$\beta_0$	-6.378*
$\beta_1$	1.315***
$\beta_2$	-0.074**

**Model Statistics:**

Adjusted R <sup>2</sup>	0.979
F -Statistic	518.9***
Sample Size (n)	23

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

<b>LIQUOR</b>	<b>Actual*</b> <b>FY 2019</b>	<b>Actual*</b> <b>FY 2020</b>	<b>Actual*</b> <b>FY 2021</b>	<b>Forecast</b> <b>FY 2022</b>	<b>Forecast</b> <b>FY 2023</b>
GENERAL FUND	11.8	12.6	14.3	13.5	13.9
PWCF	13.9	0.0	0.0	0.0	0.0
STATE CONSTRUCTION FUND	0.0	14.8	16.7	15.8	16.2
ENFORCEMENT & ADMIN	1.3	1.4	1.6	1.5	1.5
ADDICTION SERVICES	0.7	0.8	0.9	0.8	0.8
PENSION RELIEF FUND	4.0	4.3	4.9	4.6	4.7
WINE GRAPE	0.0	0.0	0.0	0.0	0.0
TOTAL	31.7	33.9	38.3	36.1	37.2

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

## Alcoholic Beverage Taxes: Wine

Compound Annual Growth Rate from 2011-2021 to trend wine consumption.

<u>WINE</u>	Actual*	Actual*	Actual*	Forecast	Forecast
	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>
GENERAL FUND	2.5	2.6	2.8	3.7	3.7
PWCF	2.0	0.0	0.0	0.0	0.0
STATE CONSTRUCTION FUND	0.0	2.1	2.3	2.3	2.4
ENFORCEMENT & ADMIN	0.5	0.5	0.6	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	0.0	0.0
TOTAL	5.8	6.1	6.7	6.9	7.0

\*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
$\beta_0$	-43,552,189
$\beta_1$	3,323***
$\beta_2$	-30,499,796***
$\beta_3$	616,555,685***
$\beta_4$	58,382,082***
$\beta_5$	-0.58***
$\beta_6$	-3,019***

**Model Statistics:**

Adjusted R <sup>2</sup>	0.943
F -Statistic	189.519***
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%
2021	282.55	41.1%

<b>Riverboat Wagering Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	322.12	14.0%
2023	315.37	-2.1%

<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%
2021	126.22	39.6%

<b>Racino Wagering Forecast Data</b>		
Fiscal Year	Adjusted Revenue (Millions \$)	Growth
2022	141.54	12.1%
2023	142.06	0.4%

## 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. By substituting the forecast values of  $x$  in 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.