

Chapter 1

Introduction

1.1 Rationale as regards Background

The world oil price plays an important role in global economy, on account of it being a central source of energy. Therefore, the price of oil impacts government planning and policy decisions. In the recent past, international crude oil price has become extremely volatile, rising from about 30 dollars per barrel in 2003 to more than 100 dollars per barrel by 2008. With the growth of the world economy and the geopolitical events in the Middle East and North Africa, there was prevalent currency speculation, and crude oil price went up to as high as 145 dollars per barrel in the middle of 2008. In the second half of 2008, the crude oil price decreased to the level of just 33 dollars per barrel. The price went down by nearly 80% as a result of the severe financial crisis and economic recession in the past because of the low caused by American subprime lending. Since the year of 2009, the world economy has been in the process of gradually recovering from the financial crisis, because of which the global demand for oil has been increasing, and so the price of crude oil has been fluctuating. Moreover, trading liquidity in the world crude oil market has been increasing, and there has been growth of a liquidity surplus due to a government policy that favors an active national fiscal stimulus package. This is also due to the currency policies in many countries that are trying to recover from the global financial crisis. These events led to the oil price moving up to 100 dollars per barrel again at the end of 2011(Zhang Y,2013). Figure 1 shows the close relationship between the changes in the ethanol prices and the changes in the crude oil prices from late 2005 through 2009, when the ethanol industry was experiencing a rapid expansion.

Ethanol is very popular in many countries experiencing high crude oil prices. However, the dynamics of the ethanol market were determined in the past by the

agricultural commodity market, particularly the market for corn (Eidman 2005, USDA 2006). Since the year of 2006, the United States has been the biggest producer of ethanol, with more than 50% of the global production. Bioethanol is mainly produced by commodities such as sugar, cereals such as corn, and oilseed. Therefore, the growing demand for biofuels can stimulate an even higher demand for feedstock such as cereals. When this happens, the cost of ethanol production depends on the feedstock prices (Natanelove et al., 2011). Ethanol is now a notable source of motor-fuel. Of course, crude oil is the main input for traditional gasoline production; accordingly, there is a relationship, or co-movement, between the expected prices of ethanol and crude oil.

Figure 1 shows the close relationship between the ethanol prices and the crude oil prices from late 2005 through 2009, when there occurred a rapid expansion of the ethanol industry.

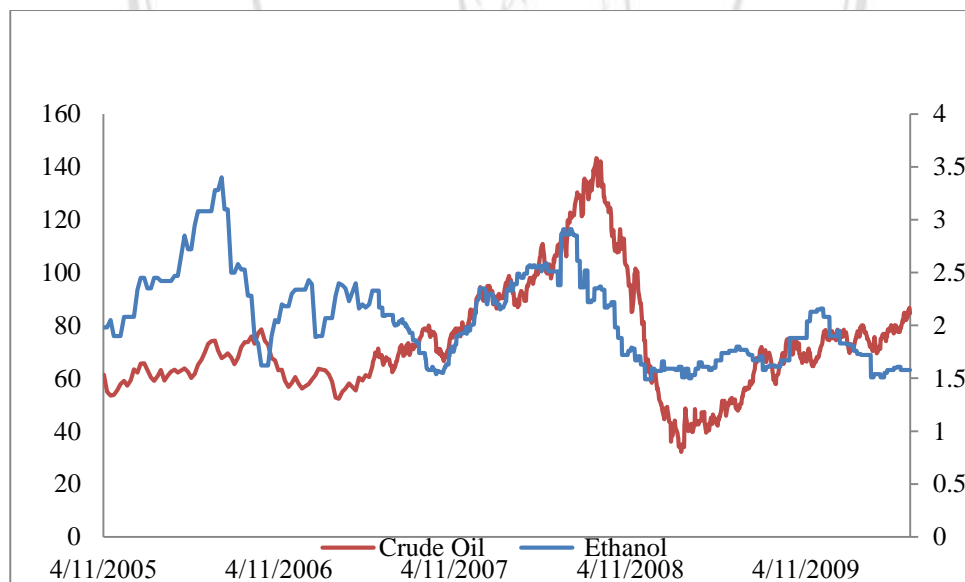


Figure 1 The co-movement of crude oil price and ethanol price

Note: the primary axis is for crude oil prices, and the secondary axis is for the ethanol prices.

The copula method is a powerful tool for linking the different margins and for measuring dependence compared to the classical linear correlation, and it is carried out by using multivariate normal distribution. As for analyzing non-linear dependence, the copula can measure dependence for heavy-tail distributions and is flexible in the cases of parametric, semi-parametric, or non-parametric models. Moreover, copulas provide more details as compared to other tools. In the domain of finance, joint extreme events can bring about tremendous losses for investors. Therefore, it is the ideal field for applying the extreme value copula to measure the dependence structure between the extremely high and the extremely low price returns. Economists have implemented the application of the extreme value copulas in their studies. The joint behavior of extreme returns in the foreign exchange rate market has been analyzed by Starica (1999) and Lu, Tian and Zhang (2008). Also, the co-movement of equity markets that have been characterized by high volatility levels was investigated by Longin and Solnik (2001). Chuangchid et al (2012) analyzed the application of Extreme Value Copulas (EVT) in palm oil price. The data are from the futures prices of Singapore, Malaysia, and Dalian commodities by using the extreme value copula of HuslerRiess and Gumbel for estimation. The result showed that the EVT can illustrate the dependence structure for the palm oil futures prices of the Singapore, Malaysia, and Dalian commodities. Pokrivcak and Rajcaniova (2011) analyzed the statistical relationship between the ethanol, gasoline, and crude oil prices by evaluating the relationship between the variables in the Impulse Response Function (IRF) and the Vector Auto-regression (VAR). The result shows that oil has no co-integration between ethanol, and ethanol and gasoline, but that oil and gasoline prices have co-integration in the relationship. Oil price shocks affect the price of gasoline.

1.2 Purpose of Study

This thesis studies the tail dependence between the price of ethanol and the price of crude oil in the spot market by using bivariate extreme value copulas.

1.3 Scope of Study

The data are from the Chicago Ethanol Spot data (USD per barrel) and the North Sea (Forties) spot Crude Oil (USD per barrel). The data were collected from EcoWin. The data span is from November 4, 2005 to December 26, 2013, at a daily frequency, which amounts to a total of 1,188 observations. Daily prices are computed as return of market “i” at time “t” relatives: $R_{i,t} = \ln(p_{i,t} / p_{i,t-1})$, where $P_{i,t}$ and $P_{i,t-1}$ are the daily spot prices for days “t” and “t-1.”

The bivariate extreme value copula method can define and examine the extreme value, or extreme price, and dependence structure between two variables as opposed to the classical bivariate value copula which cannot define the extreme value in abnormal instances. Under abnormal circumstances, it can reasonably determine the price, and can help in maximizing profit as well as in effectively limiting risks. Limiting is important for governments, investors, researchers, and private companies as all of these are involved in the power sector.

1.4 Advantages of Study

1.4.1 The results could be beneficial for any person wanting to make an investment in crude oil price and ethanol price in the stock market.

1.4.2 The results can potentially help portfolio managers, including agency investors, governments, and private companies involved in the power sector.