# Correlation Analysis on Recession Effect on Diamond Brokers During 2008-09

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## Abstract

*Surat: The deans of the world's largest diamond cutting and polishing center, Surat, have said the ongoing recession in the industry is purely "man-made." They felt that strict business discipline would help the industry regain its lost luster. Surat's diamond industry, one of the main sources of foreign income and livelihood for millions of people, is in dire straits. A number of polishing plants are in the grip of the recession, with some fear of closure. Slowing foreign demand and stagnant cut diamond rates relative to the rising cost of rough stones are the reason. While 2008-09 was due to the global economic crisis, the current situation is a creation of the diamond dealers themselves. This article is an attempt to assess the effect of the 2008-09 diamond brokerage recession on diamond broking professions. The document is a survey of diamond brokers in Surat city on primary data that was collected from 130 diamond brokers in the diamond industry located in Surat of Gujarat. The Survey concludes that the recent recession has negatively affected the socio-economic condition of the diamond broker and that the social and economic benefits program for those affected is failing to support him. This study focuses on effect of recession on income, brokerage and working hours of diamond brokers at Surat city. This study includes the correlation analysis on income, working hours and broking of diamond with respectively before recession, during recession and after recession.*

***Key Words:*** *Recession, Correlation, Diamond broker, Income, working hours, Surat*

## 1. Introduction

Gujarat is a highly industrialized coastal state that has grown faster than the Indian average. Gujarat accounts for 19% of the value added of Indian manufacturing industry, even though it employs only 9% of India's industrial workforce. Gujarat is home to the world's largest diamond cluster, a critical processing hub between diamond miners and sorters (in Russia, South Africa, Botswana and elsewhere) and finished diamond customers, who are located mostly in developed countries. 85% of the world's diamonds (57% in value) are cut and polished in Gujarat specially in Surat city.

The cluster employs over half a million people, most of whom are low-skilled and low-paid manual brokers. The diamond cluster of Gujarat has developed thanks to its conditions of competitive factors: its low salaries, its good infrastructure (by Indian standards) and its international networks of Gujaratis from Nairobi to New York. However, as the structure of the diamond industry changes, the Gujarat cluster is vulnerable to higher productivity brokers in China, supply constraints and a temporary decline in demand as the US recession unfolds. feel. To keep the cluster competitive, we recommend that the governments of India and Gujarat take further steps to liberalize product and labor markets. We also recommend complementary actions by actors in the sector, in particular collaboration institutions (IFCs) to promote mergers, research and training, with the ultimate goal of increasing the productivity of the cluster.

Diamonds and the rocks that contain them have been known in India for four thousand years. The gem, known here as the vajra, is said to be abundant in many parts of this land during ancient times. The exceptional physical properties of diamond and the means to enhance its beauty were first recognized here. The first travelers were fascinated by the hardness of these stones cut and polished by its own material. And once achieved, the beauty of the stones is preserved for eternity. These travelers brought the diamond stories to the outside world. References to Indian diamonds have entered folklore, literature and the greatest play ever written in foreign languages. This stone along with the yellow metal gold were the two greatest attractions for anyone living outside of Indian territories, including travelers, merchants, looters, chieftains, generals, and kings. In a way, much of India's medieval history and the fates of the people living here were influenced by these natural resources. Diamond mining reached its peak in the 17th century AD. It was around this time that the diamond industry employed tens of thousands of employees. The number of brokers employed in the search for diamonds and lapidaries was highest next only to the number of people employed in the armies of the rulers of the time. Historically famous diamonds like Great Moghul - 900 cts; Nizams-440 cts, Regent-410 cts, Orloff-195 cts; Daryay-e-Noor-186 cts; Shah-95 cts, Archduke Joseph-76 cts, Hope-182 cts, Kohinoor-793 cts and many unnamed and unknown large stones have been recovered from this land. From its position of importance in the knowledge of diamonds and their host rocks, India has gradually lost its preeminent position. The main sources of large diamonds could not be identified. While the various countries of the world with a similar geological configuration have seen an exponential increase in diamond production during the second half of the last century, the steadily decreasing diamond production in India has reached its lowest level. However, in recent years, a quantum shift in diamond exploration activity has occurred. Many national agencies have prioritized diamond exploration activity; In addition, multinational agencies with their vast experience in Africa, Australia and Canada have embarked on exploration activities in different parts of India. This resurgence has resulted in the identification of a number of new diamondiferous kimberlite provinces in central India and southern India. There is a strange but strong link between India and diamonds. Throughout history, India has dominated diamond production. Currently, nine out of ten diamonds recovered from diamond mines in different parts of the world enter India to be cut and polished before being transported to the international market. Surat: The deans of the world's largest diamond

cutting and polishing center, Surat, have said the ongoing recession in the industry is purely "man-made." They felt that strict business discipline would help the industry regain its lost luster. Surat's diamond industry, one of the main sources of foreign income and livelihood for millions of people, is in dire straits. A number of polishing plants are in the grip of the recession, with some fear of closure. Slowing foreign demand and stagnant cut diamond rates relative to the rising cost of rough stones are the reason. While 2008-09 was due to the global economic crisis, the current situation is a creation of the diamond dealers themselves. This article is an attempt to assess the effect of the 2008-09 diamond brokerage recession on diamond broking professions. The document is a survey of diamond brokers in Surat city on primary data that was collected from 130 diamond brokers in the diamond industry located in Surat of Gujarat. The Survey concludes that the recent recession has negatively affected the socio-economic condition of the diamond broker and that the social and economic benefits program for those affected is failing to support him. This study focuses on effect of recession on income, brokerage and working hours of diamond brokers at Surat city. This study includes the correlation analysis on income, working hours and broking of diamond with respectively before recession, during recession and after recession.

## 2. Objective:

1. To find the relation between the monthly income before recession and during recession of diamond brokers.
2. To find the relation between the monthly income before recession and after recession of diamond brokers.
3. To find the relation between the monthly income during recession and after recession of diamond brokers.
4. To find the relation between the daily working hours before recession and during recession of diamond brokers.
5. To find the relation between the daily working hours before recession and after recession of diamond brokers.
6. To find the relation between the daily working hours during recession and after recession of diamond brokers.
7. To find the relation between the daily brokering of diamonds in carats before recession and during recession.
8. To find the relation between the daily brokering of diamonds in carats before recession and after recession.
9. To find the relation between the daily brokering of diamonds in carats during recession and after recession.

## 3. Statistical Tools and techniques:

The researcher has used the various techniques of statistical analysis in this study with the help of SPSS. The calculated data could be tabulated according to the need of the study. The researcher has used the data were analyzed by using statistical tools are given below:

- Percentage
- Mean

- Standard deviation
- Correlation

**Pearson's product-moment coefficient:**

The most familiar measure of dependence between two quantities is the Pearson product-moment correlation coefficient, or "Pearson's correlation." It is obtained by dividing the covariance of the two variables by the product of their standard deviations. Karl Pearson developed the coefficient from a similar but slightly different idea by Francis Galton.

The population correlation coefficient $\rho_{X,Y}$ between two random variables $X$ and $Y$ with expected values $\mu_X$ and $\mu_Y$ and standard deviations $\sigma_X$ and $\sigma_Y$ is defined as:

$$\rho_{X,Y} = \operatorname{corr}(X,Y) = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y},$$

Where $E$ is the expected value operator, *cov* means covariance, and, *corr* a widely used alternative notation for Pearson's correlation.

The Pearson correlation is defined only if both of the standard deviations are finite and both of them are nonzero. It is a corollary of the Cauchy–Schwarz inequality that the correlation cannot exceed 1 in absolute value. The correlation coefficient is symmetric: corr($X$,$Y$) = corr($Y$,$X$).

The Pearson correlation is +1 in the case of a perfect positive (increasing) linear relationship (correlation), −1 in the case of a perfect decreasing (negative) linear relationship (anticorrelation), and some value between −1 and 1 in all other cases, indicating the degree of linear dependence between the variables. As it approaches zero there is less of a relationship (closer to uncorrelated). The closer the coefficient is to either −1 or 1, the stronger the correlation between the variables. If the variables are independent, Pearson's correlation coefficient is 0, but the converse is not true because the correlation coefficient detects only linear dependencies between two variables. For example, suppose the random variable $X$ is symmetrically distributed about zero, and $Y = X^2$. Then $Y$ is completely determined by $X$, so that $X$ and $Y$ are perfectly dependent, but their correlation is zero; they are uncorrelated. However, in the special case when $X$ and $Y$ are jointly normal, uncorrelatedness is equivalent to independence.

If we have a series of $n$ measurements of $X$ and $Y$ written as $x_i$ and $y_i$ where $i = 1, 2, ..., n$, then the *sample correlation coefficient* can be used to estimate the population Pearson correlation $r$ between $X$ and $Y$. The sample correlation coefficient is written

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{(n-1)s_x s_y} = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2 \sum_{i=1}^{n}(y_i-\bar{y})^2}},$$

Where x and y are the sample means of $X$ and $Y$, and $s_x$ and $s_y$ are the sample standard deviations of $X$ and $Y$.

This can also be written as:

$$r_{xy} = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s_y} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\ \sqrt{n\sum y_i^2 - (\sum y_i)^2}}.$$

If *x* and *y* are results of measurements that contain measurement error, the realistic limits on the correlation coefficient are not −1 to +1 but a smaller range.

**4. Sample of the study:**

Surat city has the largest diamond broker profession in Gujarat. A very small proportion of this profession is respectively Ahmedabad, Bhavnagar, Botad and Amreli in this profession respectively. Only Surat was included in this research. Surat has large numbers of diamond brokers, so the researcher took 130 samples from Surat city.

**5. Limitation of the study:**

A. The present study is based on the primary data; hence the research will be done on the information provided by the respondents through the medium of questionnaire.
B. The study is bound to migration situation, category, distance from native place, native district and reasons for migration of the diamond brokers.
C. The study is limited to the area of Surat city only.
D. Due to the time constraints researcher have decided to limit the size of the sample.

**6. Analysis:**

**6.1, Correlation between Average monthly income before recession and during recession:**

$x$ = Average monthly income before recession

$y$ = Average monthly income during recession

$\boldsymbol{r(x,y)}$ **= 0.913**

N=130

The correlation between the monthly income before recession and during recession is found 0.913. There is linear significant positive correlation between the monthly income diamond brokers before recession and during recession. If the monthly income before recession is increase than the monthly income during recession will be increase.

**6.2, Correlation between Average monthly income before recession and after recession:**

$x$ = Average monthly income before recession

$y$ = Average monthly income after recession

$\boldsymbol{r(x,y)}$ **= 0.852**

N=130

The correlation between the monthly income before recession and after recession is found 0.852. There is linear significant positive correlation between the monthly income diamond brokers before recession and after recession. If the monthly income before recession is increase than the monthly income after recession will be increase.

**6.3, Correlation between Average monthly income during recession and after recession:**

$x$ = Average monthly income during recession

$y$ = Average monthly income after recession

$\boldsymbol{r(x,y)}$ **= 0.817**

N=130

The correlation between the monthly income during recession and after recession is found 0.817. There is linear significant positive correlation between the monthly income diamond brokers during recession and after recession. If the monthly income during recession is increase than the monthly income after recession will be increase.

**6.4, Correlation between Average working hours before recession and during recession:**

$x$ = Average working hours before recession

$y$ = Average working hours during recession

$\boldsymbol{r(x,y)}$ **= 0.253**

N=130

The correlation between daily working hours before recession and during recession is 0.253. There is a linear positive correlation between daily working hours before recession and during recession. If the daily working hours before recession are increase (or decrease) than the daily working hours during recession will also increase (or decrease).

**6.5, Correlation between Average working hours before recession and after recession:**

$x$ = Average working hours before recession

$y$ = Average working hours after recession

$\boldsymbol{r(x,y)}$ **= 0.775**

N=130

The correlation between daily working hours before recession and after recession is 0.775. There is a linear positive correlation between daily working hours before recession and after recession. If the daily working hours before recession are increase (or decrease) than the daily working hours after recession will also increase (or decrease).

**6.6, Correlation between Average working hours during recession and after recession:**

$x$ = Average working hours during recession

$y$ = Average working hours after recession

$\boldsymbol{r(x,y)}$ **= 0.145**

N=130

The correlation between daily working hours during recession and after recession is 0.145. There is a linear positive correlation between daily working hours during recession and after recession. If the daily working hours during recession are increase (or decrease) than the daily working hours after recession will also increase (or decrease).

**6.7, Correlation between Average monthly broking of diamonds in carets before recession and during recession:**

$x$ = Average monthly broking of carets before recession

$y$ = Average monthly broking of carets during recession

$\boldsymbol{r(x,y)}$ **= 0.974**

N=130

The correlation between average monthly broking of diamonds in carets before recession and during recession is 0.974. There is a linear positive correlation between average monthly broking of diamonds in carets before recession and during recession, if the average monthly broking of diamonds in carats before recession are increase (or decrease) than the average monthly broking of diamonds in carets during recession will also increase (or decrease).

**6.8, Correlation between Average monthly broking of diamonds in carets before recession and after recession:**

$x$ = Average monthly broking of carets before recession

$y$ = Average monthly broking of carets after recession

$\boldsymbol{r(x,y)}$ **= 0.964**

N=130

The correlation between average monthly broking of diamonds in carets before recession and after recession is 0.964. There is a linear positive correlation between average monthly broking of diamonds in carets before recession and after recession, if the average monthly broking of diamonds in carats before recession are increase (or decrease) than the average monthly broking of diamonds in carets after recession will also increase (or decrease).

**6.9, Correlation between Average monthly broking of diamonds in carets during recession and after recession:**

$x$ = Average monthly broking of carets during recession

$y$ = Average monthly broking of carets after recession

$\boldsymbol{r(x,y)}$ **= 0.949**

N=130

The correlation between average monthly broking of diamonds in carets during recession and after recession is 0.949. There is a linear positive correlation between average monthly broking of diamonds in carets during recession and after recession, if the average monthly broking of diamonds in carats during recession are increase (or decrease) than the average monthly broking of diamonds in carets after recession will also increase (or decrease).

**7. Findings:**

1) The correlation between the monthly income before recession and during recession is found **0.913**. There is linear significant positive correlation between the monthly income diamond brokers before recession and during recession. If the monthly income before recession is increase than the monthly income during recession will be increase.

2) The correlation between the monthly income before recession and after recession is found **0.852.** There is linear significant positive correlation between the monthly income diamond brokers before recession and after recession. If the monthly income before recession is increase than the monthly income after recession will be increase.

3) The correlation between the monthly income during recession and after recession is found **0.817.** There is linear significant positive correlation between the monthly income diamond brokers during recession and after recession. If the monthly income during recession is increase than the monthly income after recession will be increase.

4) The correlation between daily working hours before recession and during recession is **0.253**. There is a linear positive correlation between daily working hours before recession and during recession. If the daily working hours before recession are increase (or decrease) than the daily working hours during recession will also increase (or decrease).

5) The correlation between daily working hours before recession and after recession is **0.775**. There is a linear positive correlation between daily working hours before recession and after recession. If the daily working hours before recession are increase (or decrease) than the daily working hours after recession will also increase (or decrease).

6) The correlation between daily working hours during recession and after recession is **0.145**. There is a linear positive correlation between daily working hours during recession and after recession. If the daily working hours during recession are increase (or decrease) than the daily working hours after recession will also increase (or decrease).

7) The correlation between average monthly broking of diamonds in carets before recession and during recession is **0.974.** There is a linear positive correlation between average monthly broking of diamonds in carets before recession and during recession, if the average monthly broking of diamonds in carats before recession are increase (or decrease) than the average monthly broking of diamonds in carets during recession will also increase (or decrease).

8) The correlation between average monthly broking of diamonds in carets before recession and after recession is **0.964.** There is a linear positive correlation between average monthly broking of diamonds in carets before recession and after recession, if the average monthly broking of diamonds in carats before recession are increase (or decrease) than the average monthly broking of diamonds in carets after recession will also increase (or decrease).

9) The correlation between average monthly broking of diamonds in carets during recession and after recession is **0.949.** There is a linear positive correlation between

average monthly broking of diamonds in carets during recession and after recession, if the average monthly broking of diamonds in carats during recession are increase (or decrease) than the average monthly broking of diamonds in carets after recession will also increase (or decrease).

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