Motor Gasoline Consumption Module
Short-Term Energy Outlook Model

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1. Overview

The motor gasoline consumption module of the *Short-Term Energy Outlook* (*STEO*) model is designed to provide forecasts of domestic motor gasoline consumption. The frequency of the *STEO* model is monthly and the model equations are used to produce monthly forecasts over a 13-to-24 month horizon (every January the *STEO* forecast is extended through December of the following year).

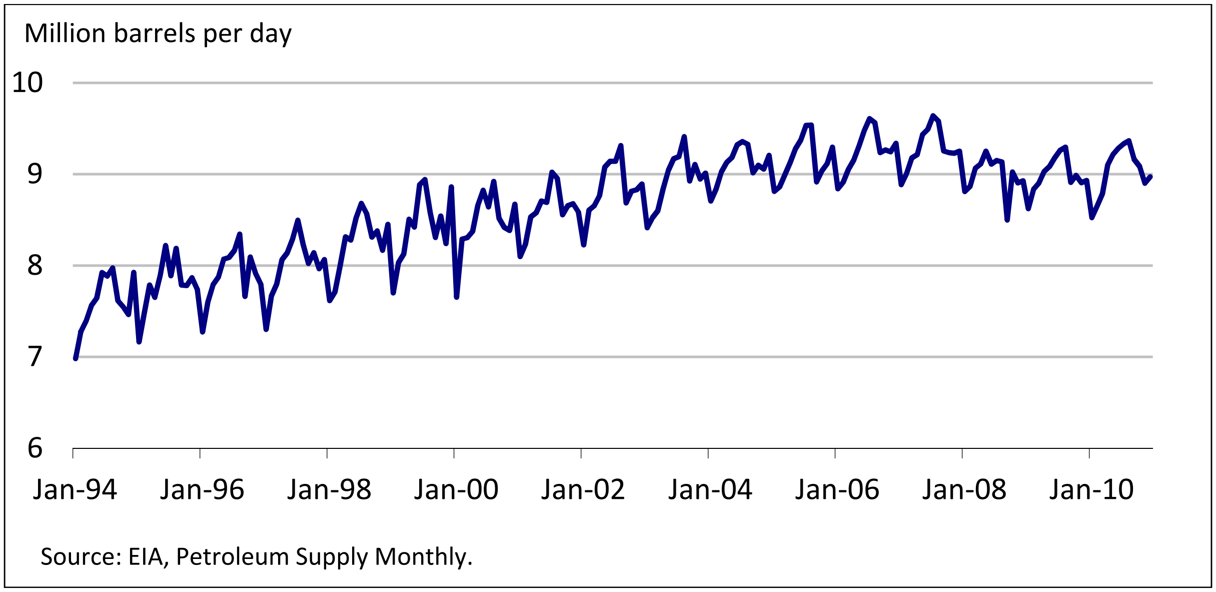
The *STEO* model contains over 2,000 equations, of which about 450 are estimated regression equations. The regression equations are estimated and the forecast models are solved using EViews Econometric Software (Quantitative Micro Software, LLC).

The motor gasoline consumption module, which is documented in this report, contains 12 equations, of which 3 are estimated regression equations. Some input variables to the motor gasoline consumption module are exogenous, coming from other modules in the *STEO* model or forecasts produced by other organizations (e.g., weather forecasts from the National Oceanic and Atmospheric Administration).

Gasoline "consumption" refers to deliveries from primary suppliers, which include refineries, blenders, pipelines, and bulk terminals.[1] Deliveries therefore differ from retail sales. Between 1999 and 2010, total motor gasoline consumption growth averaged 0.7 percent per year. Motor gasoline consumption is highly seasonal, as shown in Figure 1. Total gasoline consumption, which averaged 8.99 million barrels per day (bbl/d) during 2010, ranged from a low of 8.52 million bbl/d in January 2010 to a high of 9.36 million bbl/d in August 2010.

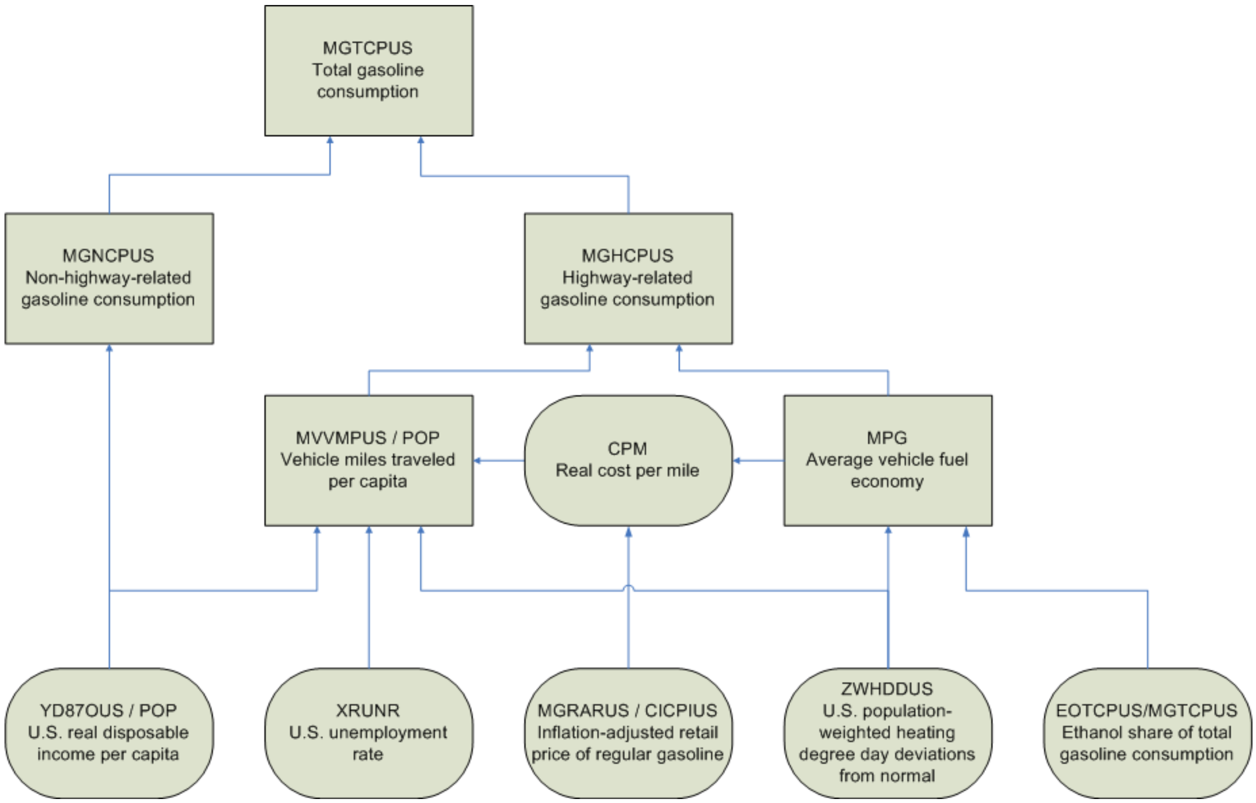
[1] In EIA terminology, deliveries are also referred to as "products supplied," "shipments," and "disappearance from supply."

Figure 1. Motor gasoline consumption, January 1994 – December 2010.



The motor gasoline consumption module derives total gasoline consumption from separate estimates of highway-related and non-highway-related gasoline consumption (Figure 2). Highway-related consumption, which accounted for 97 percent of the total in 2009, includes usage by households; public transportation systems; and commercial, institutional, and government entities. Non-highway consumption includes usage by recreational boats and agricultural and industrial (including construction) entities.

Figure 2. Flow chart of motor gasoline consumption module.



2. Data sources

The sources for monthly total motor gasoline consumption are:

- the EIA *Weekly Petroleum Status Report* for estimated monthly-from-weekly volumes for the two most recent months;
- the EIA *Petroleum Supply Monthly* for preliminary monthly data;
- the EIA *Petroleum Supply Annual* for revised final monthly data.

Separate series for highway and non-highway motor gasoline consumption are not available at a monthly frequency. Annual highway and non-highway data are published in *Highway Statistics,* Table MF24, Federal Highway Administration (FHwA), Department of Transportation. For each calendar year, monthly highway and non-highway motor gasoline consumption figures are derived by multiplying their respective annual shares by the monthly total gasoline consumption. Because of the impacts of winter weather, spring-time crop planting, fall-season harvesting, and summer recreational activity, seasonal patterns for non-highway usage are assumed to be similar to those for highway consumption. For example, the highway share of total motor gasoline consumption for 2003 was 97 percent. In August 2003 total gasoline consumption according to the *Petroleum Supply Annual* was 9.411 million bbl/d. Thus, highway demand for that month is estimated to be 9.129 million bbl/d (= 0.97 x 9.411). Non-highway demand, 0.282 million bbl/d, accounts for the remaining 3 percent of total demand.

The Federal Highway Administration reports total vehicle miles traveled in the monthly *Traffic Volume Trends* report (http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.cfm). Traffic volume trends are based on hourly traffic count data collected at approximately 4,000 continuous traffic counting locations nationwide, which are used to determine the percent change in traffic for the current month compared with the same month in the previous year. This percent change is applied to the travel for the same month of the previous year to obtain an estimate of travel for the current month. Because of the limited sample sizes and the inclusion of both gasoline- and diesel-fueled vehicles in the traffic counts, vehicle miles traveled should only be interpreted as a proxy for gasoline-fueled vehicle travel.

Average gasoline-vehicle highway fuel efficiency, in miles per gallon, is calculated as total vehicle miles traveled divided by highway gasoline consumption (Equation 1):

$$MPG \equiv (MVVMPUS / MGHCPUS) / 42 \qquad (1)$$

where,

MPG = gasoline-related highway fuel efficiency, miles per gallon;
MVVMPUS = vehicles miles traveled, million miles per day;
MGHCPUS = highway consumption of motor gasoline, million barrels per day.

Retail motor gasoline prices are published in the EIA *Weekly Petroleum Status Report*. Monthly prices are calculated as a simple average of the weekly prices.

The gasoline consumption module uses macroeconomic variables such as real personal disposable income, unemployment, and the Consumer Price Index as explanatory variables in the generation of forecasts. The macroeconomic forecasts are generated using models developed by IHS Global Insight Inc. (GI). GI updates its national macroeconomic forecasts monthly using its model of the U.S. economy. EIA re-runs the GI model to produce macroeconomic forecasts that are consistent with the *STEO* energy price forecasts.

Historical data for heating degree-days are obtained from the National Oceanic and Atmospheric Administration (NOAA).[2] NOAA also publishes forecasts of population-weighted regional heating degree-days up to 14 months out. In cases where the STEO forecast horizon goes beyond the NOAA forecast period, "normal" values are used. NOAA reports normal heating degree-days as the average of the 30-year period 1971-2000. However, the STEO model uses a corrected degree-day normal that adjusts for the warming trend that began around 1965 (*The Impact of Temperature Trends on Short-Term Energy Demand*).

3. Variable naming convention

Over 2,000 variables are used in the *STEO* model for estimation, simulation, and report writing. Most of these variables follow a similar naming convention. The following table shows an example of this convention using total motor gasoline consumption:

Characters	MG	TC	P	US
Positions	1 and 2	3 and 4	5	6 and 7
Categories	Energy or energy-related concept	Energy activity or consumption end-use sector	Type of data	Geographic area or special equation factor

In this example, MGTCPUS is the identifying code for motor gasoline (MG) total consumption (TC) in physical units (P) in the United States (US). A more detailed breakdown of naming classifications for the motor gasoline consumption module is shown below:

Energy or energy-related concepts:

MG = motor gasoline
MV = motor vehicles
ZW = weather

Energy activity or consumption end-use sectors:

[2] Heating degree-days (HDD), a measure of the relative coldness of a location, is calculated as the deviation of daily average temperature below 65 degrees; HDD = 0 if average temperature exceeds 65.

HC = highway consumption
NC = non-highway consumption
TC = total consumption
RA = regular grade gasoline
HD = heating degree days
VM = vehicle miles traveled

Type of data:
D = deviations from normal (e.g., heating degree days)
P = physical units
R = nominal retail price per standardized physical unit, including taxes

Geographic identification or special equation factor:
US = United States

Some series may be seasonally adjusted using the Census X-11 method. The seasonally adjusted series has an "_SA" appended to the end of the variable name, such as MGTCPUS_SA for seasonally-adjusted motor gasoline consumption. The seasonal factor series has an "_SF" appended to the end of the variable name, such as MGTCPUS_SF for motor gasoline consumption seasonal factors.

Regression equations with series that are not seasonally adjusted may include monthly dummy variables to capture the normal seasonality in the data series. For example, JAN equals 1 for every January in the time series and is equal to 0 in every other month.

Dummy variables for specific months may also be included in regression equations because the observed data may be outliers because of infrequent and unpredictable events such as hurricanes, survey error, or other factors. Generally, dummy variables are introduced when the absolute value of the estimated regression error is more than 2 times the standard error of the regression (the standard error of the regression is a summary measure based on the estimated variance of the residuals). No attempt was made to identify the market or survey factors that may have contributed to the identified outliers.

Dummy variables for specific months are generally designated Dyymm, where yy = the last two digits of the year and mm = the number of the month (from "01" for January to "12" for December). Thus, a monthly dummy variable for March 2002 would be D0203 (i.e., D0203 = 1 if March 2002, = 0 otherwise).

Dummy variables for specific years are designated Dyy, where yy = the last two digits of the year. Thus, a dummy variable for all months of 2002 would be D02 (i.e., D02= 1 if January through December 2002, 0 otherwise). A dummy variable might also be included in an equation to show a structural shift in the relationship between two time periods. Generally, these type of shifts are modeled using dummy variables designated DxxON, where xx = the last two digits of the years at the beginning of the latter shift period. For example, D03ON = 1 for January 2003 and all months after that date, = 0 for all months prior to 2003.

4. Motor gasoline consumption module equations

Total motor gasoline consumption is the sum of highway and non-highway consumption (Equation 2):

$$MGTCPUS \equiv MGHCPUS + MGNCPUS \tag{2}$$

Where,

MGHCPUS = highway motor gasoline consumption, million barrels per day;
MGNCPUS = non-highway motor gasoline consumption, million barrels per day;
MGTCPUS = total motor gasoline consumption, million barrels per day.

A. Highway-related motor gasoline consumption

Projections for highway motor-gasoline consumption require forecasts of both vehicle miles traveled and average vehicle fuel efficiencies. These forecasts are calculated according to the identity in equation (3), which uses forecasts generated from the regression equations (4) and (5):

$$MGHCPUS \equiv MVVMPUS / (MPG * 42) \tag{3}$$

Where,

MGHCPUS = highway motor gasoline consumption, million barrels per day;
MPG = average vehicle fuel efficiency, miles per gallon;
MVVMPUS = vehicle miles traveled, million miles per day.

1. Vehicle miles traveled

Estimates for seasonally-adjusted per-capita vehicle miles traveled are derived from regression equation (4), which is estimated using ordinary least squares:

$$
\begin{aligned}
\log(MVVMPUS\_SA/POP) = a_0 + a_1 & \log(YD87OUS/POP) \\
& + a_2 \log(CPM\_SA) \\
& + a_3 \log(XRUNR) \\
& + a_4 \log(ZWHDDUS1/ZSAJQUS
\end{aligned}
\quad (4)
$$

Where,

CPM_SA = inflation-adjusted motor gasoline cost, cents per mile, seasonally adjusted;
MVVMPUS_SA = vehicle miles traveled, million miles per day seasonally adjusted;
POP = total U.S. population, millions;
YD87OUS = real personal disposable income, billion chained 2005 dollars;
XRUNR = rate of unemployment, percent;
ZWHDDUS1 = population-weighted heating-degree day deviations from normal for December, January and February that have positive values and 0 otherwise for all months;
ZSAJQUS = number of days in each month.

Highway travel per capita is a positive function of real personal disposable income (YD87OUS) per capita. Because the equation is in logs, the estimated coefficient is an approximate measure of the short-run income elasticity of highway-related travel and real income. However, some of the travel response to income may also be captured by the negative relationship between travel and the unemployment rate (XRUNR).

Highway travel is also a negative function of the seasonally-adjusted real cost of gasoline (CPM_SA), expressed in cents per mile (equation 6). Again, because the equation is in logs, the estimated coefficient is an approximation of the short-run price elasticity of highway-related travel and price. However, the elasticity implied by this estimated coefficient may be understated because prices may affect real household income and some of the elasticity may be captured by the income coefficient.

The ZWHDDUS1/ZSAJQUS weather term captures the effects of colder-than-normal weather during the winter months, which may depress highway travel.

2. Fuel efficiency

Estimates for seasonally-adjusted motor gasoline-related fuel efficiency are derived from regression equation (5), which is estimated using ordinary least squares:

$$
\begin{aligned}
MPG\_SA = \; & b_0 + b_1 (EOTCPUS\_SA/MGTCPUS\_SA) \\
& + b_2 (ZWHDDUS1/ZSAJQUS) \\
& + b_3 \, TREND
\end{aligned} \quad (5)
$$

Where,

EOTCPUS_SA = ethanol blended into gasoline, million barrels per day, seasonally adjusted;

MPG_SA = motor gasoline-related fleet-wide fuel efficiency, miles per gallon, seasonally adjusted;

TREND = vector of integers starting at 1 for the first observation of the estimation period (January, 1998), incrementing by 1 for each subsequent observation;

ZWHDDUS1 = population-weighted heating-degree day deviations from normal for December, January and February observations which have positive values and 0 otherwise;

ZSAJQUS = number of days in each month.

The equation includes a trend variable, which captures the trend in increasing average fuel efficiency, such as related to increasing corporate average fuel economy (CAFE) standards.

Average vehicle fuel efficiency is negatively related to the ethanol volumetric share in the gasoline pool. Ethanol contains about 70 percent of the energy content of conventional gasoline. Consequently, we might expect a 0.3 percent reduction in average fuel efficiency with each 1 percent increase in the volumetric share of ethanol in the gasoline pool. The ethanol consumption forecast comes from the oxygenates module of the *STEO* model. Note that caution should be exercised in setting the estimation period of this equation because of the possible strong multicollinearity between the ethanol share and the time trend variable

The ZWHDDUS1/ZSAJQUS weather term captures the effects of colder-than-normal weather episodes.

3. Highway travel cost per mile

The inflation-adjusted cost per mile, CPM, is calculated using equation (6):

$$CPM \equiv (MGRARUS / CICPIUS) / MPG \quad (6)$$

Where,

CPM = inflation-adjusted motor gasoline cost, cents per mile;
MGRARUS = monthly average retail regular-grade motor gasoline price including taxes, cents per gallon;
CICPIUS = consumer price index for all urban consumers, 1982-1984=1.00;
MPG = motor gasoline-related highway fuel efficiency, miles per gallon.

The seasonally-adjusted cost per mile (CPM_SA) is calculated by dividing the nominal cost by the seasonal factor (CPM_SF) derived from the Census X-11 procedure (equation 7):

$$CPM\_SA = CPM / CPM\_SF \quad (7)$$

B. Non-highway-related motor gasoline consumption

Forecasts for seasonally-adjusted per-capita non-highway motor gasoline consumption are derived from regression equation (8), which is estimated using ordinary least squares

$$\begin{aligned} \log(MGNCPUS\_SA/POP) = \; & c_0 + c_1 \log(YD87OUS/POP) \\ & + c_2 MGNCPUS\_SA(-1)/POP(-1) \\ & + \text{dummy variables} \end{aligned} \quad (8)$$

Where,

MGNCPUS_SA = non-highway motor gasoline usage, million barrels per day, seasonally adjusted;
POP = total U.S. resident population, millions;

YD87OUS = inflation-adjusted real personal disposable income, billion chained 2005 dollars.

5. Forecast evaluations

In order to evaluate the reliability of the forecasts, we generated out-of-sample forecasts and calculated forecast errors. Each equation was estimated through December 2008. Dynamic forecasts were then generated for the period January 2009 through December 2010 using each regression equation. The forecasts are then compared with the actual outcomes.

Table 3 reports the differences between the annual averages of the out-of-sample dynamic forecasts and actual values for 2009 and 2010. A forecast for total gasoline consumption is derived from the forecasts of highway-related consumption (from miles traveled and average vehicle fuel efficiency) and non-highway-related consumption. The out-of-sample forecast of total gasoline consumption for 2009 was about 0.4 percent lower than actual consumption, while the forecast for 2010 was about 0.6 percent higher than actual consumption. The primary source of forecast error in 2009 was vehicle miles traveled, while the primary source of error in the 2010 forecast was average vehicle fuel efficiency.

Table 1. Actual versus out-of-sample consumption forecasts, annual averages.

	2009		2010	
Equation	**Actual**	**Forecast**	**Actual**	**Forecast**
MVVMPUS_SA	8,159	8,103	8,212	8,220
MPG_SA	22.13	22.10	22.18	22.11
MGHCPUS *	8.767	8.720	8.784	8.849
MGNCPUS	0.230	0.232	0.251	0.243
MGTCPUS *	8.997	8.958	9.034	9.092

* MGHCPUS forecast calculated based on forecasts of MVVMPUS_SA and MPG_SA.
MGTCPUS forecast calculated based on forecasts of MGHCPUS and MGNCPUS.
Source: EIA, *Short-Term Energy Outlook* model.

The differences between the monthly out-of-sample forecasts and actual values are shown in Figures 3 through 6. The forecast of highway-related gasoline consumption can be derived from the forecasts of vehicle miles traveled and average vehicle fuel efficiency and are compared with actual consumption in Figure 5.

Figure 3a. Deseasonalized vehicle miles traveled (MVVMPUS_SA) forecast versus actual, January 2009 - December 2010

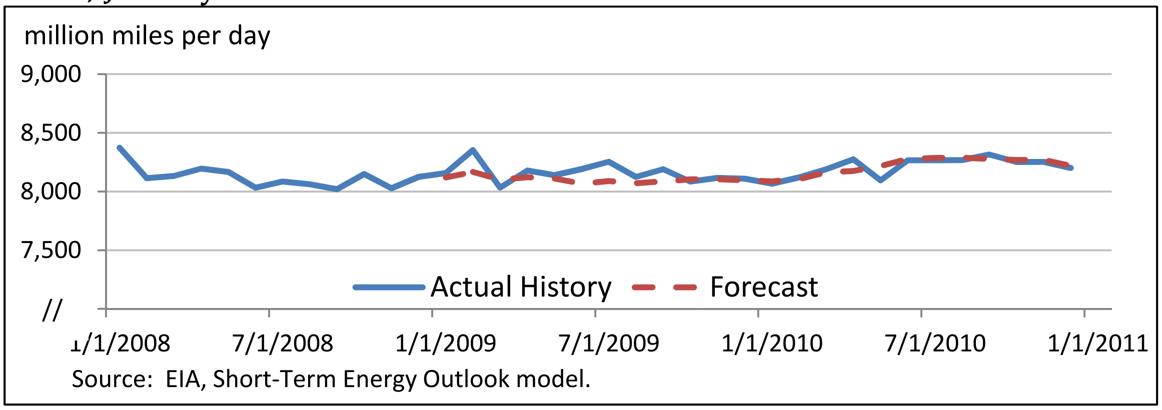


Figure 3b. Non-deseasonalized vehicle miles traveled (MVVMPUS) forecast versus actual, January 2009 - December 2010

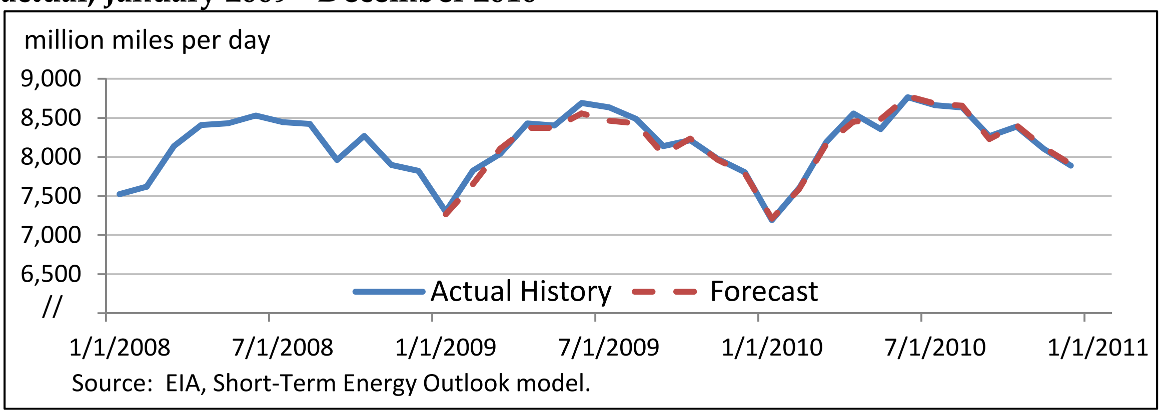


Figure 4a. Deseasonalized average vehicle fuel efficiency (MPG_SA) forecast versus actual, January 2009 - December 2010

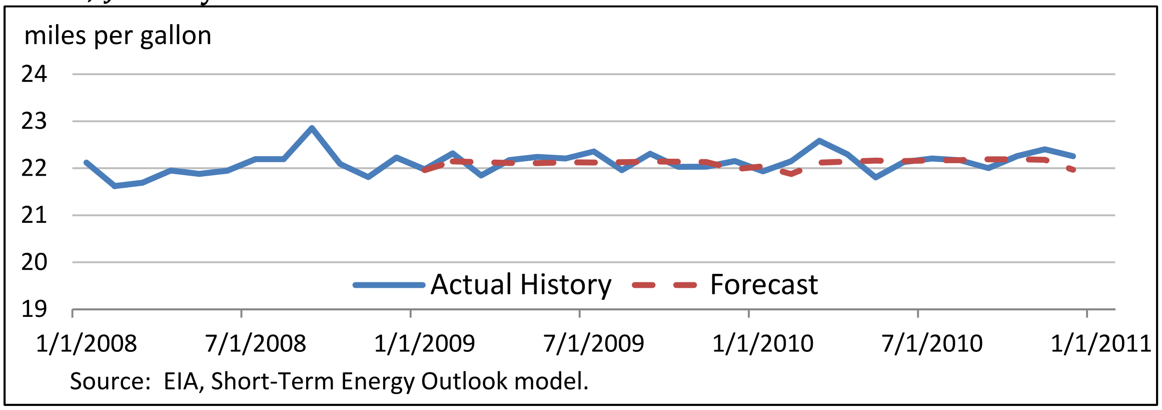


Figure 4b. Non-deseasonalized average vehicle fuel efficiency (MPG_SA) forecast versus actual, January 2009 - December 2010

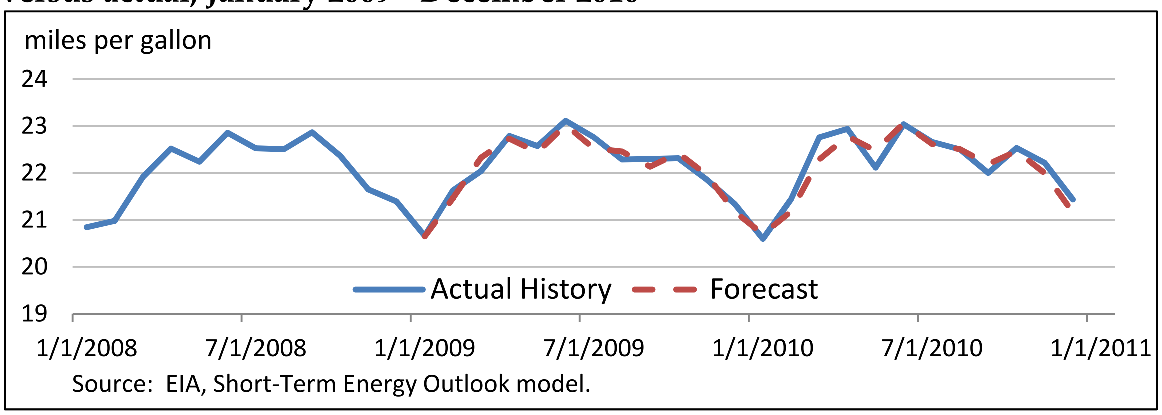


Figure 5. Non-deseasonalized highway-related motor gasoline consumption (MGHCPUS) forecast versus actual, January 2009 – December 2010.

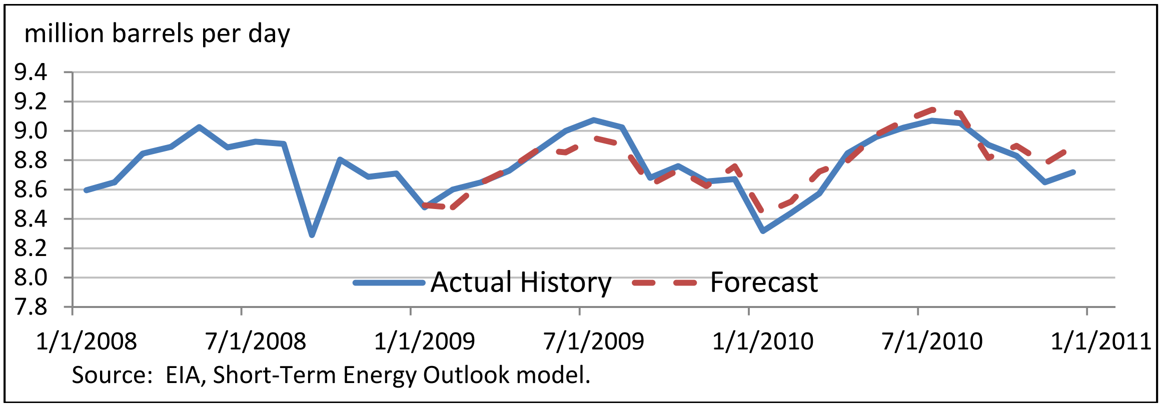


Figure 6. Non-deseasonalized non-highway motor gasoline consumption (MGNCPUS) forecast versus actual, January 2009 - December 2010.

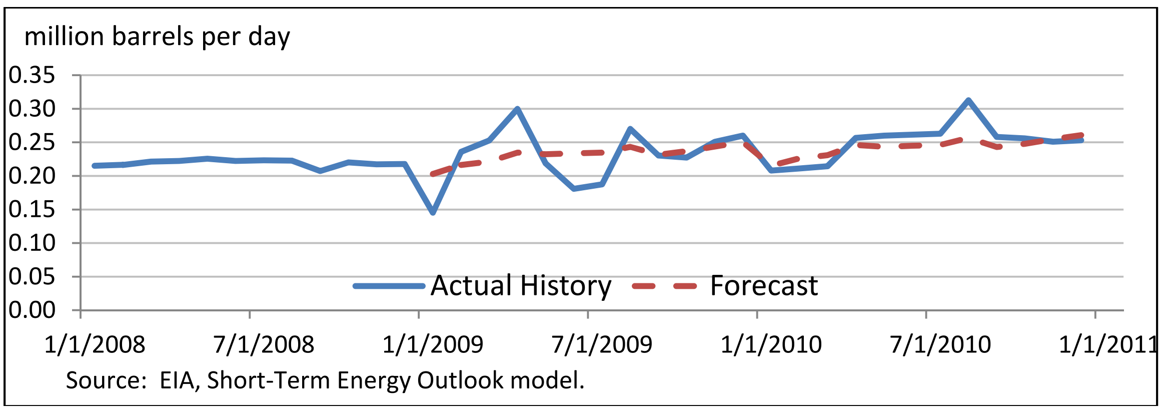


Table 5 reports summary forecast error statistics for each regression equation. The *Root Mean Squared Error* and the *Mean Absolute Error* depend on the scale of the dependent variable. These are generally used as relative measures to compare forecasts for the same series using different models; the smaller the error, the better the forecasting ability of that model.

The mean absolute percentage error (MAPE) and the Theil inequality coefficient are invariant to scale. The smaller the values the better the model fit. The Theil inequality coefficient always lies between zero and one, where zero indicates a perfect fit. The Theil inequality coefficient is broken out into bias, variance, and covariance proportions, which sum to 1. The bias proportion indicates how far the mean of the forecast is from the mean of the actual series signaling systematic error. The variance proportion indicates how far the variation of the forecast is from the variation of the actual series. This will be high if the actual data fluctuates significantly but the forecast fails to track these variations from the mean. The covariance proportion measures the remaining unsystematic forecasting errors. For a “good” forecast the bias and variance proportions should be small with most of the forecast error concentrated in the covariance proportion.

The bias proportion for each forecast series is small. The variance proportions for vehicle miles traveled and average vehicle fuel efficiency are large because the errors are calculated for deseasonalized series that have significant seasonal swings (Figures 3b and 4b).

Table 2. Regional Consumption Out-of-Sample Simulation Error Statistics

	Highway miles traveled MVVMPUS_SA	Average vehicle fuel efficiency MPG_SA	Off-highway gasoline consumption MGNCPUS_SA
Root Mean Squared Error	69.2	0.196	0.029
Mean Absolute Error	52.4	0.161	0.022
Mean Absolute Percentage Error	0.642	0.725	9.89
Theil Inequality Coefficient	0.0042	0.004	0.061
Bias Proportion	0.063	0.065	0.006
Variance Proportion	0.312	0.262	0.735
Covariance Proportion	0.625	0.673	0.258
Forecast period = January 2009 – December 2010			

Appendix A. Variable definitions

Table A1. Variable definitions, units, and sources

			Sources	
Variable Name	Units	Definition	History	Forecast
CICPIUS	Index	Consumer price index, all urban consumers (1982-1984=1.00)	GI	GI
CPM	CPG	Real cost per mile	STEO	STEO
CPM_SA	CPG	Real cost per mile, seasonally adjusted	STEO	STEO
CPM_SF	Index	Real cost per mile, seasonal adjustment factor	STEO	STEO
Dyy	Integer	= 1 if year (yy), 0 otherwise	--	--
Dyymm	Integer	= 1 if month (mm) and year (yy), 0 otherwise	--	--
DyyON	Integer	= 1 if year (yy) or later, 0 otherwise	--	--
EOTCPUS_SA	MMBD	Ethanol consumption, seasonally adjusted	PSM	STF
MGHCPUS	MMBD	Highway-related gasoline consumption	STEO	STEO
MGHCPUS_SA	MMBD	Highway-related gasoline consumption, seasonally adjusted	STEO	STEO
MGHCPUS_SF	Index	Highway-related gasoline consumption, seasonal adjustment factor	STEO	STEO
MGNCPUS	MMBD	Non-highway-related gasoline consumption	STEO	STEO
MGNCPUS_SA	MMBD	Non-highway-related gasoline consumption, seasonally adjusted	STEO	STEO
MGNCPUS_SF	Index	Non-highway-related gasoline consumption, seasonal adjustment factor	STEO	STEO
MGTCPUS	MMBD	Total motor gasoline consumption	WPSR/PSM	STEO
MGTCPUS_SA	MMBD	Total motor gasoline consumption, seasonally adjusted	STEO	STEO
MGTCPUS_SF	Index	Total motor gasoline consumption, seasonal adjustment factor	STEO	STEO
MPG	MPG	Average vehicle fuel efficiency	STEO	STEO
MPG _SA	MPG	Average vehicle fuel efficiency, seasonally adjusted	STEO	STEO
MPG _SF	Index	Average vehicle fuel efficiency, seasonal adjustment factor	STEO	STEO
MVVMPUS	MPG	Vehicle miles traveled	FHWA	STEO
MVVMPUS _SA	MPG	Vehicle miles traveled, seasonally adjusted	STEO	STEO
MVVMPUS _SF	Index	Vehicle miles traveled, seasonal adjustment factor	STEO	STEO
POP	MM	U.S. resident population	GI	GI
TREND	Integer	Time trend variable	--	--
YD87OUS		Real Disposable Personal Income	GI	GI
ZSAJQUS	Integer	Number of days in a month	--	--
ZWHDDUS1	HDD	Population-weighted heating-degree day deviations from normal for December, January and February observations which have positive values, 0 otherwise	NOAA	NOAA

Table A2. Units key

CPG	Cents per gallon
HDD	Heating degree-days
Index	Index value
Integer	Number = 0 or 1
MMBD	Million barrels per day

Table A3. Sources key

FHWA	Federal Highway Administration
GI	IHS-Global Insight macroeconomic model
NOAA	National Oceanic and Atmospheric Organization
PSM	Petroleum Supply Monthly
STEO	Short-term Energy Outlook Model
WPSR	EIA Weekly Petroleum Status Report

Appendix B. Eviews motor gasoline consumption module code

```
@IDENTITY CPM = (MGRARUS / CICPIUS) / MPG

@IDENTITY CPM_SA = CPM / CPM_SF

:EQ_MVVMPUS                                        ' regression equation

@IDENTITY MVVMPUS = MVVMPUS_SA * MVVMPUS_SF

:EQ_MPG                                            ' regression equation

@IDENTITY MPG = MPG_SA * MPG_SF

@IDENTITY MGHCPUS = MVVMPUS / (MPG * 42)

@IDENTITY MGHCPUS_SA = MGHCPUS / MGHCPUS_SF

:EQ_MGNC                                           ' regression equation

@IDENTITY MGNCPUS = MGNCPUS_SA * MGNCPUS_SF

@IDENTITY MGTCPUS = MGHCPUS + MGNCPUS

@IDENTITY MGTCPUS_SA = MGTCPUS / MGTCPUS_SF
```

Appendix C. Regression Results

C1. Seasonally-adjusted per-capita motor-gasoline-related highway travel (million miles per day)

Dependent Variable: LOG(MVVMPUS_SA/POP)
Method: Least Squares
Date: 03/18/11 Time: 16:42
Sample: 2000M01 2010M12
Included observations: 132

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.496890	0.158404	9.449816	0.0000
LOG(YD87OUS/POP)	0.542833	0.050203	10.81282	0.0000
LOG(CPM_SA)	-0.016477	0.007421	-2.220395	0.0283
LOG(XRUNR)	-0.013685	0.006421	-2.131266	0.0351
LOG(ZWHDDUS1/ZSAJQUS)*(DEC+JAN+FEB)	-0.003707	0.000760	-4.874486	0.0000
D0001+D0002	-0.027045	0.007161	-3.776637	0.0002
D0003	0.025164	0.009215	2.730851	0.0073
D0402	-0.029281	0.009024	-3.244643	0.0015
D0501	-0.027150	0.009392	-2.890817	0.0046
D0712	-0.050832	0.009605	-5.291989	0.0000
D06+D07	-0.020615	0.003635	-5.671005	0.0000
D08ON	-0.058540	0.004032	-14.51877	0.0000

R-squared	0.817493	Mean dependent var	3.296848
Adjusted R-squared	0.800763	S.D. dependent var	0.019979
S.E. of regression	0.008918	Akaike info criterion	-6.514976
Sum squared resid	0.009544	Schwarz criterion	-6.252903
Log likelihood	441.9884	Hannan-Quinn criter.	-6.408481
F-statistic	48.86450	Durbin-Watson stat	1.804822
Prob(F-statistic)	0.000000		

C2. Seasonally-Adjusted Motor Gasoline-Related Fuel Efficiency (miles per gallon)

Dependent Variable: MPG_SA
Method: Least Squares
Date: 04/15/11 Time: 08:59
Sample: 1998M01 2010M12
Included observations: 156

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.27670	0.039129	543.7605	0.0000
EOTCPUS_SA/(MGTCPUS_SA)	-5.065209	1.635948	-3.096192	0.0024
ZWHDDUS1/ZSAJQUS	-0.067481	0.020809	-3.242869	0.0015
@TREND(1997:12)	0.009087	0.001013	8.970018	0.0000
D9901	-0.630684	0.219886	-2.868236	0.0048
D9911	0.672634	0.218955	3.072022	0.0025
D9912	-0.934413	0.218840	-4.269845	0.0000
D0002	-0.912622	0.218582	-4.175200	0.0001
D0106	0.560589	0.218055	2.570860	0.0112
D0402	-0.749336	0.218278	-3.432939	0.0008
D0501	-0.571338	0.218419	-2.615788	0.0099
D0712	-0.688515	0.218230	-3.155003	0.0020
D0809	0.810672	0.219855	3.687299	0.0003

R-squared	0.733598	Mean dependent var	21.77362
Adjusted R-squared	0.711243	S.D. dependent var	0.403187
S.E. of regression	0.216657	Akaike info criterion	-0.141343
Sum squared resid	6.712484	Schwarz criterion	0.112811
Log likelihood	24.02477	Hannan-Quinn criter.	-0.038117
F-statistic	32.81522	Durbin-Watson stat	1.574358
Prob(F-statistic)	0.000000		

C3. Seasonally-Adjusted Per-Capita Non-Highway Motor Gasoline Demand (million barrels per day)

Dependent Variable: LOG(MGNCPUS_SA/POP)
Method: Least Squares
Date: 04/15/11 Time: 09:14
Sample (adjusted): 1994M02 2010M12
Included observations: 203 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.125570	0.474893	-19.21605	0.0000
LOG(YD87OUS/POP)	1.196773	0.064122	18.66410	0.0000
D99	-0.174820	0.010159	-17.20844	0.0000
D00	-0.229814	0.012936	-17.76607	0.0000
D07	-0.118528	0.008367	-14.16617	0.0000
D08	-0.263087	0.014114	-18.63969	0.0000
D09ON	-0.259931	0.014107	-18.42539	0.0000
LOG(MGNCPUS_SA(-1)/POP(-1))	0.281182	0.037180	7.562675	0.0000

R-squared	0.985598	Mean dependent var	-7.178820
Adjusted R-squared	0.985081	S.D. dependent var	0.162731
S.E. of regression	0.019876	Akaike info criterion	-4.959962
Sum squared resid	0.077038	Schwarz criterion	-4.829392
Log likelihood	511.4362	Hannan-Quinn criter.	-4.907139
F-statistic	1906.441	Durbin-Watson stat	1.365461
Prob(F-statistic)	0.000000		