Time-varying conditional discrete jumps in emerging African equity markets

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ABSTRACT

An ARJI-EGARCH model which is a modified version of the Chan and Maheu (2002) methodology is used to examine the time-varying conditional discrete jump dynamics in thinly-traded adjusted equity returns of Egypt, Nigeria and South Africa. The findings suggest that conditional discrete jump is both time-varying and sensitive to past shocks for Egypt and South Africa but not for Nigeria. Conditional discrete jump sensitivity is persistent in all the markets, and only South Africa is more likely to exhibit asymmetric conditional jump volatility. We provide evidence that the presence of thin-trading overstates the economic significance of the conditional discrete jump dynamics.

1. Introduction

Volatility in equity markets can amplify losses and magnify gains. Without volatility, hedging strategies and investment in derivative instruments may not be profitable. When volatility is conditional and continuous, some investors may be able to predict the trajectory of the volatility. Conversely, discrete jump is difficult to predict. The objective of this study is to contribute to the literature on jumps by examining the time-varying conditional discrete jump dynamics in the equity markets of Egypt, Nigeria and South Africa. By market capitalization, the South African equity market is the largest in Africa, followed by Egypt, and Nigeria. As investors are increasingly turning attention to African equity markets for diversification, this study will help...
investors understand the evolution of the volatility process on these equity markets. Equity investors are faced with large stock price changes specifically, large price declines and these large price changes, which are uncommon, affect investors significantly.

The uncommon large price changes are modelled differently from the usual small price changes because their properties are significantly different. In the continuous-time finance literature, large price changes are modelled as jump process. Researchers in option prices saw the necessity of adding jump to the diffusive process of the underlying stock. For example, in Bates (2000) and Eraker (2004), the conditional jump intensity is shown as an affine function of the diffusive variance of stock returns and the jump size follows an independent distribution process. The discrete-time Generalised Autoregressive Conditional Heteroskedasticity (GARCH) has been used to model jump intensity. Like volatility, large price changes in stock prices tend to occur in clusters, hence the use of GARCH to model jump intensity. For instance, Christoffersen, Jacobs, and Ornthanalai (2012) propose a discrete time model with a GARCH type of dynamics, where the conditional jump intensity is a function of the previous jump intensity and the jump size. Similarly, Chan and Maheu (2002), Maheu and McCurdy (2004), and Maheu, McCurdy, and Zhao (2013) propose a discrete time model of asset returns with an autoregressive conditional jump intensity.


The purpose of this paper is to examine whether conditional discrete jump on emerging African equity markets are time-varying. To our knowledge, the issue of time-varying conditional discrete jump has not been examined on these markets or on markets with pervasive thin-trading. To this end, this study attempts to add to the literature by investigating the conditional jump dynamics in the equity markets of Egypt, Nigeria and South Africa. This study assumes that equity-market innovations follow a Poisson process. Hence, we modify the mean reverting ARJI-GARCH of Chan and Maheu (2002) into ARJI-Exponential GARCH (ARJI-EGARCH) model for this study. By construction, to guarantee that the GARCH in the ARJI-GARCH model is stationary and the conditional variance is always positive requires the imposition of complicated and intractable restrictions. Thus, the non-negativity and invertibility constraints must be satisfied to make the GARCH estimates reliable. By contrast, the EGARCH model does not require these constraints.

Thin-trading, which introduces series of biases in empirical results (Lo & MacKinlay, 1990), is adjusted by applying the Miller, Muthuswamy, and Whaley (1994) methodology to the data series. The results suggest that for the equity markets of Egypt and South Africa, conditional discrete jump is both time varying and sensitive to past shocks. However, for Nigeria, it was found that the conditional discrete jump intensity is constant, and conditional discrete jump becomes sensitive when the conditional mean and the conditional variance of the distribution are a function of past returns. Conditional discrete jump sensitivity is, however, persistent in all the equity markets. Only the equity market of South Africa displays conditional discrete jump volatility asymmetry. When the ARJI-EGARCH model was applied to the logarithmic (non-adjusted return series) returns, it was found that thin-trading may overstate the economic significance of the conditional discrete jump. This is consistent with the findings of Jiang and Yao (2013). Jiang and Yao (2013) found that the jump returns of illiquid stocks are substantially higher than those of liquid stocks. For the rest of the models, we obtained spurious estimates, which may be due to the impact of thin-trading. Clearly, the results indicate that adjusting for thin-trading improves model estimation which may assure consistent estimates.

The rest of this paper is organised as follows: Section 2 presents the model of analysis, Section 3 reviews the data, Section 4 presents and discusses the empirical findings, and lastly, Section 5 concludes the paper.

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