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Diversification with volatility products

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ABSTRACT

Recent changes to clearing-house regulations have promoted exchange-traded products offering risk premia previously accessible only over-the-counter. Thus, as correlations increase between equity, bonds and commodities, a new strand of research questions the benefits of home-grown diversification using volatility products. First we ask: "What expected returns will induce equity and bond investors to perceive ex-ante diversification benefits from adding volatility?" We call this the *optimal diversification threshold*. We derive the theoretical thresholds for minimum-variance, mean-variance and Black–Litterman optimization. Empirical analysis of US and European markets shows that volatility diversification is frequently perceived to be optimal, ex-ante, but these apparent benefits are almost never realized, being eroded by high roll and transaction costs. Exchange-traded volatility only proved an effective diversifier during the banking crisis. At other times long equity and bond portfolios diversified with volatility futures have not performed as well as those without diversification, or even those diversified with commodities.

1. Introduction

Equities, bonds and commodities have become more highly correlated globally since the banking crisis.[1] Within home-grown investments alternative markets have developed for real estate, funds of hedge funds – even wine and art – amid vigorous debate on the benefits of international portfolio

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[1] See Daskalaki and Skiadopoulos (2011), Cheung and Miu (2010) and others.

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diversification.[2] Among alternative domestic diversifiers the highly innovative asset class of equity volatility arises as a natural diversification choice because its negative correlation with equity increases exactly when diversification is needed most – a fact that has been well documented since Bekaert and Wu (2000). For example, during 2008–2010 the negative correlation between the S&P 500 index and its corresponding volatility index VIX was about –0.85, measured on daily returns. Consequently if, on 1 April 2010 an S&P 500 investor had put 30% of his capital in the risk-free asset and taken an equivalent long position in the June 2010 VIX futures contract, closing the position a week before expiry, he would have achieved an (equivalent) Sharpe ratio of 3.61. Holding the S&P 500 exchange-traded fund (SPY) alone gave a negative mean excess return over the same period.

These observations motivate the question whether volatility could be an effective diversification tool for pension or mutual funds, public companies and indeed any investor that is long in domestic capital assets, i.e. equities and bonds. Many investment entities are forbidden by law to short equity, because this is generally considered as speculation rather than a position which fits long-term investment. Over-the-counter (OTC) trades such as variance swaps are also disallowed for many investors. However, changes in regulations have recently prompted a huge demand for exchange-listed volatility products. Specifically, the EMIR directive in the European Union and the Dodd–Frank Act in the U.S. now require OTC transactions to be cleared by central counter-parties in much the same way as exchange-traded products; and this has acted as a catalyst for growth in listed products such as volatility futures, notes and funds which attempt to mimic the risk-return characteristics of variance swaps.[3]

We begin by introducing a new theoretical concept. Given an investor that has a long position on each of the assets or financial instruments $X_1, X_2, \ldots, X_{k-1}$, the *optimal diversification threshold* for the asset/instrument X_k is the lowest expected return q_k on X_k for which an additional long position on X_k is perceived to be optimal, ex-ante. We derive a general expression for the optimal diversification threshold in the context of three standard optimization paradigms: minimum-variance, mean-variance and the Black and Litterman (1992) framework.

Our theoretical results are then used in an empirical study to analyze the perceived benefits of volatility diversification for long equity (or equity-bond) investors in the U.S. and European Union markets. In general, both the threshold and the corresponding optimal diversification frequency will depend on the investor, as characterized by his risk aversion, optimization framework and model parameters (and the covariance matrix of the k assets in particular). Using data from January 2006 to April 2015 we apply the optimal diversification threshold at regular monthly rebalancing points, hence identifying the frequency with which different types of investors would perceive diversification to be ex-ante optimal. Our parameter estimation method is based on historical data, and we take standard equilibrium portfolios for the Black–Litterman extension. Finally, we compare the realized performance of the optimally-diversified portfolios with that of traditional equity-bond portfolios and with the performance of an equity-bond portfolio that is diversified using commodities.[4]

There is a vast literature on volatility diversification which is reviewed in the next section. Our study is the first to apply a proper ex-ante analysis within a rolling framework, i.e. a situation where the investor periodically rebalances his portfolio based on new information. We employ three standard optimization models and we also use a much longer sample period than any previous study, almost all of which have focused on the years surrounding the banking crisis, when the realized performance of volatility futures was unusually good. Our empirical findings may be a timely warning to market players in volatility products, and especially to the investors whose interests we seek to protect.

[2] See Kroencke and Schindler (2012), Liu et al. (2014) and many others.

[3] For instance, from 2009 to 2014, the number of traded VIX futures contracts increased from 4,500 to more than 215,000 contracts with a value of more than $4bn traded on average each day. Accordingly, the market for exchange-traded products based on volatility futures has exploded in recent years and trading volume on some of these products can reach about $5bn per day. See Alexander et al. (2015) for further details.

[4] There are two possible reasons why an investor may choose to adopt a cautious stance on the benefits of volatility as a diversification tool. It may be that in the past, over a long historical period, his expected return was rarely high enough to perceive that volatility diversification was ex-ante optimal. However, it may also be that taking a position in volatility has frequently been viewed as ex-ante optimal, but that taking such position actually deteriorated rather than enhanced performance.