EXECUTIVE SUMMARY

Aggregate Jump and Volatility Risk in the Cross-Section of Stock Returns

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The main objective of this paper is to provide a comprehensive empirical investigation of the pricing of time-varying jump and volatility risk in the cross-section of expected stock returns. In particular, we consider whether aggregate jump and volatility constitute separately priced risk factors. A sizeable literature argues that aggregate volatility may be a priced factor in part because assets with high sensitivities to volatility risk hedge against the risk of significant market declines. This argument suggests that jump and volatility risk may be similar. In addition, as markets tend to be more volatile in times of extreme returns, separating jump and volatility risk is an empirical challenge. In this paper, we show that they are in fact different: they can be measured separately using option returns and they are both important economically.

Economic theory provides several reasons why aggregate jump and volatility risk should constitute separately priced risk factors. Investors seeking to hedge against changes in investment opportunities will find assets that covary positively with market volatility attractive, and thus require lower expected returns. Separately, investors who seek to insure themselves against tail events such as the recent financial crisis, i.e., more extreme events that go beyond business cycle fluctuations in investment opportunities, will find stocks with a positive loading on jump risk attractive and thus require lower expected returns.

To examine the cross-sectional pricing of aggregate jump and volatility risk we construct investable option trading strategies that load on one factor but are orthogonal to the other. Because traded S&P 500 futures options are highly liquid, their prices encode market participants' ex ante assessment of expected aggregate jump and volatility risk. These prices should therefore contain forward-looking information that we expect to be highly relevant for our analysis. The ex-ante jump risk perceived by investors may be quite different from ex-post realized jumps in prices because even high-probability jumps may fail to materialize in sample. Therefore, employing options alleviates the "Peso problem" in measuring jump risk from observed stock returns.

A straddle involves the simultaneous purchase of a call and a put option. Such strategies experience high sensitivity to volatility – they have large vegas – and, if constructed to be market-neutral, are insensitive to market returns. However, this only holds for small diffusive shocks. In a world with jumps, straddle returns are subject to hedging error due to the positive gamma of the options: if the underlying asset experiences a large move in any direction, the straddle will not remain market neutral and will earn a positive return. This implies that straddle returns are affected by both volatility and jump risk. More importantly, this observation suggests alternative trading strategies that allow us to focus on each risk separately.

A strategy constructed to be market neutral and gamma neutral but vega positive is essentially insulated from jump risk and thus only subject to volatility risk. Similarly, a strategy that is market neutral and vega neutral but gamma positive is ideal to study the effects of jump risk. We show that both strategies can be constructed by setting up long/short strategies involving market-neutral straddles. Our resulting jump risk factor-mimicking portfolio (JUMP) is a market-neutral, vega-neutral, and gamma-positive strategy involving two at-the-money straddles with different maturities. Similarly, we construct the volatility risk factor-mimicking portfolio (VOL) by combining two at-the-money straddles with different maturities into a position that is market neutral, gamma neutral, and vega positive. The JUMP and VOL strategies are directly tradable strategies that are constructed to load on one factor while being orthogonal to the other. Empirically, we find that the returns on the two strategies are essentially uncorrelated.

Our main result is that both aggregate jump and aggregate volatility are significantly priced risk factors in the cross-section of returns. Consistent with theory, we find that stocks with high sensitivities to volatility and jump risk have low expected returns, that is, volatility and jump risk both carry negative market prices of risk. Both factors are also important economically. Sorting stocks into quintile portfolios based on their contemporaneous jump betas, the long/short portfolio that buys stocks with high jump betas and sells stocks with low jump betas has an annual three-factor Fama-French alpha of –9.4% (*t*-statistic –4.44) for value-weighted portfolios.

We also find large compensation for bearing stock market volatility risk. When we sort stocks into quintiles based on their volatility betas, the long/short portfolio that buys stocks with high volatility betas and sells stocks with low volatility betas has an annual value-weighted three-factor alpha of −2.7% (t-statistic −2.40). Importantly, jump risk does not subsume volatility risk and volatility risk does not subsume jump risk.

Our results are robust to the inclusion of a battery of control variables (including controls for size, downside beta, conditional skewness and kurtosis, idiosyncratic volatility, and idiosyncratic skewness). After controlling for conditional skewness and downside beta (both of which are associated with the notion of jump risk), we observe a slight drop in the estimated market price of jump risk. Importantly, however, jump risk is different from conditional skewness and downside beta: across all specifications, the reward for bearing jump and volatility risk is always negative, stable, and both economically and statistically significant.