Short Interest and Aggregate Volatility Risk

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Short Interest Effect

- Empirical evidence (Asquith et al., JFE 2005, Boehme et al., JFQA 2006, etc.) suggests that heavily shorted stocks have lower future returns

- First story: short sellers are informed and pick the stocks that underperform, but other investors are slow or stupid and cannot use short interest as a predictor of future performance

- Second story: short interest proxies for demand for shorting, and the higher is the demand, the higher is the price (the cost of shorting)

- Costly shorting creates overvaluation, since it keeps pessimists out of the market (Miller, JF 1977)

Our Story

- We propose a firm-type story: highly shorted firms turn out to be of the type (volatile stocks with abundant real options) that is mispriced by existing models

- Our story can well coexist with the two stories above, we just try to gauge empirically their relative importance

- We are agnostic about why investors choose to short stocks with high volatility and abundant real options, we just show they do and study the asset-pricing implications

Johnson Model

$$\beta_P = E(P, S) \cdot \beta_S, \qquad \frac{\partial E(P, S)}{\partial Vol} < 0$$

- As volatility goes up
  - The beta of the asset behind the real option stays constant
  - The real option elasticity wrt the underlying asset value declines

- Therefore, the real options beta declines in volatility
- The effect on the firm value is naturally stronger if the firm has abundant real options (growth options, equity as a call option on the assets)

Extending the Johnson Model

- Both disagreement and aggregate volatility are high in recessions

- All else constant, higher disagreement has two effects, both stronger for volatile firms with valuable real options:
  - Risk exposure of real options decreases
  - Value of real options increases

- Therefore, high disagreement firms are hedges against aggregate volatility risk

- The more valuable are the real options, the greater is the hedging ability

Aggregate Volatility Risk

- Volatility increase means worse future investment opportunities (Campbell, 1993)

- Volatility increase means the need to increase precautionary savings (Chen, 2002)

- Firms with most positive return sensitivity to aggregate volatility changes have lower expected returns (Ang et al, 2006)

Aggregate Volatility

- Aggregate volatility is measured by VIX index (old definition) from CBOE

- VIX index is defined as the implied volatility of S&P100 one-month near-the-money options

- Innovations to expected aggregate volatility - proxied by daily change in VIX

- Sample: January 1986 - December 2006 (VIX availability)

FVIX Factor

- FVIX mimics daily changes in VIX

- I regress daily changes in VIX on excess returns to six size and book-to-market portfolios (sorted 2-by-3)

- The fitted part of the regression less the constant is the FVIX factor

- The correlation between FVIX and the change in VIX is 0.53

More about the FVIX Factor

- Negative FVIX beta is volatility risk (losing money when volatility increases)

- FVIX factor loses 1% per month, t-statistic -4.35 - FVIX hedges against volatility risk and has negative market beta

- CAPM alpha of FVIX is -56 bp per month, t-statistic -3.0

- Using other base assets for factor mimicking does not change the results

- FVIX is not a tradable strategy - the factor mimicking is done using the whole sample

Other Uses of FVIX Factor

- In prior work, Barinov was able to successfully use FVIX to explain several related anomalies

- FVIX explains the negative alphas of high idiosyncratic volatility firms (resolves the puzzle from Ang et al., JF 2006)

- FVIX explains the negative alphas of high analyst disagreement firms (resolves the puzzle from Diether et al., JF 2002)

- FVIX resolves the new issues puzzle and the negative alphas of high turnover firms

Descriptive Statistics

	Mean	H-L	H-Ave		Mean	H-L	H-Ave
Return	0.050	-1.159	-0.839	**IVol**	0.027	0.002	0.003
t-stat		*-5.71*	*-6.20*	**t-stat**		*2.77*	*6.36*
MB	3.073	1.131	1.079	**Disp**	0.059	0.019	0.011
t-stat		*11.9*	*11.8*	**t-stat**		*10.6*	*5.68*
Rating	12.47	3.82	3.19	**Turn**	0.185	0.123	0.118
t-stat		*23.1*	*39.9*	**t-stat**		*11.0*	*11.7*

- Firms in the top 10% on short interest make 5 bp per month
- These firms have significantly higher market-to-book and significantly worse credit rating than other firms with non-missing short interest or than an average Compustat firm
- These firms also have significantly higher volatility and disagreement

Short Interest and Volatility Risk

RSI=	>2.5%	>5%	>90%ile	>95%ile
α_{CAPM}	-0.76	-0.95	-0.93	-1.13
t-stat	*-2.84*	*-3.24*	*-3.49*	*-3.94*
α_{ICAPM}	-0.38	-0.52	-0.53	-0.69
t-stat	*-1.26*	*-1.55*	*-1.76*	*-1.99*
β_{FVIX}	0.70	0.78	0.72	0.80
t-stat	*6.11*	*5.91*	*5.60*	*5.28*

- Heavily shorted firms beat the CAPM when VIX goes up, hence they hedge against volatility risk

- This is why heavily shorted firms have negative CAPM alphas, which almost disappear when we control for FVIX

Cross-Sectional Hypotheses

- Our story: heavily shorted firms have negative CAPM alphas, because they happen to be volatile and to have a lot of real options

- Then the alphas of heavily shorted firms should become more negative if volatility and the amount of growth options increase

- This is also consistent with the Miller story about the interaction of disagreement and short sale constraints and the stories about short sellers chasing mispricing

- The part of the relation between short interest and volatility/real options that can be explained by FVIX belongs to our story, the rest - to the alternative stories

Short Interest and Disagreement

	Low	Medium	High	H-L
α_{CAPM}	-0.297	-0.544	-1.166	-0.869
t-stat	*-1.23*	*-2.04*	*-3.64*	*-3.06*
α_{ICAPM}	-0.195	-0.165	-0.767	-0.572
t-stat	*-0.78*	*-0.60*	*-2.20*	*-1.82*
β_{FVIX}	0.185	0.691	0.726	0.541
t-stat	*1.70*	*5.00*	*4.48*	*3.39*

- Heavily shorted firms have more negative CAPM alphas if analysts disagree more (if idiosyncratic volatility is higher, if turnover is higher)

- Our story explains a significant part of this effect (one-third to one-half), the rest is left to the other stories

Short Interest and Market-to-Book

	Low	**Medium**	**High**	**H-L**
α_{CAPM}	-0.210	-0.734	-1.067	-0.857
t-stat	*-0.60*	*-2.55*	*-2.95*	*-2.06*
α_{ICAPM}	-0.072	-0.277	-0.221	-0.149
t-stat	*-0.18*	*-1.00*	*-0.73*	*-0.42*
β_{FVIX}	0.249	0.831	1.539	1.289
t-stat	*2.07*	*4.38*	*7.00*	*5.05*

- Heavily shorted growth firms have more negative CAPM alphas
- Same is true about heavily shorted distressed firms
- Our story explains all of this effect for MB, half for credit rating

Short Interest and Institutions

- Asquith et al. (JFE 2005): let's view short interest as a proxy for demand for shorting, let's view institutional ownership as a proxy for supply of shares to be shorted

- If both the demand is high and supply is low, the price of shorting will be the highest

- Miller (JF 1977) story: the higher is the cost of shorting, the higher is the overpricing, since more pessimists are kept out of the market

- Prediction: negative alphas of heavily shorted stocks decrease in institutional ownership

Alternative Story

- Institutions dislike volatility and disagreement

- Hence, sorting on institutional ownership is the reverse sorting on volatility and disagreement

- Asquith et al. result is the same as "heavily shorted firms have more negative CAPM alphas if analysts disagree more"

- At least part of it can be explained by volatility risk, as above

Short Interest and Institutions

	Low	Medium	High	H-L
α_{CAPM}	-1.167	-0.701	-0.424	-0.742
t-stat	*-4.03*	*-2.73*	*-1.51*	*-2.69*
α_{ICAPM}	-0.633	-0.286	-0.300	-0.333
t-stat	*-2.32*	*-1.08*	*-1.05*	*-1.53*
β_{FVIX}	0.970	0.754	0.226	0.745
t-stat	*6.48*	*4.63*	*1.68*	*6.32*

- Heavily shorted stocks have particularly negative alphas if institutional ownership is low

- This relation is explained almost completely by controlling for FVIX

Conclusion: Short Interest Effect

- We propose a firm-type story to explain the negative alphas of heavily shorted stocks

- For some reason, these stocks have high volatility and abundant real options, which makes them good hedges against volatility risk

- We can explain the bigger part of the negative alphas of heavily shorted firms by controlling for their ability to beat the CAPM prediction when VIX goes up

Conclusion: Cross-Section

- Consistent with our story (and some other stories), the alphas of heavily shorted firms are more negative for:
  - Firms with high idiosyncratic volatility, or high analyst disagreement, or high turnover
  - Firms with high market-to-book or bad credit rating
  - Firms with low (residual) institutional ownership

- FVIX can explain 40%-80% of these patterns, which means that our firm-type story and the volatility risk explanation of the short interest effect are important