Một số lưu ý khi dùng tham khảo.

1. Dữ liệu chỉ cần dưới định dạng: date | open | high | low | close. Không phân biệt thị trường chứng khoán hay crypto miễn là có file csv. Người xem có thể tự download dữ liệu trên các trang mạng về.

2. Bản báo cáo này chưa được tối ưu do chưa có chức năng tự động update giá. => chưa thể tự cập nhập dự đoán.

In [69]:
```
import btalib
import pandas as pd
import statsmodels.api as sm
import matplotlib.pyplot as plt
import numpy as np
from sklearn import linear_model
```

In [70]:
```
# load DataFrame
btc_df = pd.read_csv('btc_bars4.csv', index_col=0)
btc_df.index = pd.to_datetime(btc_df.index, unit='ms')
```

1. SMA

Non-weighted average of the last n periods

Formula:

- movav = Sum(data, period) / period

See also:

- http://en.wikipedia.org/wiki/Moving_average#Simple_moving_average

Aliases: SMA, SimpleMovingAverage

Inputs: close

Outputs: sma

Params:

- period (default: 30) Period for the moving average calculation

In [71]:
```
sma = btalib.sma(btc_df.close)
```

2. RSI

Defined by J. Welles Wilder, Jr. in 1978 in his book *"New Concepts in Technical Trading Systems"*.

It measures momentum by calculating the ration of higher closes and lower closes after having been smoothed by an average, normalizing the result between 0 and 100

Formula:

- up = upday(data) # max(close - close(-1), 0.0)
- down = downday(data) # abs(min(close - close(-1), 0.0))
- maup = movingaverage(up, period)
- madown = movingaverage(down, period)
- rs = maup / madown
- rsi = 100 - 100 / (1 + rs)

The moving average used is the one originally defined by Wilder, the SmoothedMovingAverage

See:

- http://en.wikipedia.org/wiki/Relative_strength_index

Aliases: RSI, RelativeStrengthIndex

Inputs: close

Outputs: rsi

Params:

- period (default: 14) Period to consider
- lookback (default: 1) Lookback for up/down days
- _ma (default: smma) Smoothing moving average

In [72]:
```
rsi = btalib.rsi(btc_df, period=14)
```

3. Stoch RSI

Presented by Chande and Kroll the 1990 book: "The New Technical Trader". The RSI is fed into a atochastic-like calculation to increase its sensitivity.

The recommendation is to keep the period for looking for highest highes and lowest lows the same as the for the RSI, but it can be played with for experimentation.

Scaling to 100 is also suggested as a possiblity (the range is 0.0 => 1.0)

Formula:

- rsi = RSI(data, period)
- maxrsi = Highest(rsi, period)
- minrsi = Lowest(rsi, period)

- stochrsi = (rsi - minrsi) / (maxrsi - minrsi)

See

- https://school.stockcharts.com/doku.php?id=technical_indicators:stochrsi

Aliases: StochRsi, STOCHRSI

Inputs: close

Outputs: stochrsi

Params:

- period (default: 14) Period to consider
- _philo (default: None) Period for highest/lowest (None => period)
- _scale (default: 1.0) Scale the result by this factor

TA-LIB (with compatibility flag "_talib=True"):

ta-lib uses internally the fast stochastic to calculate the stochrsi, with these side-effects

- The scale changes from 0.0-1.0 to 0.0-100.0

- A 2nd output is returned (stochrsi as defined by its authors has only 1 output)

- The highest/lowest period is no longer symmetric with the rsi period

Compatibility does this

- Change the scale to 0.0-100.0
- Change the highest/lowest period 5
- Add a 2nd output named 'd' (as the 2nd output of the stochastic)
- Run a simple moving average on it of period 3

In [73]:
```
stochrsi = btalib.stochrsi(btc_df, period=14)
```

4. CCI

Introduced by Donald Lambert in 1980 to measure variations of the "typical price" (see below) from its mean to identify extremes and reversals

Formula:

- tp = typical_price = (high + low + close) / 3
- tpmean = MovingAverage(tp, period)
- deviation = tp - tpmean
- meandev = MeanDeviation(tp)
- cci = deviation / (meandeviation * factor)

See:

- https://en.wikipedia.org/wiki/Commodity_channel_index

Aliases: CCI, CommodityChannelIndex

Inputs: high, low, close

Outputs: cci

Params:

- period (default: 20) Period to consider
- factor (default: 0.015) Channel width factor
- _ma (default: sma) Moving Average to sue
- _dev (default: mad) Deviation to use (Def: Mean Abs Dev)

TA-LIB (with compatibility flag "_talib=True"):

Change period to 14

In [74]:
```
cci = btalib.cci(btc_df, period = 20, factor = 0.015)
```

5. Parabol SAR

Defined by J. Welles Wilder, Jr. in 1978 in his book *"New Concepts in Technical Trading Systems"* for the RSI

SAR stands for *Stop and Reverse* and the indicator was meant as a signal for entry (and reverse)

How to select the 1st signal is left unspecified in the book. Because the inputs are "high" and "low", a 1-bar MinusDM is calculated, which accounts for both downmove and upmove of high/low. This is also done by ta-lib

See:

- https://en.wikipedia.org/wiki/Parabolic_SAR
- http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:parabolic_sar

Aliases: SAR, psar, ParabolicStopAndReverse

Inputs: high, low

Outputs: sar

Params:

- af (default: 0.02) Acceleration Factor
- afmax (default: 0.2) Maximum Acceleration Factor

In [75]:
```
sar = btalib.sar(btc_df)
```

6. MACD

Moving Average Convergence Divergence. Defined by Gerald Appel in the 70s.

It measures the distance of a fast and a slow moving average to try to identify the trend.

A second lagging moving average over the convergence-divergence should provide a "signal" upon being crossed by the macd

Formula:

- macd = ma(data, pfast) - ma(data, pslow)
- signal = ma(macd, psignal)
- histogram = macd - signal

See:

- http://en.wikipedia.org/wiki/MACD

Aliases: MACD, MovingAverageConvergenceDivergence, MACDEXT, MACDFIX

Inputs: close

Outputs: macd, signal, histogram

Params:

- pfast (default: 12) Fast moving average period
- pslow (default: 26) Slow moving average period
- psignal (default: 9) Signal smoothing period
- _ma (default: ema) Moving average to use
- _masig (default: None) Signal moving average (if `None`, same as others)

TA-LIB (with compatibility flag "_talib=True"):

Start fast ema calc delivery at the offset of the slow ema

In [76]:
```
macd = btalib.macd(btc_df, pfast=20, pslow=50, psignal=13)
```

In [ ]:

In [77]:
```
# join the rsi and macd calculations as columns in original df
btc_df = btc_df.join([sma.df ,rsi.df,stochrsi.df, cci.df, sar.df, macd.df])
```

In [78]:
```
btc_df = btc_df.reset_index()
```

In [79]:
```
btc_df
```

Out[79]:

	date	open	high	low	close	sma	rsi	stochrsi	cci	sar	macd	signal	histogram
0	2021-12-03 13:00:00	56869.60	58801.00	15000.00	56860.01	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	2021-12-03 14:00:00	56863.20	56926.68	25172.90	56239.13	NaN	NaN	NaN	NaN	15000.000000	NaN	NaN	NaN
2	2021-12-03 15:00:00	56193.15	56346.63	34727.40	55980.14	NaN	NaN	NaN	NaN	15838.533600	NaN	NaN	NaN
3	2021-12-03 16:00:00	55965.90	55965.91	22643.66	54979.99	NaN	NaN	NaN	NaN	16660.296528	NaN	NaN	NaN
4	2021-12-03 17:00:00	54990.24	55080.18	43000.80	54981.54	NaN	NaN	NaN	NaN	17465.624197	NaN	NaN	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...	...
632	2021-12-29 21:00:00	47358.95	47502.57	36691.24	47208.52	47700.062333	39.938752	0.567213	-89.118954	150000.000000	-789.509302	-846.366085	56.856783
633	2021-12-29 22:00:00	47208.52	47562.18	36691.24	47274.45	47654.945333	41.173006	0.632504	-84.591837	147733.824800	-780.263875	-836.922912	56.659037
634	2021-12-29 23:00:00	47272.54	47371.70	46104.52	46466.49	47602.814000	32.388891	0.167834	-41.000094	145512.973104	-814.576715	-833.730598	19.153883
635	2021-12-30 00:00:00	46464.66	46796.96	45392.32	46692.67	47566.003000	36.474728	0.383971	-45.044464	143336.538442	-828.690764	-833.010622	4.319857
636	2021-12-30 01:00:00	46692.38	46729.02	46395.66	46530.53	47527.464667	34.848906	0.297966	-40.080339	141203.632473	-846.948297	-835.001718	-11.946578

637 rows × 13 columns

In [80]:
```
btc_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 637 entries, 0 to 636
Data columns (total 13 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   date       637 non-null    datetime64[ns]
 1   open       637 non-null    float64
 2   high       637 non-null    float64
 3   low        637 non-null    float64
 4   close      637 non-null    float64
 5   sma        608 non-null    float64
 6   rsi        623 non-null    float64
 7   stochrsi   610 non-null    float64
 8   cci        618 non-null    float64
 9   sar        636 non-null    float64
 10  macd       588 non-null    float64
 11  signal     576 non-null    float64
 12  histogram  576 non-null    float64
dtypes: datetime64[ns](1), float64(12)
memory usage: 64.8 KB
```

In [81]:
```
feature = ["rsi", "stochrsi", "cci", "sar", "macd", "signal", "histogram", "sma"]
# feature = ["rsi", "stochrsi", "cci", "sar"]
# feature = ["rsi", "stochrsi", "sar"]
data_X = btc_df[feature].iloc[61: ]  # 61 là nơi mà Nan của các chỉ báo.
                                     #Sẽ cải tiến cho trường hợp tổng quát sau.
data_X
```

Out[81]:

	rsi	stochrsi	cci	sar	macd	signal	histogram	sma
61	45.859844	0.692379	-30.548453	73330.423090	-722.103398	-886.466372	164.362974	49056.105000
62	48.000160	0.804625	-3.574990	72263.814629	-694.252968	-859.007314	164.754346	49066.899667
63	47.508775	0.778855	-6.830500	71218.538336	-669.523592	-831.938211	162.414619	49059.427000
64	43.632925	0.301310	20.617102	70194.167569	-662.232142	-807.694487	145.462345	49043.269000
65	37.725476	0.000000	-45.248749	69190.284218	-683.195850	-789.908967	106.713117	49016.738333
...	...	...	...	...	...	...	...	...
632	39.938752	0.567213	-89.118954	150000.000000	-789.509302	-846.366085	56.856783	47700.062333
633	41.173006	0.632504	-84.591837	147733.824800	-780.263875	-836.922912	56.659037	47654.945333
634	32.388891	0.167834	-41.000094	145512.973104	-814.576715	-833.730598	19.153883	47602.814000
635	36.474728	0.383971	-45.044464	143336.538442	-828.690764	-833.010622	4.319857	47566.003000
636	34.848906	0.297966	-40.080339	141203.632473	-846.948297	-835.001718	-11.946578	47527.464667

576 rows × 8 columns

Chia dữ liệu thành Train, Test

X

In [82]:
```
data_X = data_X.reset_index(drop = True)
print(data_X.shape)
# len_data
len_data_train = int(len(data_X)*0.90) # lấy 90% dữ liệu để train


#X_test,  X_train
data_X_train = data_X.iloc[:len_data_train , :]
data_X_test = data_X.iloc[len_data_train : , : ]
```

```
(576, 8)
```

In [83]:
```
data_X_train.head()
```

Out[83]:

	rsi	stochrsi	cci	sar	macd	signal	histogram	sma
0	45.859844	0.692379	-30.548453	73330.423090	-722.103398	-886.466372	164.362974	49056.105000
1	48.000160	0.804625	-3.574990	72263.814629	-694.252968	-859.007314	164.754346	49066.899667
2	47.508775	0.778855	-6.830500	71218.538336	-669.523592	-831.938211	162.414619	49059.427000
3	43.632925	0.301310	20.617102	70194.167569	-662.232142	-807.694487	145.462345	49043.269000
4	37.725476	0.000000	-45.248749	69190.284218	-683.195850	-789.908967	106.713117	49016.738333

In [84]:
```
data_X_train.shape
```

Out[84]:
```
(518, 8)
```

In [85]:
```
data_X_test.shape
```

Out[85]:
```
(58, 8)
```

Y

In [86]:
```
data_Y = btc_df["close"].iloc[61: ]
data_Y
```

Out[86]:
```
61     48866.13
62     49018.47
63     48981.46
64     48683.26
65     48151.77
         ...
632    47208.52
633    47274.45
634    46466.49
635    46692.67
636    46530.53
Name: close, Length: 576, dtype: float64
```

In [87]:
```
#data_Y
data_Y_train = data_Y.iloc[1 : len_data_train +1] # cần dự đoán cho giá của phiên sau nên + 1
data_Y_test = data_Y.iloc[len_data_train + 1 : ]
```

In [88]:
```
data_Y_train.shape
```

Out[88]:
```
(518,)
```

In [89]:
```
data_Y_test.shape
```

Out[89]:
```
(57,)
```

Date time

In [90]:
```
data_DateTime = btc_df["date"].iloc[61:] # 61 là nơi mà không còn giá trị null của các chỉ báo.
                                         #Sẽ cải tiến cho trường hợp tổng quát sau.
```

In [91]:
```
data_DateTime
```

Out[91]:
```
61    2021-12-06 02:00:00
62    2021-12-06 03:00:00
63    2021-12-06 04:00:00
64    2021-12-06 05:00:00
65    2021-12-06 06:00:00
              ...
632   2021-12-29 21:00:00
633   2021-12-29 22:00:00
634   2021-12-29 23:00:00
635   2021-12-30 00:00:00
636   2021-12-30 01:00:00
Name: date, Length: 576, dtype: datetime64[ns]
```

In [92]:
```
# len_data
len_data_train = int(len(data_X)*0.90) # lấy 90% dữ liệu để train


data_DateTime_train = data_DateTime.iloc[:len_data_train ]
data_DateTime_test = data_DateTime.iloc[len_data_train :  ]
```

In [93]:
```
data_DateTime_train.shape
```

Out[93]:
```
(518,)
```

In [94]:
```
data_DateTime_test.shape
```

Out[94]:
```
(58,)
```

Reset Index

In [95]:
```
data_X_train = data_X_train.reset_index(drop = True)
data_X_test = data_X_test.reset_index(drop = True)
data_Y_train = data_Y_train.reset_index(drop = True)
data_Y_test = data_Y_test.reset_index(drop = True)
data_DateTime_train = data_DateTime_train.reset_index(drop = True)
data_DateTime_test = data_DateTime_test.reset_index(drop = True)
```

In [96]:
```
data_X_train.head()
```

Out[96]:

	rsi	stochrsi	cci	sar	macd	signal	histogram	sma
0	45.859844	0.692379	-30.548453	73330.423090	-722.103398	-886.466372	164.362974	49056.105000
1	48.000160	0.804625	-3.574990	72263.814629	-694.252968	-859.007314	164.754346	49066.899667
2	47.508775	0.778855	-6.830500	71218.538336	-669.523592	-831.938211	162.414619	49059.427000
3	43.632925	0.301310	20.617102	70194.167569	-662.232142	-807.694487	145.462345	49043.269000
4	37.725476	0.000000	-45.248749	69190.284218	-683.195850	-789.908967	106.713117	49016.738333

In [97]:
```
## add constant cho data_X_test
data_X_test = sm.add_constant(data_X_test)
```

In [98]:
```
data_X_test.head()
```

Out[98]:

	const	rsi	stochrsi	cci	sar	macd	signal	histogram	sma
0	1.0	49.698033	0.532135	-57.302486	92075.546634	247.610710	388.437524	-140.826813	51637.037667
1	1.0	51.491370	0.629016	-46.750355	89507.211436	254.339315	369.280637	-114.941322	51706.855000
2	1.0	50.664822	0.659850	-45.711288	87092.976350	249.998674	352.240356	-102.241683	51771.174667
3	1.0	48.254841	0.524861	-52.570221	84823.595369	218.597617	333.148536	-114.550919	51778.435000
4	1.0	48.351955	0.530301	-54.765764	82690.377247	191.464682	312.907986	-121.443304	51823.043000

In [99]:
```
data_Y_train.shape
```

Out[99]:
```
(518,)
```

Train mô hình OLS

In [100…
```
import statsmodels.api as sm
data_X_train = data_X_train
data_X_train = sm.add_constant(data_X_train)
data_Y_train = data_Y_train


model0 = sm.OLS(data_Y_train, data_X_train).fit()
model0.params
print(model0.summary())

# chưa vét cạn được các biến
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                  close   R-squared:                       0.912
Model:                            OLS   Adj. R-squared:                  0.911
Method:                 Least Squares   F-statistic:                     755.2
Date:                Thu, 06 Jan 2022   Prob (F-statistic):          1.69e-264
Time:                        07:29:47   Log-Likelihood:                -3937.3
No. Observations:                 518   AIC:                             7891.
Df Residuals:                     510   BIC:                             7925.
Df Model:                           7
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const      -1670.3718   1188.761     -1.405      0.161   -4005.844     665.100
rsi           43.6639      6.654      6.562      0.000      30.590      56.737
stochrsi      72.6051    117.645      0.617      0.537    -158.524     303.734
cci            0.1120      0.211      0.530      0.596      -0.303       0.527
sar            0.0014      0.001      2.387      0.017       0.000       0.003
macd           0.9590      0.136      7.050      0.000       0.692       1.226
signal        -0.7410      0.085     -8.711      0.000      -0.908      -0.574
histogram      1.7000      0.188      9.023      0.000       1.330       2.070
sma            0.9869      0.023     43.300      0.000       0.942       1.032
==============================================================================
Omnibus:                      286.652   Durbin-Watson:                   1.758
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             7654.517
Skew:                           1.867   Prob(JB):                         0.00
Kurtosis:                      21.458   Cond. No.                     1.79e+18
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The smallest eigenvalue is 1.32e-24. This might indicate that there are
strong multicollinearity problems or that the design matrix is singular.
```

Sklearn

In [101…
```
lr = linear_model.LinearRegression()
lr.fit(data_X_train, data_Y_train)
```

Out[101…
```
LinearRegression()
```

In [102…
```
BTC_predict = lr.predict(data_X_test)
print(len(BTC_predict))
```

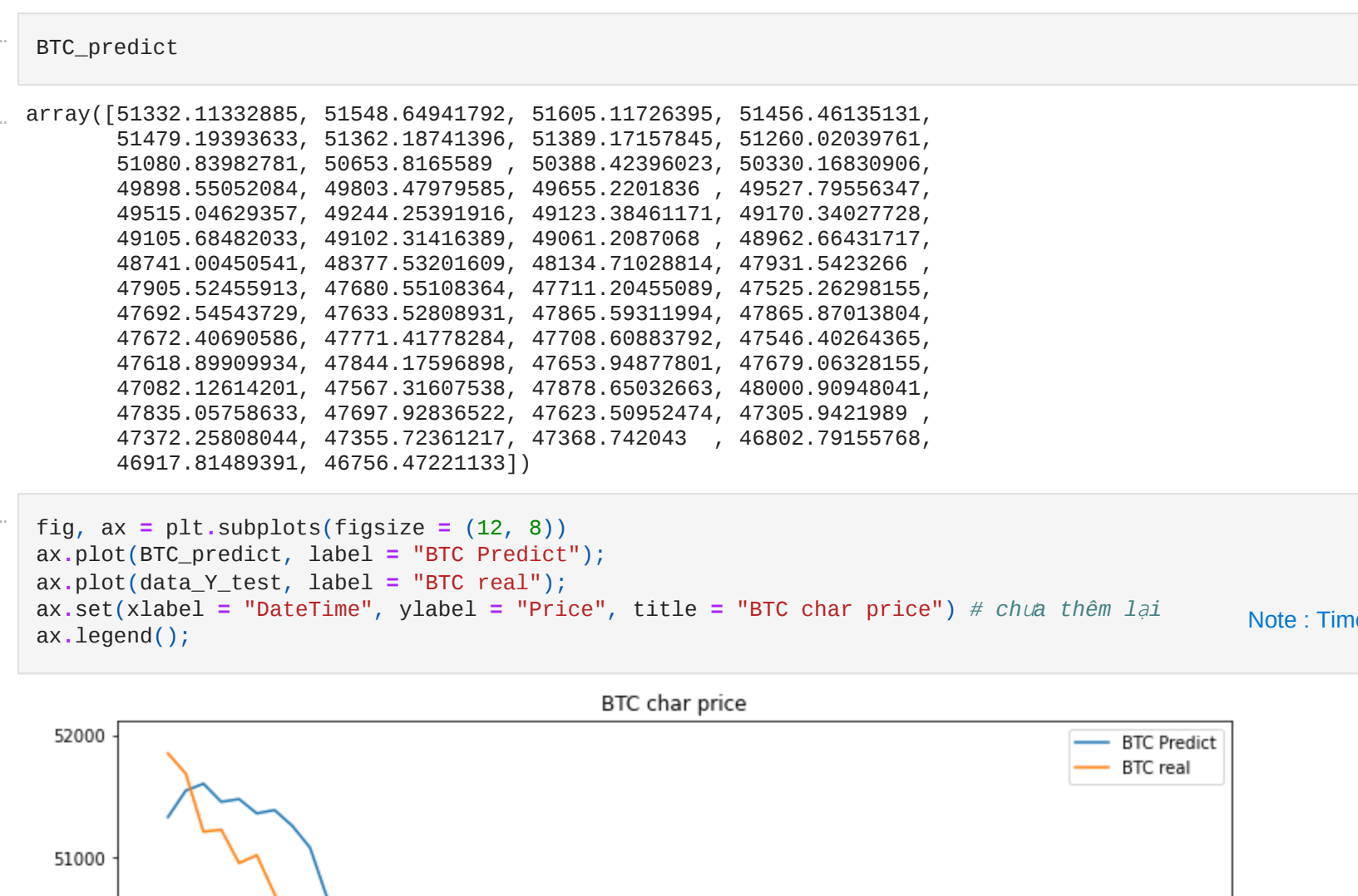
```
58
```

In [103…
```
BTC_predict
```

Out[103…
```
array([51332.11332885, 51548.64941792, 51605.11726395, 51456.46135131,
       51479.19393633, 51362.18741396, 51389.17157845, 51260.02039761,
       51080.83982781, 50653.8165589 , 50388.42396023, 50330.16830906,
       49898.55052084, 49803.47979585, 49655.2201836 , 49527.79556347,
       49515.04629357, 49244.25391916, 49123.38461171, 49170.34027728,
       49105.68482033, 49102.31416389, 49061.2087068 , 48962.66431717,
       48741.00450541, 48377.53201609, 48134.71028814, 47931.5423266 ,
       47905.52455913, 47680.55108364, 47711.20455089, 47525.26298155,
       47692.54543729, 47633.52808931, 47865.59311994, 47865.87013804,
       47672.40690586, 47771.41778284, 47708.60883792, 47546.40264365,
       47618.89909934, 47844.17596898, 47653.94877801, 47679.06328155,
       47082.12614201, 47567.31607538, 47878.65032663, 48000.90948041,
       47835.05758633, 47697.92836522, 47623.50952474, 47305.9421989 ,
       47372.25808044, 47355.72361217, 47368.742043  , 46802.79155768,
       46917.81489391, 46756.47221133])
```

In [104…
```
fig, ax = plt.subplots(figsize = (12, 8))
ax.plot(BTC_predict, label = "BTC Predict");
ax.plot(data_Y_test, label = "BTC real");
ax.set(xlabel = "DateTime", ylabel = "Price", title = "BTC char price") # chưa thêm lại
ax.legend();
```

Note : Time update



Note : Time update

In [ ]:

In [ ]: