STATE OF INDIANA

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April 2019 Revenue Forecast

Methodology and Technical Documentation

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Introduction

This document provides an overview of the April 2019 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.

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 2.6% in FY 2018, 2.8% in FY 2019, 2.1% in FY 2020 and 2.0% in FY 2021. During the same period, Indiana's real gross state product is projected to grow by 1.7% in FY 2018, 2.7% in FY 2019, 1.7% in FY 2020 and 1.4% in FY 2021.

In particular, from FY 2018 to FY 2021, income growth will be one of the main variables to watch. As the state and national unemployment rates are at low levels and potential growth from unemployed individuals getting a job becomes more limited, wage growth will be key. As wages are highly influenced by employer decisions, business confidence and profitability will be as important.

Wages and personal income in general are important variables for the General Fund revenue forecast and the overall economic activity. Income growth does not only increase the amount of dollars available for people to spend and invest but they also impact individual income taxes directly and influence profits for businesses. While income growth will be key, consumer and business confidence in relation to factors such as inflation, interest rates, productivity, and global demand will have a major impact on the forecast.

As developments on the global economic front and policy changes at the federal level continue to influence the U.S outlook, Indiana's particular labor market and industry composition will be exposed to some of its own specific dynamics over the biennium. Notably, economic activity related to manufacturing, transportation, trade, warehousing, and construction will be followed closely.

Below are potential outcomes highlighted by IHS Markit's forecast.

Risks to national forecast mostly on the downside

- Forecast risks are weighted more to the downside (30% vs. 10%)
  - > This is already the longest "recovery" on record
  - > Global economic growth slowing, especially in developed countries
  - > Policy uncertain abounds, related to current and threatened tariffs, border closures, immigration policy, health care policy, Brexit impacts, etc.
  - > With Federal Reserve policy still accommodative and Federal budget deficit widening, not much room to respond to a downturn with added stimulus
  - > Low unemployment rates have not led to wage-led inflation, but still could
  - > Our current pessimistic scenario features a mild recession (that is NOT the baseline!)
- On the upside, possible surprises include:
  - > Higher productivity growth, perhaps spurred by investments in business equipment, would allow wages to rise without triggering consumer inflation
  - > Homebuilding could (finally) move higher in response to demand, aided by recent decline in mortgage interest rates and demand from millennials
  - > Global economic growth could be higher than expected, spurring export demand

Section II: Economic Indicators for Indiana

Fiscal Year Amounts

Indiana Economic Indicators	**FY 2017**	**FY 2018**	***FY 2019 Forecast***	***FY 2020 Forecast***	***FY 2021 Forecast***
Personal Income (millions $)	295,564.84	306,574.46	318,373.50	332,067.50	345,430.57
Adjusted Personal Income (less Transfers Payments less Proprietors Income) per	81.72	84.05	85.98	88.89	91.67
Nominal Wages and Salaries (millions $)	146,322.87	152,092.68	157,503.31	164,157.52	169,615.79
Real GSP, Retail Trade (Millions 2012$)	19,544.23	20,189.33	20,675.59	20,802.49	20,952.01
US Economy					
Household financial obligations ratio	15.61	15.41	15.43	15.70	15.76
Retail Price on All Grades of Gasoline (cents $)	234.13	264.41	274.62	285.22	270.12
Before Tax Corporate Profits (billions $)	2,068.08	2,167.86	2,319.81	2,345.10	2,415.84
Industrial Production Index, Transportation Equipment (2012 = 100)	112.93	112.85	116.09	116.21	118.75
Dividend payments to Individuals and Personal Interest Income (billions $)	2,573.29	2,693.82	2,787.82	2,893.28	3,079.82
S&P 500 Index	2,266.60	2,627.11	2,787.79	2,974.36	3,084.06
Market value of household holdings of corporate equities (billions $)	22,676.76	25,965.87	27,034.33	29,587.47	30,889.20

Year-Over-Year Percentage Change

Indiana Economic Indicators	**FY 2018**	***FY 2019 Forecast***	***FY 2020 Forecast***	***FY 2021 Forecast***
Personal Income (millions $)	3.7%	3.8%	4.3%	4.0%
Adjusted Personal Income (less Transfers Payments less Proprietors Income) per Household (millions $)	2.9%	2.3%	3.4%	3.1%
Nominal Wages and Salaries (millions $)	3.9%	3.6%	4.2%	3.3%
Real GSP, Retail Trade (Millions 2012$)	3.3%	2.4%	0.6%	0.7%
US Economy				
Household financial obligations ratio	-1.3%	0.1%	1.7%	0.4%
Retail Price on All Grades of Gasoline (cents $)	12.9%	3.9%	3.9%	-5.3%
Before Tax Corporate Profits (billions $)	4.8%	7.0%	1.1%	3.0%
Industrial Production Index, Transportation Equipment (2012 = 100)	-0.1%	2.9%	0.1%	2.2%
Dividend payments to Individuals and Personal Interest Income (billions $)	4.7%	3.5%	3.8%	6.4%
S&P 500 Index	15.9%	6.1%	6.7%	3.7%
Market value of household holdings of corporate equities (billions $)	14.5%	4.1%	9.4%	4.4%

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. Both sales net of GUT and GUT models have been adjusted, as part of the December 2018 Forecast, to better address specific dynamics that are affecting sales and use tax revenues headed into the FY20-21 biennium.

The tax base for sales tax net of GUT was calculated by subtracting the historical series of gasoline use tax revenue from 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.

The tax base for the gasoline use tax has been changed from the December 2017 Forecast and now 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 and proprietors income) per household to potentially capture a measure of income that would better reflect income to spending dynamics, (2) U.S household obligations ratio as a percent of disposable income to potentially capture the impact of credit on spending dynamics, (3) the ratio of Indiana personal consumption expenditures on goods relative to services to potentially reflect the shift in spending from goods to services impacting the taxability of purchases, (4) the U.S prior year rate on existing home mortgages to potentially reflect the impact of interest rates on spending dynamics.

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 71.428% in FY 2018 to 42.865% in FY 2021.

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

Log (Sales Net of GUT Tax Base) = β0 + (β1 * Log (Indiana Adjusted Personal Income (Less Transfer Payments Less Proprietors Income) Per Household)) + (β2 * U.S Household financial obligations ratio) + (β3 *Indiana PCE Goods / PCE Services) + (β4 *U.S Prior fiscal year rate on existing home mortgages)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	6.758***
β_1	0.977***
β_2	0.029***
β_3	0.269***
β_4	-0.028***

Model Statistics:

Adjusted R^2	0.998
Predicted R^2	0.997
F –Statistic	2078.945***
DW Statistic	2.185
Sample Size (n)	22

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

Historical Revenue Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2015	6,711.39	-3.1%
2016	6,847.68	2.0%
2017	7,158.55	4.5%
2018	7,359.83	2.8%

Forecast Revenue Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	7,559.99	2.2%
2020	7,812.00	3.3%
2021	8,073.39	3.3%

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)

Log (GUT Base) = β0 + (β1 * Log (Real GSP, Retail Trade)) + (β2 * Demand for petroleum as % of Total demand for all fuels) + (β3 * Summer Gas Price x Fuel Efficiency)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	19.168***
β_1	0.238***
β_2	1.049***
β_3	0.000***

Model Statistics:

Adjusted R^2	0.900
Predicted R^2	0.874
F –Statistic	61.040***
DW Statistic	1.673
Sample Size (n)	21

*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 Revenue (Millions $)	Growth
2015	483.46	
2016	374.92	-22.5%
2017	331.08	-11.7%
2018	302.72	-8.6%

Forecast Revenue Data

Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	304.02	-0.3%
2020	263.76	-13.2%
2021	203.77	-22.7%

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.

Total State Income Tax Forecast = Total State and Local Withholding Payments + Total State and Local Estimated Payments & Other Non-Withholding Payments Net of Refunds – Local Income Tax Payments

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.

Log (Withholdings Payment Liability) = β0 + (β1 * Log (Indiana Wage Disbursements Less Personal Contribution to Social Insurance + Residence Adjustment)) + (β2 * AR (1)) + (β3 * Log (Indiana Prior Year Births)) + (β4 * Dummy for 2 Five Fridays FY Q4)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	0.204***
β_1	0.855***
β_2	0.176***
β_3	-0.153**
β_4	0.007**

Model Statistics:

Adjusted R^2	0.999
Predicted R^2	0.998
F -Statistic	4741.923***
DW Statistic	1.883
Sample Size (n)	21

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

Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	6,071.81	3.0%
2015	6,360.13	4.7%
2016	6,590.37	3.6%
2017	6,906.29	4.8%
2018	7,497.55	8.6%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	7,763.52	3.7%
2020	8,052.14	3.2%
2021	8,307.87	3.5%

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 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.

Log (Estimated Payments & Other Non-Withholding Payment Liability) = β0 + (β1 *Log (U.S Dividend payments to Individuals + Personal Interest Income)) + (β2 * Log (U.S Market value of household holdings of corporate equities))

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	4.484***
β_1	0.485***
β_2	0.260***

Model Statistics:

Adjusted R^2	0.954
Predicted R^2	0.945
F –Statistic	209.207***
DW Statistic	1.592
Sample Size (n)	21

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

Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	762.7	-11.5%
2015	984.5	29.1%
2016	897.7	-8.8%
2017	923.5	2.9%
2018	1,004.7	8.8%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	1,037.66	4.9%
2020	1,088.65	4.5%
2021	1,137.70	3.4%

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.

Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	1,930.73	9.0%
2015	2,118.59	9.7%
2016	2,263.72	6.9%
2017	2,397.79	5.9%
2018	2,637.02	10.0%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	2,843.25	7.8%
2020	2,966.73	4.3%
2021	3,065.65	3.3%

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 5.75% in FY 2019 to 5.25% in FY 2021.

Log (Corporate Payments Liability) = β0 + (β1 * Log (Last 2 Fiscal Year Moving Average of U.S Before-tax corporate profits with IVA & capital consumption adjustment)) + (β2 * Log (Last 2 Fiscal Year Moving Average of U.S Industrial Production Index, Transportation Equipment)) + (β3 * Net U.S. international investment position, billions of dollars) + (β4 * Tax Rate Change)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	-0.581
β_1	0.522***
β_2	1.313***
β_3	0.000***
β_4	32.717***

Model Statistics:

Adjusted R^2	0.991
Predicted R^2	0.982
F -Statistic	336.573***
DW Statistic	2.043
Sample Size (n)	13

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

Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	738.80	9.3%
2015	741.97	0.4%
2016	599.81	-19.2%
2017	610.96	1.9%
2018	390.63	-36.1%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	582.63	45.9%
2020	584.63	0.3%
2021	572.08	-2.1%

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
2019	214.70	10.0%
2020	194.70	-9.3%
2021	194.23	-0.2%

Utility Services Use Tax

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	10.12	45.9%
2020	10.12	0.0%
2021	10.12	0.0%

Financial Institutions Tax

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	63.61	-5.9%
2020	61.47	-3.4%
2021	57.91	-5.8%

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
β_0	-14.693***
β_1	1.807***
β_2	-0.942***
β_3	0.939***
β_4	-0.064***

Model Statistics:

Adjusted R^2	0.987
F -Statistic	609.776***
Sample Size (n)	34

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

Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	412.57	-3.7%
2015	404.29	-2.0%
2016	409.50	1.3%
2017	400.00	-2.3%
2018	383.40	-4.2%

Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	371.30	-3.2%
2020	361.30	-2.7%
2021	347.90	-3.7%

Note: The state General Fund receives 58.7% 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 dummy variables for 1987 and after and 2012 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

Log (Thousands of Gallons of Beer Sold in Indiana) = β_0 + (β_1* Log (FY Real Indiana Personal Income)) + (β_2* Log (FY Real Indiana Personal Income for FY 1979 and After)) + (β_3 * Log(FY Real Indiana Personal Income for FY 1993 and After)) + (β_4* Dummy Variable for FY 1979 and After) + (β_5 * Dummy Variable for FY 1993 and After) + (β_6 * Dummy Variable for FY 2012 and After)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	1.442***
β_1	0.869***
β_2	-0.859***
β_3	0.221***
β_4	10.147***
β_5	-2.692***
β_6	-0.087***

Model Statistics:

Adjusted R^2	0.979
F -Statistic	415.346***
Sample Size (n)	54

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

BEER	Actual FY 2017	Actual FY 2018	Forecast FY 2019	Forecast FY 2020	Forecast FY 2021
GENERAL FUND	$4.7	$4.6	$4.8	$4.8	$4.8
PWCF	$4.4	$4.3	$4.5	$4.5	$4.5
ENFORCEMENT & ADMIN	$2.1	$2.0	$2.1	$2.1	$2.1
ADDICTION SERVICES	$2.4	$2.3	$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
TOTAL	**$13.5**	**$13.3**	**$13.7**	**$13.8**	**$13.8**

Alcoholic Beverage Taxes: Liquor

Log (Thousands of Gallons of Liquor Sold in Indiana) = β_0 + (β_1 * Log (Real Indiana Personal Income)) + (β_2 * Real Price of Liquor in Indiana) + (β_3 * Log (Real Indiana Personal Income for FY 1999 and After)) + (β_4 * Dummy Variable for FY 1999 and after)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	16.450***
β_1	-0.561***
β_2	-0.078***
β_3	1.971***
β_4	-23.956***

Model Statistics:

Adjusted R^2	0.964
F -Statistic	354.667***
Sample Size (n)	54

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

LIQUOR	Actual FY 2017	Actual FY 2018	Forecast FY 2019	Forecast FY 2020	Forecast FY 2021
GENERAL FUND	$11.4	$11.9	$12.6	$13.0	$13.3
PWCF	$13.3	$14.0	$14.8	$15.2	$15.6
ENFORCEMENT & ADMIN	$1.3	$1.3	$1.4	$1.4	$1.5
ADDICTION SERVICES	$0.7	$0.7	$0.8	$0.8	$0.8
PENSION RELIEF FUND	$3.9	$4.1	$4.3	$4.4	$4.5
WINE GRAPE	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL	**$30.6**	**$32.0**	**$33.8**	**$34.9**	**$35.8**

Alcoholic Beverage Taxes: Wine

Log (Thousands of Gallons of Wine Sold in Indiana) = β_0 + (β_1* Log (Real Indiana Personal Income)) + (β_2 * Real Price of Wine in Indiana) + (β_3 * Dummy Variable for 1987 and after) + (β_4 * Dummy Variable for 2012 and after)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	-1.158
β_1	1.023***
β_2	-0.452***
β_3	-0.275***
β_4	-0.190**

Model Statistics:

Adjusted R^2	0.894
F -Statistic	113.196***
Sample Size (n)	54

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

WINE	**Actual FY 2017**	**Actual FY 2018**	**Forecast FY 2019**	**Forecast FY 2020**	**Forecast FY 2021**
GENERAL FUND	$2.4	$2.5	$2.6	$2.6	$2.7
PWCF	$1.9	$2.0	$2.1	$2.1	$2.2
ENFORCEMENT & ADMIN	$0.5	$0.5	$0.5	$0.5	$0.5
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	$0.6	$0.6	$0.7	$0.7
TOTAL	**$5.7**	**$5.9**	**$6.0**	**$6.2**	**$6.3**

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.

Total Adjusted Gross Wagering Receipts = β_0+ (β_1* Indiana Personal Income) + (β_2* CY Q4 Dummy) + (β_3* Four Winds Dummy) + (β_4* Racinos Dummy) + (β_5* Ohio Competition AGR) + (β_6* Indiana Personal Income * Four Winds Dummy)

Coefficient Statistics:

Coefficient	Estimated Coefficient
β_0	-42,568,877
β_1	3,336***
β_2	-32,135,212***
β_3	641,635,103***
β_4	59,938,029***
β_5	-0.56***
β_6	-3,146***

Model Statistics:

Adjusted R^2	0.942
F -Statistic	176.026***
Sample Size (n)	66

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

Riverboat and Racino Wagering

Riverboat Wagering Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	363.32	-19.0%
2015	336.22	-7.5%
2016	330.04	-1.8%
2017	317.60	-3.8%
2018	317.32	-0.1%

Riverboat Wagering Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	300.90	-5.18%
2020	305.99	1.69%
2021	308.39	0.78%

Racino Wagering Historical Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2014	110.71	4.5%
2015	110.55	-0.1%
2016	110.89	0.3%
2017	114.03	2.8%
2018	114.84	0.7%

Racino Wagering Forecast Data		
Fiscal Year	Adjusted Revenue (Millions $)	Growth
2019	113.25	-1.39%
2020	111.87	-1.22%
2021	112.50	0.57%

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:

$$y = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \ldots + \hat{\beta}_n x_n$$

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 2018 was used to create the models. Forecasts were then created using April 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 a "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.