Rebeco：A股低风险异象的实证研究

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> **本期遴选论文**
>
> **来源：** Journal of Asset Management 19-05-2021
>
> **作者：** David Blitz、Matthias X.Hanauer、Pim van Vliet
>
> **标题：** The Volatility Effect in China

随着中国资本市场的逐步开放，越来越多的海外机构开始关注A股市场，及A股市场的因子投资。今天为大家带来著名对冲基金Robeco关于A股低风险异象的实证研究。

核心观点

- **A股市场存在很强的低风险异象（low-risk anomaly），这种异象的主要原因是波动率，而不是Beta；**
- **A股市场的低风险异象是非常清晰的，并不能被价值和规模等其他因子所解释；**
- **A股市场以个人交易者为主的特点是低风险异象的主要原因。**

数据和方法

时间	2000年11月至2018年12月
股票范围	MSCI China A Onshore Index和MSCI China A Onshore Investable Market Index的成分股
数据	• 收益率（考虑分红配股等因素） • 自由流通市值 • 其他需要使用的基本面数据
计算方法	• 波动率（VOL）：过去3年，以个股月度收益率数据计算的标准差 • BETA：过去三年，以个股月度收益率与股票池能所有股票市值加权收益率滚动回归

实证结果

每个月，根据所有股票的VOL或BETA对股票进行从低到高的排序，并分成十组，计算下个月每组的市值加权超额收益率。

下表A部分展示了VOL因子的测试结果：

- 分组后，下一期每组的波动率（Volatility）从D1组的24.8%到D10组的35.1%，呈现单调递增的趋势，说明基于VOL分组是有效的；
- D1组的VOL最低，收益率最高，夏普比率为0.51；D10组的VOL最高，收益率最低，夏普比率为0.00，D1-D10的经Beta调整后的Alpha为16.1%；
- 综上，可以发现存在明显的低风险异象（以VOL因子表示风险）。

下表B部分展示了BETA因子的测试结果：

- 分组后，下一期每组的波动率（Volatility）从D1组的25.7%到D10组的36.5%，呈现单调递增的趋势，说明基于BETA分组是有效的。
- 但是D1组的Alpha为2.3%，统计上并不显著，D10组的Alpha为-7.4%，且D3组的收益、Alpha及Sharpe最高；D10-D1的Alpha明显小于VOL因子。
- Blitz and van Vliet (2007)在美国、欧洲及日本市场也发现了VOL因子比BETA因子更优的现象，但A股市场BETA与VOL的差距更为明显。
- BETA与VOL的差别在于BETA除了考虑了波动，还考虑了相关性。换句话说，主要是由于相关性，导致了BETA与VOL的差别。

下表C与D部分展示了Fama方法下VOL因子收益计算的方法，其中最右边的VOL列是由以下公式计算而来（BETA的计算方式也一致）

$Big\ Low\ Vol. + Small\ Low\ Vol. - (Big\ High\ Vol. + Small\ High\ Vol.)$

我们可以发现：

- VOL的Sharpe及Alpha均高于D10-D1
- Fama方法测试下， BETA同样不如VOL

Table 1 Portfolio returns based on past risk measures

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D1–D10	Univ
Panel A: Volatility deciles												
Return	12.7%	12.1%	8.3%	11.2%	11.5%	8.3%	6.6%	6.8%	6.0%	−0.2%	12.9%	8.8%
Return comp	9.6%	8.2%	4.2%	6.6%	6.7%	3.3%	1.3%	1.2%	−0.1%	−6.4%	10.6%	4.6%
Volatility	24.8%	28.1%	28.5%	30.3%	31.1%	31.3%	32.5%	33.7%	34.9%	35.1%	21.2%	29.0%
Sharpe	0.51	0.43	0.29	0.37	0.37	0.27	0.20	0.20	0.17	0.00	0.61	0.31
Beta	0.79	0.94	0.96	1.01	1.04	1.06	1.09	1.12	1.16	1.15	−0.36	1.00
Alpha	5.7%	3.9%	−0.2%	2.2%	2.3%	−1.0%	−3.0%	−3.2%	−4.2%	−10.4%	16.1%	0.0%
t-value	2.55	2.34	−0.16	1.26	1.27	−0.65	−1.55	−1.60	−1.95	−4.01	3.69	0.00
Panel B: Beta deciles												
Return	9.4%	12.2%	13.8%	8.4%	10.2%	8.9%	11.3%	7.0%	7.9%	3.2%	6.2%	8.8%
Return comp	6.1%	8.5%	9.5%	4.0%	5.6%	4.0%	6.0%	1.2%	1.9%	−3.4%	3.5%	4.6%
Volatility	25.7%	27.2%	29.6%	29.7%	30.3%	31.1%	32.6%	33.9%	34.6%	36.5%	22.8%	29.0%
Sharpe	0.36	0.45	0.47	0.28	0.34	0.29	0.35	0.20	0.23	0.09	0.27	0.31
Beta	0.80	0.90	0.99	0.99	1.02	1.05	1.09	1.13	1.16	1.19	−0.39	1.00
Alpha	2.3%	4.2%	5.1%	−0.3%	1.2%	−0.3%	1.7%	−3.0%	−2.3%	−7.4%	9.7%	0.0%
t-value	0.88	2.38	3.18	−0.21	0.73	−0.19	0.89	−1.43	−1.26	−2.74	2.06	0.00

	Big Low Vol.	Big Neutral	Big High Vol.	Small Low Vol.	Small Neutral	Small High Vol.	VOL
Panel C: 2 × 3 Size-Volatility sort							
Return	10.7%	6.5%	0.9%	13.9%	11.5%	8.8%	9.1%
Volatility	26.5%	29.5%	34.3%	30.5%	33.7%	36.0%	10.3%
Sharpe	0.40	0.22	0.03	0.45	0.34	0.25	0.88
Beta	0.84	0.99	1.13	1.00	1.10	1.17	0.00
Alpha	3.2%	−2.2%	−9.1%	5.1%	1.7%	−1.5%	9.1%
t-value	1.34	−1.28	−3.87	2.16	0.67	−0.50	3.72

	Big Low Beta	Big Neutral	Big High Beta	Small Low Beta	Small Neutral	Small High Beta	BETA
Panel D: 2 × 3 Size-Beta sort							
Return	9.3%	7.7%	3.1%	12.0%	12.5%	10.0%	6.0%
Volatility	26.2%	29.0%	35.8%	30.9%	33.7%	35.8%	10.4%
Sharpe	0.36	0.27	0.09	0.39	0.37	0.28	0.58
Beta	0.84	0.97	1.18	0.99	1.10	1.17	0.00
Alpha	1.9%	−0.9%	−7.4%	3.2%	2.8%	−0.4%	6.0%
t-value	0.86	−0.52	−2.85	1.21	1.07	−0.13	2.43

This table shows the descriptive statistics for Chinese A-share stocks sorted into portfolios based on past risk measures and the value-weighted universe (Univ) over the period December 2000–December 2018. The returns are in US dollars, value-weighted and in excess of the 30-day T-bill rate. Panel A shows the portfolio deciles sorted on 36-month volatility and panel B when stocks are sorted on 36-month beta. Portfolios are rebalanced on a monthly frequency. To control for differences in volatility, the compounded returns are also shown in Panels A and B. Panels C and D show the portfolios sorted on size (market capitalization equity) and risk in line with the standard Fama–French 2×3 portfolio sorting technique. This procedure produces six value-weight portfolios. The size breakpoint is the MSCI China A Onshore Index (solely large- and mid-cap stocks) median market capitalization but applied to all stocks. The volatility and beta breakpoints are the 30th and 70th percentiles of 36-month volatility and beta within both of these size groups. VOL (BETA) is the equal-weight average of the returns on the two low-volatility (beta) portfolios minus the average of the returns on the two high stock volatility (beta). The VOL and BETA portfolios are made beta neutral, by levering up the long leg and levering down the short leg to full-sample markets betas of 1 each. Only simple returns are shown in Panels C and D

下表展示了考虑各个行业内VOL和BETA因子的表现，每列表示一个行业（其中房地产40和金融60合并，信息技术45和通信服务50合并）。我们可以发现每个行业的Alpha均为正值。同样的，VOL的表现在绝大多数行业中要优于BETA。

	10	15	20	25	30	35	40&60	45&50	55
Panel A: VOL premium within 9 sectors (30-40-30 sort within each sector)									
Return	7.2%	6.9%	8.6%	9.2%	17.9%	7.3%	8.2%	3.4%	13.9%
Volatility	24.5%	12.7%	14.3%	14.7%	24.3%	19.7%	20.2%	15.5%	22.0%
Sharpe	0.30	0.54	0.60	0.62	0.74	0.37	0.41	0.22	0.63
Beta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alpha	7.2%	6.9%	8.6%	9.2%	17.9%	7.3%	8.2%	3.4%	13.9%
t-value	1.25	2.29	2.54	2.63	3.12	1.58	1.72	0.92	2.68
Panel B: BETA premium within 9 sectors (30-40-30 sort within each sector)									
Return	5.2%	3.3%	7.0%	1.9%	18.6%	3.6%	8.0%	1.9%	4.4%
Volatility	23.3%	12.5%	13.7%	14.8%	27.3%	23.8%	21.1%	16.4%	22.6%
Sharpe	0.23	0.26	0.51	0.13	0.68	0.15	0.38	0.11	0.20
Beta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alpha	5.2%	3.3%	7.0%	1.9%	18.6%	3.6%	8.0%	1.9%	4.4%
t-value	0.95	1.10	2.15	0.53	2.88	0.63	1.60	0.48	0.83

This table shows VOL and BAB factors within each sector. Due to the lower number of stocks per sector, VOL and BAB factors are created based on single sorts using again past 36-month volatility (beta) and the 30th and 70th percentiles as breakpoints. We use the 11 main sectors as defined by the Global Industry Classification Standard (GICS) classification, but merge two sectors with a low number of stocks with related sectors: real estate (GIGS sector code 60) with financials (40), and communication services (50) with information technology (45). The VOL and BETA factors for each sector are made beta neutral, by levering up the long leg and levering down the short leg to full-sample markets betas of 1 each

下表比较了VOL与其他Fama-French因子的表现，我们可以发现VOL的Sharpe明显最高，收益虽然比HML稍逊一点，但风险比HML小很多。

	RM-RF	SMB	HML	CMA	RMW	UMD	VOL
Return	8.8%	4.5%	10.2%	2.1%	0.9%	−1.0%	9.1%
Volatility	29.0%	16.3%	15.0%	8.2%	9.0%	13.7%	10.3%
Sharpe	0.31	0.28	0.68	0.25	0.10	−0.07	0.88
Beta	1.00	0.12	0.06	−0.07	−0.01	−0.08	0.00
Alpha	–	3.6%	9.7%	2.6%	1.0%	−0.3%	9.1%
t–value	–	0.95	2.75	1.39	0.45	−0.09	3.72

This table shows the annualized return, volatility, and Sharpe ratio for the market (RM-RF), size (SMB), value (HML), profitability (RMW), investment (CMA), momentum (WML), and volatility (VOL) factors for the Chinese A-share market over the December 2000–December 2018. For all factors besides the market, we also compute the realized CAPM beta and alpha (and the associated *t*-value)

作者对VOL与其他因子进行回归，VOL的因子收益作为因变量，其他因子收益作为自变量。一直从CAPM测试到Fama六因子模型。**可以发现：随着加入的因子越来越多，Alpha并没有明显的降低，说明VOL因子有很多其他因子没有的信息。同时，也发现定义价值因子时，EP比BM更有效。**

Panel A: Value factor (HML) based on BtM						Panel B: Value factor (VMG) based on EtP					
	CAPM	3FM	5FM	6FM	ALL		CAPM	3FM	5FM	6FM	ALL
Alpha	9.1%	8.9%	8.7%	8.0%	8.2%	Alpha	9.1%	6.8%	6.6%	5.2%	5.3%
t-value	3.72	3.95	3.88	3.51	3.49	t-value	3.72	2.91	2.96	2.27	2.27
RM-RF	0.00	0.02	0.03	0.04	0.04	RM-RF	0.00	0.03	0.03	0.03	0.03
t-value	0.00	1.06	1.53	1.59	1.60	t-value	0.00	1.24	1.33	1.57	1.58
SMB	–	−0.25	−0.19	−0.15	−0.15	SMB	–	−0.17	−0.14	−0.06	−0.06
t-value	–	−6.30	−3.94	−2.97	−2.93	t-value	–	−3.60	−2.82	−1.06	−1.05
HML	–	0.12	0.04	0.11	0.11	VMG	–	0.24	0.21	0.32	0.32
t-value	–	2.74	0.82	1.70	1.70	t-value	–	3.96	3.21	4.26	4.25
CMA	–	–	0.20	0.20	0.21	CMA	–	–	0.07	0.04	0.04
t-value	–	–	2.00	2.08	2.10	t-value	–	–	0.63	0.34	0.36
RMW	–	–	0.16	0.15	0.15	RMW	–	–	0.20	0.28	0.28
t–value	–	–	1.84	1.78	1.73	t-value	–	–	2.89	3.84	3.77
UMD	–	–	–	0.11	0.11	UMD	–	–	–	0.16	0.17
t-value	–	–	–	1.80	1.82	t-value	–	–	–	2.93	2.93
BONDS					−0.06	BONDS					−0.04
t-value					−0.37	*t*-value					−0.26
Adj. R^2	0%	19%	21%	22%	21%	Adj. R^2	0%	22%	24%	27%	27%

This table presents the results of a series of spanning tests where we regress VOL factor returns on the CAPM, Fama and French (1993) three-factor model (3FM), Fama and French (2015) five-factor model (5FM), the 5FM augmented with a momentum factor to a six-factor model (6FM), and the 6FM augmented with a Bond factor (ALL). The Bond factor is based on the excess return of the iBoxx ABF China Government Index. Panel A shows the results for the standard value factor (HML) based on the book-to-market ratio (BtM), while Panel B shows results for a value factor (VMG) based on the earnings-to-price (EtP). The sample period runs from December 2000 to December 2018

最后，通过改变计算VOL因子的所需历史数据的长度（从1个月到60个月），且区分大盘股和小盘股的方式，来测试VOL的稳健性。结果如下表：

- A部分展示了不同历史窗口长度下，VOL因子的表现，可以发现即使调整历史数据的长度，VOL因子表现没有很大的变化，比较稳健。
- B部分展示了不同持仓期下，VOL因子的表现，可以发现并没有非常显著的区别，在1个月到60个月的持仓周期中，因子的Alpha并没有很大的起伏。
- C部分显示，在大盘及小盘股中，低波动VOL因子均有效，在小盘股中风险回报比更高。
- 最后D部分测试了不同时间段，低波动因子的表现，在15-18年期间，VOL的表现最好。整体而言，从2000年以来，VOL的表现越来越强。

Panel A: Estimation period VOL factor					
	20-day	52-week	36-month	60-month	
Alpha	9.3%	10.1%	9.1%	9.3%	
Volatility	11.6%	11.0%	10.3%	8.9%	
t-value	3.40	3.87	3.72	4.38	
Sharpe	0.80	0.92	0.88	1.04	
Panel B: Holding period VOL factor					
	1-month	6-month	12-month	36-month	60-month
Alpha	9.1%	9.3%	9.1%	8.0%	7.1%
Volatility	10.3%	9.9%	9.6%	8.5%	7.9%
t-value	3.72	3.94	4.01	3.99	3.80
Sharpe	0.88	0.93	0.95	0.94	0.90
Panel C: Large- and small-cap component of VOL factor					
	VOL	VOL_B	VOL_S		
Alpha	9.1%	11.9%	6.4%		
Volatility	10.3%	16.0%	7.8%		
t-value	3.72	3.14	3.47		
Sharpe	0.88	0.74	0.82		
Panel D: Subsamples VOL factor					
	00–05	06–10	10–15	15–18	Full
Return	5.0%	5.0%	12.7%	17.2%	9.1%
Volatility	7.5%	11.8%	12.1%	8.5%	10.3%
Sharpe	0.66	0.42	1.05	2.02	0.88
Beta	0.04	0.01	−0.03	0.02	0.00
Alpha	5.4%	4.7%	13.0%	17.4%	9.1%
t-value	1.60	0.85	2.37	3.46	3.72

This table shows the annualized alpha, the associated volatility and *t*-value, and Sharpe ratio for the volatility (VOL) factor constructed based on various past volatility estimates (Panel A), for various holding periods (Panel B), for the VOL factor broken down into its separate large-cap and small-cap components (Panel C), and for several subperiods (Panel D). Panel D shows additionally also the annualized return and realized CAPM beta. The full sample period runs from December 2000 to December 2018

总结

研究表明，在中国A股市场低风险异象还是比较明显。并且主要驱动因素是波动VOL，而不是BETA。且VOL与其他因子的相关性很低，近些年该异象不太没有消失，反而越来越强。与西方国家，低波动异象逐渐消失相比，该状况可能是由于中国市场非机构主导的因素导致。

参考文献

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