Columbia Business School

High Idiosyncratic Volatility and Low Returns

Andrew Ang
Columbia University and NBER

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References

- "The Cross-Section of Volatility and Expected Returns" *Journal of Finance*, February 2006
- "High Idiosyncratic Volatility and Low Returns: International and Further U.S. Evidence" September 2007
- Available at http://www.columbia.edu/~aa610

- Co-authors:
  - Bob Hodrick – Columbia and NBER
  - Yuhang Xing – Rice
  - Xiaoyan Zhang – Cornell

Motivation

- Idiosyncratic volatility
  - Should be diversifiable if factor models are correctly specified
  - If agents cannot fully diversify away firm-specific risk, stocks with high idiosyncratic volatility should earn high expected returns (see Merton, 1987)
- Using a standard definition of systematic risk, is there a reward or discount for idiosyncratic volatility in the cross-section?
- Data from 23 countries

Measuring Idiosyncratic Volatility

- Local Fama-French (L-FF)

$$r_i = \alpha_i^L + \beta_i^L MKT^L + s_i^L SMB^L + h_i^L HML^L + \varepsilon_i^L$$

where MKT = market excess return, SMB = Fama-French size factor, HML = Fama-French value/growth factor

- Regional Fama-French (R-FF)

$$r_i = \alpha_i^R + \beta_i^R MKT^R + s_i^R SMB^R + h_i^R HML^R + \varepsilon_i^R$$

for North America, Europe, and the Far East

Measuring Idiosyncratic Volatility

- World Fama-French (W-FF)

$$r_i = \alpha_i^W + \beta_i^W MKT^W + s_i^W SMB^W + h_i^W HML^W + \varepsilon_i^W$$

defining world FF factors as value-weighted sums of the regional FF factors

- Define idiosyncratic volatility as $\sqrt{\text{var}(\varepsilon_i^L)}$, $\sqrt{\text{var}(\varepsilon_i^R)}$, or $\sqrt{\text{var}(\varepsilon_i^W)}$ using daily excess returns over the past month

Idiosyncratic Volatility and Expected Returns

- Fama-MacBeth (1973) Regression:

$$r_i(t,t+1) = c + \gamma\sigma_i(t-1,t) + \lambda_\beta' \beta_i(t,t+1) + \lambda_z' z_i(t) + \varepsilon_i(t+1)$$

where $r_i(t,t+1)$ is firm i's excess return from t to t+1

$\sigma_i(t-1,t)$ is idiosyncratic volatility computed from t-1 to t

$\beta_i(t,t+1)$ are contemporaneous factor loadings

$z_i(t)$ are firm characteristics at time t

- Test null that $\gamma = 0$
- Also examine portfolios formed on $\sigma_i(t-1,t)$

Data

- U.S. Data, 1963-2003
- MSCI 23 developed markets, 1980-2003
- Individually examine G7 countries
  - G7: Canada, France, Germany, Italy, Japan, U.K., U.S.
  - Other: Australia, Austria, Belgium, Denmark, Finland, Greece, Hong Kong, Ireland, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland
- Size, book-to-market, past return (momentum) characteristics for all stocks. Additional controls for U.S. stocks.

G7 Countries

Coefficients on W-FF Idiosyncratic Volatility

	U.S.	Canada	France	Germany	Italy	Japan	U.K.
γ	-2.014	-1.224	-1.439	-2.003	-1.572	-1.955	-0.871
T-stat	[-6.67]	[-2.46]	[-2.14]	[-3.85]	[-2.10]	[-5.18]	[-2.54]

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Interquartile Spread of $\sigma_i(t-1,t)$

36.1%	25.2%	17.8%	18.5%	16.9%	16.5%	17.4%

Economic Effect of Moving from the 25th to 75th Percentiles

-0.73%	-0.31%	-0.26%	-0.37%	-0.27%	-0.32%	-0.15%

All Countries

Geographic Areas		G7 Countries		All Countries	
Europe	Far East	G7	G7 ex US	All	All ex US
-0.668	-1.177	-1.747	-1.069	-1.536	-0.604
[-2.33]	[-3.17]	[-6.40]	[-4.14]	[-5.82]	[-2.32]

Controls:

Factor Loadings: World MKT, SMB, HML

Characteristics: Size, Book-to-market, Lagged 6-mth returns

Separate G7 Country Dummies

All Countries Value-Weighted Coefficients

Geographic Areas		G7 Countries		All Countries	
Europe	Far East	G7	G7 ex US	All	All ex US
-0.893	-1.267	-1.974	-1.287	-1.750	-0.846
[-3.17]	[-3.38]	[-6.89]	[-4.90]	[-6.41]	[-3.26]

Controls:

Factor Loadings: World MKT, SMB, HML

Characteristics: Size, Book-to-market, Lagged 6-mth returns

Separate G7 Country Dummies

Different Formation Periods

Coefficient on W-FF Idiosyncratic Volatility

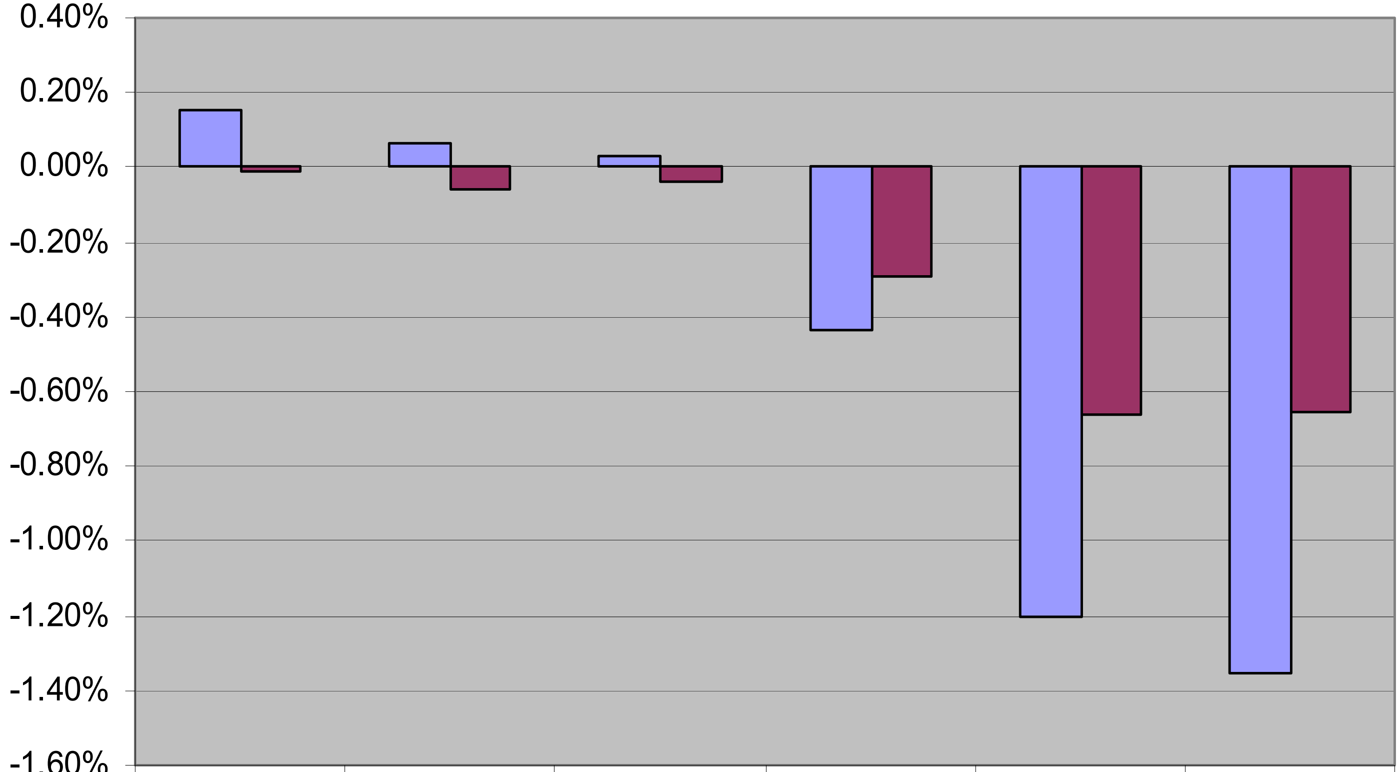
	1 month	3 months	6 months	12 months
US	-2.243	-2.461	-2.091	-1.273
	[-7.00]	[-5.68]	[-4.35]	[-2.60]
All ex US	-0.846	-0.930	-0.685	-0.605
	[-3.26]	[-2.93]	[-2.07]	[-1.98]

Portfolio Returns

- Form quintile portfolios ranked on past idiosyncratic volatility in each country
- Create portfolios across regions by forming value-weighted country quintile portfolios
- Rebalance every month
- Report alphas with respect to the W-FF risk model
- Denote the 5-1 strategy (going long quintile 5 and short quintile 1) in the U.S. as VOL^{US}

Quintile Portfolio Returns

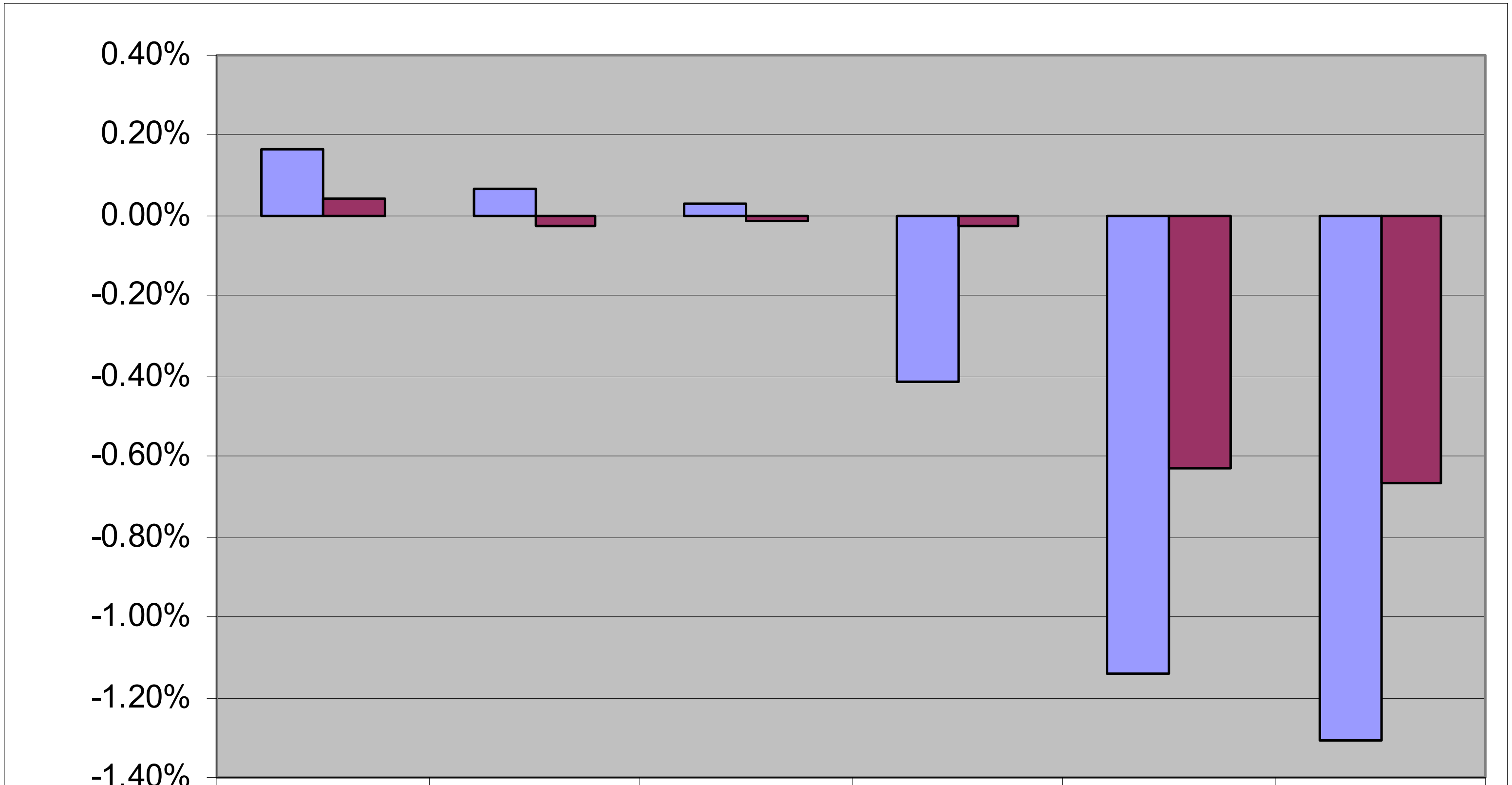
W-FF Alphas of G7 and G7ex US



	1 Low	2	3	4	5 High	High-Low
G7	0.153%	0.065%	0.027%	-0.433%	-1.201%	-1.354%
G7 ex US	-0.011%	-0.059%	-0.040%	-0.290%	-0.663%	-0.652%

Quintile Portfolio Returns

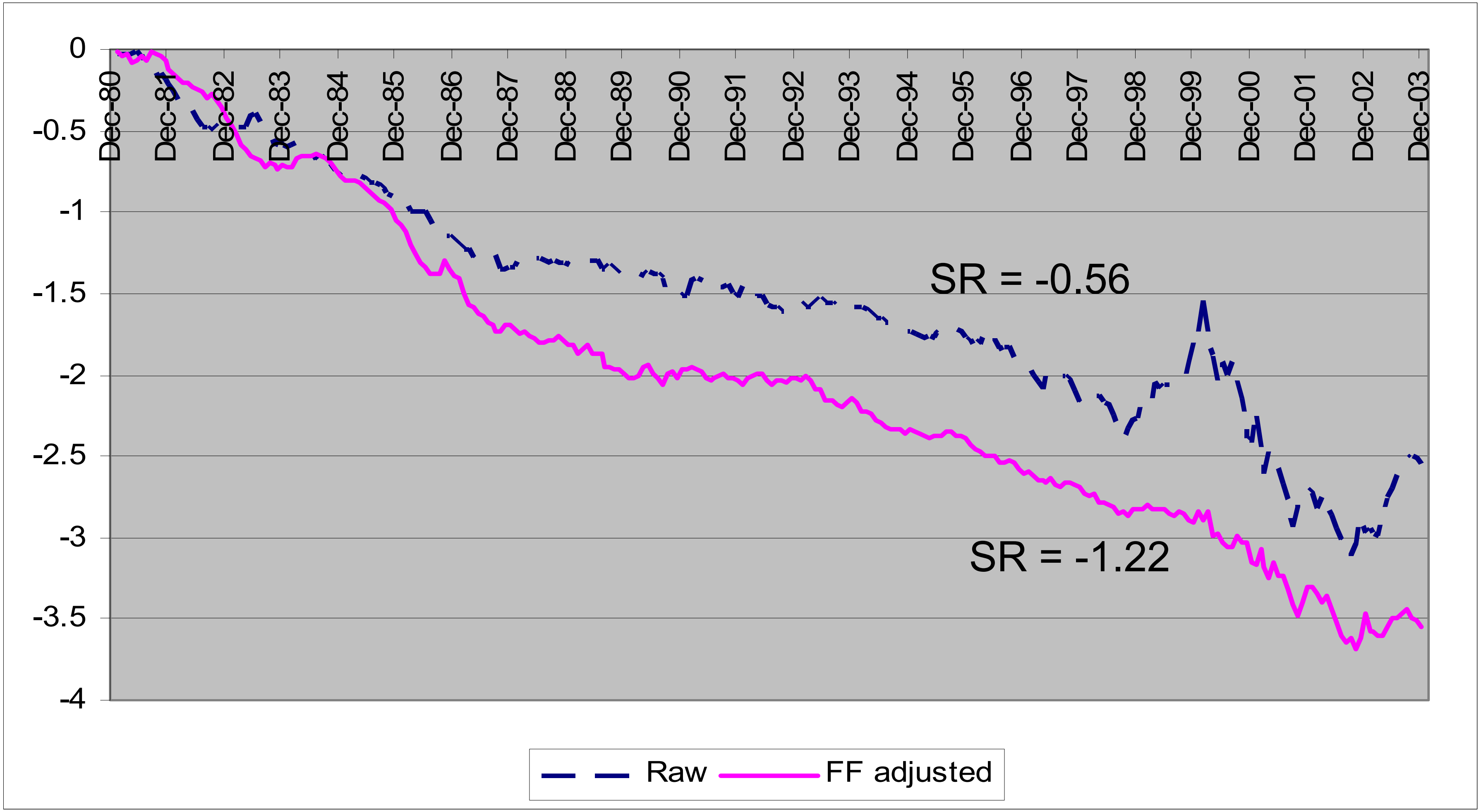
W-FF Alphas of All Countries and All ex US



	1 Low	2	3	4	5 High	High-Low
All	0.163%	0.069%	0.031%	-0.416%	-1.144%	-1.307%
All ex US	0.040%	-0.026%	-0.011%	-0.028%	-0.629%	-0.669%

Quintile Portfolio Returns (All Countries)

Cumulated 5-1 Monthly Returns



Idiosyncratic Volatility Strategies

	Alpha	MKT^W	SMB^W	HML^W
US (VOL^{US})	-1.952	0.733	1.307	-0.311
	[-5.59]			
Europe	-0.723	0.456	0.433	0.004
	[-3.01]			
G7 ex US	-0.723	0.432	0.618	-0.087
	[-2.77]			
All ex US	-0.67	0.428	0.597	-0.05
	[-3.16]			

Idiosyncratic Volatility Strategies

	Alpha	MKT^W	SMB^W	HML^W	VOL^{US}	Corr with VOL^{US}
Europe	0.134				0.370	0.65
	[0.63]					
G7 ex US	0.176				0.360	0.61
	[0.77]					
All ex US	0.148				0.348	0.63
	[0.71]					
Europe	-0.104	0.223	0.018	0.103	0.317	
	[-0.46]					
G7 ex US	-0.245	0.279	0.346	-0.023	0.208	
	[-1.04]					
All ex US	-0.283	0.283	0.338	0.012	0.198	
	[-1.34]					

Further Investigation with US Data

- Idiosyncratic volatility effect is strongest in the US
- Longer time-series data (1963-2003) allows for greater power
- More detailed data on trading costs and other stock characteristics

Robustness

- Very robust
  - Size and value factor loadings and characteristics
  - Only NYSE stocks/Size quintiles
  - Momentum (past 1, 3, 6, 12 month controls)
  - Volume, turnover, bid-ask spreads
  - Liquidity (Pastor and Stambaugh, 2003)
  - Coskewness risk (Harvey and Siddique, 2000) and skewness
  - Analyst Coverage
  - Dispersion in Analysts' Forecasts

Robustness

- Institutional Ownership
- Exposure to systematic volatility risk
- Persists for holding periods up to at least one year
- Exists in each decade; across NBER recessions and expansions; stable and volatile periods
- Exposure to private information (Easley, Hvidkjaer and O'Hara, 2002)
- Transactions costs
- Delay (Hou and Moskowitz, 2005)

US Cross-Sectional Regressions

σ(t-1,t)	-1.117	-1.023	-1.767	-0.789	-0.759	-0.937	-1.813
	[-3.24]	[-4.76]	[-5.02]	[-2.31]	[-2.96]	[-4.17]	[-4.27]
PIN	0.351						
Transaction Costs		-0.459					-1.654
Analyst Coverage			0.012				0.026
Institutions				0.004			0.001
Delay					-0.099		0.723
Skewness						-0.148	0.048

An Options Story

- Johnson (2004) proposes that since equity is a call option, leverage causes expected returns to decrease as idiosyncratic volatility decreases
- This is because an option delta ($\partial P / \partial S$) where P = equity price and S = price of an unlevered claim on the firm's assets is decreasing in volatility
- In Johnson's model, total stock volatility comprises underlying asset volatility as well as the variance of uncertainty of firm assets (dispersion of analysts' forecasts)
- Thus, controlling for leverage should explain the idiosyncratic volatility effect

Idiosyncratic Volatility and Leverage

- Fama-MacBeth regressions

$\sigma(t-1,t)$	-0.935	-1.135
	[-2.24]	[-4.45]
Leverage		-0.921
Leverage x $\sigma(t-1,t)$		1.585

- Idiosyncratic volatility portfolios controlling for leverage

  FF Alphas of quintile portfolios:

1 Low	2	3	4	5 High	5-1
0.132	0.086	-0.006	-0.455	-1.113	-1.265
					[-7.25]

Idiosyncratic Volatility and Conditional Volatility

- Idiosyncratic volatility exhibits strong cross-sectional persistence and is highly correlated with conditional volatility. In fact, a good instrument to predict future idiosyncratic volatility is past idiosyncratic volatility.
- Construct cross-sectional forecasts of future idiosyncratic volatility using lagged idiosyncratic volatility, size, book-to-market ratio, past returns, skewness, and turnover as characteristics

Idiosyncratic Volatility and Conditional Volatility

	$\sigma(t-1,t)$ Rankings					
	1 Low	2	3	4	5 High	5-1
1 Low $E_t[\sigma(t,t+1)]$	0.069	0.064	0.089	0.079	-0.070	-0.139
2	0.349	0.346	0.161	0.231	-0.089	-0.438
3	0.586	0.520	0.242	-0.007	-0.511	-1.097
4	0.638	0.183	0.028	-0.442	-0.880	-1.518
5 High $E_t[\sigma(t,t+1)]$	0.484	-0.617	-1.021	-1.487	-1.691	-2.175
Controlling for $E_t[\sigma(t,t+1)]$	0.425	0.099	-0.100	-0.325	-0.648	-1.073

Summary of Results

- Around the world, stocks with high idiosyncratic volatility tend to have low returns
- Across 23 countries, the difference in average returns between extreme quintile portfolios sorted on idiosyncratic volatility is -1.31% per month adjusted for world market, size, and value factors
- There is large comovement in the low returns of high idiosyncratic stocks across countries and the effect is largely captured by trading just U.S. stocks with high idiosyncratic volatility
- The U.S. idiosyncratic volatility effect is very robust