Research on the program trading system based on momentum and reversal strategy

2017   5

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Research on the program trading seiystem based on momentum and reversal strategy

Abstract: With the rapid development of computer technology, a large number of investors use information technology to assist trading. The program trading system based on investment transactions has become a new trend of integration of information technology and investment transactions.

Momentum and Reversal effects have been found and proved to exist in the world for a long time. Momentum and Reversal strategy, respectively, the use of momentum and Reversal factors to build a specific portfolio, such a combination of investors because of persistent behavioral bias or take the risk and the corresponding expected return. In this paper, the momentum and Reversal strategy model is used to build an application programming system.

Firstly, through the theory of Efficient Market Hypothesis and Behavioral Finance and other principle, analyzes the momentum and reversal effect on the construction of the trading system to gain theoretical support; secondly, the basic theory and based on the principle of constructing strategy model of program trading system, and proves the validity factor strategy model; thirdly, combination by statistical test selection optimization, construct the program trading system momentum and reversal strategy based on the prototype; finally, through testing and optimizing the parameters of the domestic A stock market data, combined with the risk control and capital management to further optimize the trading system, through the extrapolation test confirmed the success of construction of a transaction can be applied to practice the program trading system.

There are 12 figures,12 tables and 69 references in this paper.

1

1.1

70

70%

NYSE 2015

25.2% 1-1 70%

Medallion Fund 1988

1988 34% 5%

40% 60%

22% · 20% 10

500 20

2008

80%

资料来源：纽约证券交易所（**NYSE**）

1-1 (NYSE) 2015

90 20

2015 06

2015 6 A 2.25

99.66%   1   20.52%   1   -10

48.16%   10   -50   23.44%   1-2   50   92.12%

A

数据来源：Wind资讯
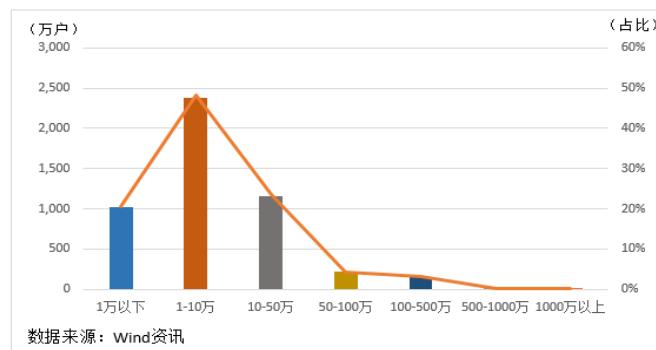
1-2 A   2015.06

1-3

2010   300

2015   2   50ETF   2015   4

50   500   ETF

（单位：亿元）

数据来源：Wind资讯
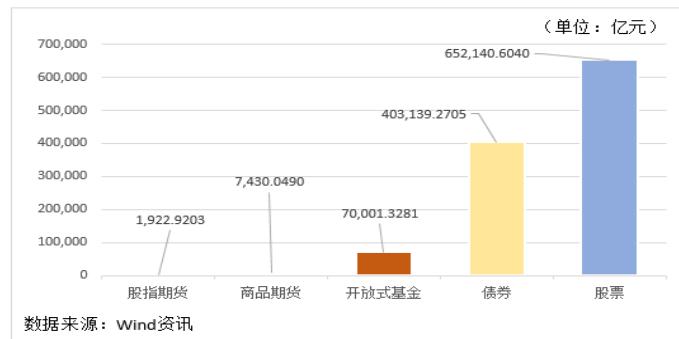
1-3 A   2015.06

1.2

1.2.1

1

2   A

3

1.2.2

1.3

1.3.1

70

·   ·

Aberration   ,   Andromeda   ·

R-Breaker

2011   Futures Truth
Magazine   200%

1-1

Trade Station   MultiCharts   eSignal   MT4   MT5
2010   4

DTS   TB

1-1

交易系统名称	时间框架	策略类型	适用市场
Aberration	长线	趋势	多市场
Andromeda	长线	趋势	多市场
Brix	长线	趋势	多市场
Checkmate	中线	趋势	多市场
Dollar Trader	长线	趋势	外汇
Golden SX	长线	趋势	多市场
R-Breaker	日内	趋势+反转	股票指数
Ready-Set-Go	长线	趋势	多市场

Futures Truth Magazine（ 2011   10

·   Bruce Babcock   1989
The Dow Jones-Irwin Guide to trading system

[1]

J ·   Perry J Kaufman   1998   Trading
Systems and Methods   ,

[2]

J ：　　　　　Perry J Kaufman　2006　　　　　　　　　　Smarter Trading
Improving Performance In Changing Markets

[28]

·　　　Curtis M Faith　2007)　　　　　　　　　Way of the Turtle:
The Secret Methods that Turned Ordinary People into Legendary Traders　,

　　　　　　　　　　　　　　　　　　　　　　·

20

[29]

·　　　Andres Pole　2007)　　　　　　　　Statistical Arbitrage:
Algorithmic Trading Insights and Techniques

[30]

Ł·　　　(Richard L·Weissman　2007),　　　　　　　Mechanical
Trading Systems:Pairing Trader Psychology with Technical Analysis

,

·　　　　　　　　　　　　　　　　　　　　　　[31]

K·　　Van K·Tharp　2007)　　　　　　　　　　Trade Your Way
to Financial Freedom

Ƙ.　　　　　　15

[32]

·　　　(David Aronson,2015)

(Evidence-Based Technical Analysis: Applying the Scientific Method

and Statistical Inference to Trading Signals)

[33]

1998

[35]   (2012)

[36]

2013

,

[37]

2014

[38]   2014

[39]   2012

,

[40]

2012   ,   alpha

alpha

[41]　　　　　2013

[42]

1.3.2

De Bondt　Thaler　1985　1987　[3][4]

Jegadeesh　Titman　　　　　　　De Bondt　Thaler　1985

CRSP　　　　1926　1　　1982　12

NYSE　　　　　　　　　　36

35　　　　50　　　　　　　　　　　　Winner

Portfolio,W　　　　　　35　　　　50

Loser Portfolio, L　　　　　1　12　13　18　24

25　36　60

L

19.6%　　　W　　　　　　　5%

L - W　　　　　24.6%

[ACAR$_{L,36}$- ACAR$_{W,36}$]

[3]　Jegadeesh

Titman　1993　　　　1965　　1989　NYSE　AMEX

16

12%　　　　　　4　　　　　1

1.31%

[5]

Conrad   Kaul(1998)

1926   1989

,   120   1   36

55   30   25

1   3-5

,   ;   3-12

,

,   [6]   1998

12   70

3　　　6

6

[11] Hon　Tonks(2003)

1955　1996　　　　　　　　　　　　　,

20　　　　　　　　　　,　　　20　　　　　　　1976　　,

[12]

(2001)　1993

,

1　3　6　9　12

25　　　　　　　　　　　　　　1993　2000

1

1　3

[44]

(2004)　　　　　　　　　　　　　　　A

1994　2001

[45]　　　　　　　　　　2013　　　　A

A

[46]

(2005)

A　　　1995　2001　　　　　　　　　　　　　,

A

[47]　　　　　　　　　　　　　　　　　　　　　(2005)

10

1996   1

A   1996   1   2003

12

[48]   (2006)

Alpha

[49]

(2007)   1997

2004

3   12

[50]   (2011)
[51]   (2011)
[52]

1.4

1.4.1

A

A

300

A

1.4.3

1

Bing　Google

2   A

3

Visual Studio

C Sharp

4

1.5

A

1

2

3

2

2.1

Momentum,

Momentum Effect

[43]

reversal to mean   Reversal

Effect   De Bondt

Thaler(1985,1987)[3][4]   Jegadeesh   Titaman   1993   [5]

:

Fama   French   1996

F-F

1.74

CAPM

Fama

[17]   Jegadeesh   Titman

[5]   Conrad

Kaul

[6] Chordia Shivakumar(2002)

,

[21] Bulkley Nawosah 2009

[22]

BSV DHS   HS   2010 [54]

1 BSV

Barberis Shleifer Vishny 1998 [13]

representative bias

similarity bias

conservatism bias   ,

2 DHS

Daniel Hirshleifer Subrahmanyam 1998 [14]

informed

overconfidence

biased self-attribution

3 HS

Hong and Stein   1998 [15]

unified theory model

News Watchers

Momentum traders

，

4

DeLong Shleifer Summers   Waldman   1990 [16]

2.2

$$= \sum_{=} \quad + \quad\quad\quad\quad\quad\quad (2\text{-}1)$$

k   k

i

1

APT Arbitrage Pricing Theory   Ross

1976 [19]

CAPM

.

CAPM

APT

Fama-French 1993 [24]

3   5

(10   )

,

K

SVM

1

2

20   34%

3

7x24

4

5

BUG

6

7

2015   6

8

8

3

A

Jegadeesh

Titman

A

3.1

1

Jegadeesh Titman

2003 [56]

2

300 180

500

ST

Wind Choice

CSMAR

3

4

5　　　　　　　　　　　　　　　　Lehmann　Chan

bid-askbounce　　　　　　　　　　　lead-leg effect

delayed period

6

10%

10%　　　　　　　　　　　　　　20%

10　　　　　　　　　　　　　　10　　　　　　　20

3-1

$$_+ \quad _+ \quad = \tag{3-1}$$

$T=t1+t2+t3$, F　　　　t1　　　　　　　　　　　　　　　F

Top　n

Bottom(n)

D　　　　　　　　　　t2

H　　　　　　　　　　　　　　　　　　　　　　　t3

3.2

ROE ROA   PE

PB   PCF   PS

3.3

2011   1   1

2015   12   31   A

2005   4   8   300   2010   12

31   300

ST

0,1

2016 [66]

1 Survivorship bias ST *ST PT

2 Look-ahead bias

3 The sin of storytelling

4 Data mining and data snooping

5 Outliers

3.4

3.4.1

1   n

$P_{i,h,1}$,n

$$= \frac{\sum_{=} \times}{\quad} - \tag{3-4}$$

$R_{w,h}$ $P_{w,i,h}$ i

$Q_{w,i,h}$ i A_0

$$= \frac{\sum_{=} \times}{\quad} - \tag{3-5}$$

$R_{l,h}$ $P_{l,i,h}$ i

$Q_{l,i,h}$ i A_0

7 A

A

300 300

$$= \overline{\quad} - \tag{3-6}$$

$R_{m,f}$ $P_{m,f}$

$P_{m,1}$

8 F

n

W n L

A

9

De Bondt Thaler

(Arithmetic Returns Calculation Method, AR)

Logarithmic Returns Calculation Method LR

Gishan Dissanaike

Multiplicative Returns Calculate-On Method,

MR

H

$$= \frac{\sum\limits_{=} \quad \times}{\sum\limits_{=} \quad _{-} \times \quad _{-}} \quad - \tag{3-7}$$

$DR_{w,h}$ $\qquad$ $P_{w,i,h}$ $\qquad$ i

$\qquad$ h $\qquad$ $Q_{w,i,h}$ $\qquad$ i

$P_{w,i,h-1}$ $\qquad$ h $\qquad$ $Q_{w,i,h-1}$ $\qquad$ i

$\qquad$ h

$$= \frac{\sum\limits_{=} \quad \times}{\sum\limits_{=} \quad _{-} \times \quad _{-}} \quad - \tag{3-8}$$

$DR_{l,h}$ $\qquad$ $P_{l,i,h}$ $\qquad$ i

$\qquad$ h $\qquad$ $Q_{l,i,h}$ $\qquad$ i

$\qquad$ $P_{l,i,h-1}$ $\qquad$ h

$Q_{l,i,h-1}$ $\qquad$ i $\qquad$ h

10

A

$$= \quad - \tag{3-9}$$

$CAR_{w,h}$ $\qquad$ $R_{w,h}$

$R_{m,h}$

$$= \quad - \tag{3-10}$$

$CAR_{l,h}$ $\qquad$ $R_{l,h}$

$R_{m,h}$

11

2

3 F H

10

4 F H

5 1

- 4 3-1

<center>3-1 (F,H) (%)</center>

形成期 持有期	5天	10天	15天	20天	30天	40天
5天	-83.76	-94.23	-75.61	-7.86	149.09	284.57
10天	-132.14	-114.61	-154.01	-147.16	-19.97	168.85
15天	-121.27	-94.66	-106.39	-126.77	3.03	-2.27
20天	-151.85	-94.67	-69.18	-80.27	159.76	99.50
30天	-125.08	-71.51	-81.07	-15.87	39.39	194.69
40天	-155.64	-21.60	82.58	0.79	-33.39	-139.32
60天	-65.50	22.28	67.98	-5.10	101.11	158.47
80天	-108.72	-131.14	176.00	30.38	36.62	-2.34
100天	54.23	2.48	-9.20	-0.71	108.98	89.55
120天	-39.83	-1.64	-34.24	209.02	118.01	22.78
180天	28.75	34.08	79.43	43.48	70.38	251.17
240天	-63.94	-131.69	-95.02	-38.75	-108.92	-92.23

形成期 持有期	60天	80天	100天	120天	180天	240天
5天	311.55	280.90	400.71	241.45	169.00	296.41
10天	39.14	17.40	157.81	48.61	78.72	152.48
15天	35.25	0.34	154.52	34.30	-4.76	126.34
20天	-54.11	111.22	59.58	-40.87	48.07	8.40
30天	-87.43	106.34	82.44	-69.23	-98.31	9.68
40天	179.89	32.13	34.28	-74.66	-25.18	-102.53
60天	-50.70	141.87	15.92	-96.11	-106.26	-171.91
80天	53.99	-82.20	14.82	-29.87	-62.99	-115.69
100天	-46.94	-23.14	-33.83	-20.42	-44.13	9.51
120天	113.24	168.13	214.06	-8.65	-94.08	-46.37
180天	42.32	116.85	-61.18	-128.25	-27.96	226.20
240天	2.02	-86.06	110.86	-6.75	111.07	4.34

2011 1 1 2015

12 31 142%-262%

144   71

100   5   1114   400.71%   25.71%

55.16%   1.11   A

3.5.2

2011   1   1   2015   12   31   A

1214

425838   2011   1   4

153   2015   12   31   492

F   F = 5   10   15   20   30   40   60   80   100

120   180   240   H   H=5   10   15   20   30   40   60

80   100   120   180   240   F

10

L   L   H

10

10   A

W   F

H

F   H

399006

300

1

60   3

2

3   F   H

10

4   F   H

5   1

- 4

3-2

3-2 (F,H) (%)

持有期 \ 形成期	5天	10天	15天	20天	30天	40天
5天	222.40	584.58	571.98	532.35	632.20	781.80
10天	363.98	89.78	184.13	139.58	143.27	280.49
15天	-45.09	-66.60	180.74	148.71	248.59	125.78
20天	255.23	91.75	148.16	147.44	147.44	105.52
30天	51.64	-17.51	293.18	115.25	198.11	33.23
40天	54.60	-17.45	16.01	112.65	15.29	227.50
60天	165.10	-49.00	202.01	66.28	33.88	34.55
80天	7.37	-21.52	122.21	30.42	37.39	60.60
100天	-50.95	-80.47	-5.60	-20.33	-15.53	49.48
120天	32.25	60.29	158.84	87.60	-7.09	-33.54
	-47.23	4.18	220.49	25.78	-7.22	-1.20

形成期 \ 持有期	60天	80天	100天	120天	180天	240天	
	844.30	1199.19	1047.07	987.83	479.56	493.16	5天
	217.43	549.12	450.23	380.51	180.81	297.21	10天
	440.57	501.29	240.04	395.67	273.80	253.63	15天
	127.61	496.71	292.71	326.87	131.45	141.76	20天
	149.51	208.41	63.76	134.53	118.36	217.34	30天
	63.53	266.52	101.02	153.43	11.18	66.32	40天
	95.23	87.43	-55.45	216.29	116.94	143.31	60天
	154.98	174.79	-31.91	80.87	-8.48	60.65	80天
	59.21	119.31	116.23	3.17	-66.67	77.35	100天
	-39.67	-33.29	-108.18	95.55	33.09	75.26	120天
	67.24	-32.39	-131.70	-41.36	42.53	135.63	180天
	-20.37	73.89	-34.50	30.98	213.25	67.22	240天

2011 1 1

2015 12 31 142%-262%

144 116

80 5 1134 1199.19% 54.36%

56.39% 1.77 A

A

A

4

4.1

:

1

2

3

4

5

6

7

4-1
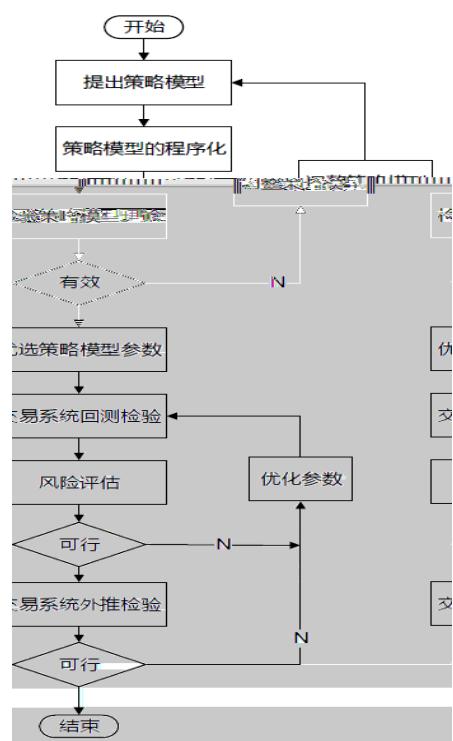
4-1

4.2

144   71

2011   1   1   2015   12   31

F   H

t

(4-1)

4-1

检验值 \ 形成期	5天	10天	15天	20天	30天	40天
p-value	0.0017	0.0073	0.5354	0.6679	0.0485	0.0457
t-stat	-4.1266	-3.2852	-0.6398	-0.4408	2.2183**	2.2524**
检验值 \ 形成期	60天	80天	100天	120天	180天	240天
p-value	0.1972	0.0611	0.0231	0.6562	0.8565	0.4361
t-stat	1.3726	2.0855*	2.6385**	-0.4576	-0.1852	0.8083

注：*为10%的显著水平，**为5%的显著水平，***为1%的显著水平

30   40   80   100

5

100   5

120

4-2

检验值 \ 持有期	5天	10天	15天	20天	30天	40天
p-value	0.0109	0.8255	0.7533	0.9896	0.7398	0.5125
t-stat	3.0561**	0.2258	-0.3222	-0.0133	-0.3407	-0.6768
检验值 \ 持有期	60天	80天	100天	120天	180天	240天
p-value	0.9738	0.4862	0.6347	0.1235	0.0979	0.1847
t-stat	0.0336	-0.7206	0.4887	1.6681	1.8084*	-1.4153

注：*为10%的显著水平，**为5%的显著水平，***为1%的显著水平

4-2   5   180

5   1   5   -80

4   120   6   180

9   5

1   180   9

7   30   5   40   5

80   5   100   5   30   180   40   180   80   180

A   7   2011/01/01 -

2015/12/31

4-3)

4-3

验证结果 动量组合(F,H)	超额累计收益率(%)	t-stat	p-value
（30，5）	149.09	1.8587*	0.0633
（40，5）	284.57	2.1641**	0.0307
（80，5）	280.90	2.2544**	0.0244
（100，5）	400.71	2.4771**	0.0134
（30，180）	70.38	1.7232*	0.0851
（40，180）	251.17	2.1646**	0.0306
（80，180）	116.85	2.0413**	0.0414

注：*为10%的显著水平，**为5%的显著水平，***为1%的显著水平

7   40   5

80   5   100   5   (40   180)   80   180   5%

100   5   p   0.0134   1%   A

A

40   5   80   5   100   5   (40   180)   80   180

100   5   400.71%

4.3

144   116

2011   1   1   2015   12   31

F   H

t

(4-4):

4-4

形成期 检验值		5天	10天	15天	20天	30天	40天
...2486**	2.0615*	t-stat	2.3641**	0.9583	4.6116***	3.0122**	2...

形成期 检验值			60天	80天	100天	120天	
).0127	0.0008	p-value	0.0264	0.0120	0.1148	0.0154	(
2.972**	4.5363***	t-stat	2.5619**	3.0029**	1.7124	2.864**	2...

注：*为10%的显著水平，**为5%的显著水平，***为1%的显著水平

5   15   20   30   40

60   80   120   180   240

10   100   40   t   2

15   t   4.6116

5   15   20   30   40   60   80   120   180

240

4-5
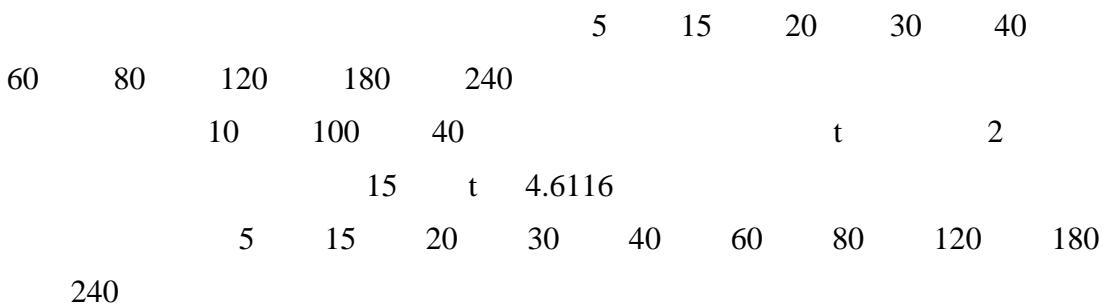
持有期 检验值	5天	10天	15天	20天	30天	40天
p-value	0.0000	0.0000	0.0009	0.0001	0.0004	0.0050
t-stat	8.6387***	6.7527***	4.4849***	5.8121***	5.0696***	3.4944***
持有期 检验值	60天	80天	100天	120天	180天	240天
p-value	0.0052	0.0158	0.4491	0.2370	0.2399	0.1155
t-stat	3.4706***	2.8515**	0.7849	1.2506	1.2425	1.7089

注：*为10%的显著水平，**为5%的显著水平，***为1%的显著水平

4-5   5   10   15   20

30   40   60   80   5   10   15

20   30   t   8.6387 6.7527 4.4849 5.8121 5.0696

0.1%   40   60 t   3.4944 3.4706   0.5%-1%

80 t 2.8515   5%

5   10

- 240   1   4-2

4-2

5 5   5 10   5 20   15 5   15 30   15 60   20

5   30 5   30 15   60 5   60 10   60 15   80

5   80 10   80 15   80 20   80 30   80 40   120

5   120 10   120 15   120 20   120 60   180 5

180 15   240 5   240 10   240 15   240 30   29

A   29

2011/01/01 - 2015/12/31

4-6

5   5   10%

11   5%   5   1%

3   0.1%   A

A

t   1%

0.1%   8

15 5   20 5   30 5   60 5   80 5   80 10   80

20   120 5   80 5
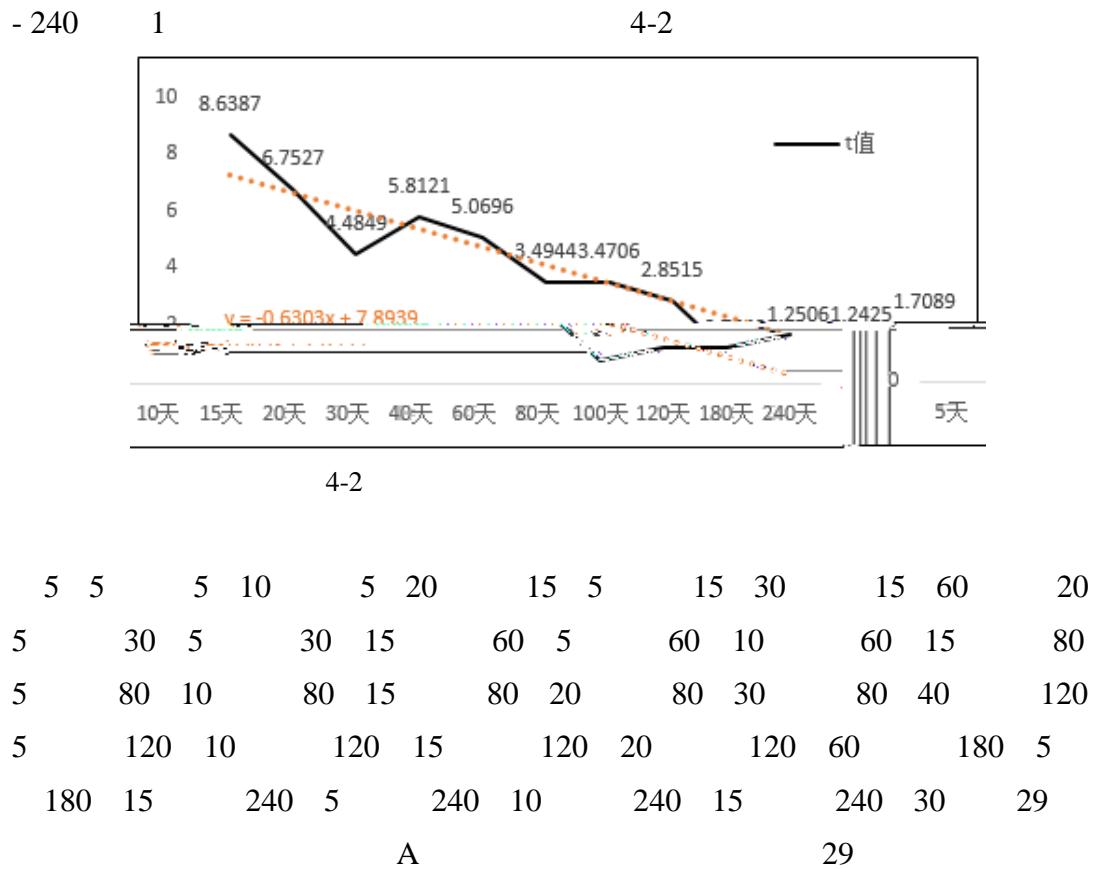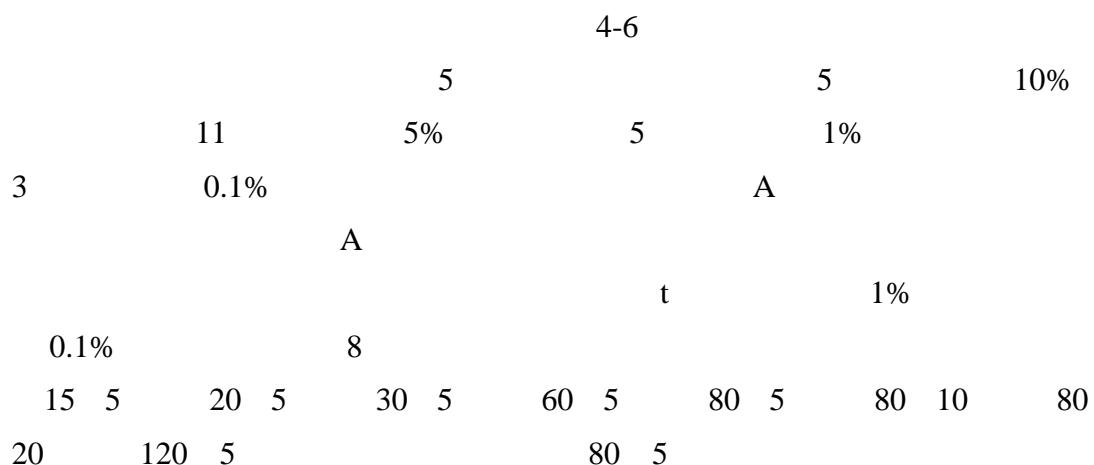
4-6

验证结果 反转组合(F,H)	超额累计收益率(%)	t-stat	p-value
(5，5)	222.40	1.7169*	0.0863
(5，10)	363.98	2.3382**	0.0195
(5，20)	255.23	1.998**	0.0459
(15，5)	571.98	2.9458***	0.0033
(15，30)	293.18	2.1399**	0.0326
(15，60)	202.01	1.7362*	0.0828
(20，5)	532.35	2.8196***	0.0049
(30，5)	632.20	3.1292***	0.0018
(30，15)	248.59	1.9959**	0.0462
(60，5)	844.30	3.4392****	0.0006
(60，10)	217.43	1.7367*	0.0827
(60，15)	440.57	2.5476**	0.0110
(80，5)	1199.19	3.8065****	0.0001
(80，10)	549.12	2.7555***	0.0060
(80，15)	501.29	2.566**	0.0104
(80，20)	496.71	2.6684***	0.0077
(80，30)	208.41	1.5848	0.1133
(80，40)	266.52	1.8502*	0.0646
(120，5)	987.83	3.3821****	0.0007
(120，10)	380.51	2.1624**	0.0308
(120，15)	395.67	2.1442**	0.0322
(120，20)	326.87	1.9768**	0.0483
(120，60)	216.29	1.4764	0.1401
(180，5)	479.56	2.2402**	0.0253
(180，15)	273.80	1.6204	0.1055
(240，5)	493.16	2.1866**	0.0290
(240，10)	297.21	1.6658*	0.0961
(240，15)	253.63	1.4795	0.1393
(240，30)	217.34	1.3564	0.1753

注：*为10%的显著水平，**为5%的显著水平，***为1%的显著水平，****为0.1%的显著水平

4.4

--

1

1

5

80   10

4

F   H

100 5   80 5

5

5

5   A

5%   8%   15%

6

Jegadeesh

10   20

30 50 60 80

5

5.1

    1

$$= \frac{\qquad}{} - \qquad\qquad\qquad\qquad (5\text{-}1)$$

    2

$$= \left(\frac{\qquad}{} \right)^{\overline{}} - \qquad\qquad\qquad (5\text{-}2)$$

n

    3

3-9   3-10

    4   Volatility

$$= \sqrt{\frac{}{-}\sum_{=}\left(- ^{-}\right)} \tag{5-3}$$

$$= \sigma$$

$$^{-}$$

t   t

5   Sharpe Ratio

$$= \frac{^{-}}{\sigma} \tag{5-4}$$

2.75 σ 5.3

6   Max Drawdown

$$= \left(- \frac{}{}\right) \tag{5-5}$$

y   x

5.2

backtesting

A

100 5

80 5 100 5

80 5

5.2.1

2011 1 1

2015 12 31

100 5 5 1 100 5

10 W

403.72%

43.74% 225.64% 178.07%

13.4% 47.52% 0.86 68.76% 2015

9 15 2011 6 3 223

54.26% 1.04

图 5-1

5-1

2015   9   68.76%

1.04   1

(100   5)   13.4%

1   5   A

5%   8%   15%

2   10   20   30   50   60
80

2011   1   1   2015   12   31

18

5-1   :

5-1   100（5

组合数、止损	评测指标	累计收益%	年化收益%	超额收益%	波动率%	夏普比率	胜率%	盈亏比	最大回撤%	交易次数	最大回撤日期
10	未止损	403.72	43.74	178.07	47.52	0.86	54.26	1.04	68.76	223	2015-09-15
10	5%	994.91	71.10	769.26	40.85	1.67	50.22	1.70	35.86	223	2015-07-08
10	8%	779.15	62.88	553.51	43.39	1.38	53.36	1.35	40.18	223	2015-07-08
10	15%	635.27	56.48	409.63	45.89	1.17	54.26	1.16	55.81	223	2015-09-15
20	5%	608.39	55.17	382.74	38.15	1.37	52.47	1.51	37.82	223	2014-05-19
20	8%	570.81	53.29	345.16	40.73	1.23	55.61	1.27	38.15	223	2015-07-08
20	15%	495.70	49.26	270.06	43.40	1.13	55.61	1.13	53.59	223	2015-09-15
30	5%	671.31	58.16	445.67	37.20	1.48	51.12	1.71	34.58	223	2014-05-19
30	8%	639.17	56.66	413.52	39.86	1.35	54.71	1.40	37.66	223	2015-07-08
30	15%	579.79	53.74	354.15	42.57	1.19	56.05	1.17	52.57	223	2015-09-15
50	5%	631.65	56.30	406.01	35.83	1.49	53.36	1.54	32.08	223	2015-07-08
50	8%	638.45	56.63	412.81	38.50	1.39	54.71	1.39	37.34	223	2015-07-08
50	15%	542.33	51.80	316.69	41.09	1.19	56.95	1.12	51.21	223	2015-09-15
60	5%	610.48	55.28	384.84	35.43	1.48	52.02	1.61	31.23	223	2015-07-08
60	8%	610.98	55.30	385.34	38.06	1.37	54.26	1.40	36.45	223	2015-07-08
60	15%	529.29	51.10	303.65	40.67	1.18	56.50	1.14	49.79	223	2015-09-15
80	5%	605.03	55.01	379.39	34.93	1.49	53.36	1.54	28.91	223	2015-07-08
80	8%	643.96	56.89	418.31	37.55	1.44	56.95	1.28	35.34	223	2015-07-08
80	15%	530.63	51.18	304.98	40.08	1.20	57.85	1.09	48.92	223	2015-09-15

10

5%   35.86%   1.67

1.7   1   769.26%   40.76%

5%

10

5-2

100   5
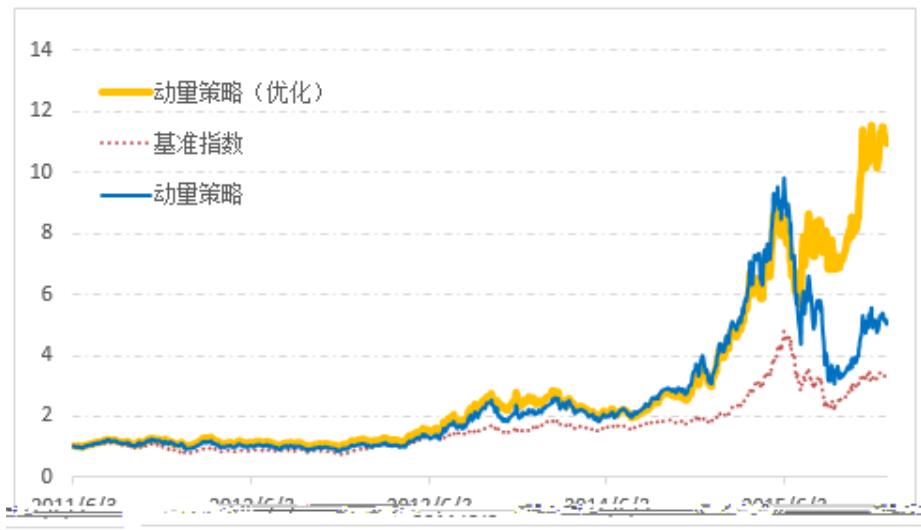
图 5-2

5.2.3

2011   1   1

2015   12   31

80   4   5   1   80   5

10   L

954.81%

68.10%   198.20%   756.61%

40.86%   44.32%   1.47

47.08%   2015   7   8   2011   5   6

227   54.63%   1.48

5-3

图5-3

5-2 80（ 5

组合数、止损	评测指标	累计收益%	年化收益%	超额收益%	波动率%	夏普比率	胜率%	盈亏比	最大回撤%	交易次数	最大回撤日 期
10	未止损	954.81	68.10	756.61	44.32	1.47	54.63	1.48	47.08	227	2015-07-08
10	5%	1066.59	71.87	868.39	39.25	1.75	49.34	2.14	36.34	227	2012-01-05
10	8%	1149.12	74.48	950.92	41.05	1.74	53.74	1.73	39.52	227	2012-01-05
10	15%	983.67	69.10	785.47	43.02	1.54	54.63	1.48	41.74	227	2015-07-08
20	5%	1221.50	76.66	1023.30	37.28	1.98	54.19	1.85	32.33	227	2012-01-05
20	8%	1252.32	77.56	1054.12	39.18	1.90	55.95	1.64	35.68	227	2012-01-18
20	15%	1140.43	74.22	942.23	41.10	1.73	57.71	1.37	37.22	227	2015-09-15
30	5%	1018.34	70.28	820.14	36.60	1.84	55.07	1.74	31.61	227	2012-01-05
30	8%	1044.65	71.16	846.45	38.53	1.77	56.39	1.57	36.77	227	2012-12-03
30	15%	960.40	68.30	762.19	40.42	1.62	58.59	1.30	37.48	227	2015-07-08
50	5%	842.40	63.98	644.19	35.79	1.70	54.19	1.72	31.84	227	2012-12-03
50	8%	869.62	65.01	671.42	37.60	1.65	55.51	1.55	36.71	227	2012-12-03
50	15%	775.77	61.35	577.57	39.54	1.48	55.51	1.40	38.83	227	2015-07-08
60	5%	769.07	61.07	570.87	35.43	1.64	54.63	1.66	31.86	227	2012-12-03
60	8%	795.75	62.15	597.54	37.18	1.59	55.51	1.54	36.23	227	2012-12-03
60	15%	712.79	58.71	514.59	39.15	1.42	56.39	1.34	38.68	227	2015-07-08
80	5%	732.12	59.54	533.91	35.07	1.61	55.07	1.64	34.65	227	2012-12-03
80	8%	731.42	59.51	533.22	36.93	1.53	56.39	1.47	38.84	227	2012-12-03
80	15%	669.46	56.81	471.25	38.86	1.38	56.83	1.31	39.34	227	2012-12-03

8%

20

5-4

47.08%　　35.68%

80　5

5-4

5.3

(   )

[33]

[35]

Kaufman [26]

Pardo [27]   · ·   De La Maza   Katz

McCormick

300

300   2005   4   8   300   2010   12   31
                        300
              300
   100   5   10
        5%   80   5
                  20   8%

5-3

5-3

评测指标 策略模型	累计收益%	年化收益%	超额收益%	波动率%	夏普比率	胜率%	盈亏比	最大回撤%	交易次数	最大回撤 日 期	基准累计%	基准年化%
动量（100，5） 5%止损，10只组合	260.19	28.04	29.50	35.85	0.70	53.08	1.05	58.13	260	2008-11-04	230.69	25.95
反转（80，5） 8%止损，20只组合	829.46	52.73	583.42	37.65	1.32	57.20	0.96	53.50	264	2008-11-04	246.03	26.59

260.19%   300   29.5%
            0.7   58.13%
      5-5   300

100 5

100 5

5%   10

583.42%   1.32   300

300

80   5   8%

20

图 5-5

6

6.1

A

A

A

A   2011   1   1

2015   12   31

300

1   A

A

5   8

100   5   80   5

2

100   5   80   5

100   5   35.86%   1.67   40.76%

5%   10

80   5   35.68%   1.9

50.32%   8%   20

3   300   100   5   (5%

10   )   29.5%

300   100   5

80   5   8%   20

583.42%   52.73%

1.32   300

6.2

1

2

1

2

3

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