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Cross hedging single stock with American Depositary Receipt and stock index futures

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ABSTRACT

This paper investigates the cross hedging effectiveness of individual stock in a market that does not have single stock futures traded using American Depositary Receipt (ADR) and stock index futures. We apply Caporin and Billio's Multivariate regime switching GARCH to capture the state-dependent covariance structure of underlying stock, ADR and stock index futures. Empirical results indicate that in general simultaneous hedging with both ADR and index futures creates hedging gains and incorporating regime switching effects further increases the hedging performances.

1. Introduction

Hedging with stock index futures has been widely studied in the futures hedging literature (Park and Switzer, 1995; Lafuente and Novales, 2003; Alizadeh and Nomikos, 2004; Lee and Yoder, 2007; Lee, 2010). Investors, however, may expose to substantial undiversified single stock risk instead of stock portfolio risk. For instance, a fund manager may hold a substantial amount of a specific stock that he does not want to close out (Brooks et al., 2007). In this case, investor may want to hedge this single stock holding instead of a portfolio of stocks. One way to hedge this single stock exposure is to purchase a single stock futures contract (SSF) written on it. In some markets, however, there does not have SSFs traded and hedging single stock futures with SSFs will not be possible. A typical way to hedge single stock holdings in a market that does not have SSFs traded is to cross hedge with stock index futures.

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In this manuscript, we suggest an alternative financial instrument, the American Depositary Receipts (ADRs) for hedging single stock holdings. The ADRs are securities traded in the US that represents ownership in the shares of a non-US company. A body of research on ADRs has found that there are information flows and volatility linkage between ADRs and their underlying stocks and ADRs offer significant benefits for investors to diversify their domestic holdings (Jiang, 1998; Kim et al., 2000; Alaganar and Bhar, 2001; Bartram and Dufey, 2001; Kutan and Zhou, 2006; Poshakwale and Aquino, 2008). All these findings suggest that ADR might be a potential instrument for hedging domestic single stock exposure.

The main focus of this study has been to investigate if ADR is a good proxy for index futures for hedging single stock holdings? We investigate if incorporating ADR with index futures to simultaneously hedge the idiosyncratic risk and systematic risk of individual stock improves the hedging performance compared to cross hedging with only index futures? Recent studies in futures hedging literature recognize that allowing the correlation of spot and futures returns to be subject to regime shifts improves hedging effectiveness (Lee and Yoder, 2007; Lee, 2010). In this article, we further investigate if allowing the correlations of ADR, index futures and underlying stock to be state-dependent improves cross hedging effectiveness. A three-dimensioned multivariate Markov switching dynamic conditional correlation GARCH (*MS-DCC*) (Caporin and Billio, 2005) is applied to implement the simultaneous hedging strategy.

The remainder of the article is organized as follows. Caporin and Billio's *MS-DCC* and simultaneous hedging strategy are presented in Section 2. Section 3 gives the minimum variance hedge ratios for simultaneous hedging and measurements of hedging performance. This is followed by discussions of data and empirical results. A conclusion ends the article.

2. Multivariate Markov switching dynamic conditional correlation GARCH (*MS-DCC*) and simultaneous hedging strategy

The specification of Caporin and Billio's *MS-DCC* (Caporin and Billio, 2005) is a model that allows the correlations of financial assets to be both time-varying and state-dependent and the specification of this model is given below:

Suppose that the observed m-dimensioned economic process $\{\mathbf{R}_t\}$ is given by

$$\mathbf{R}_t = \boldsymbol{\mu} + \mathbf{e}_t, \tag{1}$$

$$= \boldsymbol{\mu} + \mathbf{D_t}\boldsymbol{\varepsilon}_\mathbf{t}, \tag{2}$$

where $\boldsymbol{\mu}$ is an $m \times 1$ vector of conditional means, $\mathbf{e}_t = \mathbf{D_t}\boldsymbol{\varepsilon}_\mathbf{t}$ is assumed to be normally distributed

$$\mathbf{e_t}|\psi_{t-1} \sim N(0,\ \mathbf{H_t}), \tag{3}$$

where $\mathbf{H_t}$ is an $m \times m$ time-dependent variance–covariance matrix, $\boldsymbol{\varepsilon}_t = \mathbf{D}_t^{-1}(\mathbf{R_t} - \boldsymbol{\mu})$ is the normalized residual vector, N stands for normal distribution and ψ_{t-1} is the information set up to time $t-1$. $\mathbf{H_t}$ is given by

$$\mathbf{H_t}(s_t) = \mathbf{D_t}\boldsymbol{\Gamma}_\mathbf{t}(s_t)\mathbf{D_t}, \tag{4}$$

where $\mathbf{D_t}$ is a diagonal volatility matrix and $\boldsymbol{\Gamma}_\mathbf{t}(s_t)$ is the state-dependent correlation matrix, where $s_t = \{1, 2\}$ is the state variable following a first-order, two-state Markov process. In Caporin and Billio's *MS-DCC*, $\boldsymbol{\Gamma}_\mathbf{t}(s_t)$ is further decomposed into

$$\boldsymbol{\Gamma}_\mathbf{t}(s_t) = diag\{\mathbf{Q_t}(s_t)\}^{-1/2}\mathbf{Q_t}(s_t)\,diag\{\mathbf{Q_t}(s_t)\}^{-1/2}, \tag{5}$$

where $\mathbf{Q}(s_t)$ is the state-dependent conditional standardized residual covariance matrix. For the state-independent case, *MS-DCC* collapses to the regular *DCC GARCH* model proposed by Engle (2002).

Because we use both ADR and stock index futures to simultaneously hedge both firm-specific risk and market risk, a trivariate *MS-DCC* is required to implement this hedging strategy. The trivariate *MS-DCC* simultaneous hedging model is denoted as *MS-DCC(ADR + Index*) and the specification of this model is given below: