Dependence of performance of companies of a country in share market on performance of companies of other countries in share market

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Abstract

Stock price performance of companies is of major interest in both financial and academic studies. Performance of companies of a country in share market might indicate to some degree, economic growth of that country. Due to international relations between local companies and multinational corporations and many other international factors, the share market performance of a county’s companies may be dependent on the international factor to an extent. In this paper, we try to find out if this dependence exists, and if it does, how strong is it.

Introduction

There are two main schools of thought in the financial markets, technical analysis and fundamental analysis. Fundamental analysis attempts to determine a stock’s value by focusing on underlying factors that affect a company’s actual business and its prospects. Fundamental analysis can be performed on industries or the economy. Technical analysis, on the other hand, looks at the price movement of a stock and uses this data to predict its future price movements. [1]

Data collected from source (listed in the data section), contains indicators such as Date, Open, High, Low, Close and Volume. For consistency, we perform analysis on High, Close and OHLC average (average of Open High Low and Close) of the technical data collected. The formula used for calculating OHLC average is shown below.

OHLC Average = (Open + High + Low + Close) / 4

The default setting for many indicators is to use the close of the time frame as the input data. Changing this to the open, the high or low can dramatically affect how the indicator moves and the analytical insight it provides. The open, high, low and close average (OHLC average) is the average of all these settings combined. [2]

For analysis, we use Random Forest Regression. Random forests or random decision forests are an ensemble learning method for classification, regression and other tasks, that operate by constructing a multitude of decision trees at training time and outputting the class that is the mode of the classes (classification) or mean prediction (regression) of the individual trees.[3][4]

The dataset is randomly shuffled and divided into two separate sub-sets, training-set and test-set.

Training set consists of 80% of the dataset, Test set consists of remaining 20% of the dataset.

Both training and test sets consists of α[assumption 1] attribute of each of the company listed in sequential fashion.

All the India’s 66 companies are taken as criterion variables one by one, for each of these companies, a Random Forest Regression model is trained. All other variables of Japan and US are simultaneously provided to the model as predictor variables. For training, the training-set is used.

For all these 67 companies, after training of the model, predictions are done on the test-set.

The predicted values for the criterion value are compared with the actual values. Now, using these 2, Mean Absolute Error (MAE), Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) is calculated.

Now, β[assumption 2] is calculated for all the 66 different models.

Now, γ[assumption 3] is calculated.

If γ is very small as compared to 50, there is a strong relation between the share market performance of the companies of the countries in question as our model was able to predict criterion variable values that were very close to the actual criterion variable values of the test set on the basis of the values of the predictor variables.

Data

In this paper, technical data is for 66 companies of India, 67 companies of Japan and 67 companies of United States of America is collected from the internet. Selected companies according to countries are listed in appendix a, b and c respectively. We chose these companies mainly because of their popularity and due to the reason that they have existed for a long time in the share market (so as to get more data for better analysis). We’ve used the website performance.morningstar.com as the source for collecting this data. Daily data is collected from source from date 30th May 2018 till date 24th September 2004 (Sequentially).

The required fields for attribute α[assumption 1] used for analysis for each company is concatenated column wise into their own files alphabetically depending on what indicator, the analysis is being done. This encompasses the final dataset on which analysis will be done.

The final dataset’s columns looks like the table given below in fig. 1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| India 1 | … | India 66 | Japan 1 | … | Japan 67 | US 1 | … | US 67 |
| # | # | # | # | # | # | # | # | # |
| # | # | # | # | # | # | # | # | # |

Fig. 1 Columns of the final dataset

In figure 1, the symbol ‘…’ indicate continuation of series. For example, India 1… India 3 would denote India 1, India 2, India 3. Symbol ‘#’ denotes values in the rows. The number of rows, columns are not precise and are just meant to give reader a view about the final dataset.

Analysis

A random forest algorithm is trained on the training-set treating 1 company of India as the criterion variable at a time and all companies of Japan and United States of America as the predictor variables.

Now, the trained model is tested against a randomly arranged 20% of the test set.

Following plots are given for the companies India 1 and India 66 as fig. 2 and fig. 3 respectively, where red points are values of criterion variables and blue lines are the models predictions.

The x axis represents the index in the test set of the criterion variable (note that indexes are randomized from the dataset and are not a function of time as the dataset is shuffled before splitting.)

The y axis represents the value of criterion variable’s α.

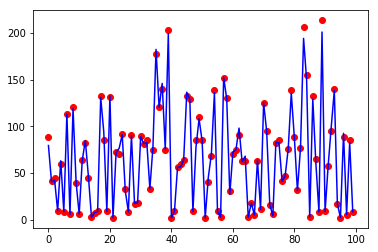


fig. 2: For company India 1

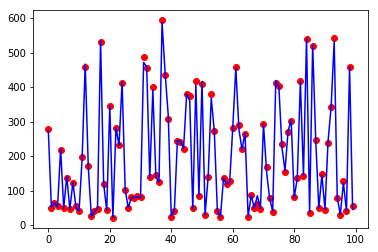


fig. 3: For company India 66

Results

Upon doing the above given experiment, the following results are obtained.

γ mean absolute error = 2.156315

γ root mean squared error= 5.816969

Average of Mean Squared Error = 16710.597253

Assumptions

1. The attribute for which analysis is being done (i.e. either OHLC average, High or Close), is assumed to be α.
2. Mean value of the criterion variable of the test set, is assumed to be β (Individual for all 66 models).
3. For mean absolute errors and root mean squared errors of the 66 models we trained, each value is divided by β and is multiplied by 100. This gives us the percentage part that is mean absolute error of β. Now all these values are averaged. This gives us the average percentage that the error is over all the 66 companies. Let this value be γ.

References

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3. Ho, T.K. (1995) Random Decision Forest. Proceedings of the 3rd International Conference on Document Analysis and Recognition, Montreal, 14-16 August 1995, 278-282.
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Appendix a

The 66 companies of India selected for experimentation are arranged alphabetically and listed as in the dataset.

(Company 1 of the dataset corresponds to the First Company alphabetically (lexical indexing).)

1. Adani Enterprises Ltd
2. Allahabad Bank
3. Ambuja Cement
4. Apollo Hospitals Enterprise Ltd
5. Aptech Ltd
6. Arvind Ltd
7. Ashok Leyland Ltd
8. Asian Paints Ltd
9. Axis Bank Ltd
10. Bajaj Auto Ltd
11. Balaji Telefilms Ltd
12. Bharat Electronics Ltd
13. Bharat Heavy Electricals Ltd
14. Britannia Industries Ltd
15. Container Corporation of India Ltd
16. Coromandel International Ltd
17. City Union Bank Ltd
18. Dabur India Ltd
19. Dena Bank
20. Dish TV India Ltd
21. Dr. Reddy's Laboratories Ltd
22. Eicher Motors Ltd
23. Eveready Industries India Ltd
24. Exide Industries Ltd
25. The Federal Bank Ltd
26. Force Motors Ltd
27. Fortis Healthcare Ltd
28. Great Eastern Shipping Co Ltd
29. Godrej Industries Ltd
30. Havells India Ltd
31. HCL Technologies Ltd
32. ICICI Bank Ltd
33. IndusInd Bank Ltd
34. Infosys Ltd
35. Kotak Mahindra Bank Ltd
36. Karnataka Bank Ltd
37. Larsen & Toubro Ltd
38. Mangalore Chemicals & Fertilizers Ltd
39. Maruti Suzuki India Ltd
40. Mastek Ltd
41. Moser Baer India Ltd
42. Mphasis Ltd
43. MRF Ltd
44. National Aluminium Co Ltd
45. Oil & Natural Gas Corp Ltd
46. Pentamedia Graphics Ltd
47. Power Grid Corp Of India Ltd
48. Punjab National Bank
49. Rajesh Exports Ltd
50. Raymond Ltd
51. Reliance Steel & Aluminum Co
52. Sonata Software Ltd
53. The South Indian Bank Ltd
54. Spicejet Ltd
55. State Bank of India
56. Sun Pharmaceuticals Industries Ltd
57. Tata Motors Ltd
58. Tata Steel Ltd
59. TVS Motor Co Ltd
60. UltraTech Cement Ltd
61. Vadilal Industries Ltd
62. Videocon Industries Ltd
63. Welspun India Ltd
64. Wipro Ltd
65. Zandu Realty Ltd
66. Zee Entertainment Enterprises Ltd

Appendix b

The 66 companies of Japan selected for experimentation are arranged alphabetically and listed as in the dataset.

(Company 1 of the dataset corresponds to the First Company alphabetically (lexical indexing).)

1. Advantest Corp.
2. Aichi Bank Ltd
3. Aichi Steel Corp
4. Aisin Seiki Co Ltd
5. Allied Telesis Holdings
6. Alps Electric Co Ltd
7. Aomori Bank Ltd
8. Asahi Group Holdings Ltd
9. ASICS Corp
10. Autobacs Seven Co Ltd
11. Bridgestone Corp
12. Canon Inc
13. Capcom Co Ltd
14. Casio Computer Co Ltd
15. Central Japan Railway Co
16. Chiyoda Corp
17. Chubu Electric Power Co Inc
18. Chugoku Electric Power Co Inc
19. Citizen Watch Co Ltd
20. Daicel Corp
21. Daiichi Sankyo Co Ltd
22. Daikin Industries Ltd
23. Daimaru Enawin Co Ltd
24. Dentsu Inc
25. Descente Ltd
26. Disco Corp
27. East Japan Railway Co
28. Eiken Chemical Co Ltd
29. Fanuc Corp
30. Fast Retailing Co Ltd
31. Fujitsu General Ltd
32. Futaba Corp
33. GS Yuasa Corp
34. Hamamatsu Photonics
35. HAZAMA ANDO Corp
36. Hitachi Ltd
37. Hokkaido Electric Power Co Inc
38. Honda Motor Co Ltd
39. Hosiden Corp
40. Hoya Corp
41. Inpex Corp
42. Isuzu Motors Ltd
43. ITOCHU Corp
44. Juki Corp
45. Kagome Co Ltd
46. Kajima Corp
47. Kawasaki Heavy Industries Ltd
48. Keihin Corp
49. Keio Corp
50. Kikkoman Corp
51. Kintetsu Group Holdings Co Ltd
52. Konica Minolta Inc
53. Kobe Electric Railway Co Ltd
54. Kubota Corp
55. Koei Tecmo Holdings Co Ltd
56. Konami Holdings Corp
57. Kumagai Gumi Co Ltd
58. Kuraray Co Ltd
59. Kurita Water Industries Ltd
60. KYB Corp
61. Mabuchi Motor Co Ltd
62. Maeda Corp
63. Makita Corp
64. Marubeni Corp
65. Mitsui & Co Ltd
66. Nissan Motor Co Ltd

Appendix c

The 66 companies of United States of America selected for experimentation are arranged alphabetically and listed as in the dataset.

(Company 1 of the dataset corresponds to the First Company alphabetically (lexical indexing).)

1. 3M Co
2. Abbott Laboratories
3. Amazon.com
4. AmerisourceBergen Corp
5. Apple Inc
6. Bank of America Corporation
7. Berkshire Hathaway Inc
8. Boston Scientific Corp
9. Cardinal Health Inc
10. Caterpillar Inc
11. Cisco Systems Inc
12. Coca-Cola Co
13. Costco Wholesale Corp
14. CVS Health Corp
15. Daimler AG
16. Dentsply Sirona Inc
17. Dominion Energy Inc
18. DowDuPont Inc
19. Duke Energy Corp
20. Exxon Mobil Corp
21. Ford Motor Co
22. Freeport-McMoRan Inc
23. General Dynamics Corp
24. General Electric Co
25. General Mills Inc
26. Honeywell International Inc
27. HP Inc
28. International Business Machines Corp
29. Ingersoll-Rand PLC
30. Intel Corp
31. International Paper Co
32. Intuit Inc
33. Jack Henry & Associates Inc
34. JetBlue Airways Corp
35. Deere & Co
36. Johnson & Johnson
37. Johnson Controls International PLC
38. Kimberly-Clark Corp
39. Eli Lilly and Co
40. Lockheed Martin Corp (LMT)
41. McKesson Corp
42. Merck & Co Inc
43. MGM Resorts International
44. NextEra Energy Inc
45. NiSource Inc
46. Northern Trust Corp
47. Northrop Grumman Corp
48. Oracle Corp
49. PepsiCo Inc
50. Pfizer Inc
51. Principal Financial Group Inc
52. Procter & Gamble Co
53. Raymond James Financial Inc
54. Roche Holding AG ADR
55. SAP SE ADR
56. Schneider Electric SE
57. Scholastic Corp
58. Southern Co
59. Southwest Airlines Co
60. Starbucks Corp
61. Stryker Corp
62. The Kroger Co
63. Tyson Foods Inc Class A
64. UnitedHealth Group Inc
65. United Technologies Corp
66. Verizon Communications Inc
67. Walmart Inc