Stocks with Extreme Past Returns: Lotteries or Insurance?

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Lottery-Like Stocks

- The skewness effect: Boyer, Mitton, and Vorkink (RFS 2010) found that stocks with more positive expected skewness earn lower future returns
- The maximum effect: Bali, Cakici, and Whitelaw (JFE 2012) found that stocks with higher maximum daily return in the past month have lower future returns
- The current theory: Barberis and Huang (AER 2008) argue that investors tend to overestimate the probability of rare positive event, and therefore bid up the prices of stocks with lottery-like payoffs

Lottery-Like or Just Volatile?

- Stocks with large extreme returns and positively skewed returns are also very volatile
- My prior work shows that stocks with high firm-specific risk are hedges against increases in market volatility
- For example, Barinov (JFQA 2013) shows that the volatility risk factor explains the disagreement effect of Diether et al. (JF 2002)
- Barinov (JCF 2012) shows that the volatility risk factor explains the new issues puzzle
- Barinov (2011) shows that the volatility risk factor explains the idiosyncratic volatility discount of Ang et al. (JF 2006), as well as the value effect

Johnson Model

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

- As idiosyncratic volatility goes up
  - The beta of the asset behind the option stays constant
  - The real option elasticity wrt the underlying asset value declines
- Therefore, the options beta declines in idiosyncratic volatility
- The effect on the firm value is naturally stronger if equity is option-like
  - Equity can be option-like because the firm owns options, e.g., growth options
  - Equity can be option-like because it is like an option itself, e.g., if the firm is distressed

Extending the Johnson Model

- Both idiosyncratic volatility and aggregate volatility are high in recessions
- All else constant, higher idiosyncratic volatility has two effects, both stronger for volatile firms with option-like equity:
  - Risk exposure of option-like equity decreases
  - Value of option-like equity increases
- Therefore, volatile firms are hedges against aggregate volatility risk
- The more option-like is the equity, 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, current ticker VXO) 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 2010 (VIX availability)

FVIX Factor

- FVIX mimics daily changes in VIX
- I regress daily changes in VIX on excess returns to five quintile portfolios sorted on prior month sensitivity to VIX changes
- The fitted part of the regression less the constant is the FVIX factor
- The correlation between FVIX and the change in VIX is 0.653

More about the FVIX Factor

- Negative FVIX beta is volatility risk (losing money when volatility increases)
- FVIX factor loses 1.21% per month, t-statistic -3.44 - FVIX hedges against volatility risk and has negative market beta
- CAPM alpha of FVIX is -46 bp per month, t-statistic -3.86
- 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

Two-Factor ICAPM

$$Ret_t - RF_t = \alpha + \beta_{MKT} \cdot (MKT_t - RF_t) + \beta_{FVIX} \cdot FVIX_t$$

- The main model in my paper is the two-factor ICAPM with the market factor and FVIX
- Negative FVIX beta is risk, positive FVIX beta means a hedge
- The results stay similar if I augment the Fama-French model with FVIX, even though a certain overlap exists between HML and FVIX due to the ability of FVIX to explain the value effect (see Barinov, 2011)

Descriptive Statistics

	Low	Max2	Max3	Max4	High	H-L
IVol	1.163	1.597	1.894	2.252	3.095	1.932
t-stat	*30.9*	*30.0*	*31.1*	*32.3*	*30.5*	*25.6*
Disp	3.988	4.268	4.910	5.470	7.807	3.819
t-stat	*23.0*	*22.1*	*18.7*	*24.9*	*23.8*	*15.8*
Error	7.685	8.294	9.850	12.298	17.72	10.04
t-stat	*23.7*	*21.8*	*21.4*	*20.3*	*21.5*	*16.5*
CVEarn	0.834	0.844	0.917	1.016	1.232	0.398
t-stat	*34.7*	*30.9*	*31.8*	*27.9*	*38.2*	*15.5*
CVCFO	1.051	1.051	1.133	1.245	1.469	0.417
t-stat	*63.3*	*61.6*	*71.0*	*75.8*	*72.1*	*24.1*

- Firms with higher daily maximum return in the past month are also very volatile

Maximum Effect and Volatility Risk

	Low	Max2	Max3	Max4	High	H-L
α_{CAPM}	0.231	0.232	0.062	-0.087	-0.369	0.600
t-stat	*1.94*	*2.39*	*0.63*	*-0.89*	*-2.35*	*2.30*
α_{FF}	0.140	0.166	0.013	-0.115	-0.279	0.419
t-stat	*1.42*	*2.26*	*0.17*	*-1.11*	*-2.32*	*2.08*
α_{ICAPM}	-0.061	-0.010	-0.089	-0.056	0.051	-0.112
t-stat	*-0.54*	*-0.12*	*-0.88*	*-0.49*	*0.35*	*-0.47*
β_{FVIX}	-0.633	-0.524	-0.328	0.068	0.912	-1.544
t-stat	*-3.45*	*-3.35*	*-2.40*	*0.63*	*3.24*	*-3.38*

- Lottery-like stocks are in fact hedges against increases in VIX
- Once this hedging ability is controlled for, there is no maximum effect in the ICAPM alphas

Maximum Effect and Growth Options

	Value	Neutral	Growth	G-V
α_{CAPM}	0.491	0.734	1.107	0.616
t-stat	*3.54*	*4.18*	*4.17*	*2.75*
α_{ICAPM}	0.222	0.265	0.383	0.161
t-stat	*1.36*	*1.31*	*1.42*	*0.66*
β_{FVIX}	-0.583	-1.017	-1.570	-0.987
t-stat	*-3.32*	*-3.85*	*-3.07*	*-2.53*

- In CAPM alphas, the maximum effect is more than twice stronger for growth firms, as predicted
- ICAPM alphas of the low-minus high maximum portfolio are flat across market-to-book groups
- Shorting growth firms with high maximum returns (high volatility) means giving up an important hedge against VIX increases

Maximum Effect and Credit Rating

	Best	Medium	Worst	W-B
α_{CAPM}	0.096	0.556	1.201	1.105
t-stat	*0.45*	*1.81*	*2.75*	*2.75*
α_{ICAPM}	-0.202	-0.125	0.117	0.318
t-stat	*-0.84*	*-0.39*	*0.30*	*0.82*
β_{FVIX}	-0.645	-1.479	-2.353	-1.707
t-stat	*-2.92*	*-4.13*	*-8.29*	*-7.62*

- In CAPM alphas, the maximum effect is more than twice stronger for distressed firms, as predicted
- ICAPM alphas of the low-minus high maximum portfolio are flat across credit rating groups
- Shorting distressed firms with high maximum returns in the past (high volatility) means giving up an important hedge against VIX increases

Maximum Effect and Short Interest

- From the point of view of an expected-utility investor, firms with high past maximum returns are overpriced
- They can remain overpriced if the cost of shorting them is high, e.g., if the shorting demand, proxied by relative short interest, is high
- The CAPM alphas line up with this story, but controlling for FVIX eliminates the link between the maximum effect and short interest
- It turns out that sorting on maximum returns and short interest is similar to sorting on idiosyncratic volatility twice

Maximum Effect and Short Interest

	Low	Medium	High	H-L
α_{CAPM}	0.321	0.545	0.948	0.627
t-stat	*2.08*	*2.59*	*3.44*	*2.35*
α_{ICAPM}	0.022	-0.016	0.242	0.219
t-stat	*0.14*	*-0.07*	*0.80*	*0.83*
β_{FVIX}	-0.628	-1.180	-1.485	-0.856
t-stat	*-5.68*	*-3.05*	*-2.82*	*-1.86*

Skewness Effect and Volatility Risk

- Firms with highly positive (expected) skewness are also highly volatile, more so than firms with highly negative skewness
- This is because volatility comes primarily from the longer right tail
- Consequently, FVIX also explains the spread in returns between firms with highly negative and highly positive skewness
- The alpha goes down from roughly 40-60 bp per month in the CAPM and Fama-French model to a few bp from zero in the ICAPM with FVIX
- The key is again the ability of lottery-like stocks with highly positive skewness to hedge against increases in VIX (due to their higher idiosyncratic volatility)

Skewness Effect in Cross-Section

- The hedge against increases in VIX is created by interaction of idiosyncratic volatility and option-like equity
- Consistent with that, volatile firms with highly positive skewness are better hedges against volatility risk if they are either growth or distressed
- This is why the skewness effect is stronger for high market-to-book firms and bad credit rating firms in the CAPM alphas, but not in the ICAPM alphas
- Also, in the CAPM alphas the skewness effect is stronger for firms with low institutional ownership and high short interest, but the relation disappears once FVIX is controlled for

Minimum Effect: Differentiating Test

- Firms with high past minimum returns are also very volatile
- In the world where investors have the taste for lotteries, they should have positive alphas, because they are exactly opposite of lotteries
- In my world, where idiosyncratic volatility matters and lottery-likeness does not, they should have negative CAPM alphas and zero ICAPM alphas, i.e., they should be exactly like firms with high past maximum returns, volatile firms, etc.

Minimum Effect and Volatility Risk

	Low	Min2	Min3	Min4	High	H-L
α_{CAPM}	0.314	0.284	0.285	0.268	-0.336	0.650
t-stat	*2.01*	*1.73*	*1.66*	*1.61*	*-1.78*	*2.99*
α_{FF}	0.164	0.109	0.104	0.113	-0.376	0.540
t-stat	*1.57*	*1.07*	*1.15*	*1.62*	*-5.15*	*3.68*
α_{ICAPM}	0.224	0.217	0.294	0.403	0.150	0.073
t-stat	*1.51*	*1.37*	*1.78*	*2.26*	*0.64*	*0.32*
β_{FVIX}	-0.196	-0.145	0.019	0.292	1.054	-1.251
t-stat	*-1.58*	*-0.90*	*0.13*	*2.61*	*3.93*	*-3.48*

- The minimum effect is as strong as the maximum effect in the CAPM alphas
- It disappears in the ICAPM alphas due to high minimum return firms being a hedge against volatility risk

Minimum Effect and Growth Options

	Value	Neutral	Growth	G-V
α_{CAPM}	0.033	0.227	0.831	0.799
t-stat	*0.21*	*1.34*	*2.83*	*3.59*
α_{ICAPM}	-0.279	-0.258	0.135	0.414
t-stat	*-1.62*	*-1.45*	*0.47*	*1.80*
β_{FVIX}	-0.677	-1.051	-1.511	-0.834
t-stat	*-3.64*	*-5.85*	*-2.92*	*-2.20*

- The minimum effect is strongly related to market-to-book, and this relation is explained by FVIX
- Expected in my world, where it is volatility, not lottery-likeness that matters, unexpected in the world with lottery-loving investors

Minimum Effect and Credit Rating

	Best	Medium	Worst	W-B
α_{CAPM}	0.013	0.617	0.978	0.965
t-stat	*0.06*	*1.77*	*2.95*	*2.68*
α_{ICAPM}	-0.273	-0.079	0.116	0.389
t-stat	*-1.21*	*-0.26*	*0.34*	*1.05*
β_{FVIX}	-0.620	-1.509	-1.869	-1.249
t-stat	*-2.73*	*-3.40*	*-5.48*	*-4.19*

- The minimum effect is also strongly related to credit rating, and this relation is explained by FVIX
- Expected in my world, where it is volatility, not lottery-likeness that matters, unexpected in the world with lottery-loving investors

Conclusion

- Lottery-like stocks are hedges against volatility risk
- This hedging property explains their low future returns
- The volatility risk story also generates new predictions about relation between returns to lottery-like stocks and measures of equity option-likeness (market-to-book, credit rating)
- FVIX can explain the relations above, as well as the relation between returns to lottery-like stocks and short-sale constraints
- The true driving force behind all the effects about is firm-specific risk, not lottery-likeness, as evidence by the existence of the mirroring minimum effect