

Estimating Motor Fuel Demand in South Carolina

FY 2023-24 and FY 2024-25



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TABLE OF CONTENTS

Introduction	2
Historical Motor Fuel Consumption and Revenue	2
Figure 1. SC Motor Fuel Consumption	2
Table 1. Summary of Motor Fuel Gallons Subject to the User Fees	3
Figure 2. Total Revenue Collected from Motor Fuel User Fees.....	4
Projections for Fiscal Years 2023-24 and 2024-25	4
Table 2. Gasoline User Fee Revenue Projections and Forecast Ranges	5
Figure 3. Gasoline User Fee Revenue in South Carolina.....	5
Table 3. Diesel Fuel User Fee Revenue Projections and Forecast Ranges.....	5
Figure 4. Diesel Fuel User Fee Revenue in South Carolina.....	6
Table 4. Motor Fuel User Fee Revenue History and Estimates	7
Appendix	8
I. South Carolina Motor Fuel Tax Rates	8
Table A1. South Carolina Motor Fuel Tax Rate Schedule	8
II. South Carolina Motor Fuel Fee Distribution.....	8
Table A2. Motor Fuel User Fee Distribution as of July 1, 2022	9
III. Models and Statistics	10
Table A3. Gasoline Demand Model Statistics and Fit.....	10
Table A4. Diesel Demand Model Statistics and Fit	12
IV. Data Sources.....	13

INTRODUCTION

This report analyzes the history of South Carolina’s motor fuel consumption and revenue and uses linear regression models to project the total revenue for the next two fiscal years. The primary types of motor fuel used in South Carolina are gasoline and diesel fuel, although gasoline is consumed at a rate of over three times more than diesel in the state. For the purposes of this report, the term “gasoline” refers to both gasoline and gasohol, and the term “diesel” refers to diesel, biodiesel, and liquified petroleum gas.

HISTORICAL MOTOR FUEL CONSUMPTION AND REVENUE

Motor fuel demand in South Carolina has generally increased over time. However, in 2020, consumption significantly decreased due to the effects of the COVID-19 pandemic. Reduced travel and restrictions significantly impacted demand, particularly for gasoline in late FY 2019-20. Additional factors such as high motor fuel prices and an increasing demand for electric and hybrid motor vehicles have also affected the consumption of motor fuels, especially gasoline.

The following chart and table show the motor fuel gallons subject to the user fees in South Carolina since 2005.

Figure 1. SC Motor Fuel Consumption

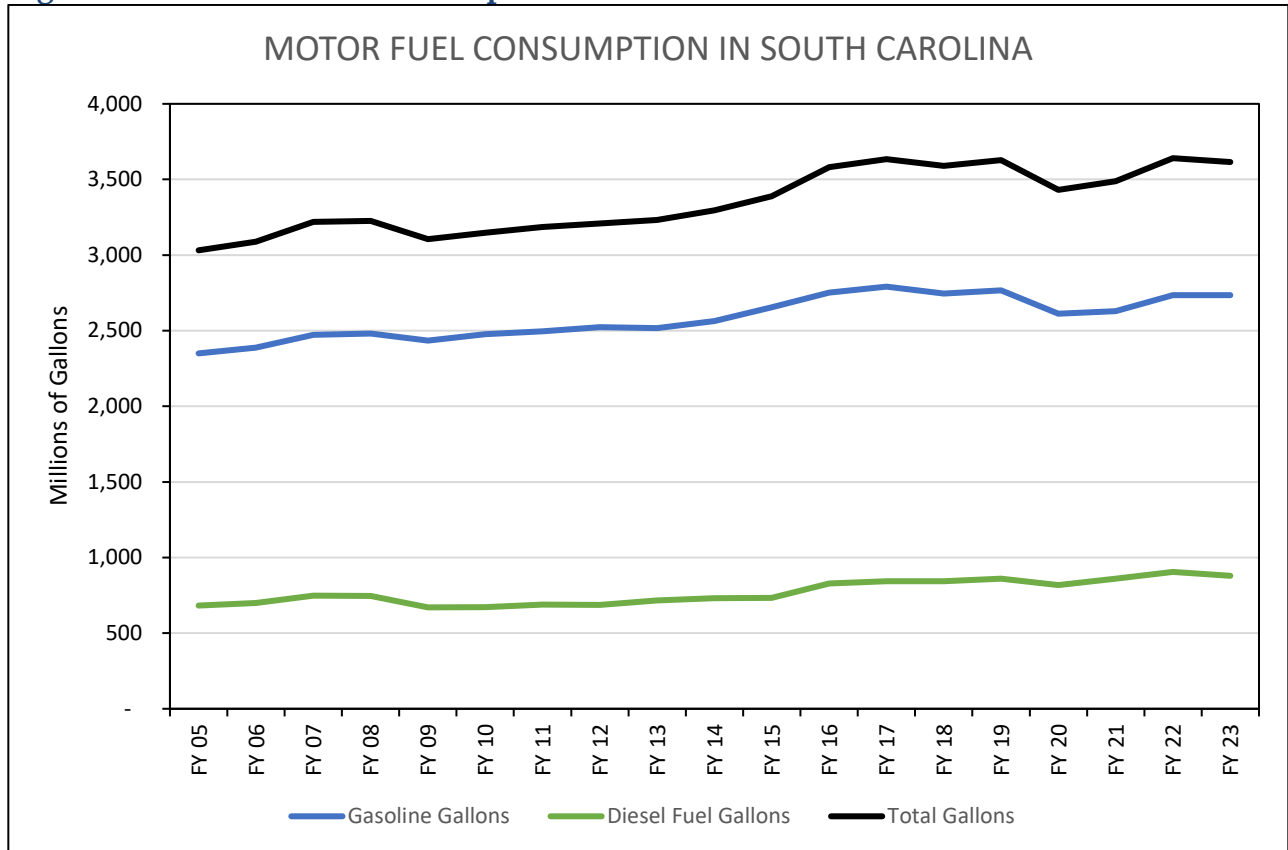


Table 1. Summary of Motor Fuel Gallons Subject to the User Fees

Fiscal Year	Gasoline (Billions of Gallons)	Diesel Fuel (Billions of Gallons)	Total Motor Fuel (Billions of Gallons)
2007-08	2.481	0.779	3.374
2008-09	2.434	0.728	3.433
2009-10	2.477	0.720	3.462
2010-11	2.497	0.739	3.353
2011-12	2.523	0.723	3.357
2012-13	2.517	0.756	3.409
2013-14	2.563	0.775	3.438
2014-15	2.655	0.790	3.535
2015-16	2.751	0.872	3.742
2016-17	2.791	0.893	3.771
2017-18	2.745	0.895	3.781
2018-19	2.767	0.902	3.787
2019-20	2.611	0.853	3.544
2020-21	2.629	0.908	3.659
2021-22	2.737	0.901	3.852
2022-23	2.735	0.880	3.615

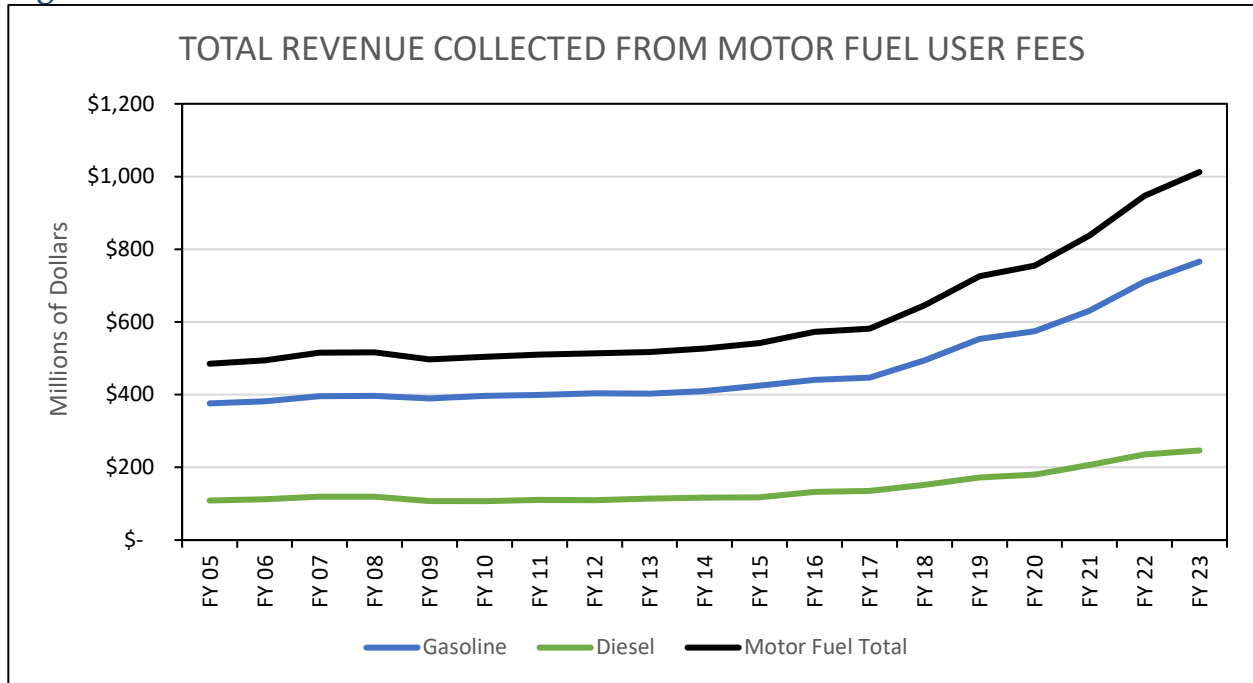
*Motor fuel gallons subject to the user fee are calculated based on total revenue.

Due to changes in the fee over time, revenue is comprised of three main components in South Carolina:

- a 16 cents-per-gallon “base” fee,
- an additional fee component that increased by 2 cents each year from FY 2017-18 through FY 2022-23, and
- a 0.75 cents-per-gallon environmental and inspection fee.

The current total fee for FY 2023-24 is 28.75 cents per gallon. Further discussion on these components, the allocations of fee revenue, and the tax rate schedule can be found in the Appendix. Figure 2 depicts the revenue collected from motor fuel user fees without the 0.75 cents component.

Figure 2. Total Revenue Collected from Motor Fuel User Fees



Note: These amounts exclude the \$0.75 environmental and inspection fees.

PROJECTIONS FOR FISCAL YEARS 2023-24 AND 2024-25

Projections for motor fuel revenue are based upon two models, one for gasoline and one for diesel fuel. Gasoline demand is predicted using the amount of the gasoline user fee, per capita personal income, and the lagged three-year moving average of average fuel economy. Diesel demand is predicted using gross domestic product (GDP), SC imports of Harmonized System Code 27 (mineral fuels, mineral oils, and products of their distillation; bituminous substances; mineral waxes), Consumer Price Index (CPI), two lag variables for diesel fuel revenue, and variables to capture the quarterly seasonality in collections. Additional details for these models are available in the Appendix.

Projecting motor fuel consumption for FY 2023-24 and FY 2024-2025 requires projections for most of the input variables for the two models. The accuracy of the forecasts of these variables affects the ability of the models to forecast motor fuel revenue. To account for the risk involved in forecasting motor fuel revenue based on forecasted input variables, we have provided forecast ranges for both gasoline and diesel consumption.

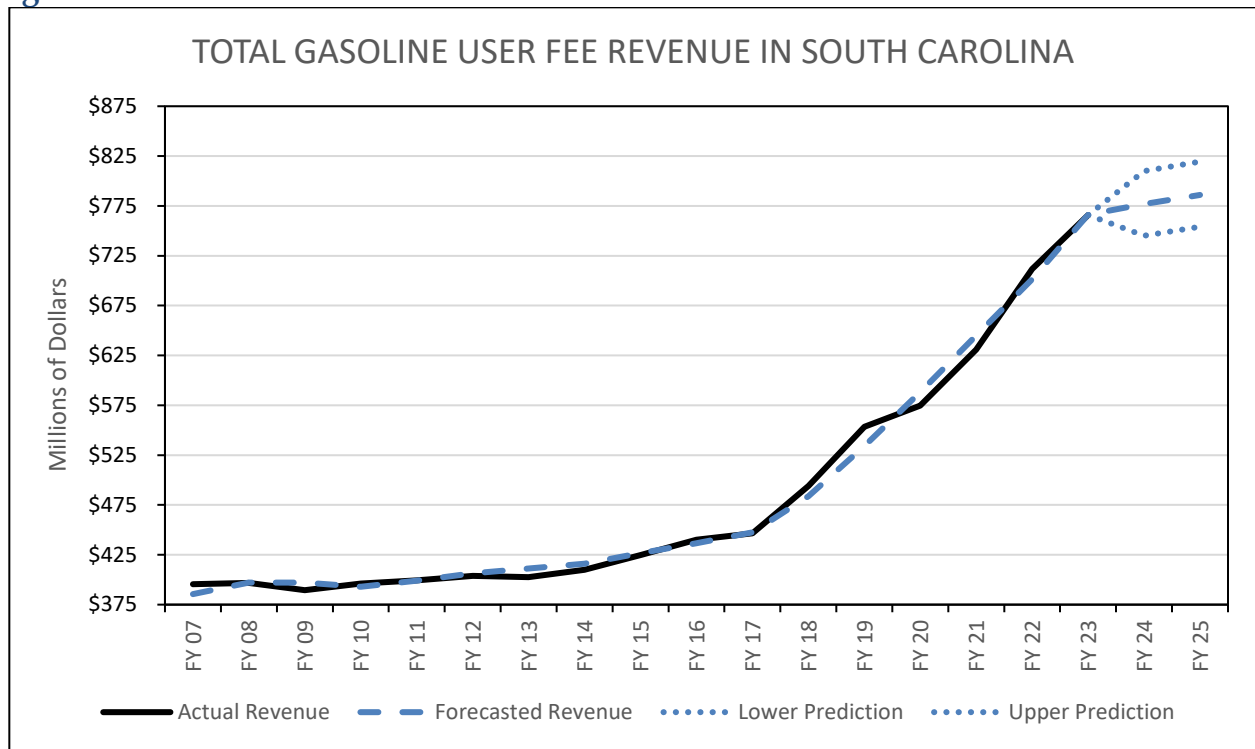
Based upon the model, we estimate motor fuel fee revenue for gasoline and its corresponding forecast range for FY 2023-24 and FY 2024-25 as follows:

Table 2. Gasoline User Fee Revenue Projections and Forecast Ranges

Fiscal Year	Gasoline User Fee Revenue Projections (Millions)	Gasoline User Fee Revenue Forecast Range* (Millions)
2022-23 (actual)	765.91	N/A
2023-24	776.81	\$745.13 – 809.83
2024-25	786.01	\$753.96 – 819.42

*(95% Prediction Intervals)

Figure 3. Gasoline User Fee Revenue in South Carolina



The following table provides our projections of the total revenue from the diesel user fee.

Table 3. Diesel Fuel User Fee Revenue Projections and Forecast Ranges

Fiscal Year	Diesel User Fee Revenue Projections (Millions)	Diesel User Fee Revenue Forecast Range* (Millions)
2022-23 (actual)	\$246.46	N/A
2023-24	\$257.93	\$232.46 - 286.20
2024-25	\$261.01	\$234.59 – 290.40

*95% Prediction Intervals

Figure 4. Diesel Fuel User Fee Revenue in South Carolina

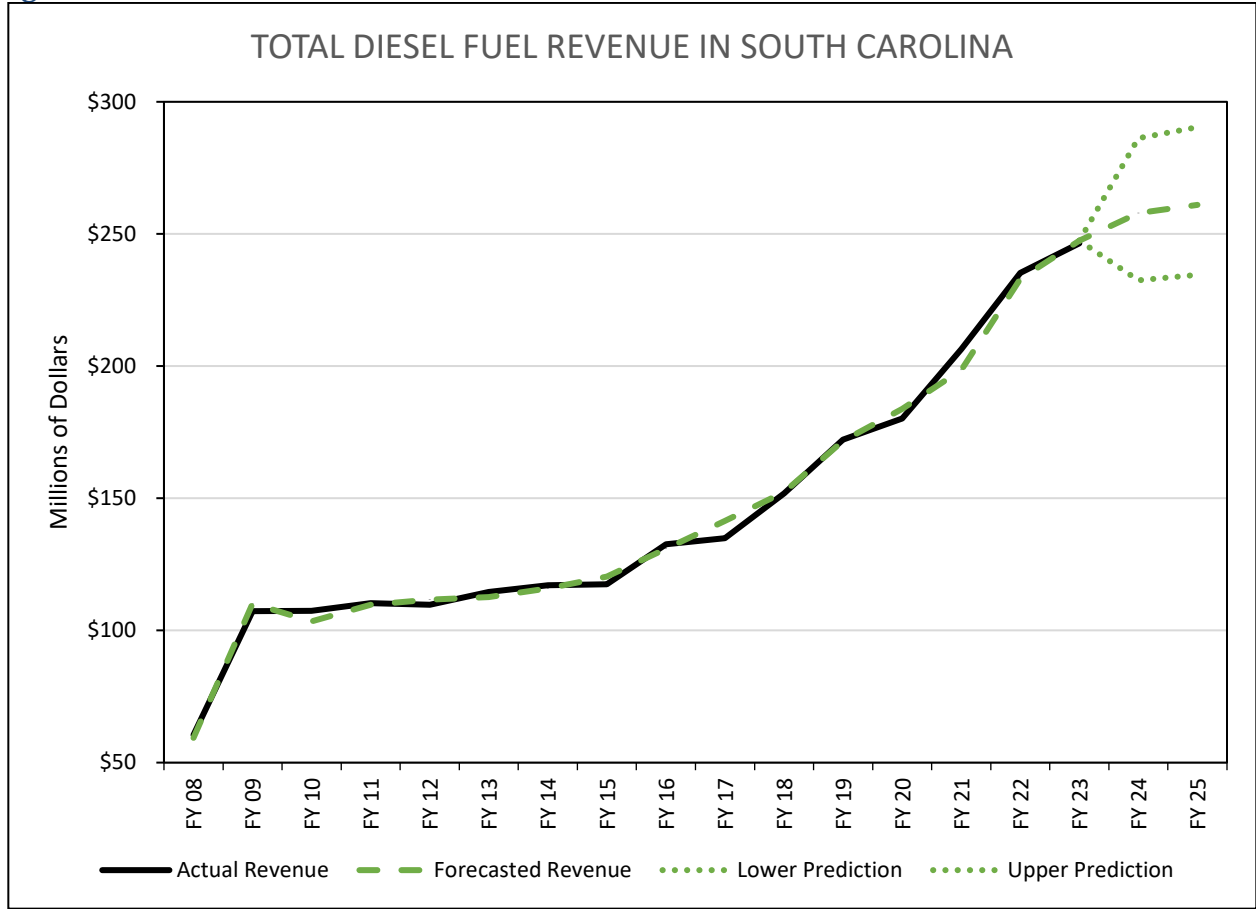


Table 4. Motor Fuel User Fee Revenue History and Estimates

Fiscal Year	Fee Per Gallon	Gasoline		Diesel Revenue		Total Motor Fuel Revenue	
		Dollars	% Change	Dollars	% Change	Dollars	% Change
2009-10	16	\$396,262,582	1.74%	\$107,442,882	0.16%	\$503,705,464	1.40%
2010-11	16	\$399,487,621	0.81%	\$110,325,004	2.68%	\$509,812,625	1.21%
2011-12	16	\$403,834,314	1.09%	\$109,744,365	(0.53%)	\$513,578,679	0.74%
2012-13	16	\$402,667,179	(0.29%)	\$114,511,278	4.34%	\$517,178,457	0.70%
2013-14	16	\$410,108,790	1.85%	\$117,137,065	2.29%	\$527,245,855	1.95%
2014-15	16	\$424,754,788	3.57%	\$117,457,502	0.27%	\$542,212,290	2.84%
2015-16	16	\$440,218,179	3.64%	\$132,645,553	12.93%	\$572,863,733	5.65%
2016-17	16	\$446,608,833	1.45%	\$134,870,908	1.68%	\$581,479,741	1.50%
2017-18	18	\$494,128,760	10.64%	\$151,935,565	12.65%	\$646,064,325	11.11%
2018-19	20	\$553,345,125	11.98%	\$172,225,934	13.35%	\$725,571,058	12.31%
2019-20	22	\$574,486,486	3.82%	\$180,172,095	4.61%	\$754,658,582	4.01%
2020-21	24	\$630,855,710	9.81%	\$206,466,083	14.59%	\$837,321,793	10.95%
2021-22	26	\$711,666,268	12.81%	\$235,278,106	13.95%	\$946,944,374	13.09%
2022-23	28	\$765,912,026	7.62%	\$246,459,165	4.75%	\$1,012,287,036	6.90%
2023-24e	28	\$776,805,113	1.42%	\$257,929,900	4.65%	\$1,023,841,926	1.14%
2024-25e	28	\$786,009,970	1.18%	\$261,005,000	1.19%	\$1,047,014,970	2.26%

e-Estimates

Note: Figures do not include the 0.75 cents per gallon environmental and inspection fees.

APPENDIX

I. SOUTH CAROLINA MOTOR FUEL TAX RATES

The following table gives an overview of how the motor fuel tax rate has changed since it was first enacted. The rate increased to 28 cents on July 1, 2022, the last year of the increases enacted in 2017.

Table A1. South Carolina Motor Fuel Tax Rate Schedule

Year	Tax	Legislative Enactment
1922	2 cents	Act 494 of 1922
1923	3 cents	Act 146 of 1923
1925	5 cents	Act 34 of 1925
1929	6 cents	Act 102 of 1929
1958	7 cents	Act 855 of 1958
1972	8 cents	Act 1575 of 1972
1977	9 cents	Act 141 of 1977
1979	10 cents	Act 197 of 1979
1980	11 cents	Act 506 of 1980
1981	13 cents	Act 177 of 1981
1987	15 cents	Act 197 of 1987
1995	16 cents	Act 136 of 1995
2017	18 cents	Act 40 of 2017
2018	20 cents	Act 40 of 2017
2019	22 cents	Act 40 of 2017
2020	24 cents	Act 40 of 2017
2021	26 cents	Act 40 of 2017
2022	28 cents	Act 40 of 2017

II. SOUTH CAROLINA MOTOR FUEL FEE DISTRIBUTION

Funds collected from the motor fuel user fee are distributed among various agencies and funds. Act 40 of 2017 set a yearly increase of the fee through FY 2022-23 and restructured the way the fee revenue is allocated. Table A2 shows a breakdown of the current distributions.

Table A2. Motor Fuel User Fee Distribution as of July 1, 2022

Gasoline Revenue Distribution	Code of Laws Section
\$18 million of the first 3¢ to the State Non-Federal Aid Highway Fund	§12-28-2910
13¢ component	-
0.13¢ (1% of 13¢) to DNR	§12-28-2730 (A)
12.87¢	-
2.66¢ to "C" Funds	§12-28-2740 (A)
10.11¢ to DOT	§12-28-2720
0.25¢ of this amount to Mass Transit	§12-28-2725
12¢ component ¹	-
1.33¢ to "C" Funds ²	§12-28-2740 (A)
10.67¢ to Infrastructure Maintenance Trust Fund ³	§12-28-310 (D)
Remaining 3¢ to the State Highway Fund	§12-28-2750

Diesel Revenue Distribution	Code of Laws Section
12¢ to Infrastructure Maintenance Trust Fund ¹	§12-28-310 (D)
Remaining 16¢ to the State Highway Fund	§12-28-2750

Total Motor Fuel User Fee³: 28¢	§12-28-310 (Act 40 of 2017)
Total Environmental and Inspection Fee: 0.75¢	§12-28-2355
0.25¢ Inspection Fee to DOT State Non-Federal Aid Highway Fund	§12-28-2355 (C) (Act 40 of 2017)
0.50¢ Environmental Impact Fee to DHEC	§12-28-2355 (B)

1 - Motor fuel user fee increased by 2¢ per year for six years beginning July 1, 2017, for a total increase of 12¢ by July 1, 2022.

2 - Pursuant to Proviso 86.1 of the FY 2022-23 Appropriations Act, the increase in "C" Funds is taken from the 2¢ increase per year of the gasoline user fee.

3 - Pursuant to Proviso 86.1 of the FY 2022-23 Appropriations Act, the Motor Fuel User Fee increase pursuant to §12-28-310 on gasoline is reduced by the increase in the allocation to "C" Funds. (See footnote 1)

III. MODELS AND STATISTICS

GASOLINE

The general equation for gasoline user fee revenue may be written as:

$$\ln R_t = f(\ln I_t, \text{lag}E_t, F_t),$$

where

R_t is the amount of per capita gasoline user fee revenue at time t ,

I_t is per capita personal income at time t ,

$\text{lag}E_t$ is the lagged three-year moving average of average fuel economy at time t ,

F_t is the motor fuel user fee at time t .

After estimating the model using annual data from calendar quarter 1 of 2008 to calendar quarter 2 of 2023, the following model was produced:

$$\ln R_t = -0.65 + 0.49 \ln I_t - 0.02 \text{lag}E + 3.09F.$$

Table A3. Gasoline Demand Model Statistics and Fit

<i>Regression Statistics</i>	
Multiple R	0.995
R Square	0.990
Adjusted R Square	0.988
Standard Error	0.019
Observations	17

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	0.490	0.163	439.367	2.595E-13
Residual	13	0.005	0.0003		
Total	16	0.494			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-0.651	1.734	-0.376	0.713	-4.398	3.095
ln(pi_pc)	-0.023	0.011	-2.089	0.057	-0.048	0.001
Lag_avg_fuel_econ	0.491	0.195	2.521	0.026	0.070	0.913
User fee	3.095	0.471	6.575	1.784E-05	2.078	4.112

DIESEL

The general equation for diesel fuel user fee revenue may be written as:

$$\ln R_t = f(\ln GDP_t, Q1_t, Q2_t, Q3_t, \ln R_{t-1}, \ln R_{t-2}, \ln M_t, \ln CPI_t),$$

where

R_t is total diesel fuel revenue at time t,

R_{t-1} is total diesel fuel revenue at time t-1,

R_{t-2} is total diesel fuel revenue at time t-2,

GDP_t is the level of gross domestic product in South Carolina at time t,

$Q1_t$ is a dummy variable for calendar quarter 1,

$Q2_t$ is a dummy variable for calendar quarter 2,

$Q3_t$ is a dummy variable for calendar quarter 3,

M_t is South Carolina imports of Harmonized System Code 27 at time t, and

CPI_t is the US Consumer Price Index at time t.

After estimating the model using quarterly data from calendar quarter 1 of 2008 to calendar quarter 2 of 2023, the following model was produced:

$$\ln R_t = -1.77 + 0.86 \ln GDP_t + 0.28 \ln R_{t-1} + 0.42 \ln R_{t-2} + 0.04 \ln M_t - 0.76 \ln CPI_t - 0.12 Q3_t - 0.04 Q1_t + 0.005 Q2_t.$$



Table A4. Diesel Demand Model Statistics and Fit

<i>Regression Statistics</i>	
Multiple R	0.9894
R Square	0.9789
Adjusted R Square	0.9757
Standard Error	0.0456
Observations	62

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	8	5.0975	0.6372	306.7221	0.0000
Residual	53	0.1101	0.0021		
Total	61	5.2076			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-1.7710	0.5125	-3.4553	0.0011	-2.7990	-0.7429
Q1	-0.0350	0.0281	-1.2455	0.2184	-0.0915	0.0214
Q2	0.0052	0.0185	0.2814	0.7795	-0.0319	0.0422
Q3	-0.1154	0.0258	-4.4727	0.0000	-0.1671	-0.0636
ln(GDP_t)	0.8599	0.1902	4.5202	0.0000	0.4783	1.2415
ln(M_t)	0.0364	0.0124	2.9265	0.0050	0.0115	0.0614
ln(CPI_t)	-0.7559	0.3093	-2.4438	0.0179	-1.3762	-0.1355
ln(D_t-1)	0.2777	0.1084	2.5626	0.0133	0.0604	0.4951
ln(D_t-2)	0.4184	0.1044	4.0077	0.0002	0.2090	0.6277

IV. DATA SOURCES

Motor Fuel User Fee Revenue: S.C. Department of Transportation

Population Estimates: U.S. Census Bureau

Personal Income: S&P Global Market Intelligence
State Analysis Data, Quarterly, South Carolina (8/24/23)

Fuel Economy:
U.S. Environmental Protection Agency (EPA)

SC GDP: U.S. Bureau of Economic Analysis
1997-2004: SAGDP2 Table
2005-2023, Quarter 1: SQGDP2 Table

Imports of HS Code 27: U.S. Census Bureau, USA Trade Online
State Imports by HS Commodities

Consumer Price Index: All Urban Consumers, U.S. Bureau of Labor Statistics

Population Forecasts: SC Revenue and Fiscal Affairs Office

Personal Income Forecasts: S&P Global Market Intelligence
S&P State Analysis Forecast Data, Quarterly Data, South Carolina (8/24/23)

Fuel Economy Forecasts:
Based on the ratio of fuel economy to Corporate Average Fuel Economy (CAFE)
Standards from the U.S. EPA, using fuel economy growth

GDP Forecasts:
2023, Quarter 2-2024, Quarter 4: Wells Fargo U.S. Economic Forecast
2025: Congressional Budget Office, "An Update to the Economic Outlook: 2020 to
2030", July 2020

Imports Forecasts: Based on a SARIMA(1,1,1)(0,0,1) model
The forecasts are based on time series estimations of a seasonal autoregressive
integrated moving average model ordered as (1,1,1) with a seasonal moving average
component.

CPI Forecasts: S&P Global Market Intelligence (8/24/23)