Int. Fin. Markets, Inst. and Money 23 (2013) 12–32

Contents lists available at SciVerse ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

Asymmetry effects of shocks in Chinese stock markets volatility: A generalized additive nonparametric approach

Ai Jun Hou*

Department of Business and Economics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark

ARTICLE INFO

Article history:
Received 3 May 2012
Accepted 27 August 2012
Available online 12 September 2012

JEL classification:
G15
C14

Keywords:
Asymmetry effect
Nonparametric GARCH model
Chinese stockmarket
News impact curve
Additive approach

ABSTRACT

The unique characteristics of the Chinese stock markets make it difficult to assume a particular distribution for innovations in returns and the specification form of the volatility process when modelling return volatility with the parametric GARCH family models. This paper therefore applies a generalized additive nonparametric smoothing technique to examine the volatility of the Chinese stock markets. The empirical results indicate that an asymmetric effect of negative news exists in the Chinese stock markets. Furthermore, compared with other parametric models, the generalized additive nonparametric model demonstrates a better performance for return volatility forecasts, particularly for the out-of-sample forecast. The results from this paper have important implications in risk management, portfolio selection, and hedging strategy.

1. Introduction

The Chinese stock markets have grown rapidly since the establishment of the Shanghai Stock Exchange (SSE) in December 1989 and the Shenzhen Stock Exchange (SZSE) in April 1991. Specially, with the recent boom in China's economy, China's stock markets have been attracting an enormous amount of attention from policy makers, investors, and academics. Chinese stock markets are interesting and deserve attention also because they exemplify many unique characteristics that differ from well-developed Western financial markets. One of the unique characteristics is that the Chinese stock markets are the only equity markets covered by the International Finance Corporation that have completely segmented trading between domestic and foreign investors (Chui and Kwok, 1998, see; Yang,

* Tel.: +45 6550 3623; fax:+45 6550 3237.
E-mail address: aijun@sam.sdu.dk

1042-4431/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.intfin.2012.08.003

2003). The A-share market is only open to Chinese domestic investors while the B-share market was only open to foreign investors before February 2001.[1] Many studies (Chui and Kwok, 1998, see; Yang, 2003) also address the fact that the Chinese stock markets are tightly controlled by the government: The markets are at most partially privatized, and the state maintains state shares in varying amounts. The presence of market segmentation and heavy government regulations give rise to mispricing and information asymmetry, making the market clearly imperfect and incomplete (Chan et al., 2007). Further, stock trading is still new to most domestic participants. The A shares are dominated by domestic individual investors who typically lack sufficient knowledge and experience in investments (China Securities and Futures Statistical Yearbook, 2004). Given the unique characteristics of the markets and given that the typical Chinese investor is more prone to speculation and less sophisticated than those from more mature markets (Tan et al., 2008), Chinese stock volatility behaves very differently from that of other markets.

This paper seeks to demonstrate that conventional volatility models, such as the GARCH-family approaches, employed for modelling stock returns in unique markets such as the Chinese stock markets are inferior to the nonparametric approach. GARCH models of stock returns rely heavily on volatility specification and known distributions of returns. In Chinese stock markets where it has been documented that information structures of stock returns are prone to changes subject to changing regulatory structures (Brooks and Ragunathan, 2003), the use of GARCH models of stock returns may insufficiently characterize the volatility of the Chinese stock market returns. Bülman and McNeil (2002) propose a nonparametric GARCH model (hereafter NP model), in which the hidden volatility process is a function of the lagged volatility and lagged value of the innovations from returns and is estimated by an iterative nonparametric algorithm. This model is more attractive than the parametric GARCH-family models because it requires neither a specification of the functional form of the hidden volatility process nor that of the distribution of the innovations.

This paper contributes to the stock return modelling literature by focusing on modelling the Chinese stock return volatility and the asymmetric effect of shocks on return volatility[2] using the NP model. Specifically, we restrict our attention to the univariate case of modelling stock returns and does not explore the possibility of spillover effects and interactions between the A and B-share markets.[3] The reason being nonparametric modelling method in a multivariate GARCH framework is at its infancy stage, and for the purpose of comparison with the standard univariate GARCH modelling approach it is important that we restrict our attention to the univariate GARCH NP model. On the methodical front, we contribute by developing a generalized additive model and applying the nonparametric approach (hereafter GAM NP model) involving the iterative estimation algorithm to the generalized additive model of Hastie and Tibshirani (1990). The motivation for estimating the GAM NP model is that it can avoid the curse of dimensionality, which is a common problem for the nonparametric estimation of a multidimensional regression.[4] Further, as will be shown in the Monte Carlo simulation and the empirical investigation, this newly proposed GAM NP model can deliver a more accurate volatility estimate than the parametric GARCH-family models and becomes computationally more efficient than the NP model. Also novel in our approach is that we extend the news impact curve from Engle and Ng (1993) to the nonparametric context and use it to measure and examine the asymmetric effect of shocks on volatility.

---

[1] In order to increase the mobility of B shares and to strengthen foreign fund investment on the capital market, with a view of paving the way towards China accession to the WTO, the Chinese government lifted the restriction of people in the territory of China investing in B shares on February 19, 2001. However, even after the rule changes, B shares cannot exceed 25% of a company's total shares to ensure that Chinese stock markets are not overly influenced by foreign investment, and domestic investors can trade and own B shares only if they have foreign currency.

[2] The asymmetric effect often refers to the volatility increasing more after a negative shock than after a positive shock of the same magnitude (Black, 1976, see; Christie, 1982).

[3] Spillover effects in the mean and volatility of A- and B-share stock returns have been investigated by Hu et al. (1997), Su and Fleisher (1998), Brooks and Ragunathan (2003). A recent study by Chen et al. (2011) investigate the changes in dynamic stochastic structure of the various industrial sectors of the Chinese A, B and Hong Kong share markets.

[4] Under the curse of dimensionality, the optimal rate of convergence of a nonparametric estimation of a multidimensional regression decreases with increasing dimensionality (Linton and Mammen, 2005). For the multidimensional smoothing, efforts must be made to alleviate the problem (Härdle et al., 2004).