

Short- and Long-Horizon Behavioral Factors

Revise and Resubmit, Review of Financial Studies

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Finance Hub – 22 de Outubro de 2018

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A growing problem in Finance...

- The “zoo” of new anomalies:

“First, which characteristics really provide independente information about average returns? Second, does each new anomaly variable also correspond to a new factor formed on those same anomalies? Third, how many of these new factors are really important (and can account for many characteristics)?”

John Cochrane
2011 Presidential Address, AFA



Source: Yahoo Finance

Basic Idea and Roadmap

- How to (try to) tame the zoo of anomalies in a parsimonious way?

1) start from two widely replicated behavioral biases: overconfidence and limited attention;

2) construct two new behavioral factors based on them – coupled with the standard risk factor - and ask:

- * Does this model explain return anomalies?
- * Does this model perform better than its competitors?
- * If the model captures mispricing, can it predict the cross-section of stock return?
- * Does the model do better for stocks that are harder to arbitrage?

Limited Attention

- Mispricing results from limited attention to high-frequency information – quarterly earnings announcement – that are corrected at short-time horizons; DellaVigna and Pollet (2009), Hirshleifer and Teoh (2003), Hirshleifer, Lim, and Teoh (2011)
- Stock prices underreact to earnings surprises, resulting in the post-earnings announcement drift (PEAD), which gets corrected upon the arrival of the next few earnings announcements; Ball and Brown (1968)
- The evidence indicates that this correction is complete within a year. The PEAD factor will be the short-run behavioral factor

Overconfidence

- Overconfidence = overprecision + overplacement
- Investors tend to be overconfident about their private information signals.
- As a consequence, they are unwilling to correct their perception as further (public) earnings news arrives.
- The correction of overconfidence-driven mispricing will take place over a much longer time (> 1 year)

Consequence of Overconfidence

- When firms issue new equity or debt, they experience low returns.
- Repurchases of equity positively predict future returns.
- Under a market timing hypothesis, managers possess inside information about the true value of their firms and issue or repurchase equity to exploit pre-existing mispricing.
- Firms undertaking equity issues will be overpriced and repurchasing firms, underpriced.
- Firms can benefit from trading against mispricing. Therefore, issuance and repurchase should be powerful indicators of mispricing.

The factors

Limited Attention – PEAD

- * Four-day cumulative abnormal return (t-2, t+1) around the most recent quarterly earnings announcement date.
- * Sort each stock into two size groups (small “S” and big “B”)
- * Independently, sort each stock into three earnings surprise group (low “L”, middle “M”, and high “H”) based on its CAR at the end of month t-1.
- * Six portfolios formed and their VW returns are calculated: SL, SM, SH, BL, BM, BH
- * $PEAD = [ret(SH) + ret(BH)]/2 - [ret(SL) + ret(BL)]/2$

The factors

- **Overconfidence** – The Financing Factor (FIN)

- * Calculate the 1-year net share issuance (NSI) the 5-year composite share issuance (CSI)

- * At the end of June, sort firms into two size groups (small “S” and big “B”)

- * Independently, sort the firms into three financing groups (low, middle, high)

- * Form six portfolios and calculate their VW returns

- * $FIN = [ret(SL) + ret(BL)]/2 - [ret(SH) + ret(BH)]/2$

Summary Statistics of Factors

Panel A: Factor premiums

	Mean	Std	<i>t</i> -value	<i>SR</i>	N. obs	Sample period
MKT	0.53	4.59	2.62	0.12	510	1972:07 – 2014:12
SMB	0.17	3.13	1.19	0.05	510	1972:07 – 2014:12
SMB(HXZ)	0.29	3.14	2.06	0.09	510	1972:07 – 2014:12
SMB(SY)	0.41	2.81	3.28	0.15	498	1972:07 – 2013:12
HML	0.41	2.94	3.14	0.14	510	1972:07 – 2014:12
HML(NM)	0.44	1.49	6.43	0.29	486	1972:07 – 2012:12
MOM	0.68	4.44	3.45	0.15	510	1972:07 – 2014:12
MOM(NM)	0.61	2.90	4.6	0.21	486	1972:07 – 2012:12
CMA	0.37	1.95	4.27	0.19	510	1972:07 – 2014:12
IVA	0.43	1.86	5.23	0.23	510	1972:07 – 2014:12
PMU	0.27	1.18	5.06	0.23	486	1972:07 – 2012:12
RMW	0.34	2.24	3.44	0.15	510	1972:07 – 2014:12
ROE	0.56	2.59	4.88	0.22	510	1972:07 – 2014:12
MGMT	0.67	2.87	5.24	0.23	498	1972:07 – 2013:12
PERF	0.65	3.90	3.73	0.17	498	1972:07 – 2013:12
FIN	0.80	3.92	4.6	0.20	510	1972:07 – 2014:12
PEAD	0.65	1.85	7.91	0.35	510	1972:07 – 2014:12

Do the other factors explain the behavioral factors?

	Mean		α	MKT	SMB	HML	MOM	PMU	RMW	CMA	IVA	ROE	MGMT	PERF	Adj. R^2
FIN	0.80*** (4.60)	(1) FF3	0.71*** (5.61)	-0.24*** (-5.55)	-0.38*** (-5.55)	0.67*** (9.22)									60.4%
		(2) Carhart	0.59*** (4.64)	-0.21*** (-5.74)	-0.38*** (-4.92)	0.72*** (10.54)	0.13*** (2.93)								63.2%
		(3) NM	-0.02 (-0.13)	-0.26*** (-8.29)		1.41*** (13.29)	0.04 (0.27)	1.23*** (4.10)							56.4%
		(4) FF5	0.34*** (3.59)	-0.13*** (-4.88)	-0.19*** (-3.58)	0.45*** (9.26)			0.68*** (9.20)	0.56*** (7.43)					73.9%
		(5) HXZ	0.31** (2.42)	-0.19*** (-4.32)	-0.25*** (-2.68)						1.14*** (10.49)	0.29*** (3.01)			58.5%
		(6) SY4	0.12 (1.14)	-0.05 (-1.22)	-0.14 (-1.25)								1.02*** (16.69)	0.13** (2.54)	68.1%
		(7) All factors	-0.03 (-0.24)	-0.06* (-1.77)	-0.14*** (-2.70)	0.41*** (5.51)	-0.04 (-0.69)	0.35** (2.07)	0.14 (0.83)	-0.42** (-2.22)	0.54*** (3.07)	0.13 (1.49)	0.58*** (10.12)	0.09 (1.51)	79.1%

- FIN offers abnormal returns relative to many factors, except for PMU of Novy-Marx (2013) and MGMT of Stambaugh and Yuan (2017)

Do the other factors explain the behavioral factors?

	Mean		α	MKT	SMB	HML	MOM	PMU	RMW	CMA	IVA	ROE	MGMT	PERF	Adj. R^2
PEAD	0.65*** (7.91)	(1) FF3	0.73*** (8.47)	-0.06*** (-2.70)	0.02 (0.34)	-0.12*** (-2.75)									3.2%
		(2) Carhart	0.56*** (7.34)	-0.03 (-1.27)	0.01 (0.40)	-0.06 (-1.47)	0.18*** (6.31)								19.2%
		(3) NM	0.54*** (6.27)	-0.02 (-0.66)		-0.09 (-1.27)	0.31*** (6.74)	-0.11 (-1.04)							20.3%
		(4) FF5	0.70*** (7.90)	-0.05** (-2.05)	-0.05 (-1.31)	-0.14*** (-2.95)			-0.05 (-0.94)	0.10 (1.18)					3.8%
		(5) HXZ	0.60*** (5.78)	-0.04* (-1.71)	0.05 (0.89)						-0.09 (-1.11)	0.16*** (2.91)			7.0%
		(6) SY4	0.53*** (5.61)	-0.00 (-0.14)	0.02 (0.42)								-0.00 (-0.03)	0.18*** (5.23)	13.6%
		(7) All factors	0.58*** (6.76)	-0.02 (-0.76)	-0.01 (-0.15)	-0.06 (-1.24)	0.15*** (3.38)	-0.15 (-1.10)	-0.03 (-0.24)	0.25* (1.72)	-0.27** (-2.11)	0.04 (0.41)	0.03 (0.41)	0.06 (1.17)	23.9%

- PEAD offers abnormally high returns relative to all factors

Do the behavioral factors explain other factors?

	Mean	α	MKT	FIN	PEAD	Adj. R^2
SMB	0.17 (1.19)	0.45*** (3.09)	0.02 (0.25)	-0.38*** (-3.44)	0.02 (0.14)	23.5%
HML	0.41*** (3.14)	0.12 (0.89)	0.03 (0.53)	0.50*** (11.94)	-0.19*** (-3.43)	43.9%
MOM	0.68*** (3.45)	-0.09 (-0.34)	-0.05 (-0.66)	0.10 (0.68)	1.11*** (5.62)	22.2%
PMU	0.27*** (5.06)	0.18*** (2.96)	-0.04 (-1.63)	0.08*** (2.68)	0.06 (1.28)	14.0%
RMW	0.34*** (3.44)	0.13 (1.50)	-0.02 (-0.63)	0.19*** (2.65)	0.10 (0.89)	12.5%
CMA	0.37*** (4.27)	0.18** (2.02)	-0.06* (-1.89)	0.26*** (5.17)	0.01 (0.25)	35.1%
IVA	0.43*** (5.23)	0.22*** (2.90)	-0.02 (-0.99)	0.30*** (9.40)	-0.02 (-0.51)	43.3%
ROE	0.56*** (4.88)	0.16 (1.24)	0.00 (0.11)	0.23*** (3.23)	0.33*** (2.86)	15.8%
MGMT	0.67*** (5.24)	0.29*** (3.05)	-0.11*** (-3.25)	0.52*** (9.72)	0.02 (0.48)	66.2%
PERF	0.65*** (3.73)	0.17 (0.87)	-0.16** (-2.29)	0.07 (0.63)	0.77*** (6.61)	19.4%

FIN and PEAD capture a large fraction of the premia of the factors from the alternative models but not vice-versa.

Explaining short- and long-run return anomalies

Panel A: Short-horizon anomalies

List of Anomalies		H-L Ret	CAPM	FF3	Carhart	FF5	NM	HXZ	SY4	FIN	PEAD	BF2	BF3
Short-horizon anomalies (12)	N. significant α at 5%	10	12	12	7	11	2	1	4	8	0	0	0
	Average $ \alpha $	0.58	0.67	0.82	0.41	0.57	0.37	0.26	0.35	0.56	0.17	0.18	0.09
	GRS F -statistic p -value	4.08*** (0.00)	4.73*** (0.00)	5.88*** (0.00)	4.25*** (0.00)	3.44*** (0.00)	4.37*** (0.00)	2.37*** (0.01)	2.70*** (0.00)	4.87*** (0.00)	2.00** (0.02)	2.38*** (0.01)	1.15 (0.32)

Panel B: Long-horizon anomalies

List of Anomalies		H-L Ret	CAPM	FF3	Carhart	FF5	NM	HXZ	SY4	FIN	PEAD	BF2	BF3
Long-horizon anomalies (22)	N. significant α at 5%	20	20	12	8	7	3	5	3	6	16	4	3
	Average $ \alpha $	0.48	0.55	0.38	0.29	0.23	0.21	0.32	0.12	0.29	0.55	0.32	0.28
	GRS F -statistic p -value	3.06*** (0.00)	3.91*** (0.00)	3.13*** (0.00)	2.22*** (0.00)	1.97*** (0.01)	1.55* (0.05)	2.08*** (0.00)	0.74 (0.80)	2.59*** (0.00)	2.29*** (0.00)	1.94*** (0.01)	1.47* (0.08)

BF3 performs best for short-run anomalies and has the second lowest t-statistic for long-run anomalies

Behavioral Factors vs Competitors

	Earnings momentum					Return momentum			Profitability						Value vs. growth		
	SUE-1	SUE-6	Abr-1	Abr-6	RE-1	R6-6	R11-1	I-Mom	ROEQ	ROAQ	NEI	FP	GP/A	CbOP	B/M	E/P	CF/P
Panel A: The five-factor model of Fama and French (2015, FF5)																	
α	0.42***	0.19*	0.87***	0.40***	0.55**	0.82***	1.15***	0.58**	0.58***	0.41***	0.42***	-0.39**	0.01	0.61***	0.10	-0.01	0.02
Panel B: The profitability-based model of Novy-Marx (2013, NM)																	
α	0.25*	0.07	0.69***	0.18*	0.23	-0.30*	-0.21	-0.42*	0.10	-0.15	0.18	0.73***	-0.14	0.04	0.07	-0.27	-0.20
Panel C: The q -factor model of Hou, Xue, and Zhang (2015, HXZ)																	
α	0.13	-0.02	0.73***	0.23*	0.14	0.21	0.39	0.14	0.10	0.04	0.13	-0.04	0.03	0.53***	0.26	0.05	0.12
Panel D: The four-factor mispricing model of Stambaugh and Yuan (2016, SY4)																	
α	0.18	0.03	0.67***	0.22**	0.28	0.02	0.09	-0.10	0.48***	0.25	0.28**	0.04	-0.02	0.41***	-0.00	-0.02	0.06
Panel E: The three-factor behavioral factor model (BF3)																	
α	0.08	-0.01	-0.04	-0.06	0.18	-0.08	0.10	-0.26	0.12	-0.07	0.04	0.20	0.06	0.14	0.36	0.22	0.21

Unlike the other models, the BF3 can explain all the anomalies above

Predicting the Cross-Section

	(1)	(10)
β_{FIN}	0.148** (2.04)	0.185*** (3.39)
β_{PEAD}	-0.019 (-0.33)	-0.010 (-0.18)
Earnings momentum	N	Y
Short-term profitability	N	
$\log(ME)$		-0.327*** (-3.62)
$\log(B/M)$		0.133* (1.74)
$r(t-1)$		-0.737*** (-9.97)
$r(t-12, t-2)$		0.098 (0.86)
$r(t-36, t-13)$		-0.208*** (-3.39)
Adj. R^2	0.4%	6.5%
N.obs	1,558,118	848,309

FIN loading strongly forecast future returns, even after controlling for most of the 34 anomalies.

PEAD, on the other hand, has no return predictability.

However, there are econometric issues associated with the instability of the PEAD loading as proxies for transient mispricing and the heavy influence of FMB regression test of small illiquid firms

Limits to Arbitrage

Panel A: β_{PEAD} of short-horizon anomaly portfolios					
Anomalies	Long legs	Short legs	Anomalies	Long legs	Short legs
SUE-1	0.18 (3.73)	-0.31 (-3.40)	R11-1	0.68 (6.15)	-0.98 (-6.05)
SUE-6	0.15 (3.24)	-0.24 (-3.09)	I-Mom	0.50 (4.74)	-0.73 (-6.31)
Abr-1	0.59 (8.57)	-0.74 (-8.78)	ROEQ	0.14 (1.63)	-0.25 (-1.95)
Abr-6	0.17 (2.87)	-0.44 (-6.79)	ROAQ	0.26 (4.72)	-0.19 (-1.69)
RE-1	0.15 (1.40)	-0.57 (-4.01)	NEI	0.18 (3.10)	-0.25 (-4.38)
R6-6	0.45 (4.39)	-0.84 (-5.02)	FP	0.25 (4.70)	-0.54 (-3.16)
Average β_{PEAD} in the long legs:		0.31			
Average β_{PEAD} in the short legs:		-0.51			
N. larger positive and significant β_{PEAD} in the long legs:				1 out of 12	
N. larger negative and significant β_{PEAD} in the short legs:				11 out of 12	

PEAD captures well the short- legs, associated with mispricing.

Limits to Arbitrage

Panel B: β_{FIN} of long-horizon anomaly portfolios

Anomalies	Long legs	Short legs	Anomalies	Long legs	Short legs
GP/A	0.01 (0.16)	-0.07 (-2.14)	IvG	-0.07 (-1.30)	-0.38 (-7.35)
CbOP	-0.19 (-6.66)	-0.41 (-8.74)	IvC	-0.13 (-2.56)	-0.23 (-4.98)
B/M	0.25 (3.94)	-0.17 (-4.70)	OA	-0.38 (-6.93)	-0.34 (-8.89)
E/P	0.23 (4.06)	-0.37 (-7.12)	POA	0.00 (0.06)	-0.35 (-7.58)
CF/P	0.24 (4.10)	-0.29 (-6.71)	PTA	0.03 (0.71)	-0.46 (-11.01)
NO/P	0.36 (5.49)	-0.40 (-7.36)	NS	0.29 (6.17)	-0.33 (-8.64)
Dur	0.23 (3.39)	-0.21 (-5.85)	IR	0.38 (13.09)	-0.37 (-11.21)
AG	0.04 (0.83)	-0.36 (-7.82)	OC/A	-0.33 (-7.54)	0.03 (0.51)
NOA	-0.24 (-7.70)	-0.18 (-2.52)	AD/M	0.25 (3.15)	-0.26 (-5.18)
IVA	0.06 (1.56)	-0.19 (-3.62)	RD/M	-0.31 (-2.08)	0.02 (0.37)
IG	-0.22 (-5.04)	-0.48 (-14.22)	OL	0.07 (1.25)	-0.20 (-3.12)

Average β_{FIN} in the long legs: 0.03

Average β_{FIN} in the short legs: -0.27

N. larger positive and significant β_{FIN} in the long legs: 3 out of 22

N. larger negative and significant β_{FIN} in the short legs: 15 out of 22

FIN indeed captures mispricing effects

Conclusion

- This paper supplements the Market factor of the CAPM with behavioral factors intended to capture overconfidence (FIN) and limited attention (PEAD) in the stock market.
- FIN is dominant in explaining long-run (>1 year) return anomalies.
- PEAD is dominant for short-horizon (<1 year) anomalies.
- The broad message is to use behaviorally-motivated factors in explaining asset mispricing, comovement, and return predictability.

Why worry? Why might there be an opportunity?

- There is no theory about why overconfidence and limited attention should be the only two biases that matter
- Neither are they the only ones that make those predictions (sticky beliefs, extrapolation, cursed beliefs ...)
- Could someone have tested many behavioral biases before...? Yes... But let's assume that was not the case
- This is a first step towards using behavioral theories (which are plenty) to produce parsimonious factors and test them in the data

Pedagogical Tips

- Book explains how to replicate the most famous anomalies and their factors:
 - size
 - value
 - momentum
 - short-term reversal
 - illiquidity
 - skewness
 - idiosyncratic volatility
 - option-implied volatility

+ Appendix of the Paper has the definition and the construction of the 32 anomaly variables used.

