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Risk adjusted momentum strategies: A comparison between constant and dynamic volatility scaling approaches

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ABSTRACT

We compare the performance of two volatility scaling methods in momentum strategies: (i) the constant volatility scaling approach of Barroso and Santa-Clara (2015), and (ii) the dynamic volatility scaling method of Daniel and Moskowitz (2016). We perform momentum strategies based on these two approaches in a diversified portfolio consisting of 55 global liquid futures contracts, and further compare these results to the time series momentum and buy-and-hold strategies. We find that the momentum strategy based on the constant volatility scaling method is the most efficient approach with an annual return of 15.3%.

1. Introduction

Over the past two decades, momentum has become one of the most widely studied financial market phenomenons and profitable trading rules, in both academia and industry. Momentum refers to the cross-sectional momentum (henceforth, XSMOM), where abnormal profits are generated by longing the best-performed stocks (winner) and shorting the poor-performed stocks (loser) in the past 3–12 months (Jegadeesh and Titman, 1993). However, recent studies suggest that momentum strategies, although generate persistent abnormal returns over time and across different asset classes,[1] suffer from occasional large crashes (i.e. momentum crash).[2] To address this issue, volatility scaling methods are used to avoid risks of momentum strategies, see, e.g., Boguth et al. (2011), Wang and Xu (2015), Barroso and Santa-Clara (2015) and Daniel and Moskowitz (2016).

According to recent literature, there are two prevalent volatility scaling methods: (i) the *Constant Volatility Scaling Approach* (henceforth, CVS) documented by Barroso and Santa-Clara (2015), and (ii) the *Dynamic Volatility Scaling Approach* (henceforth, DVS) of Daniel and Moskowitz (2016). A CVS momentum strategy weights different instruments in the portfolio based on the ratio between a constant target volatility and realised volatility. In contrast, a DVS momentum strategy weights its instruments depending on the ratio between the expected market returns and realised volatility. Both approaches perform efficiently in U.S stock markets as seen in Barroso and Santa-Clara (2015) and Daniel and Moskowitz (2016), but it is still under debate that which one is better.

The rationales of the two approaches are qualitatively different but related to each other. Barroso and Santa-Clara (2015) argue that the main risks of momentum strategies are the systematic risks which account for 87% of total risks. Hence, they introduce the CVS to control for systematic risks. Whereas Daniel and Moskowitz (2016) suggest that the major risks of momentum strategies are the time-varying beta risks caused by investors' hedging positions. To reduce these risks, the authors develop the DVS. On the other

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[1] Evidence of momentum has also been found in international stock markets, see, e.g., Fama and French (1998), Teplova and Mikova (2015), emerging markets see, e.g., Rouwenhorst (1999), Zaremba and Szyszka (2016), country indices, see, e.g., Asness et al. (1997), industries, see, e.g., Moskowitz and Grinblatt (1999), size and B/M factors, see, e.g., Lewellen (2002), commodities, see, e.g., Miffre and Rallis (2007), Shen et al. (2007), and global asset classes, see, e.g., Asness et al. (2013).

[2] See Daniel and Moskowitz (2016).

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hand, these two approaches are highly related. According to Daniel and Moskowitz (2016), the two approaches yield to the same results, when the Sharpe ratios of momentum strategies are time invariant.

In this paper, we implement volatility scaled momentum strategies based on both approaches, i.e. CVS based XSMOM and DVS based XSMOM, in a diversified portfolio consisting of 55 futures instruments similar to Asness et al. (2013) and Kim et al. (2016). Results confirm the existence of momentum crash in futures markets across different asset classes. Then we employ the Fama-–French–Carhart four-factor model to evaluate the performance of these two scaling methods. The regression results show that the Jense's alpha of CVS based XSMOM strategy (1.93%) is significantly higher than the alpha of DVS based XSMOM strategy (1.43%) using our sample data from November 1991 to May 2017.

For a more in-depth comparison between the two aforementioned approaches, we divide the entire period into three sub-periods according to Daniel and Moskowitz (2016), who claim that the motivation of designing DVS is due to the relationship between sentiment and realised volatilities. In other words, when investors experience financial stress (e.g., the 2007–2008 global financial crisis), their market activities would increase the volatilities dramatically. Hence, we generate 3 sub-periods (1991–2006, 2006–2010 and 2010–2017) based on the 2007–2008 financial crisis. During pre sub-period, we find that the abnormal returns of CVS based XSMOM are significantly higher than the XSMOM returns based on DVS. However, the superiority of CVS becomes statistically insignificant during crisis and post crisis periods.

In our cross-strategy comparison, we include a standard buy-and-hold strategy and the time series momentum strategy (henceforth, TSMOM) of Moskowitz et al. (2012) as two benchmarks. In contrast to XSMOM which focuses on relative returns, a TSMOM signal only depends on the historical returns of each future contract on its own. In particular, a TSMOM strategy generates profits by longing (shorting) the contracts with positive (negative) returns in the past 3–12 months. Moreover, we implement a time-varying weighting scheme based on volatility scaling as in Moskowitz et al. (2012). This method not only improves the performance of TSMOM strategy, but also allows a fair comparison with our volatility adjusted XSMOM strategies. Empirical results shows that the volatility scaled benchmark strategies outperform the unscaled strategies as is also confirmed in Kim et al. (2016). However, the CVS based XSMOM is still the most profitable trading strategy among all of them.

In summary, this paper contributes to the literature in the following manners. First, we identify the momentum crash in futures markets, and hence demonstrate the reasonableness to employ the volatility scaling approaches. Second, we find that the CVS based XSMOM is more efficient and profitable than the DVS based XSMOM with the difference being statistically significant. Finally, the expanded comparison suggests that the CVS based XSMOM strategy performs significantly better than the scaled TSMOM and buy-and-hold strategies.

The remainder of this paper is organised as follows. In Section 2, we provide the data sources and the summary statistics. Section 3 presents the ways in calculating XSMOM strategies and different volatility scaling methods. Then, we discuss the performance of different XSMOM strategies and regression results in Section 4. Finally, Section 5 concludes.

2. Data

Similar to Moskowitz et al. (2012) and Kim et al. (2016), we collect monthly prices from 55 global liquid futures instruments with updated time range (June 1986 to May 2017). The portfolio consists of 24 commodity contracts, 13 sovereign bond contracts, 9 currency contracts and 9 equity index contracts. In this section, both the data sources and summarised statistics of our sample data are reported.

2.1. Data sources

For each instrument, the continuous monthly futures prices are constructed by rolling all the nearest contracts to form a long time series from Bloomberg. In commodity sector, Aluminium, Copper, Nickel, Zinc are from London Metal Exchange (LME), The Brent Crude, Gas Oil, Cotton, Coffee, Cocoa, Sugar are collected from Intercontinental Exchange (ICE), Live Cattle, Lean Hogs are from Chicago Mercantile Exchange centre (CME), Corn, Soy beans, Soy Meal, Soy Oil and Wheat are downloaded from Chicago Board of Trade (CBOT), WTI crude, Unleaded Gasoline, Heating Oil, Natural Gas are from New York Commodity Exchange (COMEX). Platinum is collected from Tokyo Commodity Exchange (TOCOM).[3] In bond sector, we include Australia 3-year and 10-year Bond, Euro 2-year, 5-year, 10-year and 30-year Bond, Canada 10-year Bond, Japan 10-year Bond, Long Gilt (UK 10-year), US 2-year, 5-year, 10-year and 30-year treasury. In currency sector, we cover the currencies of Australia, Canada, Euro, Japan, New Zealand, Norway, Sweden, Switzerland, UK against US dollar. While the universe of equity sector consists of stock indices futures from SPI 200 (Australia), CAC 40 (France), DAX 30 (Germany), FTSE/MIB (Italy), TOPIX (Japan), AEX (Netherlands), IBEX 35 (Spain), FTSE 100 (U.K), and S&P 500 (U.S).

In order to explore the properties of different asset classes, we collect the monthly returns of four major financial asset class indices including MSCI world Index, S&P GSCI, Barclays Aggregate Bond Index and the US Dollar Index. These factors are downloaded from Bloomberg. Besides, we also include the percentage changes of Fama–French factors in the regression analysis. They are Fama and French (1993) small market capitalization minus big (*smb*), high book-to-market ratio minus low (*hml*), and Carhart (1997) premium on winner minus loser (*umd*). The above data is downloaded from K. French's website.

[3] According to Futures Industry Association data, Tokyo Commodity Exchange (TOCOM) Platinum contract is the world most liquid platinum futures market, with an annual trading volume of more than 4 million lots compared to the CME/NYMEX one (3,262,770 lots) in 2013.