
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 : Trades on New York stock exchange
- Daily price change 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

Plot for Nifty and SGX Nifty

<matplotlib.legend.Legend at 0x2835c04a388>



SGX Nifty Curve

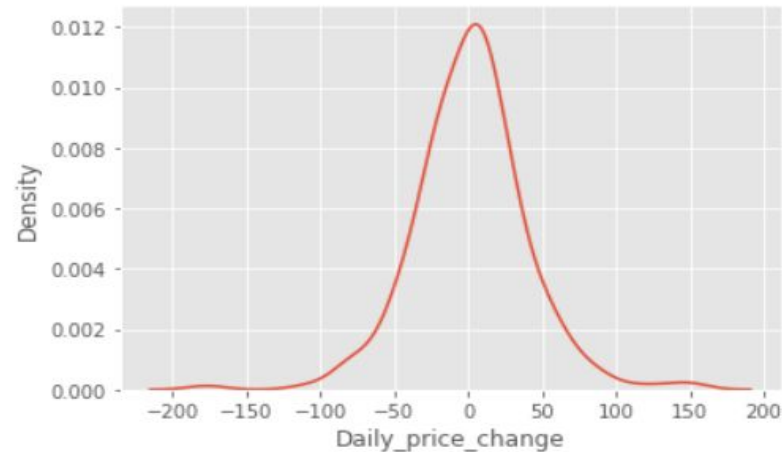
Daily Price Change

[<matplotlib.lines.Line2D at 0x2836067d688>]



Distribution Plot (KDE Plot)

<AxesSubplot:xlabel='Daily_price_change', ylabel='Density'>



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

Nifty Curve

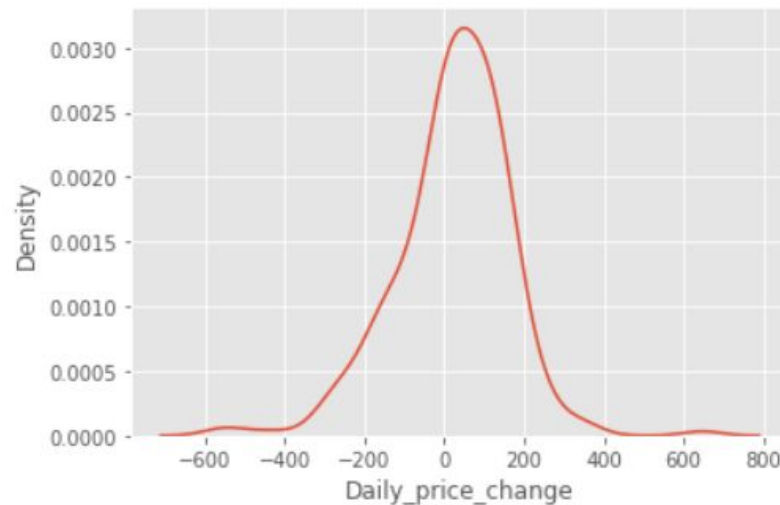
Daily Price Change

[<matplotlib.lines.Line2D at 0x2835e18b148>]



Distribution Plot (KDE Plot)

<AxesSubplot:xlabel='Daily_price_change', ylabel='Density'>



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

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 = ρ
- **Given:**
 - Standard Deviation for Inda.P returns = 1.5×0.01
 - Closing price at 30th June 2021 = USD 110
- **Approach:**
 - Find standard deviation of Inda.P Daily Price Change = $\sigma_1 = (\text{standard deviation for returns}) \times \text{closing_price} = 1.5 \times 0.01 \times 110$
 - Find standard deviation of Nifty Daily Price Change = σ_2 (based on data)
 - Calculate ρ by finding correlation between Nifty and SGX Nifty
 - Covariance of Inda.P and Nifty = $\rho \times \sigma_1 \times \sigma_2$
- **Results:**
 - $\rho = 0.54$
 - Standard Deviation of Inda.P Daily Price Change = $1.5 \times 0.01 \times 110 = 1.65$
 - Standard Deviation of Nifty Daily Price Change = 143.43 (based on data given)
 - Covariance of Inda.P and Nifty = $\rho \times \sigma_1 \times \sigma_2 = 127.20$

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

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

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

fig1

- **Assumptions:**
 - Mean of Daily Price Change for Inda.P is 0
 - Closing Prices are calculated for 1st July 2021
- **Given:**
 - Standard Deviation for Daily Price Change for Inda.P = 1.65
 - 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 add closing price at 30th June 2021 (i.e) USD 110 to both left and right limits of the interval.
- **Results:**
 - CI for daily price change = $[-0.2, 0.2]$
 - Range of Closing prices at 95% CI on 1st July 2021 = $[109.8, 110.2]$

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.

$$\text{Inda.P} = f(\text{Nifty})$$

$$\text{Nifty} = f(\text{SGX Nifty})$$

(OR)

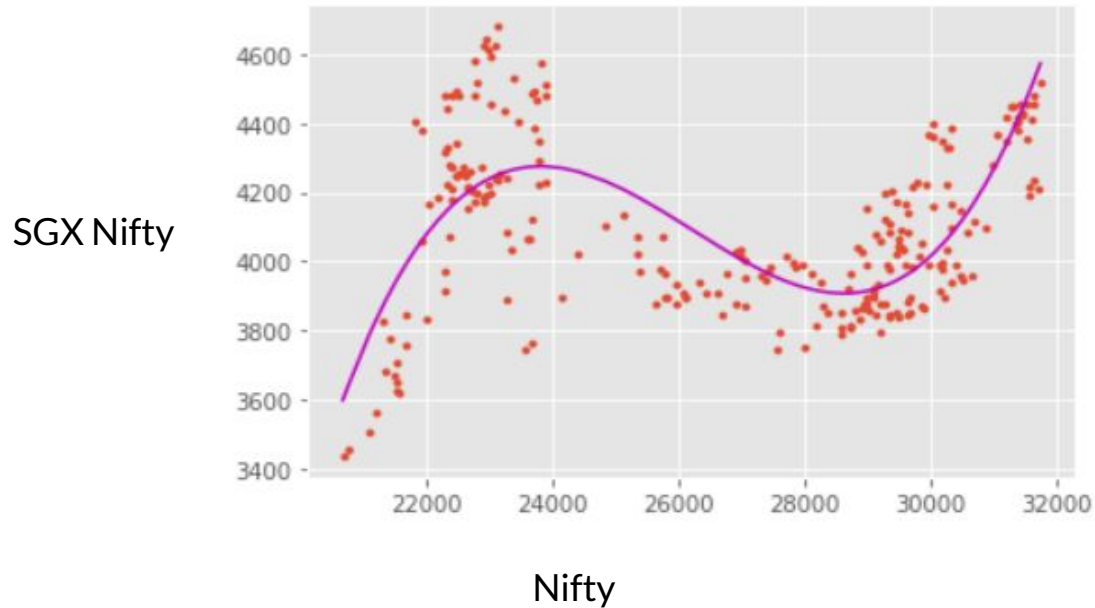
$$\text{Daily Change in price of Inda.P} = f(\text{Daily Change in price of Nifty})$$

$$\text{Daily Change in price of Nifty} = f(\text{Daily Change in price of SGX Nifty})$$

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

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

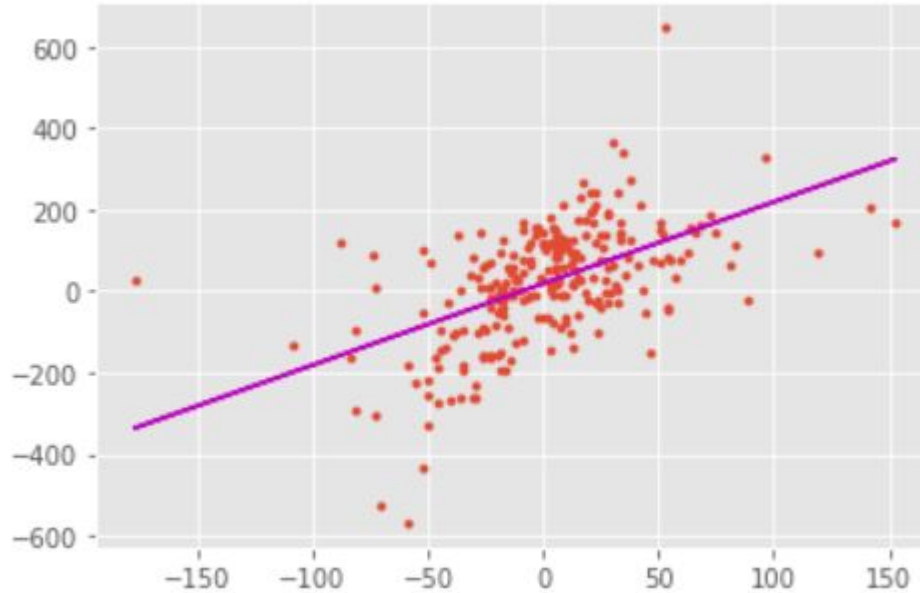
Scatter Plot for Nifty and SGX Nifty



- Based on the scatter plot cubic relation seemed a good fit.
- But a non monotonic cubic function is not invertible and we won't be able to find f such that $Nifty = f(SGX\ Nifty)$
- The problem could also be modelled as linear regression, but it won't fit the data well as evident from the scatter plot

Daily change in price plot for Nifty vs SGX Nifty

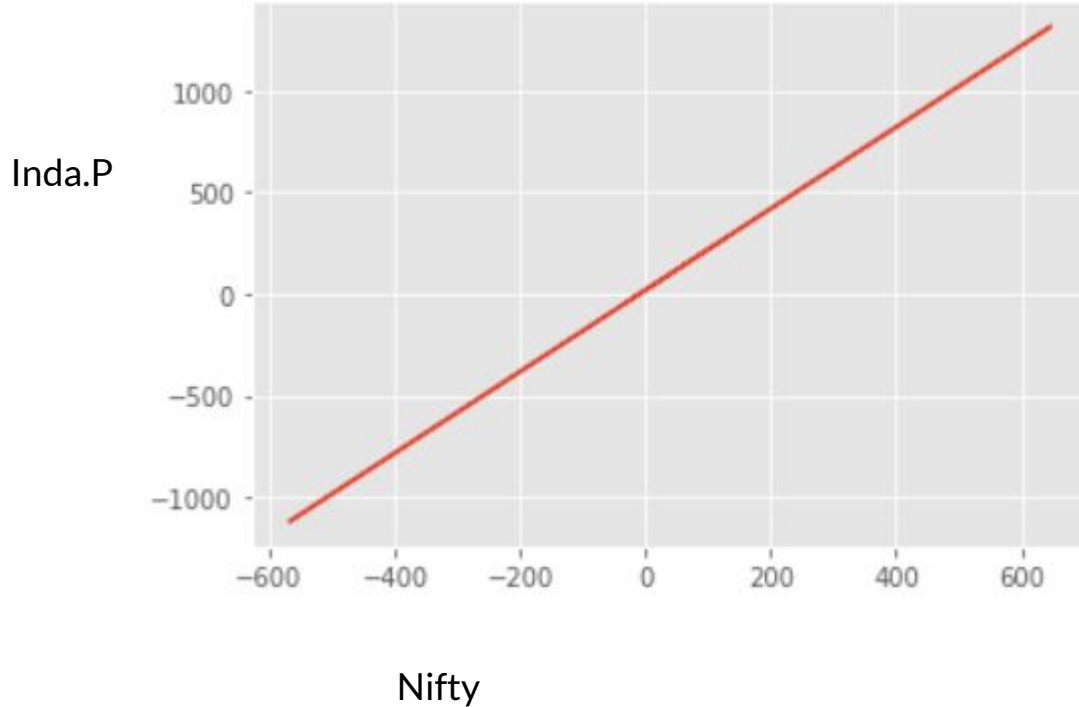
Nifty



SGX Nifty

Based on the scatter plot, linear regression seemed a good fit.

Used above linear regression model for Inda.P



- Above model was used to calculate the daily change in prices for inda.p
- Standard deviation was found to be 286.7 which was much larger than the given standard deviation value (i.e) 1.65. Also the closing price given (i.e) USD 110 was less than standard deviation for daily price change
- Hence this approach was not used.

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