动量、反转和趋势策略

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前言

- 量化投资策略中的技术面投资策略有很多：动量、反转、趋势、成交量、价格和成交量凸显策略等等。

- 这一章，我们以动量、反转和趋势策略为例。

- 动量、反转和趋势策略都属于技术面投资策略（量价投资策略），基于市场交易数据来构造量化投资策略。

提纲

- 第一节：动量效应和反转效应

- 第二节：趋势效应

第一节：动量效应和反转效应

一、动量效应和反转效应

- 我们基于历史收益率来判断其与未来收益率的关系。如果历史收益率高（低）的股票未来收益率高（低），这种现象称之为动量效应（由Jegadeesh and Titman, 1993发现并提出）。反之，如果历史收益率高（低）的股票未来收益率低（高），这种现象称之为反转效应（短期反转由Jegadeesh, 1990和Lehmann, 1990发现；长期反转由De Bond and Thaler, 1985, 1987发现）。

- 基于传统的均值回归理论，被高估的股票最终向均值靠拢，看起来反转现象应该是一个普遍现象。

一、动量效应和反转效应

- Jegadeesh and Titman (1993)尝试发现反转效应，结果惊讶地发现了动量效应 。

- 在美国，学术界在股市中发现了短期反转，中期动量和长期反转效应。

- 短期反转参考的是前一个月收益，中期动量参考的是2到12个月前累积收益，长期反转参考的是12个月前到最多5年的累积收益。

一、动量效应和反转效应

(11) $$R_{i,t+1} = \lambda_{0,t} + \lambda_{1,t}IA_{i,t} + \lambda_{2,t}ISKEW_{i,t} + \Lambda_t X_{i,t} + \varepsilon_{i,t+1},$$

where $R_{i,t+1}$ is the excess return, which is the difference between the monthly stock return on stock i and the 1-month T-bill rate at time $t+1$ or the risk-adjusted return on stock i at $t+1$, which is adjusted for the Fama–French 3 factors; $IA_{i,t}$ is either $IS_{\varphi,i,t}$ or $IE_{\varphi,i,t}$ for stock i at time t; and $X_{i,t}$ is a set of control variables. For columns 1–7, the dependent variable is the excess return (R). The risk-adjusted return (RA) is the dependent variable for columns 8–14. We adjust the Fama–MacBeth standard errors using the Newey and West (1987) correction with three lags. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

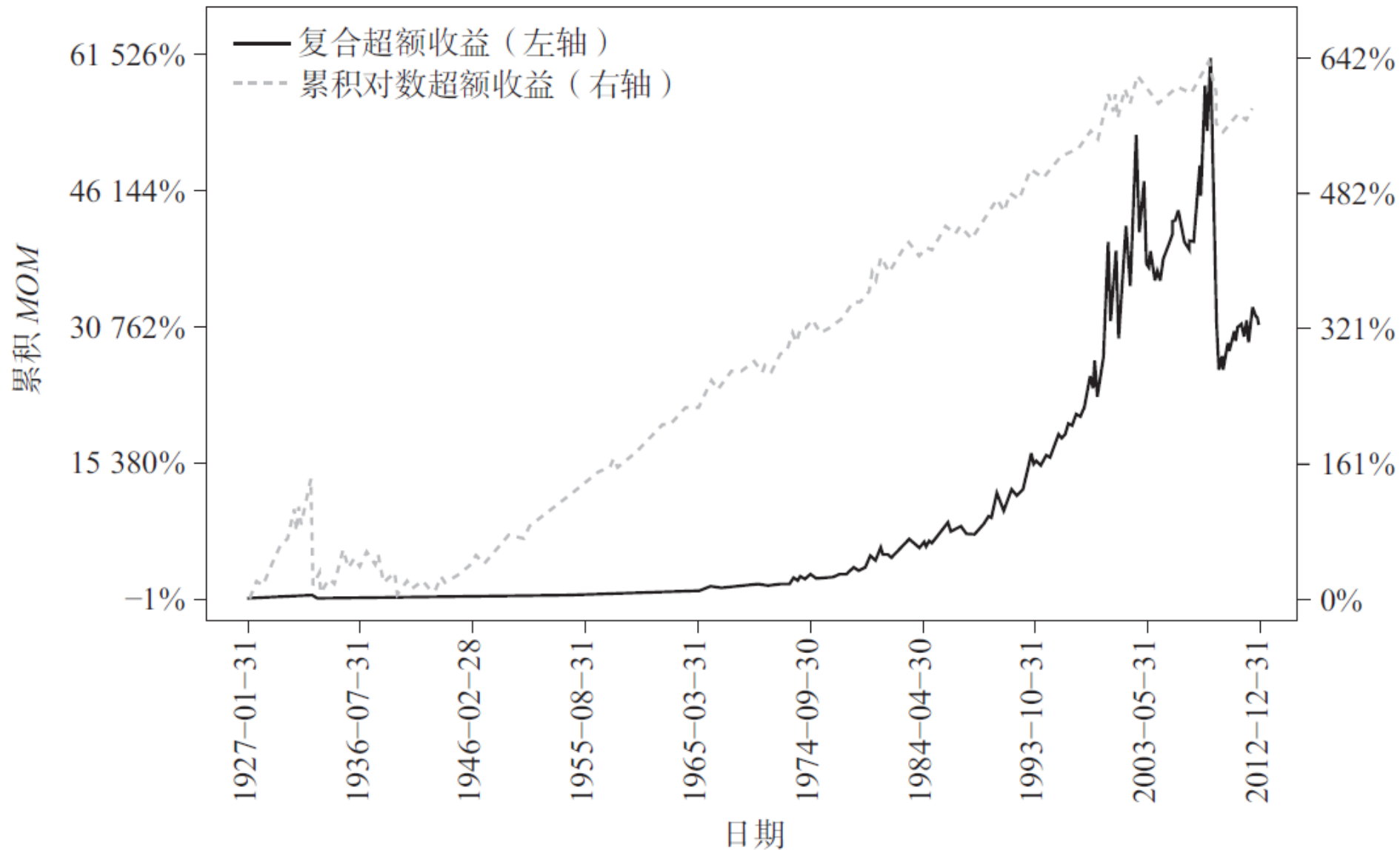|	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	R	R	R	R	R	R	R	RA	RA	RA	RA	RA	RA	RA
ISKEW	0.012 (0.43)			0.004 (0.12)	−0.005 (−0.29)	0.012 (0.42)	0.002 (0.10)	−0.020 (−1.08)			−0.027 (−1.38)	−0.015 (−0.94)	−0.022 (−1.12)	−0.011 (−0.68)
IE_{φ}		−3.866*** (−2.91)		−4.102*** (−2.88)	−3.286*** (−4.18)				−2.862*** (−3.24)		−3.232*** (−3.49)	−2.567*** (−3.60)		
IS_{φ}			−0.863*** (−2.63)			−0.894*** (−2.74)	−0.738*** (−3.51)			−0.695*** (−3.21)			−0.759*** (−3.39)	−0.667*** (−3.41)
SIZE					−0.280*** (−8.21)		−0.281*** (−8.23)					−0.245*** (−12.51)		−0.246*** (−12.54)
BM					0.185*** (3.52)		0.185*** (3.52)					0.017 (0.47)		0.017 (0.48)
MOM					0.008*** (5.62)		0.008*** (5.59)					0.008*** (5.65)		0.008*** (5.63)
TURN					0.004 (0.13)		0.003 (0.11)					0.001 (0.03)		0.001 (0.05)
ILLIQ					0.035** (2.40)		0.035** (2.41)					0.043*** (2.87)		0.043*** (2.88)
β					0.285 (1.09)		0.291 (1.11)							
MAX					0.037*** (5.00)		0.035*** (4.73)					0.022*** (2.97)		0.020*** (2.69)
IVOL					−0.445*** (−14.05)		−0.444*** (−14.06)					−0.342*** (−12.49)		−0.341*** (−12.46)
COSKEW					−1.313*** (−3.87)		−1.315*** (−3.88)					−1.113*** (−3.61)		−1.114*** (−3.62)
COKURT					0.600*** (5.32)		0.598*** (5.30)					0.681*** (8.25)		0.682*** (8.26)
REV					−0.038*** (−10.09)		−0.038*** (−10.01)							
REVA												−0.044*** (−12.28)		−0.044*** (−12.21)
Constant	0.644*** (2.84)	0.664*** (2.88)	0.659*** (2.86)	0.657*** (2.91)	1.920*** (6.90)	0.648*** (2.87)	1.925*** (6.92)	0.056 (1.59)	0.056* (1.73)	0.054* (1.66)	0.066* (1.84)	1.059*** (8.53)	0.061* (1.73)	1.067*** (8.59)
R^2	0.003	0.002	0.001	0.005	0.102	0.004	0.102	0.002	0.001	0.001	0.003	0.049	0.003	0.049

一、动量效应和反转效应

图 11.1　*MOM* 组合的累积收益

一、动量效应和反转效应
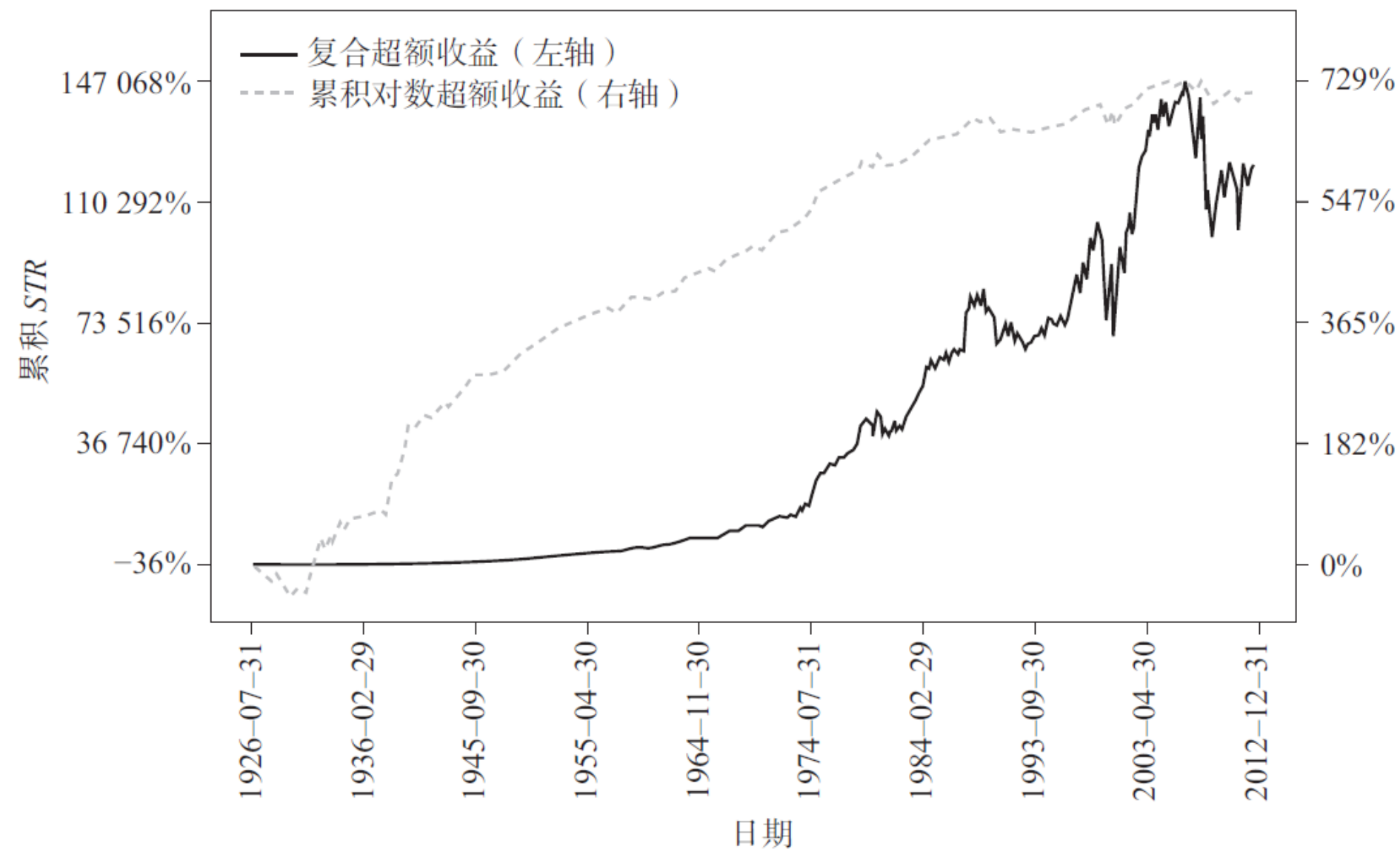

图 12.1　*STR* 组合的累积收益

一、动量效应和反转效应

- 在中国股票市场上，反转效应明显，动量效应并不明显。

一、动量效应和反转效应——中国A股

Table 4
Fama-MacBeth regression.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
DeltaES1	−0.131***	−0.121***	−0.117***	−0.108***	−0.121***	−0.105***	−0.091***	−0.087***	−0.090***	−0.094***	−0.091***	−0.065**	−0.060**
	(−4.76)	(−4.78)	(−4.76)	(−4.62)	(−5.26)	(−4.39)	(−4.01)	(−3.68)	(−3.67)	(−3.37)	(−3.28)	(−2.45)	(−2.05)
SIZE		−0.467***	−0.476***	−0.535***	−0.455***	−0.521***	−0.655***	−0.657***	−0.649***	−0.653***	−0.791***	−0.770***	−0.755***
		(−2.83)	(−2.73)	(−3.23)	(−2.64)	(−3.03)	(−3.67)	(−3.70)	(−3.67)	(−3.74)	(−3.89)	(−3.82)	(−3.75)
BM			0.176*	0.165	0.064	0.032	0.004	0.006	0.004	0.008	0.015	0.043	0.026
			(1.72)	(1.64)	(0.63)	(0.32)	(0.04)	(0.06)	(0.04)	(0.09)	(0.16)	(0.47)	(0.28)
MOM				0.003	0.001	0.000	0.002	0.003	0.003	0.002	0.002	0.004	0.004
				(0.81)	(0.27)	(0.04)	(0.73)	(0.84)	(0.83)	(0.64)	(0.71)	(1.07)	(1.19)
REV					−0.052***	−0.062***	−0.061***	−0.050***	−0.049***	−0.051***	−0.052***	−0.052***	−0.053***
					(−7.67)	(−10.24)	(−9.90)	(−6.46)	(−6.28)	(−6.24)	(−6.37)	(−6.38)	(−6.31)
BETA						−2.127**	−1.688*	−1.722*	−1.732*	−1.905**	−1.887*	−1.886*	−1.991*
						(−2.34)	(−1.76)	(−1.77)	(−1.78)	(−1.99)	(−1.94)	(−1.94)	(−1.95)
DSBETA						1.219***	1.196***	1.190***	1.207***	1.168***	1.137***	1.117***	1.118***
						(3.81)	(3.84)	(3.82)	(3.86)	(4.01)	(3.92)	(3.78)	(4.11)
TRBETA						2.633	2.847	2.636	2.677	2.374	2.328	2.280	2.055
						(0.95)	(1.02)	(0.94)	(0.94)	(0.84)	(0.81)	(0.81)	(0.77)
TURN							−1.377***	−1.327***	−1.348***	−1.169***	−1.478***	−1.397***	−1.485***
							(−4.33)	(−4.38)	(−4.45)	(−3.55)	(−4.78)	(−4.51)	(−4.95)
MAX								−0.042**	−0.040**	−0.017	−0.014	−0.014	−0.011
								(−2.54)	(−2.32)	(−0.50)	(−0.42)	(−0.42)	(−0.32)
ISKEW									−0.018	0.016	0.014	0.018	0.001
									(−0.43)	(0.34)	(0.29)	(0.37)	(0.02)
IVOL										−0.067	−0.075	−0.058	−7.681
										(−0.25)	(−0.28)	(−0.22)	(−0.28)
ILLIQ											2.138	2.311	2.387
											(0.92)	(0.99)	(1.05)
DIVOL												−0.250***	−255***
												(−2.98)	(−2.93)
ES1													0.060
													(0.77)
Constant	0.993	4.498***	3.404*	3.795**	3.739*	5.544***	6.929***	7.012***	6.976***	7.157***	8.236***	7.824***	7.380***
	(1.46)	(2.97)	(1.79)	(2.03)	(1.91)	(2.77)	(3.36)	(3.46)	(3.45)	(3.53)	(3.84)	(3.68)	(3.71)
Avg R²	0.007	0.042	0.055	0.069	0.085	0.123	0.128	0.132	0.133	0.145	0.150	0.155	0.159

The table reports the time-series averages of the slope coefficients and the associated t-values from the Fama-MacBeth regression of the stock excess returns on various pricing variables (the first column) using monthly data from January 1999 to December 2019. $ExR_{i,\,t+1} = \beta_{0,\,t} + \beta_{1,\,t}DeltaES1_{i,\,t} + \Lambda_t X_{i,\,t} + \varepsilon_{i,\,t+1}$

where $ExR_{i,\,t+1}$ is the excess return, which is the difference between the monthly stock return on stock i and one-year deposit rate at time $t+1$ and $DeltaES1_{i,\,t}$ is the $DeltaES1$ for stock i at time t. $X_{i,\,t}$ is a set of control variables. The t-values are reported using the Newey-West (1987) procedure and average R-squared statistics for each regression are presented in the last row. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

第一节：趋势效应

量化策略举例二、**趋势效应**

- Han, Zhou, and Zhu (2016)提出了趋势因子。在计算趋势因子前，首先计算出股票的价格移动平均值，然后将其标准化，得到的MA指标和下一期的收益率做横截面回归。计算均线的时间尺度L取值可以是3、5、···、1000个交易日。

$$A_{jt,L} = \frac{P_{j,t-L+1} + P_{j,t-L+2} + \cdots + P_{j,t}}{L}$$

$$\tilde{A}_{jt,L} = \frac{A_{jt,L}}{P_{j,t}}$$

$$r_{j,t} = \beta_{0,t} + \sum_i \beta_{i,t}\tilde{A}_{jt-1,L_i} + \epsilon_{j,t}, \quad j = 1, \cdots, n$$

二、趋势效应

- 我们接着可以按照以下做法给出股票的趋势因子。

$$\mathrm{E}_t[\beta_{i,t+1}] = \frac{1}{12} \sum_{m=1}^{12} \beta_{i,t+1-m}$$

$$\mathrm{E}[r_{i,t+1}] = \sum_{i} \mathrm{E}_t[\beta_{i,t+1}] \tilde{A}_{jt,L_i}$$

二、趋势效应

Table 12

Fama-MacBeth regressions.

This table reports the results of regressing monthly returns on the expected returns forecasted by the trend signals and other firm-specific variables. The regression is a modified Fama-MacBeth cross-sectional regression with weighted least squares (WLS) in the first step. The weights are the inverse of the stock variance estimated from the whole sample period. For robustness, the table reports three specifications of the forecasted expected returns, ER^{12}_{trd}, ER^{6}_{trd}, and ER^{60}_{trd} using rolling 12-month, 6-month, and 60-month averages, respectively, to estimate the true coefficients. Newey and West (1987) robust t-statistics are in parentheses and significance at the 1% level is given by ***. The sample period is from June 1930 through December 2014.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	−0.17***	−0.17***	−0.12***	−0.18***	−0.15***	−0.15***	−0.18***	−0.22***
	(−6.41)	(−3.35)	(−6.46)	(−13.06)	(−6.91)	(−11.76)	(−5.86)	(−15.30)
ER^{12}_{trd}	0.67***	0.61***	0.47***	0.58***				
	(7.84)	(4.22)	(7.87)	(17.15)				
ER^{6}_{trd}					0.54***	0.50***		
					(8.85)	(15.74)		
ER^{60}_{trd}							0.71***	0.69***
							(6.48)	(18.78)
Log(size)	−1.00**	−1.00**	−1.21***	−1.56***	−1.09**	−1.56***	−1.02**	−1.59***
	(−1.98)	(−2.19)	(−2.79)	(−3.58)	(−2.16)	(−3.59)	(−2.01)	(−3.54)
log(B/M)	1.52**	1.43**	1.39**	0.69	1.50**	0.68	1.50**	0.56
	(2.06)	(2.12)	(2.20)	(0.80)	(2.05)	(0.80)	(2.03)	(0.65)
R_{-1}		−0.24	−0.57***	−0.32***		−0.37***		−0.25***
		(−1.43)	(−7.57)	(−6.20)		(−6.57)		(−4.45)
$R_{-6,-2}$		0.61	0.76**	0.27		0.22		0.21
		(1.03)	(2.13)	(0.96)		(0.77)		(0.75)
$R_{-60,-25}$		−0.13	0.16	−1.38**		−1.39**		−1.31**
		(−0.08)	(0.11)	(−2.09)		(−2.17)		(−1.98)
IVol			−0.15	−0.10**		−0.11**		−0.12**
			(−1.39)	(−1.98)		(−2.03)		(−2.26)
Turnover			11.0*	9.91**		10.1***		10.1**
			(1.76)	(2.46)		(2.61)		(2.40)
%Zero			−0.39	−0.55*		−0.56*		−0.55*
			(−1.14)	(−1.73)		(−1.79)		(−1.66)
C/P				0.40***		0.40***		0.40***
				(3.84)		(3.99)		(3.72)
E/P				0.10		0.09		0.12
				(1.37)		(1.20)		(1.39)
S/P				−0.35		−0.32		−0.41*
				(−1.64)		(−1.56)		(−1.67)

二、趋势效应——趋势公共因子

Table 1

The trend factor and other factors: Summary statistics.

This table reports the summary statistics for the trend factor (*Trend*), the short-term reversal factor (*SREV*), the momentum factor (*MOM*), the long-term reversal factor (*LREV*), and the Fama-French three factors including the market portfolio (*Market*), *SMB*, and *HML* factors. For each factor, we report sample mean in percentage, sample standard deviation in percentage, Sharpe ratio, skewness, and excess kurtosis. The *t*-statistics are in parentheses and significance at the 1% level is given by ***. The sample period is from June 1930 through December 2014.

Factor	Mean (%)	Std dev (%)	Sharpe ratio	Skewness	Excess kurtosis
Trend	1.63*** (15.0)	3.45	0.47	1.47	11.3
SREV	0.79*** (7.21)	3.49	0.23	0.99	8.22
MOM	0.79*** (3.29)	7.69	0.10	−4.43	40.7
LREV	0.34*** (3.09)	3.50	0.10	2.93	24.8
Market	0.62*** (3.69)	5.40	0.12	0.27	8.03
SMB	0.27*** (2.63)	3.24	0.08	2.04	19.9
HML	0.41*** (3.64)	3.58	0.11	2.15	18.9

二、趋势效应——趋势公共因子

Factor	Mean (%)	Std dev (%)	Sharpe ratio	Skewness	Excess kurtosis
Panel A: Recession periods					
Trend	2.34*** (6.38)	5.05	0.46	1.02	5.73
SREV	1.20*** (3.05)	5.40	0.22	0.85	3.35
MOM	0.20 (0.25)	11.5	0.02	−3.20	17.6
LREV	0.49 (1.59)	4.15	0.12	1.25	6.22
Market	−0.67 (−1.13)	8.24	−0.08	0.50	3.90
SMB	0.02 (0.08)	3.32	0.01	0.54	2.01
HML	0.18 (0.48)	5.11	0.03	2.99	19.9
Panel B: Financial crisis (12/2007 - 06/2009)					
Trend	0.75 (0.65)	5.06	0.15	0.83	0.28
SREV	−0.82 (−0.63)	5.66	−0.14	−0.11	−1.11
MOM	−3.88 (−1.26)	13.4	−0.29	−1.42	1.77
LREV	0.03 (0.03)	3.73	0.01	0.19	−0.12
Market	−2.03 (−1.25)	7.07	−0.29	−0.21	−0.24
SMB	0.63 (1.10)	2.50	0.25	0.25	−0.79
HML	−0.44 (−0.50)	3.83	−0.11	−0.83	0.87

二、趋势效应

- Liu, Zhou, and Zhu (2022)提出中国市场上的趋势性因子。

$$R_{j,t} = \alpha_t + \sum_i \beta_{i,t}^P \tilde{M}Aj, t-1, Li^P + \sum_i \beta_{i,t}^V \tilde{M}Aj, t-1, Li^V + \varepsilon_{j,t}$$

其中，上标 P 和 V 分别代表价格和成交量。

二、趋势效应——中国A股

- MDD指的是最大回撤。

	MKT	SMB	VMG	PMO	SMB*	VMG*	Trend
Panel A: Summary statistics							
Mean (%)	0.91	1.00**	1.09***	0.89***	0.90**	1.29***	1.43***
	(1.20)	(2.42)	(4.06)	(3.26)	(2.46)	(5.11)	(6.10)
Std. dev. (%)	8.30	4.96	3.97	3.92	4.32	3.35	3.00
Sharpe ratio	0.11	0.20	0.28	0.23	0.21	0.38	0.48
Skewness	-0.38	-0.05	0.21	-0.73	0.08	0.14	0.33
MDD (%)	69.33	26.06	19.69	25.69	23.09	13.06	13.17