

Chapter– 2

STATISTICAL DATA ANALYSIS OF GOLD PRICES IN INDIA OVER 50 YEARS

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Topic chosen to perform statistical analysis is: “Gold Rate Analysis of India”. Indians are among the world’s leading consumers of gold, with the precious metal constituting a significant portion of our total imports. Indians tend to buy gold since it is considered a ‘safe’ investment. Investors study the markets for fluctuations in prices, which dictate demand of the gold.

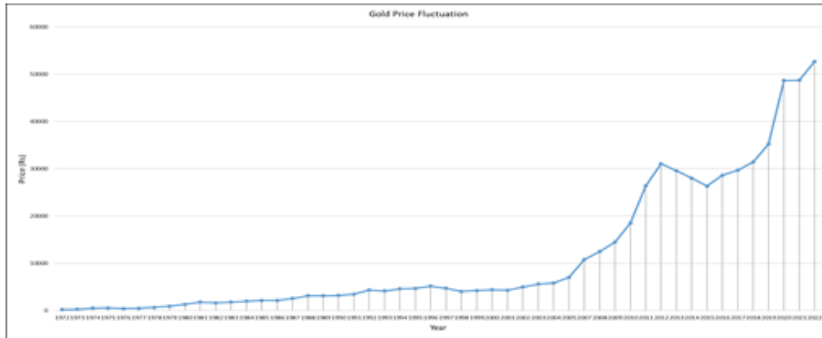
HISTORY OF GOLD IN INDIA AS MARKETING

The data based on which I analysed the gold demand or its trend among the marketing is given below:

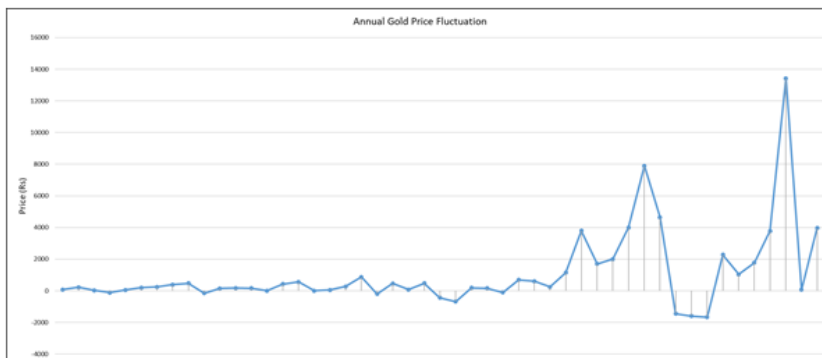
| Year | Price (24 karat per 10 grams) | Year | Price (24 karat per 10 grams) |
|------|-------------------------------|---|-------------------------------|
| 1973 | Rs.278.50 | 1999 | Rs.4,234.00 |
| 1974 | Rs.506.00 | 2000 | Rs.4,400.00 |
| 1975 | Rs.540.00 | 2001 | Rs.4,300.00 |
| 1976 | Rs.432.00 | 2002 | Rs.4,990.00 |
| 1977 | Rs.486.00 | 2003 | Rs.5,600.00 |
| 1978 | Rs.685.00 | 2004 | Rs.5,850.00 |
| 1979 | Rs.937.00 | 2005 | Rs.7,000.00 |
| 1980 | Rs.1,330.00 | 2007 | Rs.10,800.00 |
| 1981 | Rs.1,800.00 | 2008 | Rs.12,500.00 |
| 1982 | Rs.1,645.00 | 2009 | Rs.14,500.00 |
| 1983 | Rs.1,800.00 | 2010 | Rs.18,500.00 |
| 1984 | Rs.1,970.00 | 2018 | Rs.31,438.00 |
| 1985 | Rs.2,130.00 | 2019 | Rs.35,220.00 |
| 1986 | Rs.2,140.00 | 2020 | Rs.48,651.00 |
| 1987 | Rs.2,570.00 | 2021 | Rs.48,720.00 |
| 1988 | Rs.3,130.00 | 2022 (Till Today) | Rs.52,690.00 |
| 1991 | Rs.3,466.00 | <p>The data is taken from: https://www.bankbazaar.com/gold-rate/gold-rate-trend-in-india.html</p> <p>To begin with I have used the most common statistical tools- Mean, Mode, Median, kurtosis, skewness, Range, Standard Deviation and Variance to analyse the data. The calculations are shown in the table below:</p> | |
| 1992 | Rs.4,334.00 | | |
| 1993 | Rs.4,140.00 | | |
| 1994 | Rs.4,598.00 | | |
| 1995 | Rs.4,680.00 | | |
| 1996 | Rs.5,160.00 | | |
| 1997 | Rs.4,725.00 | | |
| 1998 | Rs.4,045.00 | | |

Statistical data analysis of gold prices in india over 50 years

| Year | Price(Rs)(x) | d = (x - Mean) | d ² | d ⁴ | Annual Price Fluctuation |
|-----------------|--------------------|----------------|--------------------|---------------------------------------|--------------------------|
| 1972 | 202 | -11,261.07 | 126811697.5 | 16,08,12,06,63,42,19,200.00 | 76.5 |
| 1973 | 278.5 | -11,184.57 | 125094606.1 | 15,64,86,60,47,15,36,300.00 | 227.5 |
| 1974 | 506 | -10,957.07 | 120057383 | 14,41,37,75,20,91,83,000.00 | 34 |
| 1975 | 540 | -10,923.07 | 119313458.2 | 14,23,57,01,31,35,85,000.00 | -108 |
| 1976 | 432 | -11,031.07 | 121684505.3 | 14,80,71,18,84,10,33,000.00 | 54 |
| 1977 | 486 | -10,977.07 | 120496065.8 | 14,51,93,01,86,96,38,900.00 | 199 |
| 1978 | 685 | -10,778.07 | 116166792.9 | 13,49,47,23,77,84,56,600.00 | 252 |
| 1979 | 937 | -10,526.07 | 110798149.6 | 12,27,62,29,96,47,33,700.00 | 393 |
| 1980 | 1,330.00 | -10,133.07 | 102679107.6 | 10,54,29,99,14,26,45,800.00 | 470 |
| 1981 | 1,800.00 | -9,663.07 | 93374921.82 | 8,71,88,76,02,58,06,190.00 | -155 |
| 1982 | 1,645.00 | -9,818.07 | 96394498.52 | 9,29,18,99,34,58,66,950.00 | 155 |
| 1983 | 1,800.00 | -9,663.07 | 93374921.82 | 8,71,88,76,02,58,06,190.00 | 170 |
| 1984 | 1,970.00 | -9,493.07 | 90118378.02 | 8,12,13,22,05,78,38,780.00 | 160 |
| 1985 | 2,130.00 | -9,333.07 | 87106195.62 | 7,58,74,89,31,62,43,350.00 | 10 |
| 1986 | 2,140.00 | -9,323.07 | 86919634.22 | 7,55,50,22,81,37,90,410.00 | 430 |
| 1987 | 2,570.00 | -8,893.07 | 79086694.02 | 6,25,47,05,17,17,88,150.00 | 560 |
| 1988 | 3,130.00 | -8,333.07 | 69440055.62 | 4,82,19,21,32,51,89,210.00 | 10 |
| 1989 | 3,140.00 | -8,323.07 | 69273494.22 | 4,79,88,17,00,21,27,250.00 | 60 |
| 1990 | 3,200.00 | -8,263.07 | 68278325.82 | 4,66,19,29,77,74,51,210.00 | 266 |
| 1991 | 3,466.00 | -7,997.07 | 63953128.58 | 4,09,00,02,65,57,96,750.00 | 868 |
| 1992 | 4,334.00 | -7,129.07 | 50823639.06 | 2,58,30,42,28,77,99,230.00 | -194 |
| 1993 | 4,140.00 | -7,323.07 | 53627354.22 | 2,87,58,93,12,11,62,900.00 | 458 |
| 1994 | 4,598.00 | -6,865.07 | 47129186.1 | 2,22,11,60,18,29,10,300.00 | 82 |
| 1995 | 4,680.00 | -6,783.07 | 46010038.62 | 2,11,69,23,65,42,64,790.00 | 480 |
| 1996 | 5,160.00 | -6,303.07 | 39728691.42 | 1,57,83,68,92,23,34,920.00 | -435 |
| 1997 | 4,725.00 | -6,738.07 | 45401587.32 | 2,06,13,04,13,16,20,520.00 | -680 |
| 1998 | 4,045.00 | -7,418.07 | 55027762.52 | 3,02,80,54,64,84,96,790.00 | 189 |
| 1999 | 4,234.00 | -7,229.07 | 52259453.06 | 2,73,10,50,43,46,42,490.00 | 166 |
| 2000 | 4,400.00 | -7,063.07 | 49886957.82 | 2,48,87,08,56,10,23,350.00 | -100 |
| 2001 | 4,300.00 | -7,163.07 | 51309571.82 | 2,63,26,72,16,08,54,570.00 | 690 |
| 2002 | 4,990.00 | -6,473.07 | 41900635.22 | 1,75,56,63,23,22,50,130.00 | 610 |
| 2003 | 5,600.00 | -5,863.07 | 34375589.82 | 1,18,16,81,17,58,09,770.00 | 250 |
| 2004 | 5,850.00 | -5,613.07 | 31506554.82 | 99,26,62,99,69,34,429.00 | 1150 |
| 2005 | 7,000.00 | -4,463.07 | 19918993.82 | 39,67,66,31,49,96,404.00 | 3800 |
| 2007 | 10,800.00 | -663.07 | 439661.8249 | 1,93,30,25,20,274.40 | 1700 |
| 2008 | 12,500.00 | 1,036.93 | 1075223.825 | 11,56,10,62,73,632.59 | 2000 |
| 2009 | 14,500.00 | 3,036.93 | 9222943.825 | 8,50,62,69,27,97,261.10 | 4000 |
| 2010 | 18,500.00 | 7,036.93 | 49518383.82 | 2,45,20,70,33,66,30,120.00 | 7900 |
| 2011 | 26,400.00 | 14,936.93 | 223111877.8 | 49,77,89,10,02,65,53,100.00 | 4650 |
| 2012 | 31,050.00 | 19,586.93 | 383647826.8 | 1,47,18,56,55,02,74,68,000.00 | -1450 |
| 2013 | 29,600.00 | 18,136.93 | 328948229.8 | 1,08,20,69,37,90,49,35,000.00 | -1593.5 |
| 2014 | 28,006.50 | 16,543.43 | 273685076.2 | 74,90,35,20,91,53,87,100.00 | -1663 |
| 2015 | 26,343.50 | 14,880.43 | 221427197 | 49,03,00,03,56,45,89,700.00 | 2280 |
| 2016 | 28,623.50 | 17,160.43 | 294480357.8 | 86,71,86,81,12,11,22,700.00 | 1044 |
| 2017 | 29,667.50 | 18,204.43 | 331401271.6 | 1,09,82,68,02,83,46,01,000.00 | 1770.5 |
| 2018 | 31,438.00 | 19,974.93 | 398997828.5 | 1,59,19,92,67,15,16,26,000.00 | 3782 |
| 2019 | 35,220.00 | 23,756.93 | 564391723 | 3,18,53,80,17,01,90,15,000.00 | 13431 |
| 2020 | 48,651.00 | 37,187.93 | 1382942138 | 19,12,52,89,56,18,44,80,000.00 | 69 |
| 2021 | 48,720.00 | 37,256.93 | 1388078833 | 19,26,76,28,46,69,17,70,000.00 | 3970 |
| 2022 | 52,690.00 | 41,226.93 | 1699659757 | 28,88,84,32,90,32,98,10,000.00 | |
| Sum | 5,73,153.50 | 0.00 | 10130356360 | 80,63,34,59,01,77,74,10,000.00 | |
| Count(n) | 50 | 50 | 50 | 50 | |



Graph (i): Gold Price Fluctuation



Graph (ii): Annual Gold Price Fluctuation

Below are the calculations of Statistical tools discussed above:

- 1) Mean = $\sum X / n = 573153.50 / 50 = 11463.07$
- 2) Median = $((n/2)^{\text{th}} + (n/2 - 1)^{\text{th}}) / 2 = (4334 + 4400) / 2 = 4367$
- 3) Mode = most frequent observation = 1800
- 4) Variance = $\sum(X - \text{Mean})^2 / n = 10130356360 / 50 = 202607127.2$
- 5) Standard Deviation = $\sqrt{\text{Variance}} = \sqrt{202607127.2} = 14234.01304$
- 6) Maximum Observation = 52690
- 7) Minimum Observation = 202
- 8) Range = Max Obv - Min Obv = $52690 - 202 = 52488$
- 9) Skewness = $3 (\text{Mean} - \text{Median}) / \text{S.D.} = 1.495587361$
- 10) 2nd Moment = Variance = 202607127.2
- 11) 4th Moment = $\sum(X - \text{Mean})^4 / n = 8063345901777410000 / 50 = 1.61267\text{E}+17$
- 12) Kurtosis = $4^{\text{th}} \text{ Moment} / (2^{\text{nd}} \text{ Moment})^2 = 3.928582239$

Final Results are represented in Tabular Data below:

| | |
|-------------------|--------------------|
| Mean | 11,463.07 |
| Median | 4,367.00 |
| Mode | 1,800.00 |
| Var | 202607127.2 |
| SD | 14234.01304 |
| Max | 52690 |
| Min | 202 |
| Range | 52488 |
| Skewness | 1.495587361 |
| 2nd moment | 202607127.2 |
| 4th moment | 1.61267E+17 |
| Kurtosis | 3.928582239 |

Statistics is a form of mathematical analysis that uses quantified models, representations and synopses for a given set of experimental data or real - life studies. Statistics studies methodologies to gather, review, analyse and draw conclusions from data.

To represent and analyse data we use statistical measures that include the following:

- ✓ Mean
- ✓ Median
- ✓ Mode
- ✓ Standard Deviation
- ✓ Variance
- ✓ Skewness
- ✓ Kurtosis and more.

We are going to discuss it now, one by one. Statistics is used for graphical representation of the collected data. Statistics can compare information through median, mean, and mode. Therefore, statistics concepts can easily be applied to real life, such as for calculating the time to get ready for office, how much money is required to visit work in a month, gym diet count of a week, in education, and much more. Besides this, statistics can be utilized for managing daily routines so that you can work efficiently.



With an annual demand equivalent to about 25 percent of the total physical demand worldwide, India is one of the Largest Consumer of Gold. Traditionally, there is a surge in jewellery demand during the fest or marital events. All equal, gold demand is driven firstly by income i.e., gold demand is seen to rise with income levels. From these points and the calculation analyses say that most part of Indian economy stands because of the gold marketing.

Mean tells that Rs. 11463.07 is the average price of gold in India for the dataset of 50 years. **Median** tells that Rs. 4367 is the middle most price of gold in India for the dataset of 50 years. **Mode** tells that Rs. 1800 is the most frequently occurring price of gold in India for the dataset of 50 years. **Variance** tells about the very high spread of each price from mean price of gold in India for the dataset of 50 years. **SD** tells that how each observation is spread around the mean price of gold in India for the dataset of 50 years is; basically, talks about the variability of the data around mean. **Range** tells about how widely spread out the most extreme price of gold in India for the dataset of 50 years is. **Skewness** tells about the degree of asymmetry observed in distribution graph of gold price in India for the dataset of 50 years. Distribution graph is more right side as the value of skewness is positive. **Kurtosis** tells that how flat or peak the distribution graph of gold price in India for the dataset of 50 years will be with respect to the normal distribution with values concentrating near mean. The graph will be more peaked as the value of kurtosis is greater than 3 i.e., leptokurtic.

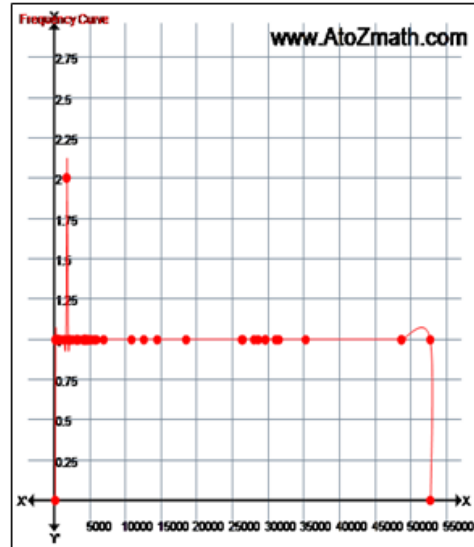
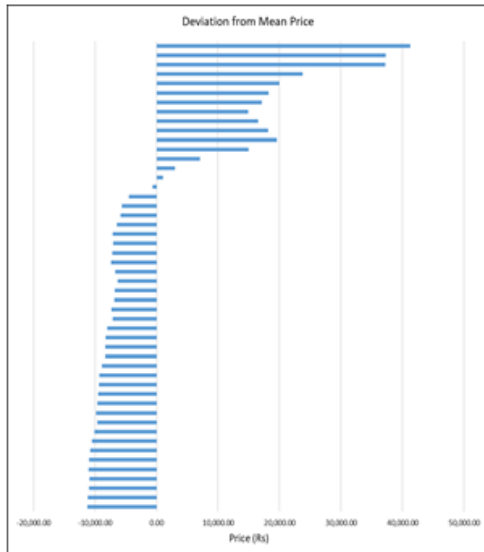
The **graph (i)** explains the annual height of the overall fluctuation happen by the price distribution set by government each year and the maximum and minimum price of gold over 50 years.

Except for a few lows between some years. The **graph (ii)** indicates the annual gold price fluctuation over 50 years, representing rise and dip of gold prices between years, and **graph (iii)** represents deviation of gold prices from mean gold price over 50

years, and **graph (iv)** is the gold price frequency distribution graph over 50 years, making 1981 and 1983 having same gold price of Rs. 1800.

And lastly, as the value of kurtosis is 3.92 (> 3), so it forms a leptokurtic distribution, means having greater peakness than normal distribution, i.e., prices are more concentrated around the mean price. Skewness is positive.

It has historically been on the rise, lending credit to the argument that gold is a safe investment over long periods.



Graph (iii): Deviation from Mean price Graph (iv): Gold price frequency distribution

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