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HW2

這次我使用KD與MACD兩個指標，當中以KD指標為主要判斷依據，當KD指標有重要變動時，再去確認MACD的動向。最終結果，我使用5分K，KD指標的超買/超賣設為80/20，fastk設為9，slowk與slowd設為3 (代表 K = 2/3K + 1/3RSV, D = 2/3D+1/3K, RSV = 100*(close-9個週期內high)/(9個週期內high-9週期內low))。MACD的短線(macd)設為19(=EMA(19))，長線(macdsignal)為27(=EMA(27))，MACD週期為11。最後各項數據Trade=807、Win rate=48.8228%、PF=1.303263、SQN=2.672621。

Step 1：初始

1. 操作時間：9:15~13:30

2.只使用KD

3. 超買/超賣=80/20

4.不在超買/超賣區時發生k crossover d/d crossover k，做多/做空

Start	2022-03-07 08:47:00
End	2023-03-03 13:46:00
Duration	361 days 04:59:00
Exposure Time [%]	84.455418
Equity Final [$]	354805.368001
Equity Peak [$]	720249.226
Return [%]	-29.038926
Buy & Hold Return [%]	-10.147846
Return (Ann.) [%]	-34.355645
Volatility (Ann.) [%]	37.338603
Sharpe Ratio	0.0
Sortino Ratio	0.0
Calmar Ratio	0.0
Max. Drawdown [%]	-51.765215
Avg. Drawdown [%]	-1.728459
Max. Drawdown Duration	246 days 02:14:00
Avg. Drawdown Duration	2 days 18:01:00
# Trades	14393
Win Rate [%]	42.972278
Best Trade [%]	0.614797
Worst Trade [%]	-1.072282
Avg. Trade [%]	-0.000368
Max. Trade Duration	0 days 00:30:00
Avg. Trade Duration	0 days 00:05:00
Profit Factor	0.987227
Expectancy [%]	-0.000336
SQN	-0.506189
_strategy	KDCross
_equity_curve	Equity DrawdownPc...
_trades	Size EntryBar ExitBar EntryPrice E...

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Step2：

1. kd>50才會做多、kd<50才會做空
2. 做多平倉後會做空、做空平倉後做多

效果：

1.交易量下降

2.勝率、PF、SQN都提升，因為避免掉kd低做多、高做空的虧損

```
Start                                          2022-03-07 08:50:00
End                                            2023-03-03 13:50:00
Duration                                         361 days 05:00:00
Exposure Time [%]                                        32.213452
Equity Final [$]                                        692392.012
Equity Peak [$]                                          701459.61
Return [%]                                               38.478402
Buy & Hold Return [%]                                   -10.028802
Return (Ann.) [%]                                        42.014102
Volatility (Ann.) [%]                                    45.039149
Sharpe Ratio                                              0.932835
Sortino Ratio                                              2.03156
Calmar Ratio                                              2.186694
Max. Drawdown [%]                                       -19.213525
Avg. Drawdown [%]                                        -1.826445
Max. Drawdown Duration                           118 days 00:30:00
Avg. Drawdown Duration                             7 days 00:52:00
# Trades                                                       540
Win Rate [%]                                             57.407407
Best Trade [%]                                            0.821108
Worst Trade [%]                                          -0.971103
Avg. Trade [%]                                             0.01287
Max. Trade Duration                                0 days 03:50:00
Avg. Trade Duration                                0 days 00:41:00
Profit Factor                                             1.171856
Expectancy [%]                                            0.013119
SQN                                                        1.25314
_strategy                                                  KDCross
_equity_curve                               Equity  DrawdownPct D...
_trades                   Size  EntryBar  ExitBar   EntryPrice  Exi...
```

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Step 3:

1. 做多range改為40~80、做空range改為60~20
2. 停損0.2%/停利0.3%

效果：

1.交易量上升

2.勝率下降，PF、SQN都提升

Start	2022-03-07 08:50:00
End	2023-03-03 13:50:00
Duration	361 days 05:00:00
Exposure Time [%]	40.396681
Equity Final [$]	889614.404
Equity Peak [$]	892814.404
Return [%]	77.922881
Buy & Hold Return [%]	-10.028802
Return (Ann.) [%]	76.612421
Volatility (Ann.) [%]	52.937466
Sharpe Ratio	1.447225
Sortino Ratio	4.040368
Calmar Ratio	4.222894
Max. Drawdown [%]	-18.14216
Avg. Drawdown [%]	-1.186293
Max. Drawdown Duration	105 days 21:20:00
Avg. Drawdown Duration	2 days 22:08:00
# Trades	631
Win Rate [%]	47.543582
Best Trade [%]	0.31775
Worst Trade [%]	-0.238446
Avg. Trade [%]	0.020976
Max. Trade Duration	0 days 03:35:00
Avg. Trade Duration	0 days 00:43:00
Profit Factor	1.243712
Expectancy [%]	0.021206
SQN	2.398808
_strategy	KDCross
_equity_curve	Equity DrawdownPct D...
_trades	Size EntryBar ExitBar EntryPrice Exi...

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Step 4:

1. 加入MACD指標，參數MACD(19,27,11)
2. 當在超買區發生d crossover k或macdsignal crossover macd或0 crossover macdhist做空
3. 當在超賣區發生k crossover d或macd crossover macdsignal或macdhist crossover 0做多
4. KD有可以做多跡象時，macd crossover macdsignal或macdhist crossover 0則做多
5. KD有可以做空跡象時，macdsignal crossover macd或0 crossover macdhist則做空
6. K/D 或 macdsignal/macd 或 macdhist/0任一組發生crossover則平倉
7. 在超買超賣區做的交易停損/停利=0.3%/2%、其他的交易停損/停利=0.3%/1.5%

效果：

1.交易量下降

2.勝率、PF、SQN都提升，但PF仍無法達到預期

```
Start                                         2022-03-07 08:50:00
End                                           2023-03-03 13:50:00
Duration                                        361 days 05:00:00
Exposure Time [%]                                       30.837212
Equity Final [$]                                       897669.482
Equity Peak [$]                                        906377.056
Return [%]                                              79.533896
Buy & Hold Return [%]                                  -10.028802
Return (Ann.) [%]                                       83.202591
Volatility (Ann.) [%]                                   41.217554
Sharpe Ratio                                              2.01862
Sortino Ratio                                            6.477402
Calmar Ratio                                             6.750605
Max. Drawdown [%]                                      -12.325205
Avg. Drawdown [%]                                       -1.166674
Max. Drawdown Duration                           51 days 01:05:00
Avg. Drawdown Duration                            2 days 20:52:00
# Trades                                                      807
Win Rate [%]                                              48.8228
Best Trade [%]                                           1.489686
Worst Trade [%]                                          -0.31713
Avg. Trade [%]                                           0.016633
Max. Trade Duration                               0 days 02:20:00
Avg. Trade Duration                               0 days 00:25:00
Profit Factor                                            1.303263
Expectancy [%]                                            0.01679
SQN                                                      2.672621
_strategy                                                 KDCross
_equity_curve                           Equity  DrawdownPct D...
_trades                Size  EntryBar  ExitBar   EntryPrice  Exi...
```

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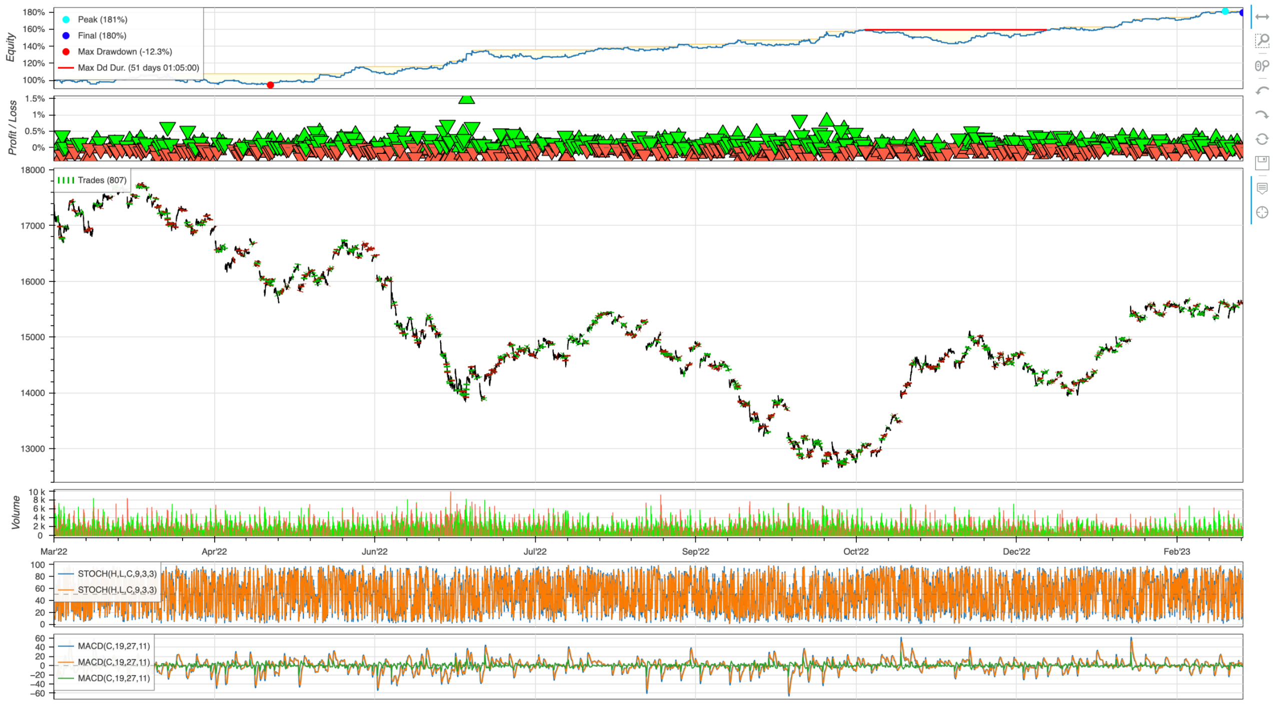
回測圖



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```
Start                                     2022-03-07 08:50:00
End                                       2023-03-03 13:50:00
Duration                                    361 days 05:00:00
Exposure Time [%]                                    3.521554
Equity Final [$]                                   553012.634
Equity Peak [$]                                      558669.6
Return [%]                                          10.602527
Buy & Hold Return [%]                              -10.028802
Return (Ann.) [%]                                   11.016103
Volatility (Ann.) [%]                               11.555304
Sharpe Ratio                                         0.953337
Sortino Ratio                                        1.864564
Calmar Ratio                                         1.077883
Max. Drawdown [%]                                  -10.220125
Avg. Drawdown [%]                                   -1.518274
Max. Drawdown Duration                      173 days 01:45:00
Avg. Drawdown Duration                       17 days 20:15:00
# Trades                                                  109
Win Rate [%]                                        44.954128
Best Trade [%]                                       0.403948
Worst Trade [%]                                     -0.209969
Avg. Trade [%]                                       0.017162
Max. Trade Duration                           0 days 01:20:00
Avg. Trade Duration                           0 days 00:20:00
Profit Factor                                        1.329806
Expectancy [%]                                        0.01729
SQN                                                  1.064074
_strategy                                             KDCross
_equity_curve                          Equity  DrawdownPct D...
_trades                Size  EntryBar  ExitBar  EntryPrice  Exi...
```

```python
from backtesting import Strategy
from backtesting.lib import crossover
import talib as ta
from datetime import time


class KDCross(Strategy):
    lower_bound = 25
    higher_bound = 75
    half = 50
    kd_period = 7
    div = 3
    n1 = 14
    n2 = 25
    macd_period = 8

    def init(self):
        self.k, self.d = self.I(ta.STOCH, high=self.data.High, low=self.data.Low, close=self.data.Close, fastk_period=self.kd_period, slowk_period=self.div, slowd_period=self.div) # line K and D
        self.macd, self.macdsignal, self.macdhist = self.I(ta.MACD, self.data.Close, self.n1, self.n2, self.macd_period) # macd

    def next(self):
        if (self.data.index[-1].time() < time(13, 30)) and (self.data.index[-1].time() > time(9, 15)):
            if crossover(self.k, self.d) and crossover(self.macd, self.macdsignal):
                if (not self.position):
                    self.buy(size=200, sl=self.data.Close[-1]*0.998, tp=self.data.Close[-1]*1.004)
                elif (self.position.is_short) and (not self.position.is_long) and (self.k[-1] > self.half) and (self.d[-1] > self.half):
                    self.position.close()
                    self.buy(size=200, sl=self.data.Close[-1]*0.998, tp=self.data.Close[-1]*1.004)
            elif crossover(self.d , self.k) and crossover(self.macdsignal, self.macd):
                if (not self.position):
                    self.sell(size=200, sl=self.data.Close[-1]*1.002, tp=self.data.Close[-1]*0.996)
                elif (self.position.is_long) and (not self.position.is_short) and (self.k[-1] < self.half) and (self.d[-1] < self.half):
                    self.position.close()
                    self.sell(size=200, sl=self.data.Close[-1]*1.002, tp=self.data.Close[-1]*0.996)
            elif (self.k[-1] < self.half) and (self.d[-1] < self.half) and (self.macd < 0) and (self.macdsignal < 0) and self.position.is_long:
                self.position.close()
                # self.sell(size=200, sl=self.data.Close[-1]*1.002, tp=self.data.Close[-1]*0.996)
            elif (self.k[-1] > self.half) and (self.d[-1] > self.half) and (self.macd > 0) and (self.macdsignal > 0) and self.position.is_short:
                self.position.close()
                # self.buy(size=200, sl=self.data.Close[-1]*0.998, tp=self.data.Close[-1]*1.004)
            elif (self.k[-1] > self.higher_bound) and (self.d[-1] > self.higher_bound) and (crossover(self.d, self.k)) and self.position.is_long:
                self.position.close()
            elif (self.k[-1] < self.lower_bound) and (self.d[-1] < self.lower_bound) and (crossover(self.k, self.d)) and self.position.is_short:
                self.position.close()

        elif (self.data.index[-1].time() >= time(13, 30)) and self.position:
            self.position.close()
```

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```
Start                                     2022-03-07 08:50:00
End                                       2023-03-03 13:50:00
Duration                                    361 days 05:00:00
Exposure Time [%]                                   37.536261
Equity Final [$]                                    837077.12
Equity Peak [$]                                     840277.12
Return [%]                                          67.415424
Buy & Hold Return [%]                              -10.028802
Return (Ann.) [%]                                   73.135034
Volatility (Ann.) [%]                               45.912397
Sharpe Ratio                                         1.592926
Sortino Ratio                                        4.300059
Calmar Ratio                                         4.668085
Max. Drawdown [%]                                  -15.667031
Avg. Drawdown [%]                                   -1.254311
Max. Drawdown Duration                      115 days 21:40:00
Avg. Drawdown Duration                        3 days 09:22:00
# Trades                                                  767
Win Rate [%]                                        48.370274
Best Trade [%]                                       0.267759
Worst Trade [%]                                     -0.238446
Avg. Trade [%]                                       0.015267
Max. Trade Duration                           0 days 03:00:00
Avg. Trade Duration                           0 days 00:33:00
Profit Factor                                        1.200914
Expectancy [%]                                       0.015441
SQN                                                  2.179598
_strategy                                             KDCross
_equity_curve                          Equity  DrawdownPct Dr...
_trades                Size  EntryBar  ExitBar   EntryPrice   Ex...
```

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