The Cross-Section of Volatility and Expected Returns

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Introduction

Definition

- Volatility
- Aggregate Volatility
- Idiosyncratic Volatility relative to FF3 model

Introduction

Background and Motivation

- Considerable research has examined the time-series relation between the volatility of the market and the expected return.
- As a systematic risk factor, aggregate volatility should be priced.
- Option studies reveal a negative price for market volatility
- Earlier researchers find positive relation between idiosyncratic volatility and average return

Introduction

Literature

- Pricing volatility

Campbell and Hentschel(1992): framework

Chernov and Ghysels (2000), Benzoni (2002), and Jones(2003) : option studies have estimated a negative price of risk for market volatility using options on an aggregate market index or options on individual stocks

Lintner(1965), Lehmann(1990): positive coefficient on IVOL and average return

Introduction

Contribution

- A systematic investigation of whether the volatility of the market is a priced risk factor and estimation of the price of aggregate volatility risk.

- Examine the idiosyncratic volatility relative to standard Fama and French model at firm level

Research Design

Theory and Empirical Framework

- Multifactor model concludes that:

$$\alpha_t^i = E_t(r_{t+1}^i) = \beta_{m,t}^i \lambda_{m,t} + \beta_{v,t}^i \lambda_{v,t} + \sum_{k=1}^{K} \beta_{k,t}^i \lambda_{k,t}$$

- β is the coefficient for risk and λ is the price of risk

Research Design

Theory and Empirical Framework

- Proxy for aggregate volatility risk

VIX: index represent the implied volatility of an option contract on S&P100 index that has a maturity of 1 month

- Two-factor model

$$r_t^i = \beta_0 + \beta_{MKT}^i MKT_t + \beta_{\Delta VIX}^i \Delta VIX_t + \varepsilon_t^i,$$

- β measures the sensitive to aggregate volatility

Research Design

Theory and Empirical Framework

- Define idiosyncratic volatility by ff3:

$$r_t^i = \alpha^i + \beta_{MKT}^i MKT_t + \beta_{SMB}^i SMB_t + \beta_{HML}^i HML_t + \varepsilon_t^i.$$

- IVOL is the standard deviation of ε: $\sqrt{\mathbf{var}(\varepsilon_t^i)}$

Results

Portfolio-sorted Regressions

- Portfolios sorted by exposure to aggregate volatility risk

								Factor Loadings			
Rank	Mean	Std. Dev.	% Mkt Share	Size	B/M	CAPM Alpha	FF-3 Alpha	Pre-Formation $\beta_{\Delta VIX}$	Pre-Formation β_{FVIX}	Next Month Post-Formation $\beta_{\Delta VIX}$	Full Sample Post-Formation β_{FVIX}
1	1.64	5.53	9.4%	3.70	0.89	0.27	0.30	−2.09	−2.00	−0.033	−5.06
						[1.66]	[1.77]				[−4.06]
2	1.39	4.43	28.7%	4.77	0.73	0.18	0.09	−0.46	−0.42	−0.014	−2.72
						[1.82]	[1.18]				[−2.64]
3	1.36	4.40	30.4%	4.77	0.76	0.13	0.08	0.03	0.08	0.005	−1.55
						[1.32]	[1.00]				[−2.86]
4	1.21	4.79	24.0%	4.76	0.73	−0.08	−0.06	0.54	0.62	0.015	3.62
						[−0.87]	[−0.65]				[4.53]
5	0.60	6.55	7.4%	3.73	0.89	−0.88	−0.53	2.18	2.31	0.018	8.07
						[−3.42]	[−2.88]				[5.32]
5-1	−1.04					−1.15	−0.83				
	[−3.90]					[−3.54]	[−2.93]				
Joint test p-value						0.01	0.03				0.00

Results

Portfolio-sorted Regressions

- Fama-Macbeth factor premiums on 25 portfolios sorted by β_{MKT} and $\beta_{\Delta VIX}$

Panel A: Fama–MacBeth (1973) Factor Premiums				
	I	II	III	IV
Constant	−0.145	−0.527	−0.202	−0.247
	[−0.23]	[−0.88]	[−0.31]	[−0.36]
MKT	0.977	1.276	1.034	1.042
	[1.11]	[1.47]	[1.13]	[1.13]
FVIX	−0.080		−0.082	−0.071
	[−2.49]		[−2.39]	[−2.02]
STR		−0.194		
		[−2.32]		
SMB	−0.638	−0.246	−0.608	−0.699
	[−1.24]	[−0.59]	[−1.13]	[−1.25]
HML	−0.590	−0.247	−0.533	−0.232
	[−0.95]	[−0.40]	[−0.82]	[−0.34]
UMD			0.827	0.612
			[0.83]	[0.59]
LIQ				−0.021
				[−1.00]
Adj R^2	0.67	0.56	0.65	0.79

Results

Portfolio-sorted Regressions

- Portfolios sorted by VOL and IVOL

Rank	Mean	Std. Dev.	% Mkt Share	Size	B/M	CAPM Alpha	FF-3 Alpha
Panel A: Portfolios Sorted by Total Volatility							
1	1.06	3.71	41.7%	4.66	0.88	0.14	0.03
						[1.84]	[0.53]
2	1.15	4.48	33.7%	4.70	0.81	0.13	0.08
						[2.14]	[1.41]
3	1.22	5.63	15.5%	4.10	0.82	0.07	0.12
						[0.72]	[1.55]
4	0.99	7.15	6.7%	3.47	0.86	−0.28	−0.17
						[−1.73]	[−1.42]
5	0.09	8.30	2.4%	2.57	1.08	−1.21	−1.16
						[−5.07]	[−6.85]
5-1	−0.97					−1.35	−1.19
	[−2.86]					[−4.62]	[−5.92]
Panel B: Portfolios Sorted by Idiosyncratic Volatility Relative to FF-3							
1	1.04	3.83	53.5%	4.86	0.85	0.11	0.04
						[1.57]	[0.99]
2	1.16	4.74	27.4%	4.72	0.80	0.11	0.09
						[1.98]	[1.51]
3	1.20	5.85	11.9%	4.07	0.82	0.04	0.08
						[0.37]	[1.04]
4	0.87	7.13	5.2%	3.42	0.87	−0.38	−0.32
						[−2.32]	[−3.15]
5	−0.02	8.16	1.9%	2.52	1.10	−1.27	−1.27
						[−5.09]	[−7.68]
5-1	−1.06					−1.38	−1.31
	[−3.10]					[−4.56]	[−7.00]

Results

Portfolio-sorted Regressions

- Portfolios sorted by IVOL controlling for other factors

		Ranking on Idiosyncratic Volatility					
		1 Low	2	3	4	5 High	5-1
NYSE Stocks Only		0.06	0.04	0.02	−0.04	−0.60	−0.66
		[1.20]	[0.75]	[0.30]	[−0.40]	[−5.14]	[−4.85]
Size Quintiles	Small 1	0.11	0.26	0.31	0.06	−0.43	−0.55
		[0.72]	[1.56]	[1.76]	[0.29]	[−1.54]	[−1.84]
	2	0.19	0.20	−0.07	−0.65	−1.73	−1.91
		[1.49]	[1.74]	[−0.67]	[−5.19]	[−8.14]	[−7.69]
	3	0.12	0.21	0.03	−0.27	−1.49	−1.61
		[1.23]	[2.40]	[0.38]	[−3.36]	[−10.1]	[−7.65]
	4	0.03	0.22	0.17	−0.03	−0.82	−0.86
		[0.37]	[2.57]	[2.47]	[−0.45]	[−6.61]	[−4.63]
	Large 5	0.09	0.04	0.03	0.14	−0.17	−0.26
		[1.62]	[0.72]	[0.51]	[1.84]	[−1.40]	[−1.74]
Controlling for Size		0.11	0.18	0.09	−0.15	−0.93	−1.04
		[1.30]	[2.49]	[1.35]	[−1.99]	[−6.81]	[−5.69]
Controlling for Book-to-Market		0.61	0.69	0.71	0.50	−0.19	−0.80
		[3.02]	[2.80]	[2.49]	[1.47]	[−0.48]	[−2.90]
Controlling for Leverage		0.11	0.11	0.08	−0.24	−1.12	−1.23
		[2.48]	[2.20]	[1.19]	[−2.45]	[−7.81]	[−7.61]
Controlling for Liquidity		0.08	0.09	−0.01	−0.16	−1.01	−1.08
		[1.71]	[1.53]	[−0.09]	[−1.62]	[−8.61]	[−7.98]
Controlling for Volume		−0.03	0.02	−0.01	−0.39	−1.25	−1.22
		[−0.49]	[0.39]	[−0.32]	[−7.11]	[−10.9]	[−8.04]
Controlling for Turnover		0.11	0.03	−0.11	−0.49	−1.34	−1.46
		[2.49]	[0.58]	[−1.79]	[−6.27]	[−11.0]	[−10.7]
Controlling for Bid–Ask Spreads		−0.07	−0.01	−0.09	−0.49	−1.26	−1.19
		[−1.21]	[−0.18]	[−1.14]	[−5.36]	[−9.13]	[−6.95]
Controlling for Coskewness		−0.02	−0.00	0.01	−0.37	−1.40	−1.38
		[−0.32]	[−0.02]	[0.08]	[−2.30]	[−6.07]	[−5.02]
Controlling for Dispersion in Analysts' Forecasts		0.12	−0.07	0.11	0.01	−0.27	−0.39
		[1.57]	[−0.76]	[1.12]	[0.09]	[−1.76]	[−2.09]

Results

Conclusions

- Estimate a cross-sectional price of volatility risk of approximately -1% per annum, and this estimate is robust to controlling for size, value, momentum, and liquidity effects

- Stocks with high idiosyncratic volatility have abysmally low average returns.

THANKS!