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FE520 Trading Strategy for a stock:
—Moving Average

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Content

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- Chapter II: Code Implementation
- Chapter III: Back testing
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Chapter I

Introduction:

- The trading strategy selected aims to observe moving average as one of the indicators used in analyzing stocks
- The concept involves creating a constantly updated average price that is based on historical data
- It is used in technical analysis to signal optimal buy and sell choices
- A common problem faced by investors is whether to buy or sell a stock to maximize their return
- The importance of the model is that these buy and sell signals assist investors in making these important decisions

Chapter I

Moving Average Strategy

- By analyzing a short-term and long-term moving averages for historical data over a 5-day and 10-day period, profitable investment decisions can be captured
- This helps determine the trend direction
- At the point when the price crosses above the moving average, this will indicate a buy strategy and an upward trend
- On the other hand, when it crosses below the moving average, a sell strategy or downward trend will prove to generate a higher return

Chapter I

Methodology

- To determine buy and sell strategies for a few stocks, the following process was followed:
- Import pandas, pandas datareader, numpy, yfinance, pyplot and matplotib
- Data time set for one year from 1 January 2020 to 1 January 2021
- Data frame created and data generated from yahoo finance based on date to gather Open, High, Low and Closing price for stock
- Two variables created – 5-day and 10-day moving averages
- Rolling widow of 10 for long-term moving average and 5 for short-term moving average
- Flags then added to determine when two variables cross over
- Data plotted using matplotlip.pyplot

Chapter II

Codes

```
|: import yfinance as yf
   import numpy as np
   import pandas as pd
   import pandas_datareader as pdr
   import matplotlib.pyplot as plt

   #Datetime package
   from datetime import date
```

```
|: start = pd.to_datetime('2020-01-01') #set start day-time
   end = pd.to_datetime('2021-01-01') #set end day-time
```

```
|: ticker = ['NFLX'] #choose the stock
```

```
|: NT=yf.download(ticker,start=start, end=end) # get the stock data



   day = np.arange(1, len(NT) + 1) #day to get the day time
   NT['day'] = day # get the dataframe
   NT.drop(columns=['Adj Close', 'Volume'], inplace = True) #drop the useless data
   NT = NT[['day', 'Open', 'High', 'Low', 'Close']] #set the day,open,high,low,close
   print(NT) #print the data
```

```
[**********************100%**********************]  1 of 1 completed
            day        Open        High         Low       Close
Date
2020-01-02    1  326.100006  329.980011  324.779999  329.809998
2020-01-03    2  326.779999  329.859985  325.529999  325.899994
2020-01-06    3  323.119995  336.359985  321.200012  335.829987
2020-01-07    4  336.470001  336.700012  330.299988  330.750000
2020-01-08    5  331.489990  342.700012  331.049988  339.260010
...         ...         ...         ...         ...         ...
2020-12-24  249  515.119995  519.349976  512.210022  513.969971
2020-12-28  250  516.429993  523.659973  507.130005  519.119995
2020-12-29  251  519.900024  536.549988  515.479980  530.869995
2020-12-30  252  530.130005  533.260010  523.690002  524.590027
2020-12-31  253  525.530029  545.500000  523.150024  540.729980

[253 rows x 5 columns]
```

Chapter II

```
NT['5-day'] = NT['Close'].rolling(5).mean() #get the rolling5 as short line
NT['10-day'] = NT['Close'].rolling(10).mean() #get the rolling10 as long line
NT.head()
```

```
/var/folders/83/wyld6rbs37jg06dnrv50h1sh0000gn/T/ipykernel_13165/727068757.py:1: SettingWithC
opyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guid
e/indexing.html#returning-a-view-versus-a-copy
  NT['5-day'] = NT['Close'].rolling(5).mean() #get the rolling5 as short line
/var/folders/83/wyld6rbs37jg06dnrv50h1sh0000gn/T/ipykernel_13165/727068757.py:2: SettingWithC
opyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guid
e/indexing.html#returning-a-view-versus-a-copy
  NT['10-day'] = NT['Close'].rolling(10).mean() #get the rolling10 as long line
```

Date	day	Open	High	Low	Close	5-day	10-day
2020-01-02	1	326.100006	329.980011	324.779999	329.809998	NaN	NaN
2020-01-03	2	326.779999	329.859985	325.529999	325.899994	NaN	NaN
2020-01-06	3	323.119995	336.359985	321.200012	335.829987	NaN	NaN
2020-01-07	4	336.470001	336.700012	330.299988	330.750000	NaN	NaN
2020-01-08	5	331.489990	342.700012	331.049988	339.260010	332.309998	NaN

Chapter II

```
NT['signal'] = np.where(NT['5-day'] > NT['10-day'], 1, 0) #if short>long set 1 else 0  (golden fork buy)
NT['signal'] = np.where(NT['5-day'] < NT['10-day'], -1, NT['signal']) #if short< long set -1 else signal (dead fork)
NT.dropna(inplace=True) #drop the NA data (we could change the value)
NT.head()
```

```
/var/folders/83/wyld6rbs37jg06dnrv50h1sh0000gn/T/ipykernel_13165/312035067.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  NT['signal'] = np.where(NT['5-day'] > NT['10-day'], 1, 0) #if short>long set 1 else 0
/var/folders/83/wyld6rbs37jg06dnrv50h1sh0000gn/T/ipykernel_13165/312035067.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  NT['signal'] = np.where(NT['5-day'] < NT['10-day'], -1, NT['signal']) #if short< long set -1 else signal
/Users/rz/opt/anaconda3/lib/python3.9/site-packages/pandas/util/_decorators.py:311: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return func(*args, **kwargs)
```

Date	day	Open	High	Low	Close	5-day	10-day	signal
2020-01-15	10	338.679993	343.170013	336.600006	339.070007	336.278003	334.294000	1
2020-01-16	11	343.500000	343.559998	335.850006	338.619995	336.870001	335.175000	1
2020-01-17	12	341.000000	341.570007	337.380005	339.670013	338.994006	336.552002	1
2020-01-21	13	340.000000	341.000000	332.589996	338.109985	338.832001	336.780002	1
2020-01-22	14	332.549988	336.299988	323.600006	326.000000	336.294000	336.305002	-1

```
NT['return'] = np.log(NT['Close']).diff()#find the first discrete difference of objects over the given axis
NT['system_return'] = NT['signal'] * NT['return'] #get the system return with signal*return
NT['entry'] = NT.signal.diff() #set different number as entry
NT.to_csv('NT_data.csv') #to csv
```

Chapter II

```
plt.rcParams['figure.figsize'] = 12, 6 #set the figure size
plt.grid(True, alpha = .3) #set the grid with clarity 0.3
plt.plot(NT.iloc[-252:]['Close'], label = 'NT')  #get NT stock index 252 days
plt.plot(NT.iloc[-252:]['5-day'], label = '5-day') #plot short
plt.plot(NT.iloc[-252:]['10-day'], label = '10-day') #plot long
plt.plot(NT[-252:].loc[NT.entry == 2].index, NT[-252:]['5-day'][NT.entry == 2], '^',
         color = 'g', markersize = 10) #set the color green buy:entry==2
plt.plot(NT[-252:].loc[NT.entry == -2].index, NT[-252:]['10-day'][NT.entry == -2], 'v',
         color = 'r', markersize = 10) #set the color red sell entry==-2
plt.legend(loc=2);#Place a legend on the Axes
```

Chapter II

Buy Signal

Sell Signal

Moving Average Graph

Chapter III

Back Testing

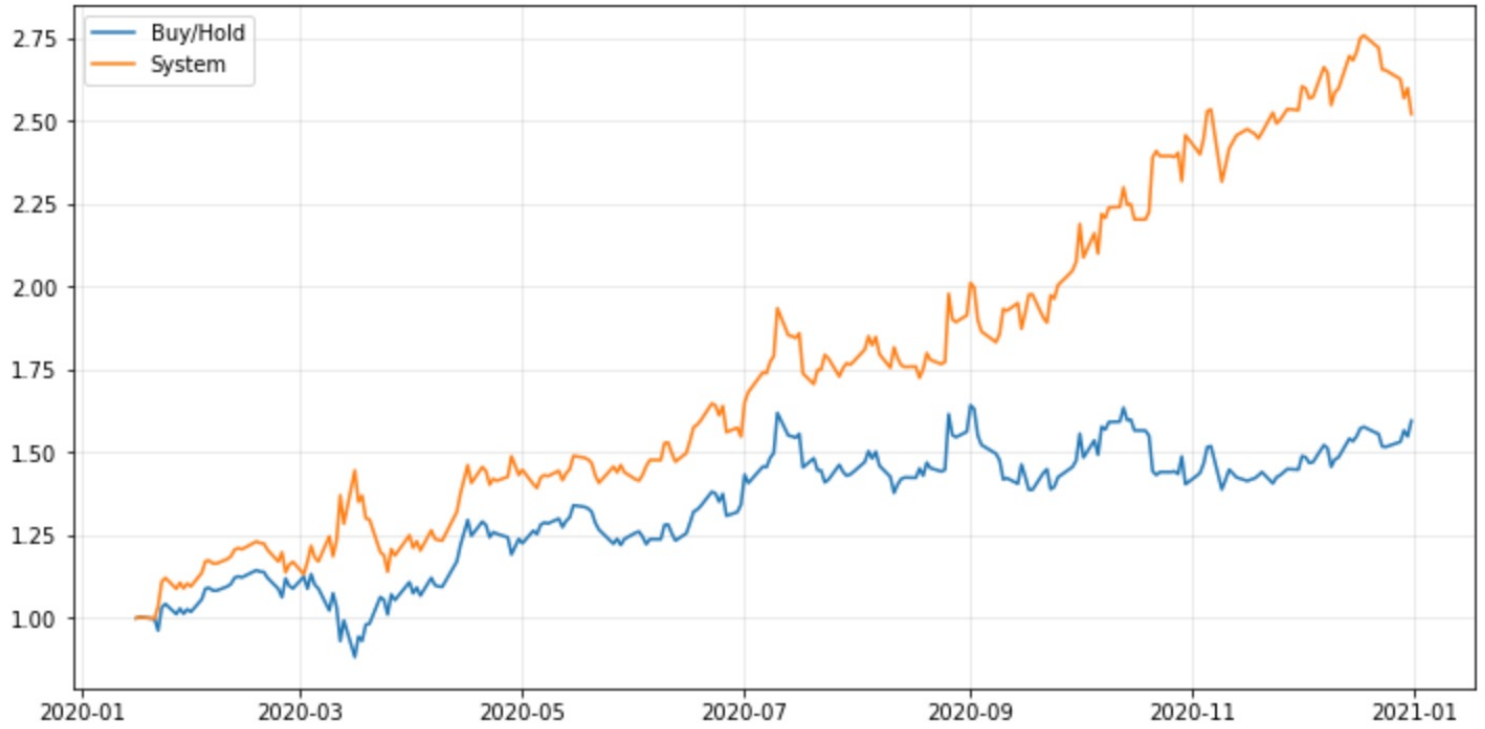
```
#MA return
np.exp(NT['system_return']).cumprod()[-1] -1
```

```
1.5214498424481913
```

```
#return
np.exp(NT['return']).cumprod()[-1] -1
```

```
0.5947443559987391
```

```
plt.plot(np.exp(NT['return']).cumprod(), label='Buy/Hold') #calculate the normal stock return
plt.plot(np.exp(NT['system_return']).cumprod(), label='System') #calculate the MA strategy return
plt.legend(loc=2)
plt.grid(True, alpha=.3)
```



Chapter III

```
#sell time
dasell=da[da['entry']==2]
dasell=pd.DataFrame(dasell)
print(dasell['Date'])
print('-------------')
#buy time
dabuy=da[da['entry']==-2]
dabuy=pd.DataFrame(dabuy)
print(dabuy['Date'])

```

SELL

```
5      2020-01-23
33     2020-03-04
47     2020-03-24
76     2020-05-05
98     2020-06-05
116    2020-07-01
118    2020-07-06
137    2020-07-31
151    2020-08-20
176    2020-09-25
204    2020-11-04
216    2020-11-20
219    2020-11-25
Name: Date, dtype: object
-------------
```

BUY

```
4      2020-01-22
27     2020-02-25
36     2020-03-09
70     2020-04-27
90     2020-05-26
115    2020-06-30
117    2020-07-02
128    2020-07-20
144    2020-08-11
164    2020-09-09
193    2020-10-20
210    2020-11-12
217    2020-11-23
240    2020-12-28
Name: Date, dtype: object
```

Chapter III

Maximum Drawdown

```
def get_max_drawdown_fast(array):
    drawdowns = []
    max_so_far = array[0]
    for i in range(len(array)):
        if array[i] > max_so_far:
            drawdown = 0
            drawdowns.append(drawdown)
            max_so_far = array[i]
        else:
            drawdown = max_so_far - array[i]
            drawdowns.append(drawdown)
    return max(drawdowns)
```

```
get_max_drawdown_fast(df3)
```

```
0.2079417759654498 8
```

Chapter III

Sharpe Ratio & Sharpe Yearly Return

```
#calculate sharpe ratio, and sharpe yearly return

#sharpe ratio
def calculate_sharp(data):

    avg_return = data.mean()
    std_return = data.std()
    sharp = avg_return / std_return
    sharp_year = sharp * np.sqrt(252)
    return sharp, sharp_year
```

```
print(calculate_sharp(df3)) #system_return sharpe
```

```
(0.13004967839435294, 2.064474642692326)
```

```
print(calculate_sharp(dfreturn)) #return sharpe
```

```
(0.06521753932961961, 1.0352963411144855)
```

Chapter III

Bollinger Band Strategy

Chapter III

Bollinger Band Strategy

```
#Bollinger Band figure
fig = go.Figure()

#Set up traces
fig.add_trace(go.Scatter(x=NFLX_data.index, y= NFLX_data['Middle Band'],line=dict(color='blue', width=.7), name = 'Midd
fig.add_trace(go.Scatter(x=NFLX_data.index, y= NFLX_data['Upper Band'],line=dict(color='red', width=1.5), name = 'Upper
fig.add_trace(go.Scatter(x=NFLX_data.index, y= NFLX_data['Lower Band'],line=dict(color='green', width=1.5), name = 'Low

fig.add_trace(go.Candlestick(x=NFLX_data.index,
                open=NFLX_data['Open'],
                high=NFLX_data['High'],
                low=NFLX_data['Low'],
                close=NFLX_data['Close'], name = 'market data'))
# Add titles
fig.update_layout(
    title='Bollinger Band Strategy',
    yaxis_title='Stock Price (USD per Shares)')

# X-Axes
fig.update_xaxes(
    rangeslider_visible=True,
    rangeselector=dict(
        buttons=list([
            dict(count=1, label="1m", step="month", stepmode="backward"),
            dict(count=6, label="6m", step="month", stepmode="backward"),
            dict(count=1, label="YTD", step="year", stepmode="todate"),
            dict(count=1, label="1y", step="year", stepmode="backward"),
            dict(step="all")
        ])
    )
)

#Show
fig.show()
```

Chapter IV

Improvements with relevant topics

- 1. We assumed zero interest rates, no transaction costs
- 2. We didn’t consider the turnover rate and the other risks
- 3. This trading strategy can‘t pinpoint the exact minutes and seconds to trade, just show the date to buy or sell your asset
- 4. Transactions need to be made by hands and it’s not automatic
- 5. More stocks could be added as a portfolio

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