making in the state of uncertainty. Forecasting of oil prices has always been a matter of great importance due to its influence in driving a country's economy.

Forecasting using time-series is a technique for the prediction of events through a sequence of time. The techniques predict future events by analyzing the trend of the past, on the assumption that future trend will hold similar to historical trend.

A time-series invariably gives a bivariate distribution, one of the two variables being time and the other being the value of the phenomenon at different points of time (Gupta and Kapoor, 2016).

The theoretical developments in time-series analysis started early with stochastic processes. The first actual application of autoregressive models to data can be brought back to the work of G. U. Yule and J. Walker in the 1920's and 1930's.

In this work, the growth of petrol prices has been examined for last fifteen years and shown the trend of fluctuations graphically by trend lines. The main objective of this study is to use the result of this analysis to forecast the petrol prices for next five years by analyzing the trends of the past prices, assuming that the past behaviour continues.

Materials and Methods :

Research design is a blue print of the study conducted, which includes data collection, process of data and finally interpretation of the data (Pankaj Raj, 2015). The data we have collected was regarding the prices of petroleum from Petrol Pump (Boring Road, Patna).

The research methodology of this study is divided into three parts.

(i) For the analysis of fluctuations in petroleum prices, we have used the method of moving average. The moving average of length m gives a new series of the arithmetic means of m successive values in a time-series (Gupta et.al, 1980).

(ii) The responses collected were further observed and then estimated with the help of principle of least squares method. The principle of least squares is the most popular and widely used method of fitting mathematical functions to a given set of data (Gupta & Kapoor, 2016).

(iii) The average monthly trend for all the annual periods has also been shown in our work through which we can depict the seasonal variations. Seasonal variation is defined as repetitive and predictable movement around the trend line in one year or less (Levin & Rubin, 1991).

Results and Discussion :

The monthly average petrol prices per unit litre for last fifteen years as obtained from Boring Road, Patna are tabulated in Table 1.

Table 1. Monthly Average Prices of Petrol of Last Fifteen Years

Monthly time period	Avg petrol price (Rs./l)	Trend values	Seasonal index
Sep	62.74	61.70	99.81
Oct	62.61	61.91	99.6
Nov	62.13	62.12	98.84
Dec	61.58	62.34	97.96
Jan	61.82	62.55	98.35
Feb	61.92	62.76	98.5
Mar	62.33	62.98	98.16
Apr	62.63	63.19	99.63
May	63.53	63.40	101.07
Jun	64.31	63.62	102.31
Jul	64.35	63.83	102.37
Aug	64.38	64.04	102.42
Total	754.33		1199.02
Avg	62.86		99.92

The annual average prices of petrol per unit litre for the last fifteen years as obtained from Boring Road, Patna are shown in Table 2.

Table 2. Annual Average Prices Of Petrol Of Last Fifteen Years

ANNUAL PERIOD	AVERAGE PETROL PRICES (IN Rs./lit) (y_t)	t = INITIAL YEAR + FINAL YEAR / 2
2004-05	42.96	2004.5
2005-06	50.64	2005.5
2006-07	47.78	2006.5
2007-08	49.1	2007.5
2008-09	47.77	2008.5
2009-10	52.11	2009.5
2010-11	63.04	2010.5
2011-12	73.89	2011.5
2012-13	75.25	2012.5
2013-14	79.45	2013.5
2014-15	70.57	2014.5
2015-16	64.41	2015.5
2016-17	70.06	2016.5
2017-18	78.04	2017.5
2018-19	77.93	2018.5

The trend of fluctuations in petrol prices in last 15 years can be represented numerically by trend values and graphically by trend line by any of the two methods, viz.,

1. Principle of least squares
2. Moving average method

The trend values for the petrol prices observed in last fifteen years are calculated using the principle of least squares. We have shifted the origin to the middle time-period, viz., 2011.5, **x = t- 2011.5**

And the trend values has been calculated using trend equation (y_e=62.87+2.56x).

All these data are plotted in order to get the graph of actual data and the trend line as shown in Fig 1.

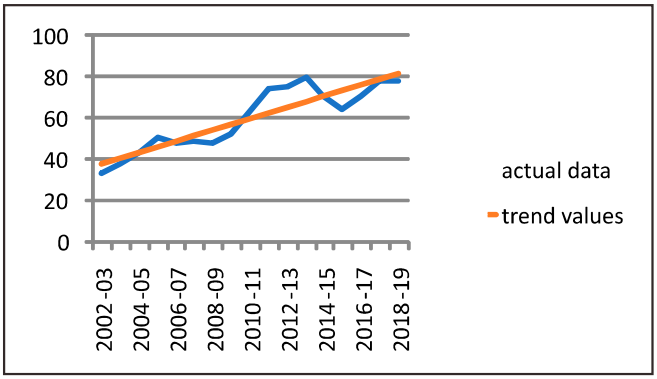

Fig. 1. Graph for actual data and trend line for annual average petrol price

The 3 and 5 yearly moving average values for petrol prices is tabulated in Table 3.

Table 3. Calculated 3 & 5 yearly moving average using moving average

Annual period	Actual Data (Rs./l)	3 yrly M.A.	5 yrly M.A.
04-05	42.96		
05-06	50.65	47.13	
06-07	47.78	49.17	47.65
07-08	49.1	48.22	49.48
08-09	47.77	49.66	51.96
09-10	52.11	54.31	58.18
10-11	63.04	64.69	63.41
11-12	78.89	72.39	69.75
12-13	75.25	77.86	73.44
13-14	79.45	75.09	73.71
14-15	70.57	71.48	71.95
15-16	64.41	68.35	72.51
16-17	70.06	70.84	72.20
17-18	78.04	75.34	
18-19	77.93		

To obtain the predicted petrol prices for coming years, the trend equation y_e = 62.87 + 2.56x can be used as obtained in Table 4.

Table 4. Predicted values of petrol prices of next five annual periods

Annual periods	t = initial year + final year/2	x=t-2010.5	Predicted prices (Rs./l)
2019-20	2019.5	9	84.59
2020-21	2020.5	10	87.36
2021-22	2021.5	11	90.13
2022-23	2022.5	12	92.90
2023-24	2023.5	13	95.67

Table 1 shows the monthly fluctuations of petrol prices in last fifteen years.

From Fig 1, the graph shows overall increasing annually trend in petrol prices for Boring Road, Patna.

The fluctuation appears linear and gives a straight line.

An increase of an average of Rs 3.00 is observed for every next year i.e. 2019-20 till 2023-24 compared to the previous estimate. No work has been done in India till date in this context.

Limitations:

- As long-term projections need more data to support them but due to unavailability of long-period record of petrol prices, this research has been done on very small scale using data for very short period ,i.e., for fifteen years. In this case, there is greater possibility of error because the passage of time will inevitably introduce new variables.
- The result of this analysis has been used to forecast the future oil prices but the estimate will be valid only if the future trend holds similar to the past trend.

Conclusion :

The aim of this work was to analyze the fluctuations in petrol prices with reference to Boring Road, Patna. By analyzing the historical petrol prices, it is observed that oil prices generally peak between September and October. Then prices start to make lower highs between October and November. Finally, they hit the bottom by December is noticed that oil prices tend to rise in August (due to the summer driving season), which results in a rise in gasoline demand. But, towards mid-September and October, oil prices tend to peak out. Oil prices tend to fall during early October (due to sluggish demand in the winter) and on the yearly basis, from 2004 the price of oil rose significantly till 2008. In the middle of the financial crisis of 2007-2008 the price of oil underwent a significant decrease. The price sharply rebounded after the crisis and again increases in 2009. In the middle of 2014, price started declining (due to a significant increase in oil production in USA and declining demand in emerging countries). Again, the oil prices hit its highest level since 2014, as geopolitical fears cause concerns to rise over potential disruption to supplies. This ups and downs push more people into poverty and leading to a more pathetic situation.

On the basis of the trend which we have analyzed, the petrol price will reach Rs. 96 till 2024 and will still be increasing, if the past trend continues. It is nothing but adding fuel to the fire. The change in oil prices affects the prices of daily essential commodities which are transported on a daily basis. This will have a severe impact on poor people rather than rich and corrupted people. The community that suffers the most is the “aam aadmi”.

Though the results of this study satisfactorily fulfil the objectives of this research, it is concluded

that TIME-SERIES analysis is a potential model to forecast the future values and is an appropriate tool for forecasting petrol prices.

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