TWAP

September 29, 2021

1 Time Weighted Average Price (TWAP)

https://en.wikipedia.org/wiki/Time-weighted_average_price

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

import warnings
warnings.filterwarnings("ignore")

# fix_yahoo_finance is used to fetch data
import fix_yahoo_finance as yf
yf.pdr_override()
```

[2]:
```
# input
symbol = 'AAPL'
start = '2018-01-01'
end = '2019-01-01'

# Read data
df = yf.download(symbol,start,end)

# View Columns
df.head()
```

```
[**********************100%**********************]  1 of 1 downloaded
```

[2]:

Date	Open	High	Low	Close	Adj Close	Volume
2018-01-02	170.160004	172.300003	169.259995	172.259995	168.339050	
2018-01-03	172.529999	174.550003	171.960007	172.229996	168.309738	
2018-01-04	172.539993	173.470001	172.080002	173.029999	169.091522	
2018-01-05	173.440002	175.369995	173.050003	175.000000	171.016678	
2018-01-08	174.350006	175.610001	173.929993	174.350006	170.381485	

```
2018-01-02  25555900
2018-01-03  29517900
2018-01-04  22434600
2018-01-05  23660000
2018-01-08  20567800
```

[3]:
```
TP = (df[['Open','High','Low','Adj Close']].sum(axis=1))/4
```

[4]:
```
n=10
df['TWAP'] = TP.rolling(n).mean()
```

[5]:
```
df.head(15)
```

[5]:

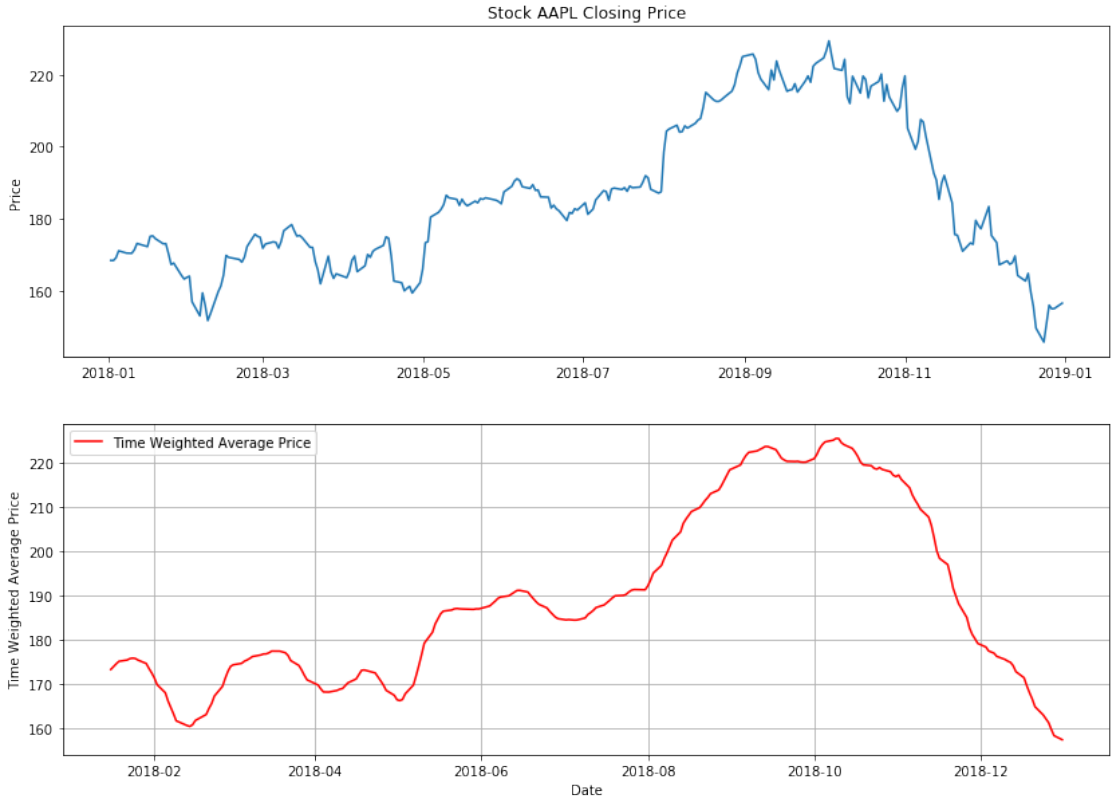
Date	Open	High	Low	Close	Adj Close	Volume	TWAP
2018-01-02	170.160004	172.300003	169.259995	172.259995	168.339050	25555900	NaN
2018-01-03	172.529999	174.550003	171.960007	172.229996	168.309738	29517900	NaN
2018-01-04	172.539993	173.470001	172.080002	173.029999	169.091522	22434600	NaN
2018-01-05	173.440002	175.369995	173.050003	175.000000	171.016678	23660000	NaN
2018-01-08	174.350006	175.610001	173.929993	174.350006	170.381485	20567800	NaN
2018-01-09	174.550003	175.059998	173.410004	174.330002	170.361954	21584000	NaN
2018-01-10	173.160004	174.300003	173.000000	174.289993	170.322845	23959900	NaN
2018-01-11	174.589996	175.490005	174.490005	175.279999	171.290329	18667700	NaN
2018-01-12	176.179993	177.360001	175.649994	177.089996	173.059113	25418100	NaN
2018-01-16	177.899994	179.389999	176.139999	176.190002	172.179611	29565900	173.240558
2018-01-17	176.149994	179.250000	175.070007	179.100006	175.023361	34386800	173.876416
2018-01-18	179.369995	180.100006	178.250000	179.259995	175.179718	31193400	174.515165
2018-01-19	178.610001	179.580002	177.410004	178.460007	174.397949	32425100	175.085576
2018-01-22	177.300003	177.779999	176.600006	177.000000	172.971176	27108600	175.379939
2018-01-23	177.300003	179.440002	176.820007	177.039993	173.010254		

```
2018-01-23  32689100  175.687408
```

[6]:
```
fig = plt.figure(figsize=(14,10))
ax1 = plt.subplot(2, 1, 1)
ax1.plot(df['Adj Close'])
ax1.set_title('Stock '+ symbol +' Closing Price')
ax1.set_ylabel('Price')

ax2 = plt.subplot(2, 1, 2)
ax2.plot(df['TWAP'], label='Time Weighted Average Price', color='red')
#ax2.axhline(y=0, color='blue', linestyle='--')
#ax2.axhline(y=0.5, color='darkblue')
#ax2.axhline(y=-0.5, color='darkblue')
ax2.grid()
ax2.set_ylabel('Time Weighted Average Price')
ax2.set_xlabel('Date')
ax2.legend(loc='best')
```

[6]:
```
<matplotlib.legend.Legend at 0x1e8bd550710>
```



1.1 Candlestick with Time Weighted Average Price (TWAP)

[7]:
```
from matplotlib import dates as mdates
import datetime as dt

dfc = df.copy()
dfc['VolumePositive'] = dfc['Open'] < dfc['Adj Close']
#dfc = dfc.dropna()
dfc = dfc.reset_index()
dfc['Date'] = pd.to_datetime(dfc['Date'])
dfc['Date'] = dfc['Date'].apply(mdates.date2num)
dfc.head()
```

[7]:

	Date	Open	High	Low	Close	Adj Close	Volume	TWAP	VolumePositive
0	736696.0	170.160004	172.300003	169.259995	172.259995	168.339050	25555900	NaN	False
1	736697.0	172.529999	174.550003	171.960007	172.229996	168.309738	29517900	NaN	False
2	736698.0	172.539993	173.470001	172.080002	173.029999	169.091522	22434600	NaN	False
3	736699.0	173.440002	175.369995	173.050003	175.000000	171.016678	23660000	NaN	False
4	736702.0	174.350006	175.610001	173.929993	174.350006	170.381485	20567800	NaN	False

[8]:
```
from mpl_finance import candlestick_ohlc

fig = plt.figure(figsize=(14,10))
ax1 = plt.subplot(2, 1, 1)
candlestick_ohlc(ax1,dfc.values, width=0.5, colorup='g', colordown='r', alpha=1.
 ↪0)
ax1.xaxis_date()
ax1.xaxis.set_major_formatter(mdates.DateFormatter('%d-%m-%Y'))
ax1.grid(True, which='both')
ax1.minorticks_on()
ax1v = ax1.twinx()
colors = dfc.VolumePositive.map({True: 'g', False: 'r'})
ax1v.bar(dfc.Date, dfc['Volume'], color=colors, alpha=0.4)
ax1v.axes.yaxis.set_ticklabels([])
ax1v.set_ylim(0, 3*df.Volume.max())
ax1.set_title('Stock '+ symbol +' Closing Price')
ax1.set_ylabel('Price')

ax2 = plt.subplot(2, 1, 2)
ax2.plot(df['TWAP'], label='Time Weighted Average Price', color='red')
```

```
#ax2.axhline(y=0, color='blue', linestyle='--')
#ax2.axhline(y=0.5, color='darkblue')
#ax2.axhline(y=-0.5, color='darkblue')
ax2.grid()
ax2.set_ylabel('Time Weighted Average Price')
ax2.set_xlabel('Date')
ax2.legend(loc='best')
```

[8]: <matplotlib.legend.Legend at 0x1e8bef93a20>