Mini Project - 1

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Problem Statement

GIVEN:

- There are 3 Traders :
  - Trader A : Trades on Nifty (India)
  - Trader C : Trades on SGX Nifty
  - Inda.P
- Daily price change(returns) for above trades usually follows a gaussian distribution
- Daily price changes for iShares MSCI India ETF and NIFTY are related in the same way as those for NIFTY and SGX NIFTY.
- Time series data for NIFTY and SGX NIFTY is given

TO FIND

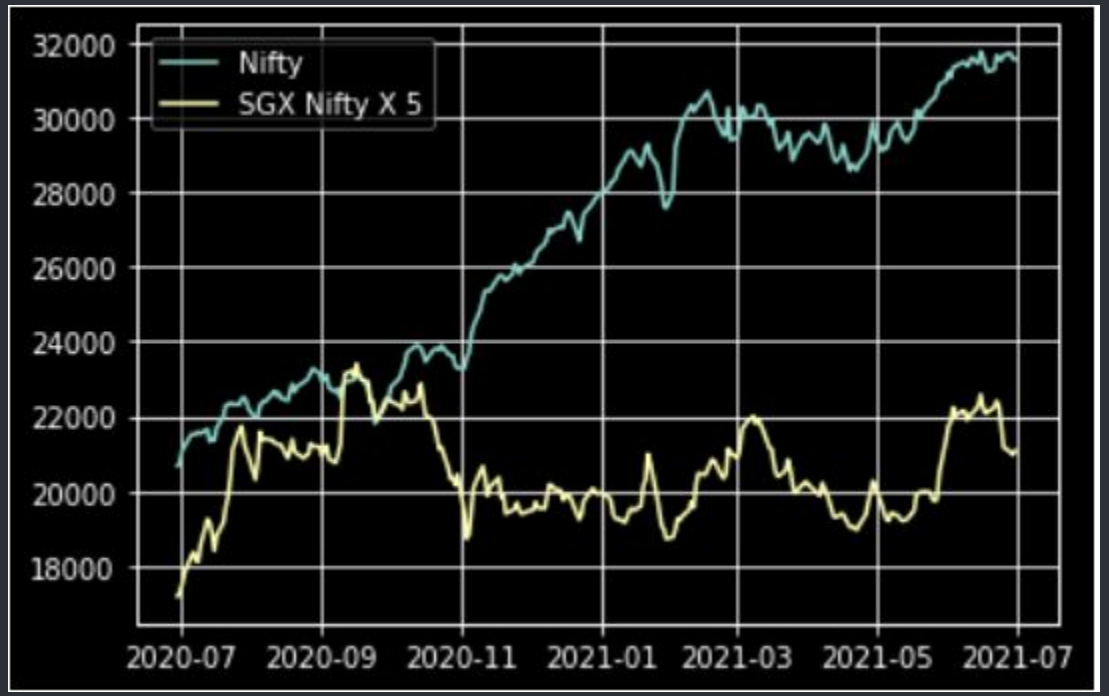
- Covariance of INDA.P and NIFTY
- Closing Price of INDA.P at 95% Confidence Interval
- Other Interesting alternates
- A strategy to maximize profit and minimize risk

1

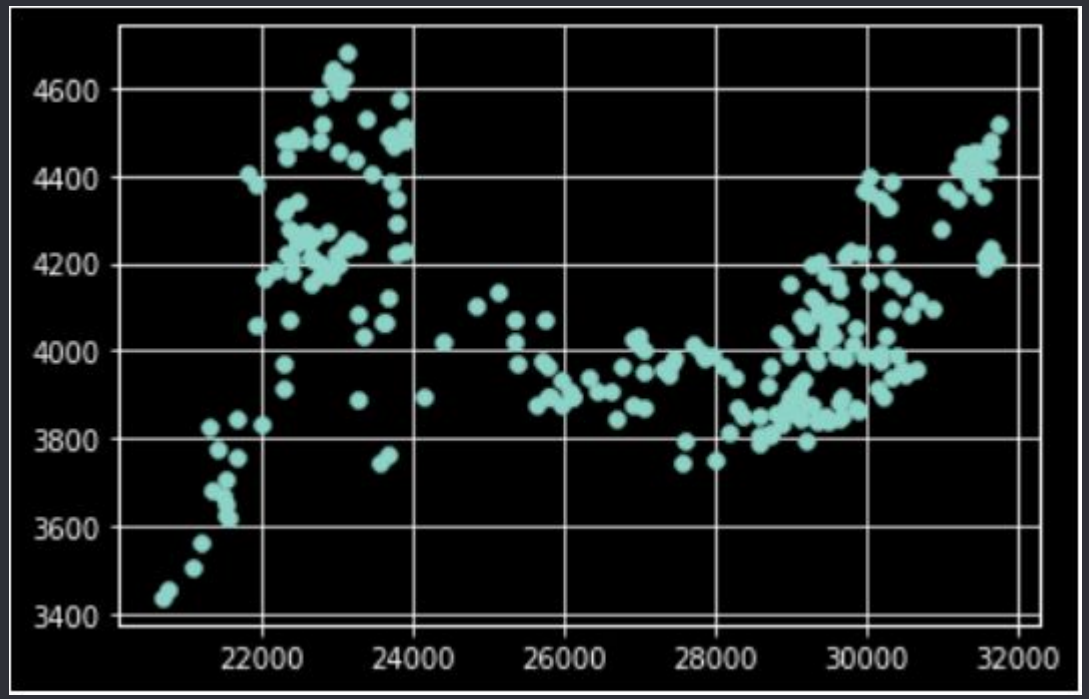
Exploratory Analysis

Exploratory analysis and visualizations

Plot for Nifty and SGX Nifty

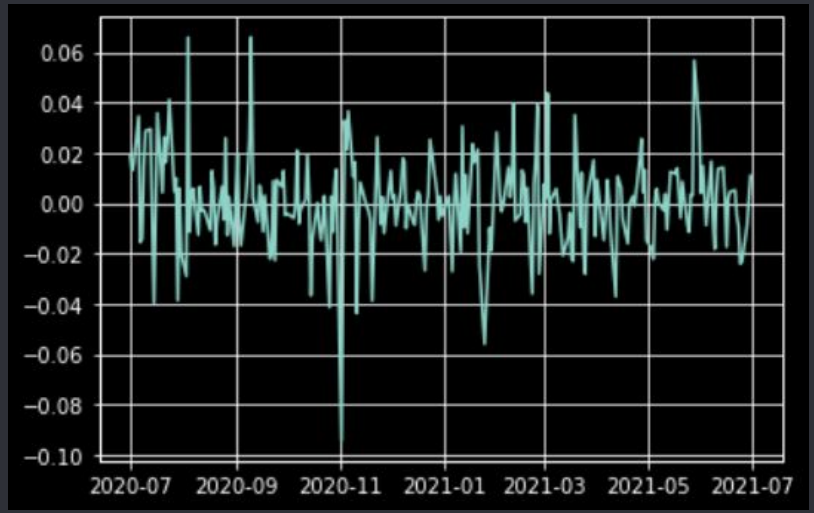


Scatter Plot for Nifty and SGX Nifty

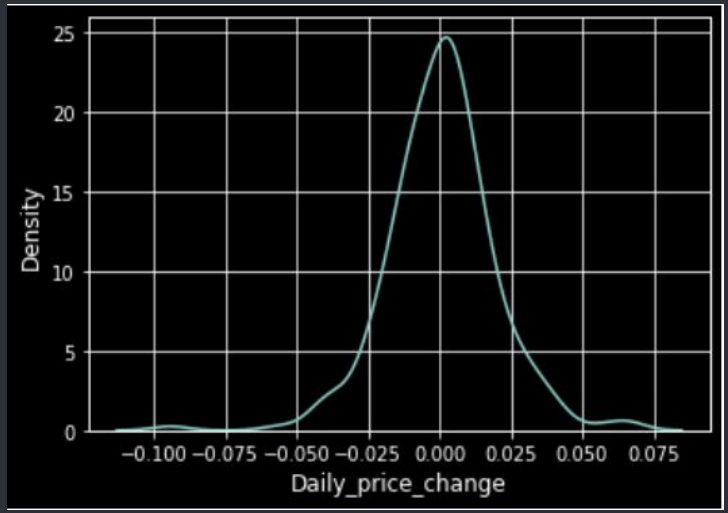


SGX Nifty

Daily Price Change



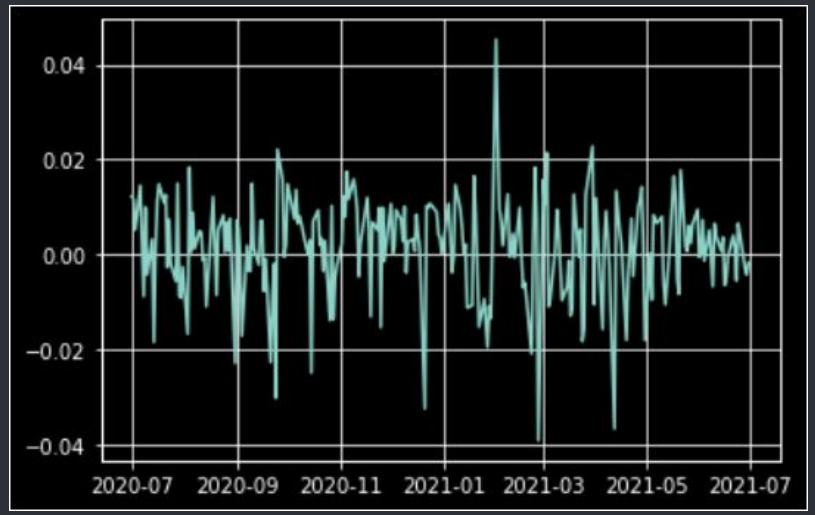
Distribution Plot



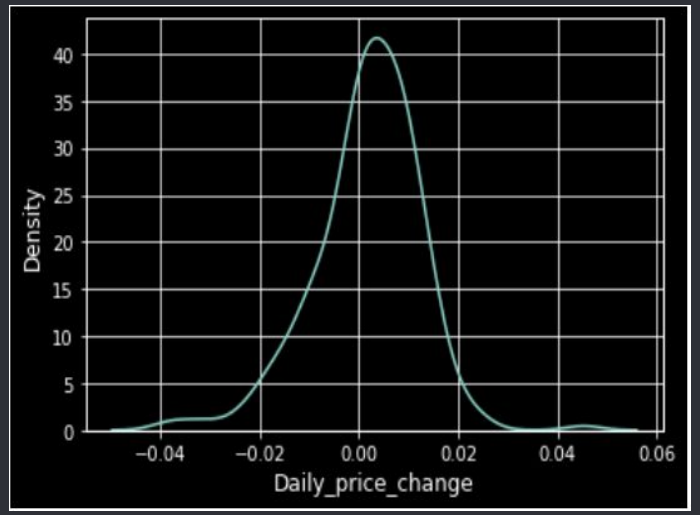
Based on KDE Plot, it is observed that distribution of SGX Nifty is almost normal

Nifty

Daily Price Change



Distribution Plot



Based on KDE Plot, it is observed that distribution of Nifty is a bit skewed towards left

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Solution Approach

Solutions to problem 1&2

Consider standard deviation of returns of INDA.P to be 1.5% and the price of INDA.P on 30th June 2021 to be USD 110. Calculate its covariance with NIFTY

Assumption: Inda.P and Nifty have same correlation as Nifty and SGX Nifty = rho

Given:

- Standard Deviation for Inda.P returns = 1.5 x 0.01
- Closing price at 30th June 2021 = USD 110

Approach:

- Find standard deviation of Inda.P Daily Price Change = sigma1 = (standard deviation for returns) x closing_price = 1.5 x 0.01
- Find standard deviation of Nifty Daily Price Change = sigma2 (based on data)
- Calculate rho by finding correlation between Nifty and SGX Nifty
- Covariance of Inda.P and Nifty = rho x sigma1 x sigma2

Results:

- Find standard deviation of Inda.P Daily Price Change = sigma1 = 1.5 x 0.01
- Find standard deviation of Nifty Daily Price Change = sigma2 = 0.0106
- Calculate rho = 0.544
- Covariance of Inda.P and Nifty = rho x sigma1 x sigma2 = 8.727e-05

Calculate closing prices for INDA.P at 95% confidence level for given data of NIFTY and SGX NIFTY.

Assumptions:

- Mean of Daily Price Change for Inda.P is 0

Given:

- Standard Deviation for Daily Price Change for Inda.P = 1.5*0.01
- Closing price at 30th June 2021 = USD 110
- z=1.96 for 95% CI

Approach:

- Calculate Confidence Interval for Daily Price Change of Inda.P using fig1.
- Once the confidence interval is found, we can find the price for the previous day and back trace it to find prices for all days.

Results:

- CI for daily price change = [-0.2,0.2]
- Blue color in the fig2 indicates the closing prices of Inda.P at 95% confidence interval.

$$\mathrm{CI} = \bar{X} \pm (z \times \sigma_{\bar{X}})$$

$$\sigma_{\bar{X}} = \frac{s}{\sqrt{N}}$$

Fig1

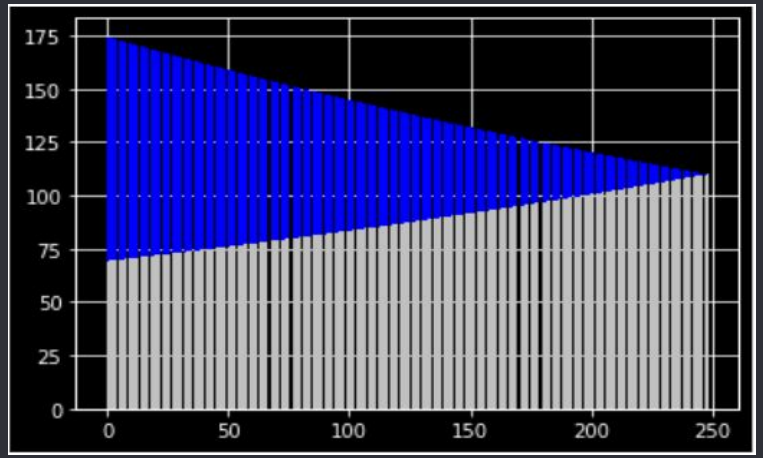


Fig2

3

Alternate Solution and Ideas

Solutions to problem 3&4

Submit a short-write up explaining your approach as clearly as possible and other interesting alternates

In the problem statement it was given that Inda.P and Nifty has same relation as Nifty and SGX Nifty. This could be one possible interpretation of what same relation could mean.

Daily Change in price of Inda.P = f(Daily Change in price of Nifty)

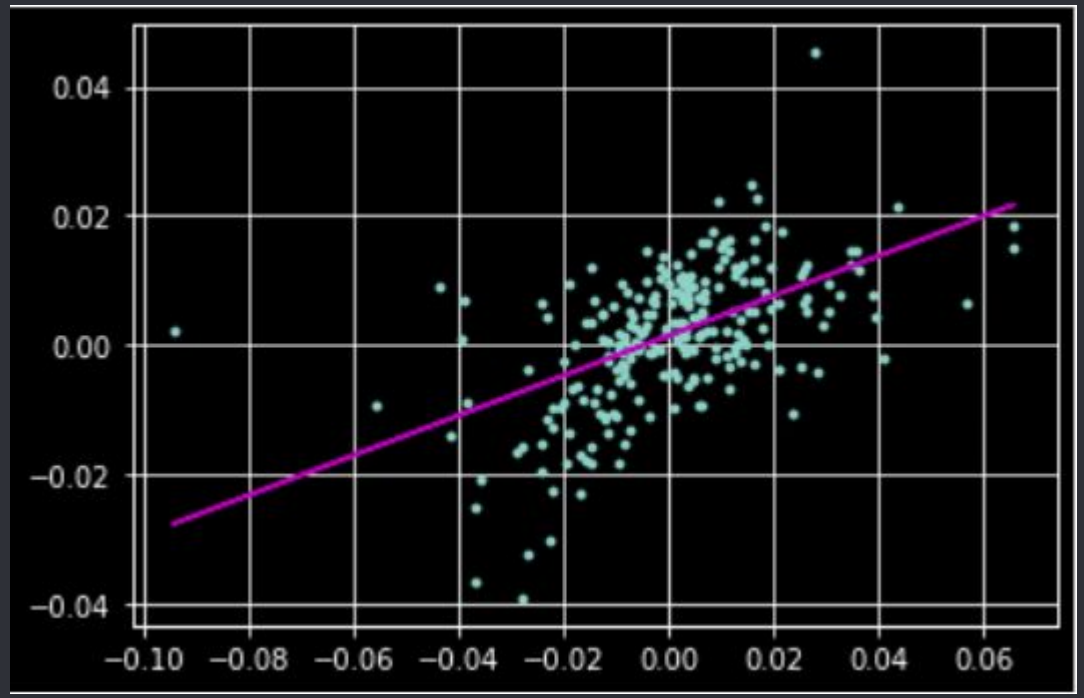
Daily Change in price of Nifty = f(Daily Change in price of SGX Nifty)

(Note the function f in both the cases are same)

In order to find the f, regression approach was carried out.

Daily change in price plot for Nifty vs SGX Nifty

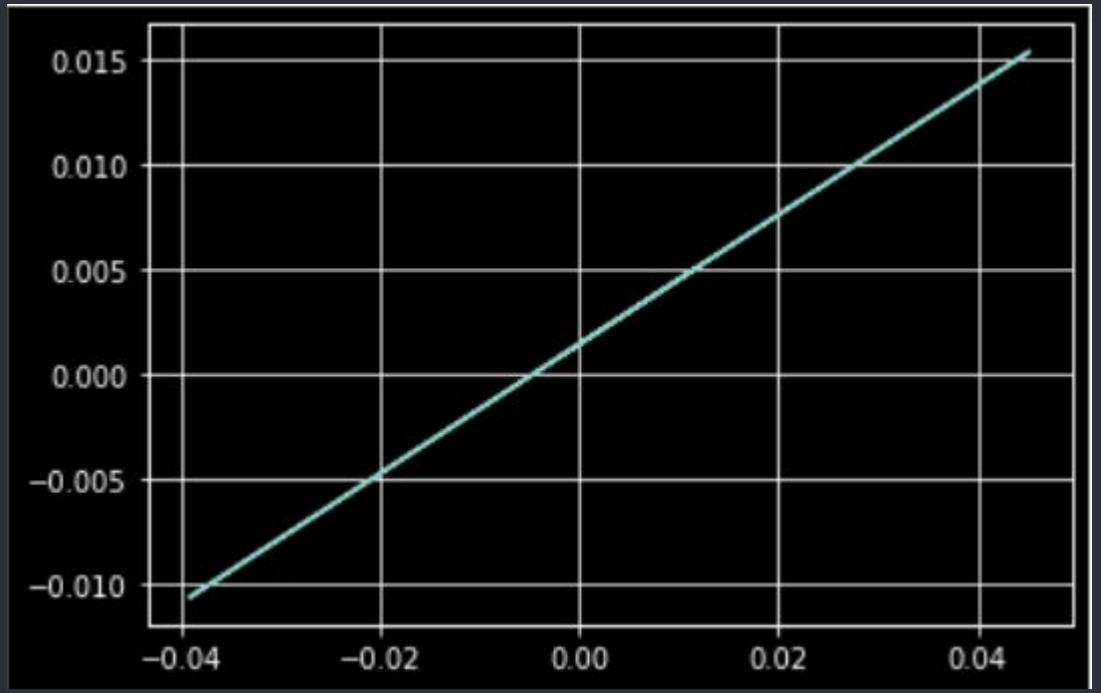
Nifty Daily Price Change



SGX Nifty Daily Price Change

Used above linear regression model for Inda.P

Inda.P Daily Price Change



Nifty Daily Price Change

- Above model was used to calculate the daily change in prices for Inda.P
- Standard deviation of Inda.P was found to be 0.0032 (sigma1) which was smaller than the given standard deviation value (i.e) 0.015.
- The p-value for the coefficient of the Daily Price Change(returns) was almost 0, which indicates that the values obtained for Inda.P were significant.
- Since the linear regression was used, correlation (rho) between the Inda.P and Nifty was taken 1.
- Covariance = sigma1 x sigma2 x rho = 3.531e-05

Think of how you can use the statistical properties of these products, to develop a systematic strategy to make profits – briefly explain your idea

Given the distribution curve for the prices, one could say that :

- If mean of the prices is higher then the return will also be higher.
- If standard deviation of the prices is higher, then risk associated is also higher.

A good strategy would be to choose the shares which has higher mean and lower standard deviation.

Another strategy to make profit may be to Maximizing the gain or Minimising the losses. For example, sell may be executed whenever price is more by 2% or whenever it is less by 1% of cost price. In case of short term trading, this strategy may be used.

One could also use options. For example if prices of Nifty are increasing compared to SGX Nifty, then we know that prices of Inda.P would also increase compared to Nifty. Under such cases one could long a call for Inda.P.

Thank You