A REPORT

ON

DATA ANALYSIS FOR INVESTMENTS

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Abstract

This report aims to provide individuals with a theoretical understanding of statistics with a comprehensive understanding of the stock exchange market and the rationale for investment. Focusing on the National Stock Exchange (NSE) and the Nifty 50 Index, this report examines the fundamentals of the stock market. It describes the index methodology and the significance of using it to evaluate market performance.

In addition, the report compares the advantages of investing in the stock market versus depositing money with a reputable bank. It highlights the benefits of investing, such as wealth creation, beating inflation, portfolio diversification, capital appreciation, and dividend income. In addition, the report examines effective investment strategies by examining historical data and related information. It discusses the frequency of investment, the stock market's operating hours, and the optimal investment time. It also discusses the industry sector and domestic versus international investment considerations.

The report investigates the possibility of identifying the probability distribution that best fits the opening and closing prices of ICICI Bank Ltd., one of the stocks comprising the Nifty 50 Index. Using Python programming language and utilizing libraries such as NumPy, pandas, and Matplotlib, it analyses the opening and closing prices of ICICI Bank over time to determine trends and patterns. This report equips readers with fundamental knowledge of the stock market, investment rationale, effective investment strategies, and statistical analysis of stock prices. It is a valuable resource for those who wish to comprehend the stock market and make intelligent investment decisions.

Understanding the Stock Exchange Market

The stock exchange market is an integral part of the economy because it is where publicly traded company shares can be bought and sold. This report aims to explain the stock market's importance, why it works, and how it works more formally and thoroughly, aimed at people with a basic understanding of statistics.

What is **NSE**? What is the **Nifty 50 Index**?

India's **National Stock Exchange** (NSE) is a well-known stock exchange that works as a regulated market. It makes it easier for people to trade stocks, derivatives, and exchange-traded funds electronically. The **NSE** helps the Indian capital market grow and stay stable by providing an open and efficient trading environment.

The **NSE** keeps track of the **Nifty 50 Index**, a well-known stock market index in India. It comprises 50 large, well-known companies from different parts of the economy. The **Nifty 50 Index** measures how well the Indian stock market is doing.

The Index Methodology

The Nifty 50 Index is made up of and calculated based on the index methodology. The stocks that comprise the index are chosen carefully, looking at market capitalization, liquidity, and sector representation. Companies with significant market capitalization and a lot of trading activity are included in the index. This makes sure that their performance is reflected in the market as a whole. Each stock's weight in the index is based on its free-float market capitalization, which shows how many shares can be traded on the open market. This method ensures that the **Nifty 50** Index is a true reflection of the market and makes it easier to track market trends and the performance of investments.

The Importance of Investing: Alleviating Stress and Maximizing Financial Potential

Consider a simple scenario to comprehend the significance of investing. Suppose an individual earns Rs. 40,000/- per month and spends Rs. 20,000/- on essential expenses such as shelter, food, transportation, shopping, and medical care. This amount represents the monthly surplus.

Now, let us consider the following assumptions to illustrate the advantages of investing:

1. **Increase in Salary**: The employer increases the salary by 6% annually.
2. **Annual Increase in Cost of Living**: The cost of living rises by approximately 10% yearly.
3. **Working Life**: The individual is currently 35 and plans to retire at age 55, resulting in 20 years of working life.
4. **Fixed Expenses**: Monthly expenses remain constant, and additional costs are not anticipated.
5. **Cash Retention**: The individual retains Rs. 20,000/- in excess cash as hard currency.

Based on these assumptions, let us analyze the 20-year evolution of the cash position.

Analyzing the numbers reveals a concerning situation.

NO INVESTMENTS :			
YEARS	YEARLY INCOME	YEARLY EXPENSE	SAVINGS
1	480,000	240,000	240,000
2	537,600	264,000	273,600
3	602,112	290,400	311,712
4	674,365	319,440	354,925
5	755,289	351,384	403,905
6	845,924	386,522	459,402
7	947,435	425,175	522,260
8	1,061,127	467,692	593,435
9	1,188,462	514,461	674,001
10	1,331,078	565,907	765,170
11	1,490,807	622,498	868,309
12	1,669,704	684,748	984,956
13	1,870,068	753,223	1,116,846
14	2,094,477	828,545	1,265,932
15	2,345,814	911,400	1,434,414
16	2,627,312	1,002,540	1,624,772
17	2,942,589	1,102,794	1,839,795
18	3,295,700	1,213,073	2,082,627
19	3,691,184	1,334,380	2,356,803
20	4,134,126	1,467,818	2,666,307
TOTAL SAVINGS in CRORES			20,839,172
TOTAL SAVINGS in CRORES			**2.08**

Several facts become evident:

1. **Accumulated Wealth**: After twenty years of diligent work, the individual has amassed Rs. 2.08 Crores.
2. **Unchanged Lifestyle**: Due to fixed expenses, the individual's lifestyle remains the same over the years, and aspirations for a better home, car, and vacations may still need to be fulfilled.
3. **Post-Retirement Scenario**: Assuming expenses continue to grow at a rate of 8%, a retirement corpus of Rs. 1.46 Crores would be sufficient to support the individual for approximately eight years after retirement. After the eighth year, the individual would face financial difficulties with no savings to rely on.
4. **Future Financial Challenges**: What would one do if one ran out of money in eight years? How would they sustain their life? Is there a way to ensure a more substantial sum at the end of twenty years?

At this point, the assumptions are simplistic and real-life situations are more complex. However, it is essential to note that the above calculation does not consider any investments, resulting in stagnant or zero growth of retained capital.

Let us now consider an alternative scenario where, instead of leaving the cash idle, the individual decides to invest it in an option that yields a 14% annual growth. For instance, if Rs. 2,40,000/- is retained in the first year and invested at a rate of 14% per year for 20 years (assuming investment at the end of the first year), the individual would accumulate Rs. 28,93,366/- at the end of the 20th year. The formula used for this calculation is:

= 240000 * (1 + 14%)^(19) = 2893366.

The table below illustrates the cash balance if the individual chooses to invest:

WITH INVESTMENTS :				
YEARS	YEARLY INCOME	YEARLY EXPENSE	SAVINGS	SAVINGS INVESTED @ 14%
1	480,000	240,000	240,000	2,893,366
2	537,600	264,000	273,600	2,893,366
3	602,112	290,400	311,712	2,891,585
4	674,365	319,440	354,925	2,888,117
5	755,289	351,384	403,905	2,883,051
6	845,924	386,522	459,402	2,876,474
7	947,435	425,175	522,260	2,868,468
8	1,061,127	467,692	593,435	2,859,113
9	1,188,462	514,461	674,001	2,848,485
10	1,331,078	565,907	765,170	2,836,656
11	1,490,807	622,498	868,309	2,823,696
12	1,669,704	684,748	984,956	2,809,672
13	1,870,068	753,223	1,116,846	2,794,648
14	2,094,477	828,545	1,265,932	2,778,685
15	2,345,814	911,400	1,434,414	2,761,842
16	2,627,312	1,002,540	1,624,772	2,744,175
17	2,942,589	1,102,794	1,839,795	2,725,738
18	3,295,700	1,213,073	2,082,627	2,706,582
19	3,691,184	1,334,380	2,356,803	2,686,756
20	4,134,126	1,467,818	2,666,307	2,666,307
TOTAL SAVINGS in CRORES				56,236,783
TOTAL SAVINGS in CRORES				**5.62**

Investment Strategy | Cash Balance

Without Investing | **Rs. 2.08 Crores** With Investing | **Rs. 5.62 Crores**

The cash balance has significantly increased by deciding to invest surplus funds. The decision to invest has resulted in a cash balance that is **2.74** times higher compared to the scenario without investing. This puts the individual in a much better position to manage their life after retirement.

Now, returning to the original question of why one should invest, there are several compelling reasons:

1. **Fight Inflation**: Investing enables individuals to cope better with the rising cost of living, commonly known as inflation.
2. **Build Wealth**: By investing, individuals can accumulate a more extensive corpus by the end of their designated period. This period could be until retirement or any other financial goal such as children's education, marriage, home purchase, or retirement vacations.
3. **Enhance Livelihood**: Investing helps individuals achieve their financial goals and improves their quality of life.

Investing is crucial because it allows individuals to combat inflation, build wealth, and enhance their livelihood by achieving their financial aspirations. It empowers their money to grow, ensuring a more secure and prosperous future.

Investing in financial markets offers potential benefits that surpass the limitations of relying solely on bank deposits, reducing specific **stressors**. Here is why:

1. **Inflation Protection**: Bank deposits may not keep pace with inflation, leading to a decrease in the actual value of money over time. Investing provides opportunities for higher returns that can help counter the impact of inflation, alleviating concerns about the erosion of purchasing power.
2. **Growth Potential**: While bank deposits offer stability, the returns are typically modest. Investing in financial markets can generate higher returns and capital appreciation, allowing

money to grow faster. This growth potential can alleviate the stress of limited financial progress and provide a pathway to achieving long-term financial goals.

3. **Diversification**: Investing enables diversification across different asset classes, reducing the risk of relying on a single investment. Diversification can mitigate the stress of market volatility and protect wealth from significant losses.
4. **Long-term Financial Goals**: Investing is beneficial for achieving long-term financial objectives such as retirement planning, funding education expenses, and purchasing a home. The power of compounding can significantly grow savings over time, reducing the stress of financial insecurity in the future.
5. **Professional Expertise**: With investing, individuals can tap into the knowledge and experience of professional fund managers and advisors who can guide them in making informed investment decisions. This expertise can alleviate the stress of managing investments independently and provide a sense of confidence in the investment strategy.
6. **Flexibility and Liquidity:** Unlike bank deposits, investing provides flexibility and liquidity options. Portfolios can be adjusted, and funds can be accessed based on changing financial needs, providing control and reducing the stress of limited financial options.
7. **Tax Advantages**: Certain investment options offer tax benefits, such as tax-free investment accounts and tax-deductible contributions to retirement plans. These advantages can optimize the tax position and increase overall returns, reducing the stress of tax burdens and maximizing investment growth.

While investing involves risks, a well-structured investment plan, diversification, and a long-term perspective can help mitigate these risks and alleviate the stress associated with financial uncertainty. It is essential to consider risk tolerance and investment horizon and seek professional advice to make informed investment decisions.

Investment Strategies and Considerations: A Comprehensive Analysis

Assessing historical data and associated information provides valuable insights for effective investment strategies. The following findings address key questions and considerations for investors:

Operational Hours of the Stock Market: The National Stock Exchange (NSE) in India operates from Monday to Friday, adhering to specific trading hours. The market opens at 9:15 AM Indian Standard Time (IST) and closes at 3:30 PM IST. It is essential to align investment activities within these hours when the market is active and functional.

Optimal Timing for Investments: To optimize investment decisions, it is advisable to analyze market trends, news, and other relevant factors before making investment choices. Evaluating market conditions and conducting thorough research can help identify potential opportunities and mitigate risks associated with timing.

Sector Selection for Investment: Choosing the appropriate industry or sector for investment involves assessing multiple factors. Considerations such as investment goals, risk appetite, market conditions, and individual research play a vital role. Major sectors in the Indian stock market include Information

Technology (IT), Banking, Pharmaceuticals, Automobiles, FMCG (Fast-Moving et al.), and Energy. Diligent evaluation of sector performance and prospects is necessary for informed decision-making.

Domestic vs International Investing: The decision to become a domestic or international investor depends on individual circumstances and preferences. Domestic investing focuses on securities within one's own country, considering local market dynamics, currency factors, and economic conditions. On the other hand, international investing offers exposure to global markets, diversification benefits, and potential growth opportunities. Evaluating risk tolerance, understanding regulations, and considering tax implications are crucial when considering international investments.

Adopting a disciplined approach to investing, incorporating market hours, sector analysis, and alignment with individual investment objectives, can enhance investment effectiveness. Thorough research, diversification of investments, and seeking professional guidance contribute to making informed investment decisions.

Enhancing Investment Effectiveness: Strategies and Considerations

Optimizing Investment Frequency: Strategic Recommendations

Based on the analysis of historical data and market trends, we have evaluated different investment frequencies and their potential impact on investment outcomes. Here are the key findings:

1. Average Turnover per Day: ₹ 23,794.03
2. Number of Trading Days: 1,240
3. Number of Months: 12
4. Average Turnover per Month: ₹ 22,877.17

Considering these metrics, our investment strategy recommends investing once a month. This approach allows for a focused and disciplined investment approach, allowing one to assess market conditions, conduct thorough research, and make informed investment decisions.

By investing monthly, you can take advantage of longer-term trends, mitigate the impact of short-term market volatility, and benefit from cost-averaging effects. This investment frequency balances actively managing your portfolio and avoiding excessive trading, which can lead to increased transaction costs and potential performance dilution. The **Python** file will be attached to further understand the code and strategy used.

Stock Market Operational Hours: Understanding Trading Timings

India's National Stock Exchange (NSE) operates from Monday to Friday, adhering to specific trading hours. The market opens at 9:15 AM I**ndian Standard Time** (IST) and closes at 3:30 PM **IST.** It is essential to align investment activities within these hours when the market is active and functional. To optimize investment decisions, it is advisable to analyze market trends, news, and other relevant factors before making investment choices. Evaluating market conditions and conducting thorough research can help identify potential opportunities and mitigate risks associated with timing..

Industry Allocation: Selecting the Right Sector for Investment

Choosing the appropriate industry or sector for investment involves assessing multiple factors. Considerations such as investment goals, risk appetite, market conditions, and individual research play a vital role. Major sectors in the Indian stock market include Information Technology (IT), Banking, Pharmaceuticals, Automobiles, FMCG (Fast-Moving et al.), and Energy. Diligent evaluation of sector performance and prospects is necessary for informed decision-making.

Domestic or International Investing: Targeting the Right Market

The decision to become a domestic or international investor depends on individual circumstances and preferences. Domestic investing focuses on securities within one's own country, considering local market dynamics, currency factors, and economic conditions. On the other hand, international investing offers exposure to global markets, diversification benefits, and potential growth opportunities. Evaluating risk tolerance, understanding regulations, and considering tax implications are crucial when considering international investments.

Adopting a disciplined approach to investing, incorporating market hours, sector analysis, and alignment with individual investment objectives, can enhance investment effectiveness. Thorough research, diversification of investments, and seeking professional guidance contribute to making informed investment decisions.

Analysis of Best-Fit Probability Distribution and Trend Analysis of ICICI Bank Ltd.'s Opening/Closing Prices

This section focuses on determining the best-fit probability distribution for the opening and closing prices of ICICI Bank Ltd. Furthermore, we investigate any discernible trends or patterns using Python programming and libraries such as NumPy, pandas, and Matplotlib. The objective is to gain insights into the underlying behaviour of the stock prices and identify potential investment opportunities.

Analysis of Best-Fit Probability Distribution for Opening/Closing Prices of ICICI Bank Ltd: KS Test and Chi-Squared Test Results

Introduction: This section presents the analysis of determining the underlying best-fit probability distribution for the opening and closing prices of ICICI Bank Ltd. We employed two statistical tests: the **Kolmogorov-Smirnov** (**KS**) and **chi-squared** tests. These tests provide insights into the suitability of different probability distributions for modelling the price data. This analysis aims to identify the most appropriate distribution and enhance our understanding of the price behaviour for potential investment strategies.

Methodology: To assess the goodness of fit, we utilised the **KS** test, which compares the observed data against theoretical distributions. Additionally, we applied the **chi-squared** test, which examines the relationship between observed and expected frequencies. Both tests provide statistical measures to determine the best-fit distribution for the opening and closing prices.

KS Test Results: For the KS test, we considered several probability distributions, including the normal, log-normal, exponential, and gamma distributions. The test results for both the opening and closing prices are as follows:

- **Opening Prices:**
  - KS test statistic for normal distribution: 0.1418, p-value: 0.0000
  - KS test statistic for log-normal distribution: 0.1125, p-value: 0.0000
  - KS test statistic for exponential distribution: 0.1014, p-value: 0.0000
  - KS test statistic for gamma distribution: 0.1062, p-value: 0.0000
- **Closing Prices:**
  - KS test statistic for normal distribution: 0.1393, p-value: 0.0000
  - KS test statistic for log-normal distribution: 0.1129, p-value: 0.0000
  - KS test statistic for exponential distribution: 0.1026, p-value: 0.0000
  - KS test statistic for gamma distribution: 0.1064, p-value: 0.0000

Chi-Squared Test Results: We assessed the opening and closing prices using appropriate bins for the chi-squared test. The test results are as follows:

- **Opening Prices:**
  - The chi-squared test statistic: 0.0
  - P-value: 1.0
- **Closing Prices:**
  - The chi-squared test statistic: 0.0
  - P-value: 1.0

Interpretation: The **KS** test results indicate that none of the tested distributions (normal, log-normal, exponential, gamma) provides a good fit for the opening and closing prices of ICICI Bank Ltd. This suggests that the price data does not conform closely to any probability distribution.

Similarly, the **chi-squared** test results indicate no significant deviation between the observed and expected frequencies for the opening and closing prices. Therefore, the distributional fit of the data does not strongly favour any specific distribution.

Conclusion: Based on the KS test and chi-squared test results, it is challenging to determine a single best-fit probability distribution for the opening and closing prices of ICICI Bank Ltd. The price data exhibits characteristics that need to be adequately captured by any tested distributions. Further analysis and consideration of alternative modelling approaches may be necessary to understand the underlying behaviour and identify potential investment strategies.

Identification of Trends and Patterns in Open/Close Prices of ICICI Bank Ltd.

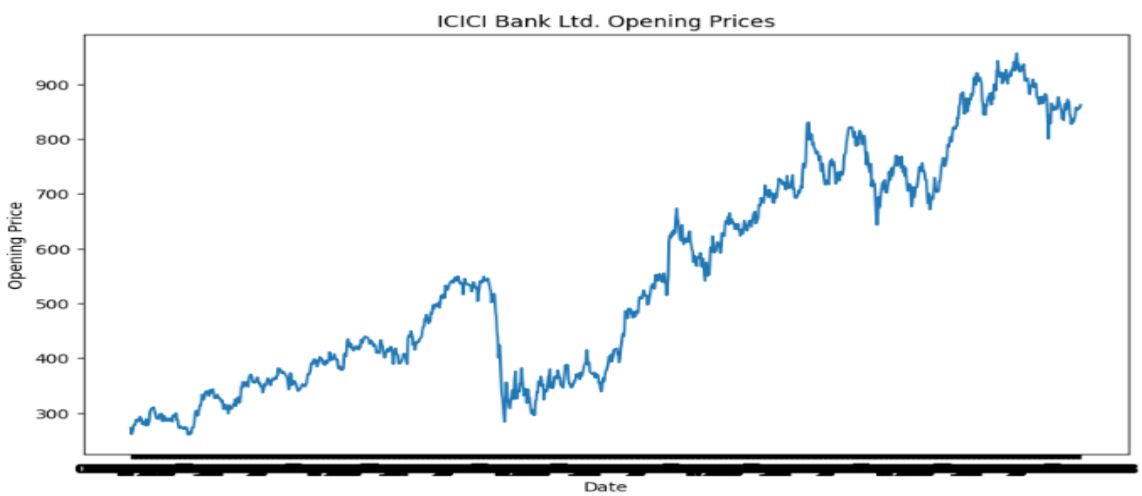
The analysis of open and close prices of ICICI Bank Ltd. reveals vital summary statistics that provide insights into the trends and patterns observed in the data. The summary statistics for both the opening and closing prices are as follows:

Opening Price Summary Statistics:

Mean: 551.9745432883241

Median: 521.4

Standard Deviation: 200.47477108282055
Skewness: 0.3437801076594918
Closing Price Summary Statistics:
Mean: 551.9390389197775
Median: 522.9
Standard Deviation: 200.48195621669163
Skewness: 0.34182207743347803



There seems to be an **upward trend** in the opening and closing prices of ICICI Bank. There are some fluctuations in the stock price, but overall it seems to be **increasing**. Also, we can see seasonal variations in the prices.

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