Why Does Higher Variability of Trading Activity Predict Lower Expected Returns?

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Turnover Variability Puzzle

- If the stock's turnover/volume variability measures variability of liquidity, then it should be positively related to future returns to the stock

- More variable turnover means higher probability of illiquid states, which sounds like risk

- Chordia et al. (JFE 2001): in the data, higher variability of volume or turnover means lower, not higher future returns

- This is the turnover variability puzzle

Contribution

- Variability of volume and turnover is unrelated to variability of other measures of liquidity or liquidity risk

- Variability of other liquidity measures is unrelated to future returns

- Variability of volume and turnover is positively related to measures of firm-specific uncertainty/volatility

- This why the turnover variability puzzle is explained by aggregate volatility risk

Johnson Model

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

- As firm-specific uncertainty 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 uncertainty

Extending the Johnson Model

- Both firm-specific uncertainty and aggregate volatility are high in recessions

- All else constant, higher uncertainty 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 uncertainty 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 lower future consumption and the need to increase savings for consumption-smoothing motives (Campbell, 1993)

- Volatility increase means higher future volatility and 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

- Since turnover variability proxies for uncertainty, the turnover variability puzzle will be explained by aggregate volatility risk

- The turnover variability puzzle will be stronger for growth firms (abundant growth options) and distressed firms (equity is like a call option on the assets)

- The relation between the turnover variability puzzle and growth options / distress will be explained by aggregate volatility risk

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 my prior work, I 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 highly shorted firms

Variability of Turnover and Variability of Liquidity

	Low	CV2	CV3	CV4	High	H-L
CV Illiq	0.460	0.584	0.713	0.836	0.973	0.513
t-stat	*36.6*	*43.5*	*36.0*	*32.2*	*30.6*	*14.4*
CV γ_{PS}	7.157	7.065	7.088	7.118	6.811	-0.346
t-stat	*48.2*	*52.2*	*61.8*	*73.2*	*85.8*	*-3.18*
CV β_{PS}	1.052	1.027	0.985	0.959	0.929	-0.123
t-stat	*31.5*	*37.5*	*40.3*	*41.4*	*37.9*	*-5.08*
CV β_{Sadka}	0.998	0.953	0.915	0.875	0.857	-0.141
t-stat	*37.9*	*39.4*	*40.7*	*47.6*	*48.6*	*-4.95*
CV β_{Uilliq}	0.987	0.966	0.954	0.918	0.915	-0.072
t-stat	*31.8*	*34.5*	*35.8*	*37.2*	*32.6*	*-3.02*

Variability of Turnover and Firm-Specific Uncertainty

	Low	CV2	CV3	CV4	High	H-L
IVol	0.013	0.016	0.020	0.024	0.028	0.015
t-stat	*28.4*	*31.4*	*28.6*	*25.7*	*25.3*	*16.1*
Disp	0.034	0.043	0.051	0.058	0.062	0.028
t-stat	*14.0*	*13.9*	*13.6*	*15.7*	*18.9*	*17.2*
Error	0.081	0.107	0.141	0.166	0.172	0.097
t-stat	*7.19*	*9.67*	*9.35*	*9.71*	*14.2*	*12.7*
CV Earn	0.486	0.609	0.782	0.920	1.032	0.546
t-stat	*15.9*	*17.3*	*17.3*	*18.8*	*23.2*	*20.9*
CV CF	0.582	0.754	0.989	1.183	1.404	0.822
t-stat	*34.3*	*34.4*	*27.2*	*26.9*	*28.6*	*14.2*

Tables 1 and 2: Conclusion

- Volume/turnover variability is, if anything, negatively related to variability of other measures of liquidity/liquidity risk

- Firms with volatile volume/turnover have higher idiosyncratic volatility, higher analyst disagreement, bigger analyst forecast errors, more variable earnings and cash flows

- Hence, volume/turnover variability measures firm-specific uncertainty, not variability of liquidity

Variability of Liquidity and Returns

	Illiq	Gamma	PS	Sad	UIlliq
CV	-0.255	0.035	0.009	0.220	-0.026
t-stat	*-1.15*	*0.64*	*0.16*	*2.81*	*-0.46*
Controls	YES	YES	YES	YES	YES

- Variability of other liquidity/liquidity risk measures is, if anything, positively related to future returns

- I also find that the link between variability of liquidity/liquidity risk and future returns does not depend on market-to-book and credit rating

The Main Story

- During bad times, when investors especially hate losses, aggregate volatility increases

- At the same time, firm-specific uncertainty increases

- Higher uncertainty makes the losses of real options on volatile assets smaller (compared to other assets with similar market beta)

- **High uncertainty firms (e.g., firms with high variability of trading activity) have negative CAPM alphas and positive FVIX betas**

Variability of Turnover and Aggregate Volatility Risk

	Low	CV2	CV3	CV4	High	L-H
α_{CAPM}	0.023	-0.073	-0.224	-0.363	-0.526	0.549
t-stat	*0.18*	*-0.49*	*-1.45*	*-2.26*	*-3.20*	*2.97*
α_{ICAPM}	-0.070	0.068	0.081	0.053	-0.122	0.052
t-stat	*-0.99*	*0.54*	*0.50*	*0.30*	*-0.69*	*0.30*
β_{FVIX}	-0.229	0.153	0.349	0.425	0.322	-0.551
t-stat	*-6.93*	*3.24*	*7.50*	*8.66*	*8.38*	*-11.9*

- Controlling for FVIX eliminates the negative alpha of high turnover firms, because these firms beat the CAPM when VIX goes up, as high uncertainty firms should do

Variability of Turnover and Real Options

	1	2	3	4
CV Turn	-0.237	0.225	0.088	0.762
t-stat	*-2.12*	*1.20*	*0.52*	*2.72*
MB*CV		-0.888		-1.193
t-stat		*-2.85*		*-3.51*
Lev*CV			-0.669	-0.787
t-stat			*-2.48*	*-2.77*

Market-to-Book and Volatility Risk

	Value	MB2	MB3	MB4	Growth	G-V
α_{CAPM}	0.140	0.389	0.213	0.446	0.776	0.636
t-stat	*0.52*	*1.53*	*0.80*	*1.59*	*2.99*	*2.75*
α_{ICAPM}	-0.283	-0.042	-0.293	-0.094	0.114	0.397
t-stat	*-1.14*	*-0.18*	*-1.34*	*-0.41*	*0.60*	*1.60*
β_{FVIX}	-0.749	-0.764	-0.897	-0.957	-1.172	-0.423
t-stat	*-5.21*	*-5.87*	*-8.31*	*-9.10*	*-11.3*	*-3.28*

- Turnover variability effect is stronger for growth stocks
- It happens because if you short growth stocks with high uncertainty (same as turnover variability), you forego important hedge against VIX increases

Credit Rating and Volatility Risk

	Best	Cred2	Cred3	Cred4	Worst	W-B
α_{CAPM}	0.000	0.153	0.608	0.393	1.043	1.043
t-stat	*0.00*	*0.61*	*1.95*	*1.27*	*2.84*	*2.75*
α_{ICAPM}	-0.396	-0.259	-0.034	-0.418	0.146	0.542
t-stat	*-1.66*	*-0.98*	*-0.12*	*-1.25*	*0.42*	*1.48*
β_{FVIX}	-0.426	-0.446	-0.811	-0.863	-0.868	-0.442
t-stat	*-4.28*	*-4.00*	*-6.85*	*-7.83*	*-7.33*	*-3.89*

- Turnover variability effect is stronger for stocks with bad credit rating (their equity is a lot like call option on the assets)
- It happens because if you short stocks with bad credit rating and high uncertainty (same as turnover variability), you forego important hedge against VIX increases

Perreira and Zhang (2010)

- Perreira and Zhang (2010) suggest that turnover variability proxies for the variability of the Amihud measure

- The Amihud measure is absolute return over volume - measures price impact

- Volume is on top of turnover and on the bottom of the Amihud measure - they are mechanically related

- Perreira and Zhang: Variability of price impact may be a good thing, hence the negative relation to future returns

- Variable price impact means higher chance of low price impact, and we will wait out the times when price impact is high

Turnover Variability and the Amihud Measure

	Low	**CV2**	**CV3**	**CV4**	**High**	**L-H**
Illiq	0.025	0.074	0.180	0.383	0.963	0.938
t-stat	*4.59*	*4.84*	*5.04*	*5.74*	*7.86*	*7.87*

- For low turnover variability firms, the price impact is 2.5 bp per \$1 mln trade
- For high turnover variability firms, the price impact is 96.3 bp per \$1 mln trade
- It is very improbable that price impact of high turnover variability firms will ever be less than that of low turnover variability firms, no matter how variable it is

Variability of the Amihud Measure and Expected Returns

	Low	CV2	CV3	CV4	High	L-H
α_{CAPM}	0.451	0.305	0.308	0.277	-0.030	0.481
t-stat	*1.72*	*1.47*	*1.53*	*1.31*	*-0.11*	*2.26*
α_{ICAPM}	0.429	0.270	0.318	0.432	0.444	-0.014
t-stat	*1.59*	*1.31*	*1.54*	*1.79*	*1.36*	*-0.09*
β_{FVIX}	-0.038	-0.063	0.017	0.275	0.840	-0.878
t-stat	*-0.39*	*-0.87*	*0.26*	*2.98*	*6.43*	*-11.5*

- Controlling for FVIX, there is no relation between variability of the Amihud measure and future returns
- Variability of the Amihud measure picks up the same thing turnover variability picks up - firm-specific uncertainty

Conclusion

- Higher turnover variability means higher firm-specific uncertainty, but lower variability of liquidity/liquidity risk

- Turnover variability puzzle is similar to the idiosyncratic volatility discount of Ang et al. (JF 2006) and the analyst disagreement effect of Diether et al. (JF 2002)

- Like those puzzles, turnover variability puzzle is explained by aggregate volatility risk

Conclusion

- The negative CAPM alphas of high turnover variability firms arise because these firms beat the CAPM when VIX goes up

- The turnover variability puzzle and the aggregate volatility risk loadings are larger for growth firms and distressed firms

- Variability of other measures of liquidity/liquidity risk is, if anything, positively related to future returns

- The strength of this relation does not depend on market-to-book and credit rating