North American Journal of Economics and Finance 37 (2016) 458–471

Contents lists available at ScienceDirect

North American Journal of Economics and Finance

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

Relationship between oil, stock prices and exchange rates: A vine copula based GARCH method

Riadh Aloui [a], Mohamed Safouane Ben Aïssa [b,*]

[a] LAREQUAD & ISGS, University of Sousse, Rue Abedelaziz El Bahi, B.P. 763, 4000 Sousse, Tunisia
[b] LAREQUAD & FSEGT, University of Tunis El Manar, B.P. 248, El Manar II, 2092 Tunis, Tunisia

ARTICLE INFO

Article history:
Available online 17 May 2016

Keywords:
Vine copulas
Dependence measures
Crude oil price
Stock index
Exchange rate

ABSTRACT

In this paper, we apply a vine copula approach to investigate the dynamic relationship between energy, stock and currency markets. Dependence modeling using vine copulas offers a greater flexibility and permits the modeling of complex dependency patterns for high-dimensional distributions. Using a sample of more than 10 years of daily return observations of the WTI crude oil, the Dow Jones Industrial average stock index and the trade weighted US dollar index returns, we find evidence of a significant and symmetric relationship between these variables. Considering different sample periods show that the dynamic of the relationship between returns is not constant over time. Our results indicate also that the dependence structure is highly affected by the financial crisis and Great Recession, over 2007–2009. Finally, there is evidence to suggest that the application of the vine copula model improves the accuracy of VaR estimates, compared to traditional approaches.

1. Introduction

Crude oil is one of the most important commodities in the current global world. Over the past decade, the greater instability in energy markets and the persistence of oil prices at higher levels are

* Corresponding author. Tel.: +216 58 450 000; fax: +216 71 872 277.
E-mail addresses: riadh.aloui@isg.rnu.tn (R. Aloui), safouane.benaissa@univ-amu.fr (M.S. Ben Aïssa).

http://dx.doi.org/10.1016/j.najef.2016.05.002
1062-9408/

largely responsible of the slowing world economic growth (Aydin & Mustafa, 2011; Sanchez, 2011). Through the increasing importance of oil price in the economic activity, the study of the relationship between energy, stock and currency markets becomes of greater importance for policy makers, economists and investors.

During the last financial crisis, oil prices experienced very large fluctuations as a clear structural change around the second quarter of 2008 is apparent in Fig. 1. In fact, the spot price of crude oil had a very sharp increase, rising from 20$ per barrel at the beginning of 2002 to 147$ per barrel in July 2008, surpassing its 1980 record high in constant prices. Recent unrest in North Africa and the Middle East and fears about the spread of political instability to other major oil producing countries have contributed to higher oil prices and added more instability to energy markets.

Economic theory suggests that oil shocks have a significant effect on the stock market activity and exchange rate movements. Huang, Masulis, and Stoll (1996) argue that the impact of crude oil movements on stock markets can be completely explained by their effect on current and future real cash flows. Many recent papers found that an increase in oil prices implies a decrease in stock returns (Chiou & Lee, 2009; Miller & Ratti, 2009; Nandha & Faff, 2008; Park & Ratti, 2008). By now, this idea has become widely accepted in the literature and seems to be virtually axiomatic. More recent studies such as Arouri and Nguyen (2010) and Fayyad and Daly (2011) demonstrate that the impact of oil on stock markets is sensitively different across economic sectors (e.g., oil versus non-oil industries) and across countries (e.g., net oil-exporting versus net oil-importing ones). According to Bjornland (2009) and Jimenez-Rodriguez and Sanchez (2005), a positive association between oil price movements and stock market returns is expected in the case of an oil exporting country, as the country's income will increase. It follows an increase in expenditures and investments which in its turn create more employment opportunities and the value of stocks will go up.

Studying the relationship between energy and currency markets has also received considerable attention in the literature. The importance of oil prices as an explanatory variable of exchange rate movements has been well documented in Krugman (1983), Golub (1983) and Rogoff (1991). In fact, the influence of high oil prices on export competition and price level of a country will lead to frequent and uncertain changes in the exchange rate. Moreover, oil prices are denominated in U.S dollar, and so fluctuations in the exchange rate cause changes to the crude oil supply, demand and price. Using different datasets, the existing empirical studies have mainly found that the oil price increase is associated with a dollar appreciation (Aloui, Ben Aïssa, & Nguyen, 2013; Ding & Vo, 2012; Wu, Chung, & Chang, 2012). By contrast, some other studies demonstrate a negative relationship between oil prices and the U.S. dollar exchange rates (Narayan, Narayan, & Prasad, 2008; Zhang, Fan, Tsai, & Wei, 2008).

The inconsistency in empirical findings can be explained by the distinct features of the investigated countries and the different extent of the used datasets. In this paper, our objective is to investigate whether the relationship between oil, stock and exchange rate is positive, negative or unclear. To overcome the limitation of pair dependence analysis, which is evident in the related literature, we examine the relationship between oil, stock and exchange rate in a multivariate framework. As pointed out by a number of studies, it is important to understand the dependence between several variables interacting simultaneously, not in isolation of one another. The omission of one important variable in the extended system can be misleading because the channel through which the two other variables are connected is omitted from the incomplete system.

As documented, for example, by Jondeau and Rockinger (2006), Junker, Szimayer, and Wagner (2006) and McNeil, Frey, and Embrechts (2005), the widely used measure of dependence, known as the Pearson correlation coefficient, may not appropriately describe the type of dependence between returns and, consequently, could lead to underestimate the joint risk of extreme events. In order to overcome this problem, the use of the copula methodology may be a very promising solution to characterize the multivariate distributions of asset returns. While there is a large literature exploring dependence using bivariate copulas, the choice is much more restricted in the multivariate case. The two most popular choices allowing multivariate dependence to be modeled with a non-restricted correlation matrix are the normal and the Student-t copulas. However, these models are restrictive in the tail and they do not allow asymmetric dependence. Recently, Bedford and Cooke (2001) and Bedford and Cooke (2002) introduced vine or pair-copula construction of multivariate distribution. These models are flexible graphical models enabling the extensions to higher dimensions using a