One Hundred Years of Rare Disaster Concerns and Commodity Prices

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This paper shows that rare disaster concern, defined as the news-implied volatility, performs very well at predicting the return of index commodity futures throughout the whole nearly century period of 1926 to 2016. This result holds after controlling for the current business cycle conditions, the macroeconomic variables, and the Volatility Index (VIX). We also find that rare disaster concern performs very well at predicting index commodity futures returns out-of-sample. The results remain robust while considering different macroeconomic conditions such as recession (expansion), contango (backwardation), or increased (decreased) inflation.

Introduction

For decades, a substantial literature has proposed rare disaster models as an important rational foundation for understanding various longstanding asset pricing anomalies such as the equity premium puzzle, the volatility puzzle, the forward premium puzzle, and the stock return predictability (*e.g.*, Rietz, 1988; Barro, 2006; Gabaix, 2012; Gourio, 2012; Wachter, 2013). Naturally, risk averse investors require a compensation for the extreme loss they may incur during the unlikely but extremely harmful states of the economy. As such, a high likelihood of rare disasters implies a high risk premium in forward-looking financial markets. This suggests that rare disaster concerns should predict asset returns. Whereas various studies (*e.g.*, Berkman *et al.*, 2009; Manela and Moreira, 2017) have built a link between rare disaster concerns and asset pricing quantities,[1] few studies, if any, provide empirical evidence that rare disaster concerns can predict commodity returns.

Why the Paper's Research Questions are Important

It is not surprising that there should exist a resounding connection between rare disaster concerns and commodity prices because such concerns affect consumption behaviors, production decisions, fiscal and monetary policies, and global trade. Through affecting agent behaviors and macroeconomic policies, rare disaster concerns provide people with incentives to adjust their behavior through which the demand and supply of commodity will be impacted, and therefore so will commodity prices. However, to date, the literature on the relationship between rare disaster concerns and subsequent index commodity future returns is very scarce and provides few empirical results. Especially, so far, no paper has investigated the ability of rare disaster concerns to predict subsequent index commodity futures return in the long run.

In this paper, we fill this gap by providing a new finding that the perceived rare disaster risks play a prominent role in predicting commodity futures index return using nearly one hundred years of data from 1926 to 2016.

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Data

In this paper, the monthly commodity futures index excess return data are directly downloaded from Levine *et al.* (2018)'s website.[2] Together with rare disaster data, which is obtained from Manela and Moreira (2017)'s website, the data spans from July 1926 to March 2016. We use the excess return of an equal-weight commodities portfolio as our main proxy for the commodity index excess return.

In this paper, we use six specific types of disaster measures of Manela and Moreira (2017): government, financial intermediation, natural disaster, stock market, war, and unclassified uncertainties, respectively. These disaster measures have a forward-looking advantage because they are constructed based on the combination of news and option implied volatility. Hence, they are ideal empirical proxies for the rare disaster concerns, *i.e.*, the forward-looking measure of disaster risk.

Methodology

Our rare disaster concerns are constructed using six underlying disaster proxies of Manela and Moreira (2017). An advantage of these measures is that they are constructed in an *ex-ante* way and capture perceived rare disaster risks. Another advantage is that these measures capture rare disaster risk from a multiple-dimensions perspective such as wars, economic disasters, and natural disasters. Naturally, investors are generally risk averse to these different types of rare disasters. We employ a simple principal component analysis (PCA) to harness disaggregated information dispersed in various rare disaster risks. The PCA method allows us to eliminate noise and separate out the representative component from the six measure of *ex-ante* rare disaster proxies. We simply apply a PCA procedure on the six disaster measures in squared form following Manela and Moreira (2017). For a given month, we use the

standardized PCAs as the principal component representation of the six rare disaster measures. Using the standardized measure allows the principal components for the six disaster measures to be comparable.

Results

Our empirical analysis reveals that rare disaster concerns are able to significantly predict index commodity futures returns from 1926 to 2016. The forecasting power of rare disaster concerns is beyond and above the predictive ability contained in popular economic predictors such as economic variables and business cycle conditions. Additionally, we evaluate the out-of-sample performance of the rare disaster concern as a predictor for the index commodity futures return. For this purpose, we perform out-of-sample one-month ahead forecasts with several predictors, including the rare disaster concern index, business cycle variables, 14 economic variables proposed by Goyal and Welch (2008), and the VIX. We find strong evidence that the predictive power of the rare disaster concerns dominate that of the other predictors. Additionally, we show that an investor who forms her strategy based on timing rare disaster concerns does not only make positive investment profits but also enjoys significant economic gains. All these results confirm that the rare disaster concern is an important predictor of subsequent index commodity futures returns.

Following Levine *et al.* (2018), we employ three particular state variables to represent macro states for investigating commodity predictability. The first represents whether the commodity futures market as a whole was in backwardation or contango. The aggregate backwardation or contango is defined as the equal-weighted average level of backwardation or contango for all the commodities in the market. The second state variable is represented by the National Bureau of Economic Research (NBER) expansion and recession periods. The third state variable is unexpected inflation, as measured by the one-year change in one-year inflation. The results imply that rare disaster concerns generate better predictability in periods of Recession, Backwardation and "Inflation Up."

Conclusion

In this paper, we investigate the ability of rare disaster concerns to predict index commodity futures returns. We find that rare disaster concerns are by far the best predictor of monthly index commodity futures returns. The magnitude of its predictive effect on subsequent index commodity futures return is sizable. This result not only holds in a long sample period from 1926 to 2016, and is even better in recent sample periods (1955-2016 and 1985-2016). Also, the result is robust to the alternative sample periods or controls that we consider.

The predictability of rare disaster concerns is also economically significant: an investor implementing a mean-variance strategy based on commodity index return forecasts would obtain a higher Sharpe Ratio if she predicts the future commodity returns with the current disaster measure. The annualized returns are equal to 15.094%, with an annualized Sharpe Ratio and a certainty equivalent equal to 0.312 and 3.499%, respectively.

Endnotes

1 Manela and Moreira (2017) find that the aggregate rare disaster index (NVIX) have in-sample predictive ability for U.S. stock returns at long horizons.

2 Levine *et al.* (2018) provide the arithmetic commodity futures excess return across different commodities including futures available prior to 1960 (the start of most academic studies) and those that are currently incorporated in the S&P Goldman Sachs Commodity Index (GSCI). The complete list of these futures are aluminum, Brent crude oil, cattle, cocoa, coffee, copper, corn, cotton, feeder cattle, gas oil, gold, heating oil, hogs, Kansas wheat, lard, lead, natural gas, nickel, oats, pork, short ribs, silver, soybeans, soybean meal, soybean oil, sugar, gasoline, wheat, WTI (West Texas intermediate) crude oil, and zinc.

References

Barro, R., 2006, "Rare Disasters and Asset Markets in the Twentieth Century," *Quarterly Journal of Economics,* Vol. 121, No. 3, August, pp. 823-866.

Berkman, H., Dimitrov, V., Jain, P., Koch, P. and S. Tice, 2009, "Sell on the News: Differences of Opinion, Short-Sales Constraints, and Returns around Earnings Announcements," *Journal of Financial Economics*, Vol. 92, No. 3, June, pp. 376-399.

Gabaix, X., 2012, "Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro-Finance," *Quarterly Journal of Economics,* Vol. 127, No. 2, May, pp. 645-700.

Gourio, F., 2012, "Disaster Risk and Business Cycles," *American Economic Review*, Vol. 102, No. 6, October, pp. 2734-2766.

Goyal, A. and I. Welch, 2008, "A Comprehensive Look at the Empirical Performance of Equity Premium Prediction," *Review of Financial Studies*, Vol. 21, No. 4, July, pp. 1455-1508.

Levine, A., Hua Ooi, Y., Richardson, M. and C. Sasseville, 2018, "Commodities for the Long Run," *Financial Analysts Journal,* Vol. 74, No. 2, December, pp. 55-68.

Manela, A. and A. Moreira, 2017, "News Implied Volatility and Disaster Concerns," *Journal of Financial Economics,* Vol. 123, No. 1, January, pp. 137-162.

Rietz, T., 1988, "The Equity Risk Premium a Solution," *Journal of Monetary Economics,* Vol. 22, No. 1, July, pp. 117-131.

Wachter, J. A., 2013, "Can Time-Varying Risk of Rare Disasters Explain Aggregate Stock Market Volatility?", *Journal of Finance,* Vol. 68, No. 3, June, pp. 987-1035.

Keywords

Commodity return predictability, rare disaster concern, News Implied Volatility (NVIX).

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