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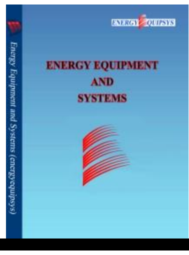

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Forecasting the gasoline consumption in Iran's transportation sector by ARIMA method

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ABSTRACT

Transportation is one of the important bases of the national economy of any country. The development of the transportation sector has been accompanied by economic growth. In developing countries, the development of the transportation sector and the increasing number of vehicles increase energy consumption in this sector. Therefore, the management and energy supply of this sector are two of the main priorities of the governments in these countries. In this research, taking into account the data related to the gross domestic product, the number of gasoline cars produced, the number of passengers within and outside the province, and the price of gasoline, a regression equation was written using the least squares method to determine the effect of these components on consumption. Gasoline should be evaluated. Furthermore, with Iran's gasoline consumption data from 1962 to 2021, we have forecast the gasoline consumption between 2022 and 2031 with the ARIMA method. The research results show that between 2021 and 2022, Iran's gasoline consumption had a downward trend; its amount was -0.45%; and it had an upward trend from 2023 to 2031; it grew by 52.09% between these years.

Keywords: Transportation, Regression, least Squares Method, Gasoline Consumption, ARIMA.

1. Introduction

Transportation has an important role in the national economy [1, 2] and is divided into three subsections, namely road, aviation and marine. The increasing number of vehicles in these three subsectors is leading to an increase in energy consumption [3]. The transportation sector consumes more than a quarter of the global energy and accounts for 23% of carbon emission [4, 5]. In recent decades, energy consumption within the transport sector in OECD and non-OECD countries has increased [6]. Energy consumption in OECD country was 39758611 TJ in 1990, and it increased to 53736955 TJ in 2019. non-OECD Europe and Eurasia consumed 7126598 TJ in 1990, and it increased to 6500984 TJ in 2019. Non-OECD Asia Oceania, for example, increased by 33.6% between 1990-2019,while non-OECD Asia (excluding China) increased by 75.7% [7] .

In recent years, we have seen that gasoline consumption in passenger car transport sector has increased in developing countries and emerging economies [8]. Transportation sector

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plays the important role in economy, moving commodities, providing service and passenger transfer is the important duty of transportation sector [2]. One of the energy consumers in the developing country is transport sector; macroeconomic aspect transportation sector is an important performer in economic growth [9]. Iran is the largest country in the Middle East and has the biggest fossil fuel resources in the world [10]. Iran has 11% of universal oil reserves and 15.3% of universal natural gas reserves [11]. Petroleum products include liquefied gas, gasoline, kerosene, diesel, fuel oil and jet fuel. In 2018, petroleum products and natural gas have provided 98% of Iran’s total energy. In 2018, the consumption of Iranian oil products was 4959 thousand barrels of crude oil. Of this amount, 510 thousand barrels of crude oil equivalent were used for gasoline consumption, 39 thousand barrels of crude oil equivalent for kerosene consumption, 542 thousand barrels of crude oil equivalent for diesel, 87 thousand barrels of crude oil equivalent for fuel oil consumption, 30 thousand barrels of crude oil equivalent for Aviation fuel consumption, 46 thousand barrels of crude oil equivalent were used for liquid gas consumption, and 3705 thousand barrels of crude oil equivalent were used for natural gas consumption [12]. In 1961, gasoline consumption in Iran was 1764 thousand liters per day, and in 2020 it will increased 75000 [13]. In Iran, 10 refineries are responsible for producing gasoline. In Table 1 shows the name of refineries that produce gasoline, and the amount of gasoline produced in these refineries [12].

Between petroleum products, gasoline and diesel are used more than other petroleum products in Iran's transportation sector: gasoline (79%), diesel (88.3%), CNG (20.8%), Aerial fuels (4.5%), Fuel oil (13.6%) [14]. Transportation accounts for nearly 25% of total energy consumption in Iran, or 309.2 million barrels of crude oil.

Main reasons of high gasoline consumption in Iran are as follows [15]:

- low gasoline price in Iran compared with other countries.
- There is no consumption management policy.
- high fuel subsidies in Iran.
- Iran's economy is heavily dependent on fuel and fears of rising prices for goods and services.
- Increasing the vehicles number
- worn and old Iranian vehicles
- New cars produced in Iran cannot meet international standards.

Table 2 shows the price of gasoline in Iran and neighboring countries. In neighboring countries and the Middle East, Iran has the lowest gasoline prices. Because, Iran pays the most subsidies to gasoline and other energy carriers, energy is cheap in Iran. According to the report of the Islamic parliament research center of Iran, Iranian government has paid 10.5 billion dollars in 2017 [16].

Table 3 shows the amount of gasoline subsidy allocated to various cars in 2017. In this report, the price of gasoline is calculated based on FOB Persian Gulf, and in that year, the price of gasoline based on FOB Persian Gulf was 42 cents.

Table 1. Name of the gasoline refineries and amount of gasoline Production in 2018[1]

Refinery Name	Amount of Production
Persian Gulf Star	21.3
Arak	14.8
Bander Abbas	11.1
Abadan	10.5
Esfahan	9.5
Teheran	6.7
Tabriz	3.3
Lavan	2
Shiraz	1.4
Kermanshah	0.6

1. million liters per day

Table 2. countries with the lowest price for gasoline in world in 2022 [17]

Country	Price ($\$/_{liter}$)
Iran	0.053
Kuwait	0.341
Turkmenistan	0.428
Iraq	0.514
Bahrain	0.531
Qatar	0.577
Azerbaijan	0.588
Saudi Arabia	0.620
Oman	0.621
Afghanistan	0.995
United Arab Emirates	1.067
Pakistan	1.072
Turkey	1.178

Table 3. The amount of gasoline subsidy allocated to different cars in 2017

car type	Subsidy (million dollars)
car	6405
pickup truck	2205
Taxi	840
motorcycle	630
Truck and lorry	420
Total	10500

In 1985, Cervero used an ARIMA model to forecasted gasoline consumption on US highways between 1977-1983. He made predictions for the three states of California, New York and Iowa using monthly gasoline consumption data. The result showed that amount of RSME for California was 0.046, New York was 0.035 and for Iowa was 0.013 [18]. Akar et al using the time series for 2005-2020, they calculated Turkey's primary energy demand. They study their own methods used “ARIMA” and “SARIMA” According to the obtained results; the ARIMA model was more accurate [19]. In 2010, Zhen Li et al used 8 time series models in their research, on of them, this model was ARIMA model. They wanted to get the most accurate result by comparing these models. According to their result, gasoline demand will increase by 20.8% from 2000 to 2020 [20]. In 2013, Akpinar et al calculated natural-gas consumption in Turkey using the ARIMA model. They used the gas consumption data between 2009-2012. The time-series data was daily, and they converted the data to monthly and then forecasted gas consumption with Arima model. They presented 7 models, which includes all months [21]. Mahia et al, 1n 2019 forecasted electricity consumption in Guangdong province in China by ARIMA model. According to their research, the best model is ARIMA(1,1,1) [22]. In 2021, Güngör et al impact of the Covid-19 outbreak on gasoline consumption in Turkey. They used daily gasoline consumption data for the 40-day periods before and after the announcement of the first case of Covid-19 in Turkey (March 10, 2020) to make forecasting. The best models for this study were SARIMA(7,7)(1,1) [23].

The escalation in the utilization of gasoline in the transportation sector of Iran poses significant challenges. The extensive utilization of fluid fuels, specifically gasoline, has resulted in predicaments such as the squandering of national resources, degradation of atmospheric condition, and the discharge of greenhouse gases [24].

Today, autoregressive integrated moving average (ARIMA) is one of the most efficient methods in the subject of time series. This method can be one of the best methods to replace traditional linear methods [25]. To implement this model, it is assumed that the considered time series is linear and follows a certain known statistical distribution such as the normal distribution. This method uses historical data of univariate time series to analyze its trend and predict the future cycle. ARIMA is one of the most popular and widely used models for time series forecasting analysis [25, 26]. The ARIMA model is a combination of autoregressive (AR) coefficients (multiplied by past values of time-series data) and moving average (MA) coefficients (multiplied by past random shocks) [19].

In response to these challenges, this paper presents a efficient approach to forecast gasoline consumption in Iran's transportation sector. While previous studies have used various methods and models for forecasting energy consumption, our focus on employing the Autoregressive Integrated Moving Average (ARIMA) model for forecasting gasoline consumption in Iran is a distinctive aspect of this research. The ARIMA model has shown its effectiveness in time series forecasting and is well-suited to the annual data available for gasoline consumption in Iran. Using this model, we aim to provide accurate and data-driven predictions that can inform policy decisions and help mitigate the adverse effects of high gasoline consumption. Moreover, this research can help the current discussion about gasoline use in Iran by explaining the particular reasons behind the high usage., including low gasoline prices, fuel subsidies, vehicle fleet composition, and international standards compliance. By addressing these factors within the context of our forecasting model, we hope to provide valuable insights into potential policy interventions that can lead to a more sustainable and economically resilient transportation sector.

In this study, we present a pioneering approach that amalgamates advanced econometric techniques, specifically the innovative application of the ARIMA (AutoRegressive Integrated Moving Average) model, with an exhaustive analysis of the multifaceted determinants influencing the conspicuous patterns of gasoline consumption within Iran's transportation sector. Our research represents a significant departure from traditional forecasting methodologies by not only introducing a robust predictive model but also delving into the intricate interplay of economic, demographic, and price-related factors that underpin the country's gasoline demand. This holistic perspective aims to offer a more comprehensive and accurate understanding of the problem at hand, transcending the limitations of conventional forecasts. Furthermore, our findings hold the potential to contribute substantively to evidence-based policymaking, facilitating the enhancement of Iran's energy landscape. By offering actionable insights and a precise forecasting tool, our work aligns with the broader global agenda to mitigate carbon emissions, fostering sustainability in the energy sector.

2. Data and methodology

Energy is consumed in different sectors, and energy consumption in each sector depends upon different factors. In the transportation sector, energy consumption is a function of fuel price, gross domestic product (GDP), number of vehicles, life of vehicles, and population, number of passengers, distance from origin to destination, etc. Regression is a common statistical approach that examines relationships between variables. Regression allows researchers to examine the specific effects variables have on one another in light of the effects of other variables [27].

In order to study the effect of each of these factors on fuel consumption, a regression equation between these factors and the amount of fuel consumed must be written. The best and most efficient regression equation between these factors and gasoline consumption is obtained using the ordinary least squares method. Unfortunately, information on the lifespan of cars and the population of Iran is not available on an annual basis. Therefore, it is impossible to write an accurate regression equation with a high statistical value. In this paper, taking into account the data related to the gross domestic product, the number of gasoline cars produced, the number of passengers within and outside the province, and the price of gasoline, a regression equation was written using the least squares method to evaluate the effect of these components on gasoline consumption. In this study, gasoline consumption was considered an independent variable, and other parameters were considered dependent variables. In Table 4, the names of independent and dependent variables are given in the Eviews software.

Table 4. Names intended for independent and dependent variables in Eviews software

Variable name	The name considered in the software
Gasoline consumption	GC
Gasoline price	GP
gross domestic product	GDP
Number of car	NC
passengers within province	Pass
passengers outside province	Passin

Table 5. value of the parameters used for regression equation [28]

year	GC	GP[1]	GDP	NC	Pass	Passin
2006	73660000	800	5476337	10768000	18945000	7107000
2007	64450000	1000	5844885	1115800	20305000	7489000
2008	66931000	1000	5840481	1262800	24382000	8593000
2009	64800000	1000	5840800	1371530	27057000	9568000
2010	6126700	1000	6175274	1812500	26024000	8962000
2012	59857000	4000	6364369	1552594	25770000	8488000
2013	63493000	4000	5873423	906700	26176000	9226000
2014	68409000	4000	5854329	729400	26330000	9120000
2015	69591000	7000	6042535	1109300	27207000	8769000
2016	71003000	10000	5946680	965800	24323000	8507000
2017	74741000	10000	6691109	1332900	21742000	7724000
2018	80714000	10000	-	150200	21552000	7776000
2019	89115000	10000	-	935500	21364000	8038000

The values of the parameters used in the regression equation are shown in Table 5. According to these values, we can write a regression equation for the effects of gasoline price, GDP, number of cars, passengers in the province, and passengers outside the province on gasoline consumption.

In this study, gasoline consumption is an independent variable, while other parameters are. The dependent variable So in our regression, gasoline consumption was selected as an independent variable and other parameters were selected as the dependent variables.

The main purpose of this research is to forecast gasoline consumption in Iran. Therefore, other equations must be used for forecasting. Regression only examines the effect of different factors on each other. In order to be able to forecast the gasoline consumption in Iran, we use the ARIMA method. The ARIMA method is one of the methods of measuring the amount of demand and is used in cases where we intend to examine a variable. For this reason, we use the ARIMA method for this research.

ARIMA model has three parameters, p is the number of autoregressive (AR),q is the number of moving average (MA) and d is the number of differences (I). The AR (p) can be expressed as:

An ARIMA (p, q) process, is a stationary process $\{Y_t\}$ which satisfies the relation:

$$y_t = \varnothing + \theta_1 y_{t-1} + \theta_2 y_{t-2} + \ldots + \theta_p y_{t-p} + \varepsilon_t \quad (1)$$

In Eq.(1) p is the lag order and t= (1, 2, …., n)

Also, the q order moving average process, MA (q), can be expressed as:

$$y_t = \varnothing + \varepsilon_t - \lambda_1 \varepsilon_{t-1} - \lambda_2 \varepsilon_{t-2} - \ldots - \lambda_q \varepsilon_{t-q} \quad (2)$$

In Eq. (2) q is the lag order of the error term $\in_t$.

ARMA is combine of the AR and MA. ARMA (p, q) can be expressed as:

$$y_t = \varnothing + \theta_1 y_{t-1} + \theta_2 y_{t-2} + \ldots + \theta_p y_{t-p}$$
$$+ \varepsilon_t - \lambda_1 \varepsilon_{t-1} - \lambda_2 \varepsilon_{t-2} - \ldots - \lambda_p \varepsilon_{t-q}$$

Usually, the real data are not stationary in nature, but in ARMA, model assumes the time-series data is stationary. First order difference process of time series y_t is defined as:

$$\Delta y_t = y_t - y_{t-1} \quad (3)$$

e.g if y_t is non-stationary series, we will take a

1. Iranian Rial (unit of Iran money)

first-dissidence of y_t, so Δy_t becomes stationary. Then, the ARIMA $(p, 1, q)$ model is:

$$\Delta y_t = \varnothing + \theta_1 \Delta y_t + \theta_2 \Delta y_{t-2} + \ldots + \theta_p \Delta y_{t-p} + \varepsilon_t - \lambda_1 \varepsilon_{t-1} - \lambda_2 \varepsilon_{t-2} - \ldots - \lambda_q \varepsilon_{t-q} \quad (4)$$

The data related to gasoline consumption from the years 1961–2021 was collected from the statistics of the National Petroleum Products Processing and Distribution Company (Table 6).

In this study, Eviews 10 is used for forecasting gasoline consumption. In the first step, we should know whether our data are "stationary" or not. We can investigate whether our data are stationary as part of the "unit root test." Figure 1 shows that the collected data aren't "stationary" because the absolute value of the dickey-fuller test's "t-statistic" is -0.124714 and this quantity is less than 1%, 5%, and 10% of the "test critical values," and the quantity of "prob" is greater than 0.005%, requiring us to differentiate from the data.

With first-order differentiation, the prob value should be reduced to 0.0001%, and the absolute value of the t-statistic of the Dickey-Fuller test becomes larger than the values of 1%, 5%, and 10% test critical values (Fig. 2).

The results of Fig. 1 show that the collected data have been stationary. For more certainty, we can also calculate the second-order differential. Figure 3 shows the second-order differential results. The results show that the prob value has become zero and the absolute value of the “t-statistic” of the Dickey-Fuller test has become larger than the 1%, 5%, and 10% test critical values.

After that, our data became "stationary," using the correlogram part, and showed an "AC" and "PAC" diagram (Fig. 4).

Table 6. The amount of gasoline consumed in Iran 1961-2021[1]

year	amount	year	amount	year	amount
1961	1761	1982	12430	2002	45806
1962	1819	1983	16284	2003	50523
1963	1918	1984	18110	2004	56272
1964	2027	1985	18110	2005	60670
1965	1956	1986	19737	2006	67000
1966	2092	1987	18518	2007	73660
1967	2333	1988	19257	2008	64450
1968	2584	1989	19488	2009	66931
1969	2926	1990	20978	2010	64800
1970	3362	1991	22688	2011	61267
1971	3861	1992	24566	2012	59857
1972	4378	1993	26885	2013	63493
1973	5458	1994	29397	2014	68409
1974	6773	1995	31274	2015	69591
1975	8530	1996	31359	2016	71003
1976	10729	1997	32940	2017	74741
1978	12658	1998	34973	2018	80714
1979	13775	1999	37701	2019	89115
1980	15585	2000	39142	2020	97000
1981	13140	2001	42535	2021	75000

1. million liters per day

Null Hypothesis: GC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.124714	0.9414
Test critical values:	1% level	-3.546099	
	5% level	-2.911730	
	10% level	-2.593551	

*MacKinnon (1996) one-sided p-values.

Fig. 1. The preliminary result of study Stationary and non-Stationary

Null Hypothesis: D(GC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.964123	0.0001
Test critical values:	1% level	-3.548208	
	5% level	-2.912631	
	10% level	-2.594027	

*MacKinnon (1996) one-sided p-values.

Fig. 2. First order differentiation results

Null Hypothesis: D(GC,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.670196	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

*MacKinnon (1996) one-sided p-values.

Fig. 3. The result of the second order differentiation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.958	0.958	57.808	0.000
		2	0.892	-0.301	108.82	0.000
		3	0.833	0.129	154.06	0.000
		4	0.780	-0.014	194.50	0.000
		5	0.732	0.013	230.78	0.000
		6	0.687	-0.011	263.32	0.000
		7	0.642	-0.028	292.26	0.000
		8	0.599	0.009	317.94	0.000
		9	0.561	0.026	340.91	0.000
		10	0.525	-0.026	361.45	0.000
		11	0.485	-0.076	379.33	0.000
		12	0.439	-0.066	394.26	0.000
		13	0.389	-0.043	406.25	0.000
		14	0.333	-0.122	415.24	0.000
		15	0.269	-0.123	421.20	0.000
		16	0.210	0.073	424.94	0.000
		17	0.157	-0.064	427.08	0.000
		18	0.110	0.010	428.14	0.000
		19	0.068	0.012	428.57	0.000
		20	0.028	-0.054	428.64	0.000
		21	-0.010	0.007	428.65	0.000
		22	-0.046	-0.043	428.86	0.000
		23	-0.080	0.010	429.50	0.000
		24	-0.110	-0.004	430.76	0.000
		25	-0.138	0.016	432.79	0.000
		26	-0.167	-0.054	435.84	0.000
		27	-0.197	-0.017	440.20	0.000
		28	-0.226	-0.023	446.11	0.000

Fig. 4. Result of AC and PAC

According to the AC and PAC diagram value of AR is (1) and value of PAC is (0).

3. Result and discuss

In this section, we will examine the regression result and the ARIMA result. First, we examine the regression result and then the ARIMA result.

The results from the regression equation in the Eviews software are shown in eqs. (5) and (6). The results show that if the GDP increases by 1%, gasoline consumption will increase by 7%, and if the price of gasoline increases by 1%, gasoline consumption will change by 3%. The value of other variables is negative, which means that these variables do not have a direct effect on gasoline consumption. If the study period increases, these parameters will have a positive effect on gasoline consumption. Equation (5) is an equation that is written in the Eviews software to obtain regression.

$$\begin{aligned} &LOG(GC) = C(1) + C(2)*LOG\\ &(GDP) + C(3)*LOG(PAS) +\\ &C(4)*LOG(PASIN) + C(5)*\\ &LOG(NC) + C(6)*LOG(GP) \end{aligned} \tag{5}$$

and Eq.(6) is the regression output.

$$\begin{aligned} &LOG(GC) = 20.9943429086 +\\ &0.0787939841179*LOG(GDP)\\ &0.111900097311*LOG(PAS) -\\ &0.105981987051*LOG(PASIN) -\\ &0.0657787874933*LOG(NC) +\\ &0.0336014290665*LOG(GP) \end{aligned} \tag{6}$$

ARIMA is a traditional statistical model. ARIMA is a linear model, and future value is cramped to be a linear function of past data. time series forecasting such as ARIMA mostly use to demand forecast [29]. An ARIMA model is labeled as an ARIMA model (p, d, q) wherein:

- p is the number of autoregressive terms;
- d is the number of differences;
- q is the number of moving averages;

Yule was first person that in 1926 presented Autoregressive (AR) then in 1937 Slutsky presented Moving Average (MA) schemes and in 1983 Wold combined AR and MA and presented ARMA. Box and Jenkins in 1976 generalize ARMA. The Box-Jenkins methodology of ARIMA models uses the minimum number of parameters, so this is an advantage to this method. Furthermore, using the ARIMA model needs good knowledge about the mathematical and statistical [30]. The forecasting results are shown in Figs. 5-11. Figure 8 shows the summary of the model for prediction. According to the results, the ARIMA (1, 0, 0) model is the best model, which includes 56 observations and 10 years of forecasting. And Akaike value is -2.03588, which is the best value among the selected models.

Figure 5 shows the forecasting amount of gasoline consumption; the red line represents gasoline consumption until 2019, and the blue line represents the forecasted amount (Fig. 6). Because the energy information for 2021 has not been published in any government report, the researchers have included it as one of the forecast years. Based on the entered information, the software has forecasted that Iran's gasoline consumption will have a downward trend in 2021. That the results from the software in 2021 will be very close to the news published by Iran's official news agencies regarding gasoline consumption. On the other hand, with the Corona virus epidemic and the imposition of traffic restrictions, gasoline consumption in Iran has also decreased.

Automatic ARIMA Forecasting
Selected dependent variable: DLOG(GC)
Date: 10/21/22 Time: 20:00
Sample: 1961 2020
Included observations: 59
Forecast length: 10

Number of estimated ARMA models: 49
Number of non-converged estimations: 0
Selected ARMA model: (1,0)(0,0)
AIC value: -2.0358811116

Fig. 5. Summary of gasoline consumption prediction results in Iran

Figure 7 shows the comparison chart for gasoline consumption forecasting. This chart shows that the software has chosen the best line based on the models it has implemented.

In Fig. 8, the output of the ARIMA equation is given, and according to the value of Prob, it can be concluded that the estimated equation is of high precision because the value of Prob is less than 5%.

To be sure of the estimated model, we also used the forecasting function of the software. The results from the forecasting function match the results from our model (Fig. 9). Figure 10 shows all the Akaike values obtained by the software.

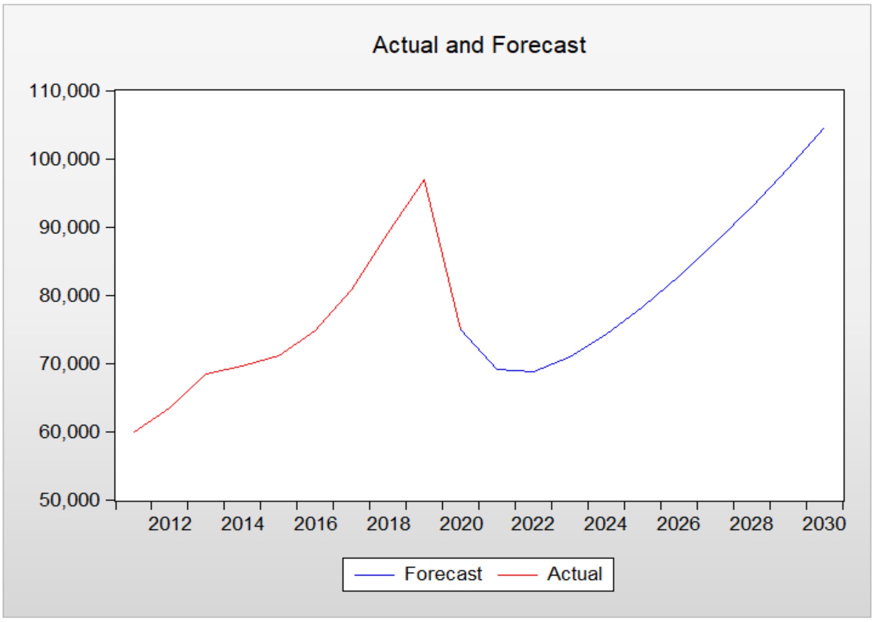

Fig. 6. Gasoline consumption prediction chart from 2021-2031

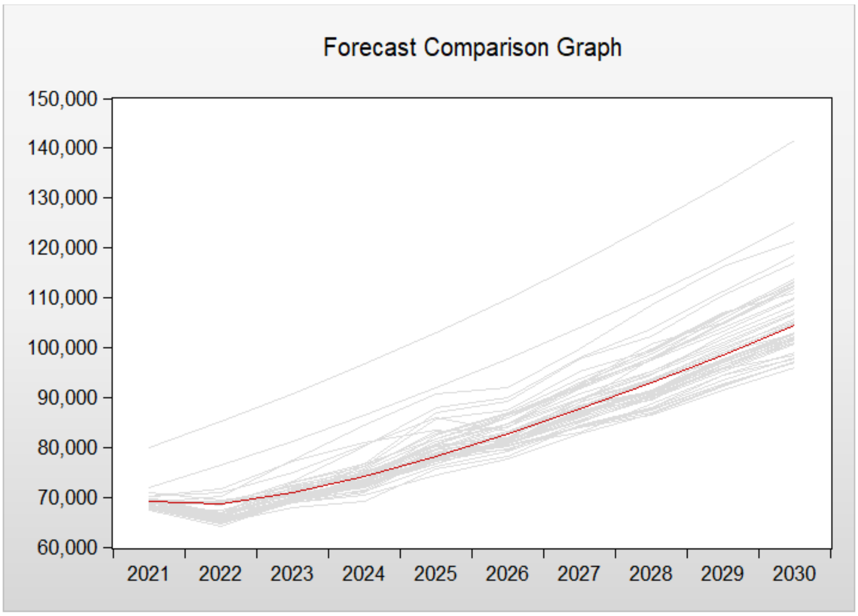

Fig. 7. Comparison of gasoline consumption forecast charts from 2021-2031

Dependent Variable: DLOG(GC)
Method: ARMA Maximum Likelihood (BFGS)
Date: 10/21/22 Time: 20:00
Sample: 1962 2020
Included observations: 59
Convergence achieved after 4 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.058826	0.023992	2.451927	0.0174
AR(1)	0.447838	0.179076	2.500832	0.0153
SIGMASQ	0.006879	0.000843	8.164354	0.0000

R-squared	0.163899	Mean dependent var	0.063558
Adjusted R-squared	0.134038	S.D. dependent var	0.091486
S.E. of regression	0.085134	Akaike info criterion	-2.035881
Sum squared resid	0.405875	Schwarz criterion	-1.930244
Log likelihood	63.05849	Hannan-Quinn criter.	-1.994645
F-statistic	5.488780	Durbin-Watson stat	1.753036
Prob(F-statistic)	0.006656		

Inverted AR Roots	.45

Fig. 8. The output of the equation estimated by the software

Model Selection Criteria Table
Dependent Variable: DLOG(GC)
Date: 10/21/22 Time: 20:00
Sample: 1961 2020
Included observations: 59

Model	LogL	AIC*	BIC	HQ
(1,0)(0,0)	63.058493	-2.035881	-1.930244	-1.994645
(0,2)(0,0)	63.954663	-2.032361	-1.891511	-1.977379
(2,0)(0,0)	63.110611	-2.003750	-1.862900	-1.948767
(1,1)(0,0)	63.087764	-2.002975	-1.862125	-1.947993
(1,2)(0,0)	64.046694	-2.001583	-1.825520	-1.932855
(0,3)(0,0)	63.980811	-1.999350	-1.823287	-1.930622
(2,1)(0,0)	63.910579	-1.996969	-1.820906	-1.928241
(3,0)(0,0)	63.853516	-1.995034	-1.818972	-1.926307
(3,2)(0,0)	65.660355	-1.988487	-1.741999	-1.892268
(0,1)(0,0)	61.592471	-1.986185	-1.880548	-1.944949
(2,2)(0,0)	64.475259	-1.982212	-1.770937	-1.899739
(3,1)(0,0)	64.427143	-1.980581	-1.769306	-1.898108
(1,3)(0,0)	64.373764	-1.978772	-1.767497	-1.896298
(4,0)(0,0)	64.330423	-1.977302	-1.766027	-1.894829
(0,4)(0,0)	64.103000	-1.969593	-1.758318	-1.887120
(1,4)(0,0)	64.696389	-1.955810	-1.709322	-1.859591
(2,3)(0,0)	64.477695	-1.948396	-1.701909	-1.852178
(4,1)(0,0)	64.460271	-1.947806	-1.701318	-1.851587
(5,3)(0,0)	67.401763	-1.945822	-1.593697	-1.808367
(1,5)(0,0)	65.360940	-1.944439	-1.662739	-1.834474
(5,0)(0,0)	64.347871	-1.943996	-1.697508	-1.847777
(0,6)(0,0)	65.334094	-1.943529	-1.661829	-1.833564
(0,5)(0,0)	64.237550	-1.940256	-1.693768	-1.844037
(4,3)(0,0)	65.840983	-1.926813	-1.609900	-1.803103
(6,0)(0,0)	64.550379	-1.916962	-1.635262	-1.806998
(4,2)(0,0)	64.513408	-1.915709	-1.634009	-1.805744
(2,4)(0,0)	64.512854	-1.915690	-1.633990	-1.805726
(3,5)(0,0)	66.502391	-1.915335	-1.563210	-1.777880
(3,3)(0,0)	64.491755	-1.914975	-1.633275	-1.805010
(6,2)(0,0)	66.486913	-1.914811	-1.562686	-1.777355
(5,1)(0,0)	64.464004	-1.914034	-1.632334	-1.804070
(4,4)(0,0)	65.902742	-1.895008	-1.542883	-1.757553
(2,5)(0,0)	64.896556	-1.894799	-1.577886	-1.771089
(0,0)(0,0)	57.889738	-1.894567	-1.824142	-1.867076
(6,3)(0,0)	66.650834	-1.886469	-1.499131	-1.735268
(6,1)(0,0)	64.611612	-1.885139	-1.568227	-1.761430
(5,2)(0,0)	64.514017	-1.881831	-1.564919	-1.758121
(3,4)(0,0)	64.491871	-1.881080	-1.564168	-1.757371
(2,6)(0,0)	65.490614	-1.881038	-1.528913	-1.743582
(3,6)(0,0)	66.413574	-1.878426	-1.491089	-1.727225
(1,6)(0,0)	64.379499	-1.877271	-1.560359	-1.753561
(5,4)(0,0)	65.955378	-1.862894	-1.475557	-1.711693
(4,5)(0,0)	65.833669	-1.858768	-1.471431	-1.707568
(5,5)(0,0)	66.576716	-1.850058	-1.427508	-1.685112
(4,6)(0,0)	66.451444	-1.845812	-1.423262	-1.680865
(6,4)(0,0)	66.276534	-1.839883	-1.417333	-1.674936
(6,5)(0,0)	67.224451	-1.838117	-1.380355	-1.659425
(5,6)(0,0)	67.010122	-1.830852	-1.373089	-1.652160
(6,6)(0,0)	67.337856	-1.808063	-1.315088	-1.615625

Fig. 9. The number of models analyzed by the software

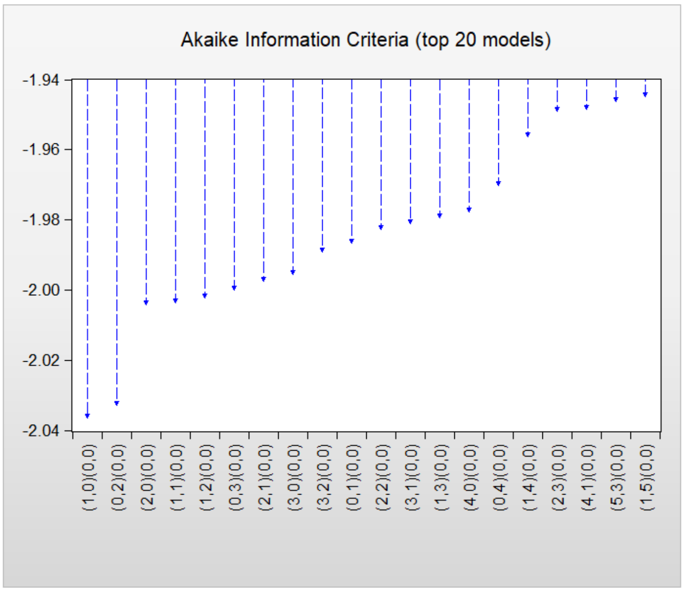

Fig.10. shows all the Akaike values obtained by the software

Table 7. The results of forecasted values

year	amount
2022	69046.19
2023	68732.05
2024	70856.39
2025	74200.34
2026	78249.46
2027	82779.36
2028	87694.86
2029	92960.84
2030	98570.87
2031	104532.7

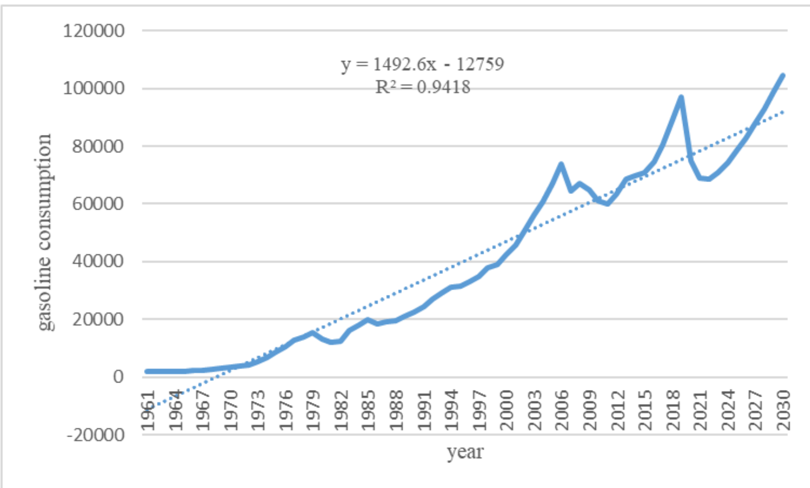

Fig. 11. Gasoline consumption chart with predicted values from 1961-2030 in Iran

Table 8. result of the validation and actual data

Year	Forecasting data	Actual Data	Gasoline Price[1]	Error
2011	62223.27	59857	4000	3.95%
2012	62677.67	63493	4000	1.28%
2013	63417.56	68409	4000	7.20%
2014	64585.13	69591	7000	7.19%
2015	65752.70	71003	10000	7.39%
2016	66920.27	74741	10000	10.46
2017	68087.85	80714	10000	15.64%
2018	69255.42	89115	10000	22.28%
2019	70422.99	97000	22500	27.39%
2020	71590.57	75000	22500	4.55%

4. Validation

In this study, we forecast gasoline consumption in Iran between 2020-2030. We want to validate our model now. We have the gasoline consumption statistics for the period 1961–2020 for validation, so again we are forecasting gasoline consumption, but now between 2010–2020. We use gasoline consumption data between 1961-2010 for forecasting until 2010–2020. We compare the newly obtained data with real data to determine the validity of the model. Table 8 shows the validation results with actual results from 2010 to 2020.

Table 7 compares validation data to real data. Gasoline prices in Iran were steady in 1394–1394; as a result, there was an increase in consumption and a high mistake rate in 1395–1395. However, the rate of increase in prices fluctuated in other years. On the other hand, inconspicuous variables that have contributed to uncertainty include the difference in value between the Iranian rial and the US dollar as well as the deterioration of the cars employed in the Iranian transportation system[31].

5. Conclusion

Transportation is one of the principal foundations of economic growth in any country. In developing countries, due to lifestyle changes and the increasing number of vehicles, energy consumption within the transportation sector will have an upward trend, so supplying energy to this sector has become one of the principal priorities of policymakers. In this research, Iran's gasoline consumption data has been collected from the years 1961–2021, and with the help of Eviews software and the ARIMA time series model, Iran's gasoline consumption has been forecasted for the years 2021–2030. The results showed that in 2020 and 2021, we will see a decrease in gasoline consumption, and from 2023–2030, gasoline consumption will have an upward trend. In 2030, Iran's average daily gasoline consumption will reach 104,532.7 liters per day. Future research will look into the impact of unobservable factors such as the disparity between the Iranian rial and the US dollar in order to obtain a more accurate and comprehensive prediction result.

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