Size and Value in China

by

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Introduction

- China
  - world's second largest stock market
  - unique political and economic environments
  - market and investors separated from the rest of the world
- What about return factors in China's stock-market?
  - Are size and value important factors?
  - If so, are they well captured by replicating Fama-French?
  - Are other factors useful?

What we find for China

- Both size and value are important factors
- Both factors should be constructed differently from Fama-French
  - eliminate smallest 30% of listed stocks
  - measure value using E/P rather than B/M
- Both size and value explain significant return variance
  - greater marginal contributions than in the U.S.
- Both size and value exhibit large average premia
  - each over 1% per month
- Our size and value factors explain most documented anomalies
  - unlike the Fama-French model applied to China
- An additional sentiment-based factor explains remaining anomalies

Data

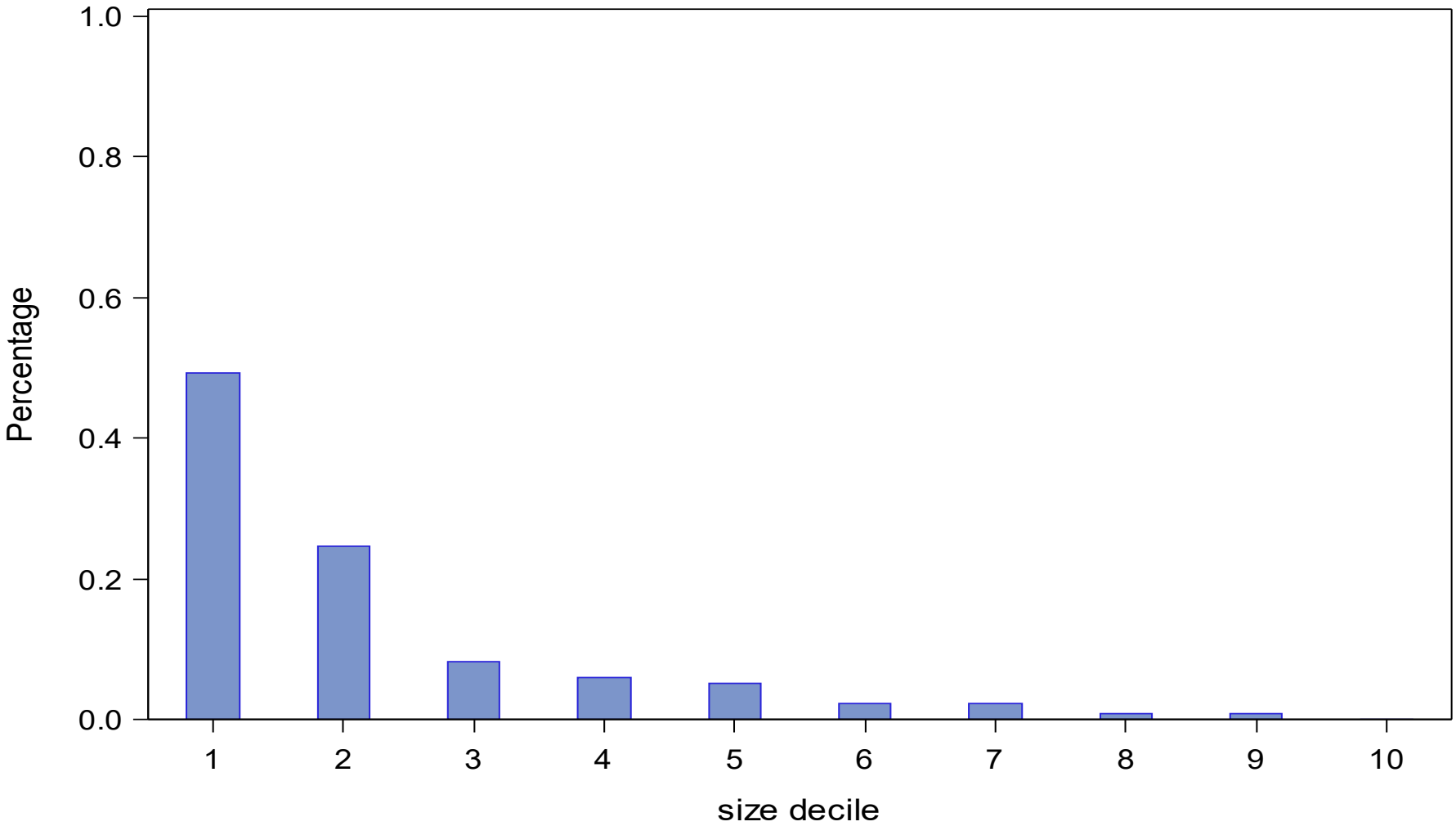
- A-Shares: the domestically traded stock market
- Data source: Wind Information Inc. (WIND)
  - largest and most prominent financial data provider in China
  - serves 90% of China's financial institutions
  - we use data on returns, trading, financial statements, and M&A
- Sample period: January 2000 through December 2016
  - less uniformity in accounting standards prior to 1999
  - gives at least 50 stocks in all portfolios, after filters

Small Stocks and IPO Constraints

- IPO process in China
  - controlled by China Securities Regulatory Commission (CSRC)
  - constrains IPOs by controlling review speeds
  - approval times are typically over 3 years, with long wait list
- Reverse mergers (RMs) are often an alternative
  - public "shell" exchanges shares for private company's assets
  - merged company is effectively the previously private one
  - processing time is 6-12 months
  - also common in the US, but not using shells on the major exchanges

Small stocks are the most likely RM shells

83% come from the smallest 30%



Shell Value of Small Stocks

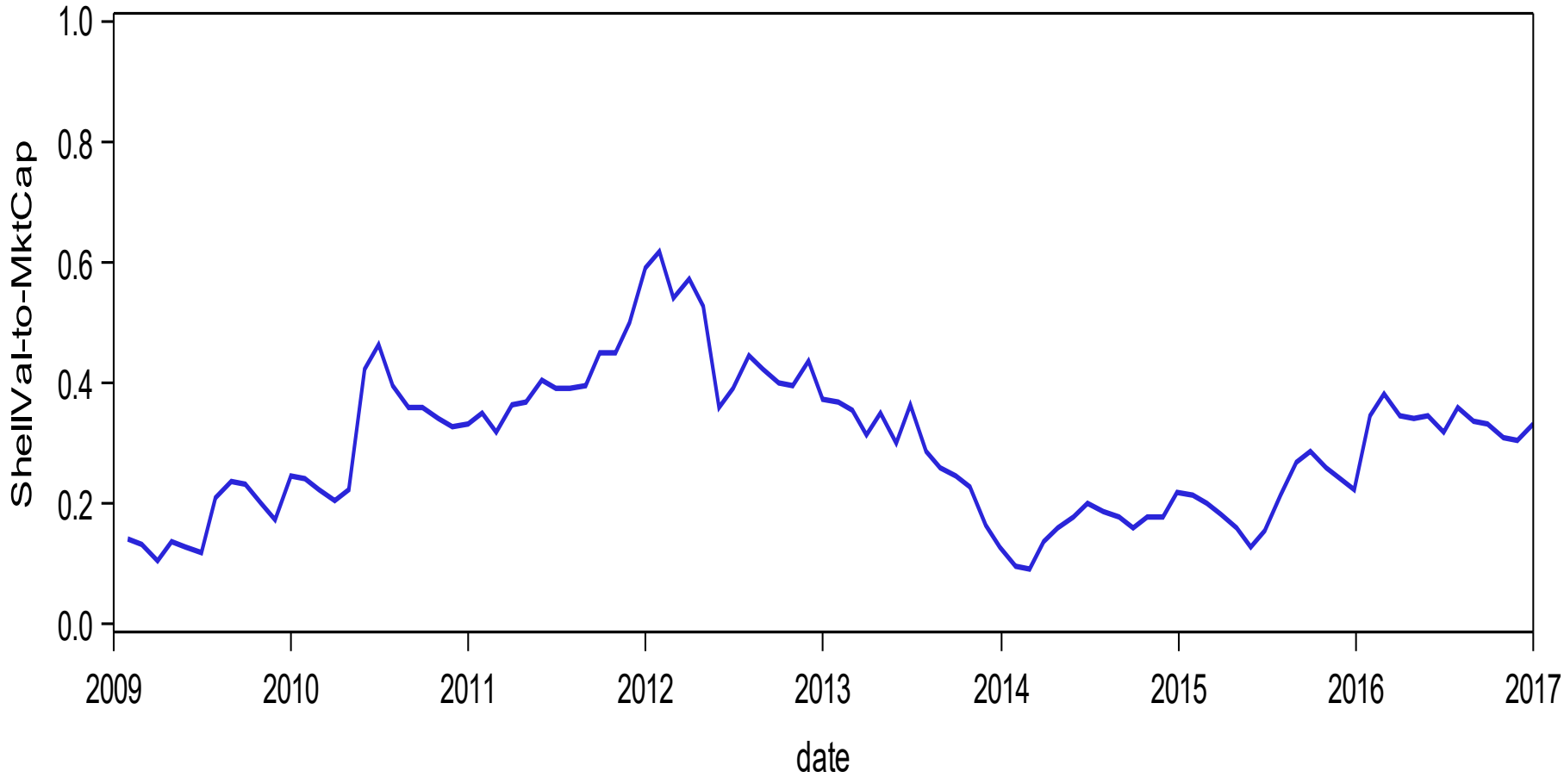
- Potentially becoming a RM shell
  $\Rightarrow$ significant component of small-stock value and return variation
- Conclusion buttressed independently by Lee, Qu, Shen (2017)
- Shell value: lottery with repeated entry until a win

$$S = \frac{pG + (1-p)S}{1+r} = \frac{pG}{r+p}$$

  - S: shell value ("lottery ticket" value)
  - r: discount rate
  - p: probability of becoming RM shell if in smallest 30% ("win")
  - G: stock's appreciation if it becomes a RM shell ("payoff")
- Estimate p and G using two-year rolling window; set r to 3%

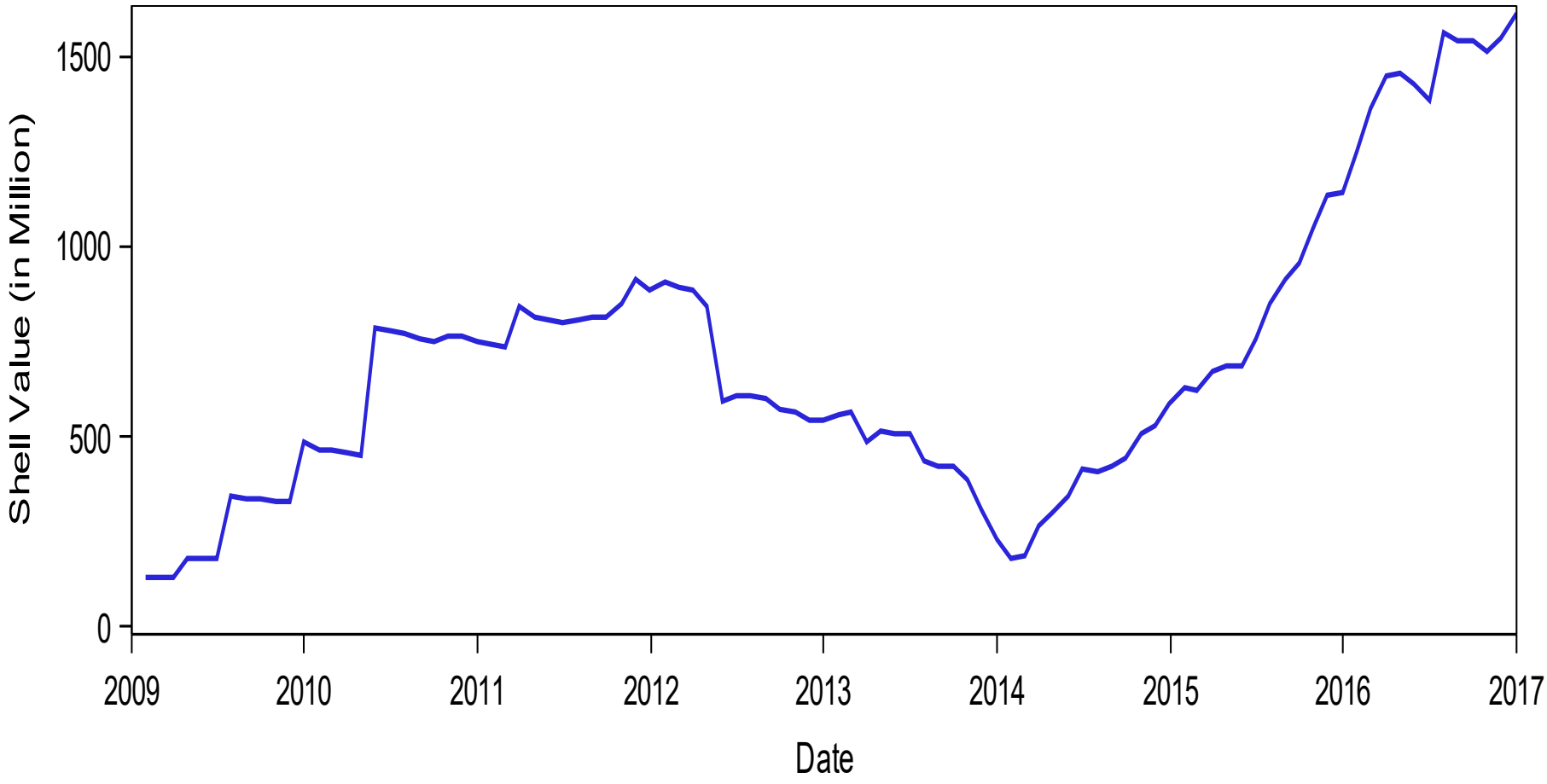
Estimated (Shell Value)/(Market Cap) for Smallest 30%

Average equals 0.295 over 2009–2017



Estimated Shell Value (RMB) for Smallest 30%

Five-fold increase over 2009–2017



Return Reactions to Earnings Surprises across Different Size Groups in the Chinese and US Markets

$$R_{i,t-k,t+k} = a + b\,SUE_{i,t} + e_{i,t},$$

	China			US		
	Smallest	Middle	Largest	Smallest	Middle	Largest
			Panel A: $k = 0$			
b	0.14	0.17	0.24	0.19	0.07	0.05
	(6.34)	(12.42)	(17.28)	(7.51)	(6.99)	(9.90)
R^2	0.003	0.010	0.017	0.005	0.003	0.002
			Panel B: $k = 3$			
b	0.43	0.58	0.59	0.52	0.20	0.13
	(9.74)	(17.91)	(17.60)	(7.84)	(6.03)	(10.68)
R^2	0.006	0.016	0.021	0.012	0.005	0.003

Choosing a Valuation Ratio

- Our approach: same as Fama and French 1992
- Horse race among valuation ratios
- Fama-MacBeth regression using individual-stock returns
- Valuation ratio: (accounting-based fundamental)/(equity price)
- Entrants:
  - earnings to price (EP)
  - book to market (BM)
  - assets to market (AM)
  - cash flow to price (CP)

Fama-MacBeth Regressions of Stock Returns on Beta, Size, and Valuation Ratios

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	0.0149	0.0581	0.0571	0.0659	0.0629	0.0690	0.0564	0.0716	0.0728
	(1.94)	(3.32)	(3.19)	(3.90)	(3.74)	(4.03)	(3.19)	(4.40)	(4.39)
β	−0.0002		−0.0010	−0.0018	−0.0017	0.0002	−0.0010	−0.0002	−0.0004
	(−0.09)		(−0.37)	(−0.71)	(−0.67)	(0.07)	(−0.37)	(−0.06)	(−0.15)
logME		−0.0049	−0.0046	−0.0046	−0.0048	−0.0068	−0.0047	−0.0066	−0.0064
		(−2.91)	(−2.69)	(−2.73)	(−3.00)	(−4.34)	(−2.80)	(−4.49)	(−4.40)
logBM				0.0057				0.0022	0.0035
				(3.21)				(1.31)	(1.76)
logAM					0.0045			0.0014	
					(3.03)			(0.99)	
EP^+						0.9503		0.7825	0.7960
						(4.88)		(4.38)	(5.06)
$D(EP < 0)$						0.0006		−0.0005	−0.0001
						(0.31)		(−0.29)	(−0.04)
CP^+							0.0546	0.0181	
							(3.41)	(1.35)	
$D(CP < 0)$							0.0019	0.0016	
							(3.11)	(2.37)	
R^2	0.0196	0.0277	0.0441	0.0652	0.0677	0.0615	0.0454	0.0832	0.0776

Constructing Factors: Model CH-3

- Eliminate smallest 30% of stocks
- Use EP rather then BM
- Otherwise follow Fama and French 1993
  - big (B) and small (S) split at median size
  - value (V), middle (M) and growth(G) splits at 30%, 40%, 30%
  - $EP < 0$ included in growth
    - ★ comove more with low positive EP
    - ★ results robust to omitting
    - ★ about 15% of sample on average
- Size and value factors

$$SMB = \frac{1}{3}(S/V + S/M + S/G) - \frac{1}{3}(B/V + B/M + B/G),$$

$$VMG = \frac{1}{2}(S/V + B/V) - \frac{1}{2}(S/G + B/G).$$

- Market factor: value-weighted return minus one-year deposit rate

Summary Statistics for the CH-3 Factors

2000–2016

			Correlations		
Factor	Mean	Std. Dev.	*MKT*	*SMB*	*VMG*
MKT	0.66	8.09	1.00	0.12	−0.27
SMB	1.03	4.52	0.12	1.00	−0.62
VMG	1.14	3.75	−0.27	−0.62	1.00

CH-3 Model's Ability to Explain Individual Stocks' Variances in China

Factors	Avg. R-square
Panel A: All individual stocks in China	
MKT	0.385
MKT, *SMB*	0.507
MKT, *VMG*	0.471
MKT, *SMB*, *VMG*	0.536
Panel B: All but the smallest 30% stocks in China	
MKT	0.417
MKT, *SMB*	0.528
MKT, *VMG*	0.501
MKT, *SMB*, *VMG*	0.562

FF-3 Model's Ability to Explain Individual Stocks' Variances in the US

Factors	Avg. R-square
MKT	0.177
MKT, *SMB*	0.231
MKT, *HML*	0.226
MKT, *SMB*, *HML*	0.273

Abilities of Models CH-3 and FF-3 to Explain Each Other's Size and Value Factors

	Alphas with respect to:	
Factors	CH-3	FF-3
FFSMB	-0.04	-
	(-0.66)	-
FFHML	0.34	-
	(0.97)	-
SMB	-	0.47
	-	(7.03)
VMG	-	1.39
	-	(7.93)

Chinese Anomalies in the Literature

Category	Anomaly	References	CAPM alpha (monthly %)	
			Unconditional	Size-neutral
Size	Market Cap	Wang and Xu (2004), Eun and Huang (2007), Cheung, Hoguet, and Ng (2015), Chen, Hu, Shao, and Wang (2015), Cakici, Chan, and Topyan (2015), Hsu, Viswanathan, Wang, and Wool (2017), and Carpenter, Lu, and Whitelaw (2017). Reported insignificant: Chen, Kim, Yao, and Yu (2010) and Cheung et al. (2015).	0.97 (1.82)	—
Value	EP	Cakici et al. (2015) and Hsu et al. (2017). Reported insignificant: Chen et al. (2010) and Chen et al. (2015).	1.37 (2.93)	1.89 (4.72)
Value	BM	Wang and Xu (2004), Eun and Huang (2007), Chen et al. (2010), Cheung et al. (2015), Cakici et al. (2015), Hsu et al. (2017), and Carpenter et al. (2017). Reported insignificant: Chen et al. (2015).	1.14 (2.13)	1.10 (2.22)
Value	CP	Cakici et al. (2015). Reported insignificant: Wang and Di Iorio (2007) and Chen et al. (2010).	0.70 (1.69)	0.76 (2.25)
Profitability	ROE	Guo, Zhang, Zhang, and Zhang (2017). Reported insignificant: Li, Yao, and Pu (2007).	0.93 (2.11)	1.50 (4.10)
Volatility	1-Mo. Vol.	Cheung et al. (2015), Cakici et al. (2015), and Hsu et al. (2017). Reported insignificant: Chen et al. (2010).	1.03 (2.31)	0.90 (2.19)
Volatility	MAX	Carpenter et al. (2017).	0.81 (2.03)	0.60 (1.61)

Chinese Anomalies in the Literature

Category	Anomaly	References	CAPM alpha (monthly %)	
			Unconditional	Size-neutral
Reversal	1-Month Return	Cakici et al. (2015), Hsu et al. (2017), and Carpenter et al. (2017). Reported insignificant: Cheung et al. (2015).	1.49 (3.07)	1.66 (3.68)
Turnover	12-Mo. Turn.	Zhang and Liu (2006) and Eun and Huang (2007). Reported insignificant: Chen et al. (2010).	0.53 (1.09)	0.74 (1.75)
Turnover	1-Mo. Abn. Turn.	Li (2004) and Zhang and Liu (2006).	1.27 (2.92)	1.39 (3.68)
Investment	Asset Growth	Chen et al. (2010). Reported insignificant: Hsu et al. (2017), Guo et al. (2017), and Lin (2017).	0.22 (0.72)	−0.05 (−0.20)
Accruals	Accruals	Li, Niu, Zhang, and Largay (2011) and Hsu et al. (2017). Reported insignificant: Chen et al. (2010).	0.08 (0.39)	−0.15 (−0.70)
Accruals	NOA	Chen et al. (2010) and Hsu et al. (2017).	0.38 (1.03)	0.42 (1.22)
Illiquidity	Amihud-Illiq.	Carpenter et al. (2017) and Chen et al. (2010).	0.83 (1.62)	0.63 (1.55)

CAPM Alphas for Anomalies

Unconditional Sorts

Category	Anomaly	α	$t(\alpha)$
Size	Market Cap	0.97	1.81
Value	EP	1.37	2.93
Value	BM	1.14	2.13
Value	CP	0.70	1.69
Profitability	ROE	0.93	2.11
Volatility	1−Month Vol.	1.03	2.31
Volatility	MAX	0.81	2.02
Reversal	1−Month Return	1.49	3.06
Reversal	12−Mon Turn.	0.53	1.09
Turnover	1−Mo. Abn. Turn.	1.27	2.92

CAPM Alphas for Anomalies

Size-Neutral Sorts

Category	Anomaly	α	$t(\alpha)$
Value	EP	1.89	4.72
Value	BM	1.10	2.22
Value	CP	0.76	2.25
Profitability	ROE	1.50	4.11
Volatility	1−Month Vol.	0.90	2.19
Volatility	MAX	0.60	1.61
Reversal	1−Month Return	1.65	3.68
Reversal	12−Mon Turn.	0.74	1.74
Turnover	1−Mo. Abn. Turn.	1.39	3.68

CH-3 Alphas for Anomalies

Unconditional Sorts

Category	Anomaly	α	$t(\alpha)$
Size	Market Cap	0.21	1.71
Value	EP	0.04	0.16
Value	BM	0.64	1.02
Value	CP	0.20	0.45
Profitability	ROE	−0.36	−0.88
Volatility	1−Month Vol.	0.23	0.44
Volatility	MAX	0.27	0.65
Reversal	1−Month Return	0.93	1.70
Turnover	12−Month Turn.	0.42	1.30
Turnover	1−Mo. Abn. Turn.	1.28	2.86

CH-3 Alphas for Anomalies

Size-Neutral Sorts

Category	Anomaly	α	$t(\alpha)$
Value	EP	0.23	0.82
Value	BM	0.61	0.98
Value	CP	0.18	0.54
Profitability	ROE	−0.37	−1.04
Volatility	1−Month Vol.	0.20	0.42
Volatility	MAX	0.00	0.00
Reversal	1−Month Return	1.13	2.12
Turnover	12−Month Turn.	0.25	0.69
Turnover	1−Mo. Abn. Turn.	1.24	3.04

FF-3 Alphas for Anomalies

Unconditional Sorts

Category	Anomaly	α	$t(\alpha)$
Size	Market Cap	0.16	1.36
Value	EP	1.54	5.57
Value	BM	−0.28	−1.25
Value	CP	0.63	1.40
Profitability	ROE	1.75	5.67
Volatility	1−Month Vol.	0.83	2.11
Volatility	MAX	0.74	1.85
Reversal	1−Month Return	0.94	1.97
Turnover	12−Month Turn.	0.83	2.96
Turnover	1−Mo. Abn. Turn.	1.34	2.86

FF-3 Alphas for Anomalies

Size-Neutral Sorts

Category	Anomaly	α	$t(\alpha)$
Value	EP	1.76	5.49
Value	BM	−0.01	−0.04
Value	CP	0.52	1.73
Profitability	ROE	2.01	5.72
Volatility	1−Month Vol.	0.76	2.06
Volatility	MAX	0.43	1.14
Reversal	1−Month Return	1.21	2.55
Turnover	12−Month Turn.	0.80	2.46
Turnover	1−Mo. Abn. Turn.	1.37	3.26

Comparing Models' Abilities to Explain Anomalies

Unconditional Sorts

Measure	Unadjusted	CAPM	FF-3	CH-3
Average $\lvert\alpha\rvert$	0.94	1.02	0.90	0.45
Average $\lvert t\rvert$	1.89	2.12	2.66	1.09
GRS_{10}	7.30	7.31	6.00	1.49
p_{10}	$<$0.0001	$<$0.0001	$<$0.0001	0.15
GRS_7	4.40	4.45	6.86	1.74
p_7	0.0002	0.0001	0.0001	0.10

Comparing Models' Abilities to Explain Anomalies

Size-Neutral Sorts

Measure	Unadjusted	CAPM	FF-3	CH-3
Average $\lvert\alpha\rvert$	1.08	1.17	0.99	0.47
Average $\lvert t\rvert$	2.55	2.82	2.71	1.04
GRS_9	8.24	8.08	7.97	1.97
p_9	$<$0.0001	$<$0.0001	$<$0.0001	0.05
GRS_7	8.15	8.10	9.11	2.33
p_7	$<$0.0001	$<$0.0001	$<$0.0001	0.03

Adding a Fourth Factor

- Turnover and reversal anomalies survive CH-3
- Turnover $\Rightarrow$ individual stock sentiment
  (Baker and Stein, 2004; Lee, 2013)
- China seems susceptible to sentiment effects
  - individuals hold 88% of free-floating shares (101 million accounts)
  - shorting is very costly
- Fourth factor: *PMO* (Pessimistic Minus Optimistic)
  - uses abnormal turnover (past month's / past year's)
  - otherwise follows same construction as *VMG*

Anomaly Alphas under a Four-Factor Model

Unconditional Sorts

Category	Anomaly	α	$t(\alpha)$
Size	Market Cap	0.23	1.41
Value	EP	0.02	0.08
Value	BM	0.75	1.04
Value	CP	0.31	0.57
Profitability	ROE	−0.29	−0.68
Volatility	1−Month Vol.	−0.27	−0.51
Volatility	MAX	−0.59	−1.64
Reversal	1−Month Return	0.49	0.87
Turnover	12−Month Turn.	0.04	0.11
Turnover	1−Mo. Abn. Turn.	−0.00	−0.01

Anomaly Alphas under a Four-Factor Model

Size-Neutral Sorts

Category	Anomaly	α	$t(\alpha)$
Value	EP	0.43	1.42
Value	BM	0.57	0.82
Value	CP	0.19	0.49
Profitability	ROE	−0.30	−0.76
Volatility	1−Month Vol.	−0.27	−0.59
Volatility	MAX	−0.77	−2.05
Reversal	1−Month Return	0.71	1.28
Turnover	12−Month Turn.	−0.07	−0.19
Turnover	1−Mo. Abn. Turn.	0.17	0.67

Conclusions

- Both size and value are important factors in China
- Both factors should be constructed differently from Fama-French
  - eliminate smallest 30% of listed stocks
  - measure value using E/P rather than B/M
- Both size and value explain significant return variance
  - greater marginal contributions than in the U.S.
- Both size and value exhibit large average premia
  - each over 1% per month
- Our size and value factors explain most documented Chinese anomalies
  - unlike the Fama-French model applied to China
- An additional sentiment-based factor explains remaining anomalies

Abilities of CH-3 and FF-5 to Explain Each Other's Factors

	Alphas with respect to:	
Factors	CH-3	FF-5
SMB	-	0.14
	-	(2.41)
VMG	-	0.43
	-	(4.39)
FFSMB	0.01	-
	(0.18)	-
FFHML	0.34	-
	(0.96)	-
FFRMW	−0.10	-
	(−0.86)	-
FFCMA	−0.08	-
	(−0.51)	-