Analyst Disagreement and Aggregate Volatility Risk

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Analyst Disagreement Effect

- Diether at al. (JF 2002) find that firms with higher analyst disagreement about next year earnings earn lower future returns
- It is puzzling - looks like investors are paying a premium for bearing earnings uncertainty
- Miller (JF 1977) - under short sale constraints, only optimistic investors trade, hence the marginal investor is overoptimistic
- Because all pessimists are kept out of the market, more disagreement means more overpricing and lower future returns

What We Know about AD Effect

- AD effect is stronger if credit rating is bad (Avramov et al., JFE 2009)
- AD effect is stronger if short sales constraints are more severe (Boehme et al., JFQA 2006)
- AD effect is stronger if institutional ownership is low (Nagel, JFE 2005)
- AD effect is stronger if price impact is high (Sadka and Scherbina, JF 2007)

Johnson Model

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

- As disagreement 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 disagreement

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)

Empirical Hypotheses

- Higher analyst disagreement means lower aggregate volatility risk
- Analyst disagreement effect is explained by aggregate volatility risk
- AD effect is stronger for the firms with abundant growth options (high market-to-book)
- AD effect is stronger for distressed firms (bad credit rating) - these firms have valuable option created by leverage
- The latter two results are explained by aggregate volatility risk

Firm Characteristics

- Analyst disagreement - standard deviation of one-year earnings forecasts over the absolute value of the average forecast (data from IBES)
- Credit rating - S&P rating from Compustat, coded from 1=AAA to 22=D (higher is worse)
- Residual institutional ownership - orthogonal to size
- Probability to be on special - coefficients from D'Avolio (JFE 2002) generalized to the whole Compustat population by Ali and Trombley (JBES 2006)
  - When you short-sell, you leave the proceeds with the lender
  - The lender pays you the risk-free rate less the fee (the cost of selling short)
  - If the fee is greater than the risk-free rate, the stock is on special

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

The Main Story

- During bad times, when investors especially hate losses, aggregate volatility increases
- At the same time, analyst disagreement increases - necessary condition for my story
- Higher disagreement makes the losses of real options on volatile assets smaller (compared to other assets with similar market beta)
- **High disagreement firms have positive FVIX beta**

Table 3B: Analyst Disagreement and Aggregate Volatility Risk

	Low	Disp2	Disp3	Disp4	High	L-H
α_{CAPM}	0.298	-0.068	0.023	0.098	-0.241	0.539
t-stat	*2.15*	*-1.00*	*0.30*	*0.93*	*-1.54*	*2.03*
α_{ICAPM}	0.038	-0.125	0.048	0.149	-0.042	0.081
t-stat	*0.30*	*-1.55*	*0.56*	*1.12*	*-0.25*	*0.30*
β_{FVIX}	-0.461	-0.100	0.044	0.091	0.352	-0.813
t-stat	*-4.92*	*-1.30*	*0.72*	*0.91*	*4.27*	*-5.03*
α_{FF}	0.256	-0.045	0.050	0.047	-0.277	0.532
t-stat	*2.21*	*-0.58*	*0.60*	*0.45*	*-1.77*	*2.20*
α_{FF}	0.038	-0.122	0.043	0.103	-0.095	0.133
t-stat	*0.37*	*-1.80*	*0.53*	*0.99*	*-0.67*	*0.64*
β_{FVIX}	-1.691	-0.596	-0.055	0.436	1.413	-3.104
t-stat	*-10.19*	*-3.83*	*-0.37*	*2.04*	*6.07*	*-9.51*

Table 3: AD Effect Explained!

- AD effect is 50 to 75 bp per month in CAPM/FF alphas
- Adding FVIX reduces the alphas to 35 bp (EW returns) and 10 bp (VW returns), all but one insignificant
- Low disagreement means large negative FVIX beta (risk)
- High disagreement means large positive FVIX beta (hedge)
- FVIX beta differential is highly significant

The Main Story

- During bad times, when investors especially hate losses, aggregate volatility increases
- At the same time, analyst disagreement increases
- Higher disagreement makes the losses of real options on volatile assets smaller
- **The difference in returns and FVIX betas between high and low AD firms is wider for the firms with valuable real options (high market-to-book or bad credit rating)**

Table 5A: Analyst Disagreement Effect and Market-to-Book

Value-Weighted Returns

	Value	MB2	MB3	MB4	Growth	G-V
α_{CAPM}	0.238	0.284	0.136	0.249	1.275	1.037
t-stat	*0.78*	*0.84*	*0.49*	*0.73*	*3.43*	*2.25*
α_{ICAPM}	0.350	0.204	-0.076	-0.289	0.546	0.196
t-stat	*1.15*	*0.60*	*-0.26*	*-0.75*	*1.39*	*0.41*
β_{FVIX}	0.199	-0.141	-0.376	-0.954	-1.290	-1.490
t-stat	*1.51*	*-1.06*	*-2.44*	*-4.01*	*-5.98*	*-5.68*

Table 5C: Analyst Disagreement Effect and Credit Rating

Equal-Weighted Returns

	Best	Cred2	Cred3	Cred4	Worst	W-B
α_{CAPM}	0.197	-0.066	-0.069	0.548	1.134	0.938
t-stat	*0.82*	*-0.26*	*-0.24*	*1.55*	*2.27*	*1.95*
α_{ICAPM}	0.249	-0.045	-0.048	0.472	0.826	0.577
t-stat	*1.01*	*-0.16*	*-0.15*	*1.24*	*1.55*	*1.17*
β_{FVIX}	0.093	0.038	0.038	-0.134	-0.547	-0.639
t-stat	*0.87*	*0.36*	*0.34*	*-0.79*	*-2.72*	*-3.19*

Table 5: Conclusion

- AD effect is stronger for growth firms - new evidence, consistent with my story
- This is explained by FVIX - consistent with my story
- AD effect is stronger if credit rating is bad (Avramov et al., JFE 2009) - explained by FVIX
- Leverage instead of credit rating does not work - too negative correlation with market-to-book

AD Effect and Institutional Ownership

- Nagel (JFE 2005) - AD effect is high when institutional ownership (IO) is low - short sale constraints plus mispricing?
- Institutional investors like low AD and low volatility risk - but they cannot have both
- If AD is low, they buy higher AD and lower volatility risk firms
- If AD is high, they buy lower AD and higher volatility risk firms
- For low IO firms, sorting on AD means more difference in volatility risk

Table 6A: AD Effect and Residual Institutional Ownership

Equal-Weighted Returns

	Low	RInst2	RInst3	RInst4	High	L-H
α_{CAPM}	1.096	0.643	0.547	0.595	0.631	0.465
t-stat	*3.61*	*2.51*	*2.31*	*2.88*	*2.68*	*1.83*
α_{ICAPM}	0.458	0.159	0.150	0.327	0.437	0.020
t-stat	*1.88*	*0.54*	*0.59*	*1.39*	*1.67*	*0.10*
β_{FVIX}	-1.131	-0.858	-0.703	-0.475	-0.343	-0.788
t-stat	*-7.91*	*-4.27*	*-5.48*	*-3.92*	*-2.10*	*-8.17*

Table 6A: Conclusion

- Dependence of AD effect on IO is fully explained by FVIX
- Exploiting AD effect when IO is low means large volatility risk
- FVIX also explains away the huge AD effect for lowest IO firms
- FVIX beta of the low minus high AD portfolio strongly and monotonically increases with IO

AD Effect and Probability to Be on Special

- Boehme et al. (JFQA 2006) - AD effect is stronger if short interest is higher
- I use the estimated probability to be on special instead
- It is strongly related to AD - lenders are unwilling to lend high AD firms
- Sorting on AD and the probability is like sorting on AD twice

	Low	**Disp2**	**Disp3**	**Disp4**	**High**	**L-H**
Short	0.037	0.039	0.048	0.059	0.077	-0.040
t-stat	*26.3*	*24.6*	*28.3*	*30.1*	*33.4*	*-25.3*

Table 6B: AD Effect and Probability to Be on Special

Equal-Weighted Returns

	Low	Short2	Short3	Short4	High	1-5
α_{CAPM}	0.202	0.474	0.354	0.479	0.521	0.329
t-stat	*0.70*	*1.80*	*1.36*	*1.86*	*2.01*	*0.95*
α_{ICAPM}	0.163	0.469	0.244	0.158	0.141	-0.009
t-stat	*0.56*	*1.68*	*0.82*	*0.57*	*0.43*	*-0.02*
β_{FVIX}	-0.070	-0.009	-0.195	-0.568	-0.672	-0.602
t-stat	*-0.91*	*-0.09*	*-1.30*	*-2.85*	*-2.85*	*-2.30*

AD Effect and Liquidity

- AD effect is indeed higher for illiquid firms
- FVIX has nothing to do with it
- AD effect is visible for all firms, including most liquid
- FVIX cannot explain AD effect only in the bottom liquidity quintile
- Part of AD effect is liquidity, but normally AD effect is volatility risk

AD Effect and VIX Changes

- Buying low AD firms and shorting high AD firms means trailing the CAPM when VIX increases
- This is especially true for growth firms and firms with high short sale constraints
- But less true for illiquid firms and highly levered firms, mixed for bad credit rating firms
- During VIX increases, Disp portfolio performs by 20% worse than what the CAPM predicts
- All results are relative to assets with the same market beta
  - High AD firms have high beta and still lose more than low AD firms when the market heads down and VIX goes up
  - But the difference in the losses is much more narrow what you would think looking at the market betas

AD Effect and Conditional CAPM

- Buying low AD firms and shorting high AD firms means increasing exposure to market risk when the market risk is high
- Even more so for growth firms, firms with bad credit rating, and firms with high short sale constraints
- But less so for illiquid and highly levered firms
- **What we see in Tables 7 and 8 is the same as what we get with FVIX**

Conclusion

- **Real options on high AD assets beat the CAPM when volatility increases**
- Volatility risk factor (FVIX) can explain why:
  - High AD firms earn lower returns than low AD firms
  - AD effect is stronger for growth firms (new evidence)
  - AD effect is stronger for firms with bad credit rating
  - AD effect is stronger for firms with high short sale constraints (low IO, high Prob to be on special)
- There is a liquidity/mispricing part of AD effect, but
  - FVIX is almost always sufficient to explain AD effect
  - Thus, liquidity story is not really necessary except for the case of AD effect among extremely illiquid firms
- Replacing FVIX by change in VIX and using Conditional CAPM yields qualitatively similar results