AN ANALYSIS OF THE DEPENDENCE BETWEEN CRUDE OIL PRICE AND ETHANOL PRICE USING BIVARIATE EXTREME VALUE COPULAS

AUJCHARAPRAN ROJMANEEBUNPOT

MASTER OF ECONOMICS

GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
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A THESIS SUBMITTED TO CHIANG MAI UNIVERSITY IN PARTAL FULFILIMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ECONOMICS

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THIS THESIS HAS BEEN APPROVED TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ECONOMICS

Examination Committee:

Kantaporn Chuangchid .....Chairman

(Lect. Dr. Kantaporn Chuangchid)

..... Member

(Prof. Dr. Songsak Sriboonchitta)

..... Member

(Lect. Dr. Chukiat Chaiboonsri)

Advisory Committee:

.....Advisor

(Prof. Dr. Songsak Sriboonchitta)

..... Co-advisor

(Lect. Dr. Chukiat Chaiboonsri)

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Author	Ms. Aujcharapran Rojmaneebunpot
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Advisory Committee	Prof. Dr. Songsak Sriboonchitta Advisor Lect. Dr. Chukiat Chaiboonsri Co-advisor

ABSTRACT

This paper studies the dependence structure between the returns of ethanol prices and crude oil prices. Since our focus was on the dependence behavior based on component-wise maxima, bivariate extreme value copulas were adopted. Our empirical study used two energy spot prices, the Chicago Ethanol Spot data and the North Sea (Forties) spot Crude Oil at the daily base. The data are collected from EcoWin. The data span is from November 4, 2005, to December 26, 2013, at a daily frequency.

The results showed that after the middle of the year 2009, the dependence between these two energy sources in the U.S. was weak. This analysis could benefit those who are planning to invest in crude oil and ethanol. Moreover, it can guide government investors and private companies that manage power sector portfolios.

หัวข้อวิทยานิพนธ์ การวิเคราะห์การขึ้นอยู่แก่กันระหว่างราคาน้ำมันดิบกับราคาเอทานอลโดยวิธีไบวาริเอทเอ็กซ์ทรีมวาลูคอปูลา

ผู้เขียน นางสาวอัจฉราพรรณ โรจน์มณีบรรพต

ปริญญา เศรษฐศาสตรมหาบัณฑิต

คณะกรรมการที่ปรึกษา ศ.ดร.ทรงศักดิ์ ศรีบุญจิตต์ อาจารย์ที่ปรึกษาหลัก
อ.ดร.ชูเกียรติ ชัยบุญศรี อาจารย์ที่ปรึกษาร่วม

บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อทำการวิเคราะห์การขึ้นอยู่แก่กันระหว่างผลตอบแทนของราคาเอทานอล และราคา น้ำมันดิบ โดยเน้นพฤติกรรมของการเคลื่อนไหวราคา จากค่าสุดโต่ง โดยใช้วิธี ไบวาริเอทเอ็กซ์ทรีมวาลูคอปูลา (Bivariate Extreme Value Copulas) การศึกษาในครั้งนี้ใช้ราคา แบบ spot price รายวันของพืชพลังงานสองตัว คือ ราคาเอทานอล และราคาน้ำมันดิบ โดยใช้ข้อมูล จาก Chicago Ethanol Spot data (USD per barrel) และNorth Sea (Forties) spot Crude Oil (USD per barrel) โดยนำฐานข้อมูลมาจากโปรแกรม EcoWin ระยะเวลาที่ทำการศึกษาข้อมูลจาก วันที่ 4 เดือนพฤจิกายน ค.ศ.2005 ถึง วันที่ 26 เดือน ธันวาคม ค.ศ. 2013

ผลการศึกษาพบว่า หลังจากปี ค.ศ. 2009 การเคลื่อนไหวราคาของทั้งสองตัวแปรในตลาดสหรัฐอเมริกา มีความสัมพันธ์ กันในระดับต่ำ ซึ่งผลการศึกษานี้สามารถ เป็นประโยชน์ต่อบุคคลผู้สนใจลงทุนเกี่ยวกับราคาน้ำมันดิบ และ ราคาเอทานอลในตลาดหุ้น นอกจากนี้ ยังเป็นประโยชน์ต่อการบริหารจัดการ และเป็นแนวทางบริหารกำไร (portfolio) ของรัฐบาล หน่วยงานเอกชน หรือนักลงทุน ที่สนใจลงทุนในส่วนของ พืชพลังงาน

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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.

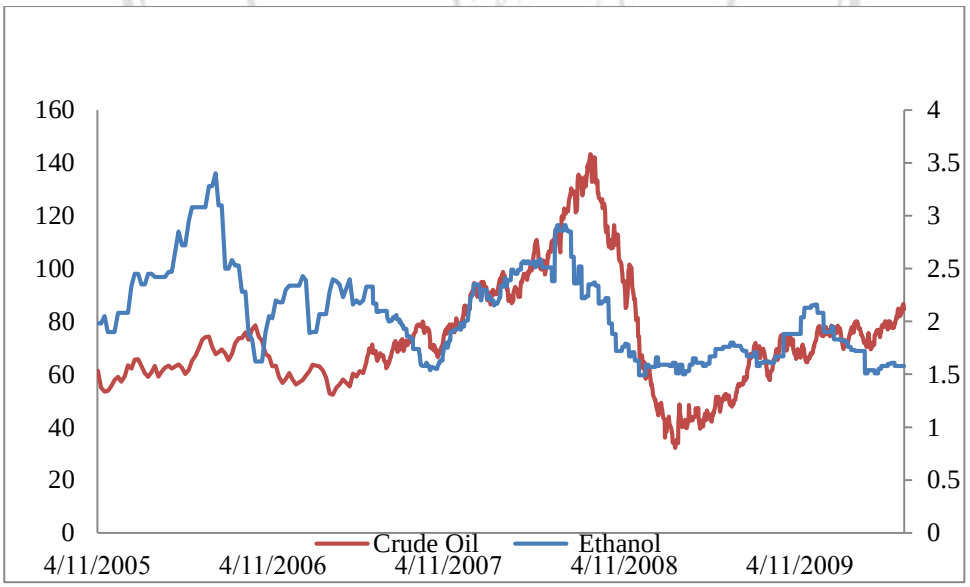

Figure 1 The co-movement of crude oil price and ethanol price

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.

Chapter 2

Theoretical Foundation and Literature Review

2.1 Extreme Value Theory

Extreme value theory (EVT) has been one of the most significant statistical disciplines for the applied sciences for a long period of time. EVT is mainly used for modeling and analysis of the extreme values of the data of interest with a very low probability to happen (Alves and Neves, 2010). There are two approaches for finding the extremes of the data of interest.

1. Block Maxima (BM).
2. Peaks-Over Threshold (POT).

BM and POT are the statistical analyses of maxima or minima, and exceed over a upper or a lower threshold (Lai and Wu, 2007). Pokrivcak and Rajcaniova (2011) analyzed the statistical relationship between ethanol, gasoline, and crude oil prices by evaluating the relationship between the variables in the Impulse Response Function (IRF) and the Vector Autoregression (VAR). The result shows that oil prices have no co-integration between ethanol, and ethanol and gasoline, but that oil and gasoline prices have co-integration in the relationship. Price of oil has a shock effect on the price of gasoline.

This paper aims to study the tail dependence between the price of crude oil and the price of ethanol in the spot market by using bivariate extreme value copulas.

2.2 Generalized Extreme Value (GEV) Distribution

For a single margin, abstract is the maxima sequence, which is the same as defined before, and “i” is the number of blocks. F is the general price distribution, and G is the

asymptotic extreme value distribution. The EVT shows that by founding a series of a_n and b_n, the maxima can be converted to be the general extreme value distribution (GEV) G (Coles, 2001; Beirlant, 2004):

$$G(x; b, a, \xi) = exp\left\{-\left[1 + \xi\left(\frac{x-b}{a}\right)\right]^{-1/\xi}\right\}. \quad (2.1)$$

Where ξ is the shape parameter explaining the behavior of the tail of the distribution. When $\xi < 0$ the distribution is the Weibull, $\xi > 0$ the Fréchet, and $\xi = 0$ the Gumbel.

2.3 Bivariate block maxima

The bivariate block maxima model could be investigated using the non-parametric and parametric approaches. We use the parametric approach in this study to investigate the tail dependence between the prices of crude oil and ethanol with the bivariate BM, which is provided below (Chuangchid et al, 2012):

Let (X, Y) be a bivariate random vector of the maxima which is an i.i.d. sequence for a certain time period. Let the distribution of (X, Y) be the bivariate extreme value distribution (BEVD) that is approximated with the cumulative distribution function (cdf) G. The BEVD is investigated by margins G_1 and G_2, which are necessarily EVD, by using its Pickands dependence function A (Rakonzai and Tajvidi, 2010):

$$G(x, y) = \exp\left\{\log\big(G_1(x)G_2(y)\big)\, A\left(\frac{\log(G_2(y))}{\log(G_1(x)G_2(y))}\right)\right\}. \quad (2.2)$$

Let, A(t) be the stracture of the dependence of the margins. The Pickands dependence function A is necessarily convex and is inside the triangle assigned by the points (0, 1), (1, 1), and (1/2, 1/2). A(t) shows the following:

1) $A(t)$ is convex;

2) $max\{(1-t), t\} \leq A(t) \leq t$; and

3) $A(0) = A(1) = 1$.

In the second property of A, $G(x,y) = min\{G_1(x), G_2(y)\}$, whereas the upper bound corresponds to (complete) independence.

2.4 Parametric Models of Copulas

2.4.1 Gumbel copula (logistic copula)

Invented by Gumbel (1960), the Gumbel or logistic, copula is the oldest of the EVC models. It belongs to both the extreme value and the Archimedean copulas. The dependence function A(w) is given as follws:

$$A(w) = [(1-w)^r + w^r]^{1/r}, \tag{2.3}$$

Where $r \geq 1$. The parameter r is the degree of dependence, ranging from complete independence ($r = 1$) to complete dependence ($r = \infty$). Therefore, the Gumbel extreme value copula is given as

$$C(u_1,u_2) = \exp\left\{-[(-\ln u_1)^r + (-\ln u_2)^r)^{1/r}\right\}. \tag{2.4}$$

2.4.2 Galambos copula (negative logistic model)

Let, $\hat{C}_\phi$ be the distribution of the (1-U1,…, 1-Ud) random vector. The tail dependence function could be written as follow:

$$C_*(u_1,\dots,u_k) = exp\left[-\sum_{\substack{J\subset\{1,\dots,k\}\\ |J|\geq 2}} (-1)^{|J|}\left\{\sum_{j\in J}(-logu_j)^{-\alpha}\right\}^{-1/\alpha}\right]\prod_{j=1}^{k} u_{j,} \quad \alpha > 0,. \tag{2.5}$$

2.4.3 Tawn copula (asymmetric logistic copula)

The Tawn copula, or the (asymmetric logistic copula,) is much more flexible and combine several existing models such as the logistic($\emptyset = \theta = 1$), a mixture of logistic and independence models. Complete dependence corresponds to $\emptyset = \theta = 1$ and $r = \infty$, whereas complete independence corresponds to $\emptyset = 0$ or $\theta = 0$ or r=1. The dependence function is as follows:

$$A(w) = [\theta^r(1-w)^r + \emptyset^r w^r]^{1/r} + (0-\emptyset)w + 1 - \theta, \quad (2.6)$$

with $\emptyset \leq 1$ or $\theta \geq 0$ and $r \geq 1$, and the copula function

$$C(u_1, u_2) = \exp\left\{\ln u_1^{1-\theta} + \ln u_2^{1-\phi} - [(-\theta \ln u_1)^r + (-\phi \ln u_2)^r]^{1/r}\right\}. \quad (2.7)$$

2.4.4 Husler-Reiss (HR) copula

The drawbacks of the logistic and the negative logistic copulas are that they are too limited for large dimensional problems since the dependence is described only by a single parameterθ. However, the HR copula does not have this problem; we give the corresponding distribution of the bivariate case:

$$C_*(u_1, u_2) = exp\left[\Phi\left\{\frac{a}{2} + \frac{1}{a}\log\left(\frac{log u_2}{log u_1}\right)\right\}\log u_1 + \Phi\left\{\frac{a}{2} + \frac{1}{a}\log\left(\frac{\log u_1}{\log u_2}\right)\right\}\log u_2\right], \quad (2.8)$$

where Φ is the standard normal cumulative distribution function.

In our case, specifically, let u_1 be the ethanol price return marginal and "v" be the crude oil price marginal. We apply from the above mentioned discussion the four EV copulas to calculate the dependence of the two energy prices.

2.5 Kendall tau Dependence Measure

The Kendall tau can be expressed uniquely in terms of the copula; it is in the range [-1, 1].

$$\tau = 4\int_0^1 \int_0^1 C(u, v)\, dC(u, v) - 1. \quad (2.9)$$

Especially, in terms of the dependence function A, the particular Kendall tau is given as follows:

$$\tau = \int_0^1 \frac{t(1-t)}{A(t)} A''(t)dt. \tag{2.10}$$

For the EV copula, the Kendall tau can be explicated to be the best choice for the dependence function and the linear correlation coefficient.

2.6 Extreme Value Copulas

Extreme value copulas could be analyzed to find suitable models to obtain the dependence structure of the extreme values, with the presence of the component wise maxima. Here, we consider the bivariate case for our specific problem. Let $X_i = (X_{i1}, X_{i2}), i \in \{1,...,n\}$ be an i.i.d. sample random vectors with general distribution function F, margins F_1, F_2, and copula C_F. F is assumed to be continuous. Consider the vector of the component wise maxima:

$$M_n = (M_{n,1}, M_{n,2}), \qquad where\ M_{n,j} = \bigvee_{i=1}^{n} X_{ij}. \tag{2.11}$$

Because the joint functions of M_n are given by F^n and the marginal distributions are expressed by F_1^n, F_2^n, the copula is C_n of M_n:

$$C_n(u_1, u_2) = C_F(u_1^{1/n}, u_2^{1/n})^n. \tag{2.12}$$

It is clear that the extreme value copula is the same as the Generalized Extreme Value (GEV) distribution, which shares the max-stable property (Gudendorf and Segers, 2009). Therefore, the simple of extreme- value copulas could be obtained by employing the max-stability. Also, we can see from the literature studies that copula is max-stable if and only if it is an extreme- value copula. The understanding of extreme value copula is when we know the maxima distribution; here, we know the joint

maxima distribution. This is the point at which the extreme value copula is different from other copulas, and also gives the evidence to use the GEV as the margin.

2.7 Literature Review

Martin Schlather (2001) studied those bivariate distributions that have their focus on the tail behavior by using Frechet margins, which can be distinguished by the coefficient about tail dependence and a weakened varying function. The feature is possible sometimes, and it is not denoted by the fact that the domain of attraction is focused on the distribution location of a bivariate extreme value distribution.

Results have shown that bivariate distributions, whose intensities are provided as a mixture of the densities of two Frechet variables in two, are completely independent and have two independent variables. The four members of this level have illustrated that the coefficient about tail dependence and the membership in the dominion of temptation of an extreme value distribution have two undiagnosed properties of distributions upon using unit Frechet margins.

SimlaTokgoz and Amani Elobeid (2006) studied the effect of price shocks in three output and input markets that are significant to ethanol: corn, sugar, and gasoline. The work examined the impact of shocks of these markets on ethanol and correlated agricultural markets in Brazil and the United States.

Their results show that the constituent of a country is a vehicle that defines the guidance for explaining ethanol consumption to the differentiation in gasoline price. Changes in feedstock costs influence the profitability of ethanol production and the household price of ethanol. In Brazil, commodities are influenced by sugarcane; thus, any changes in the sugar market influence the competing ethanol market.

Erik Brodin and Holger Rootzén (2008) studied hurricane and wind storm risks. This study developed extreme value methods that can be made applicable to storm insurance. The methods were used for the losses from 1982 to 2005 incurred by the

biggest Swedish insurance company by using both a new bivariate and a univariate Generalized Pareto Distribution (GPD). The bivariate model led to reduced measures of risk, except for extreme events.

Their results demonstrate that the bivariate model offered a more substantive picture of real inaccuracies. Moreover, this model enabled the analysis of the effects of changes in the insurance portfolio, and showed that losses are somewhat unlinked to portfolio changes. In addition, it was observed that there was a low trend in the sizes of small personal claims.

Pa ́l Rakonczai and Nader Tajvidi (2010) studied the modeling of extremes values, that is, multivariate peaks over threshold and extreme value distribution models, using multivariate generalized Pareto distributions. These models were compared in their ability to forecast extremes in wind speed data in many German cities. When using such extreme cases, fitting univariate margins requires some knowledge about the dependence structure.

Their results show that parametric cases of the bivariate maxima are completely developed. Another alternative way to model the dependence was gotten from non-parametric dependence functions. Investigating only the maxima can conceal the time feature inside the given period. Both exceedances and maxima have been used for bivariate datasets occurring from the wind time series that was estimated in northern Germany.

Kantaporn Chuangchid, Aree Wiboonpongse, Songsak Sriboonchitta and Chukiat Chaiboonsri (2012) studied the dependence structure of the extreme value of growth rate between factors having an effect on palm oil prices, which are crude oil price and soybean oil price, by using the Bivariate Extreme Value method. The data were taken from the daily soybean oil, crude oil, and palm oil prices ranging from July 1988 to January 2012.

Results show that the relationship between palm and soybean prices has some dependence at extreme price levels. But the growth rates of crude oil price and palm oil prices have only weak dependence at extreme price levels.

Mutita Kaewkheaw, Pisit Leeahtam, and Chukiat Chaiboosri (2012) studied the behavior of the U.S. dollar index and gold price. Their work employed bivariate extreme value copulas for illustrating the dependence structure between the return of the U.S. dollar index and gold price.

The results show that the returns on the U.S. dollar index and gold price are independent.

Ribatet Mathieu and Sedki Mohammed (2012) studied max-stable processes and extreme value copulas. The problem encountered was in modeling extreme values. The extreme value theory shows how to analyze max-stable distributions and set some limitations on the copulas to be managed. While the theory for multivariate extremes is well defined, it's normally guided outside the copula framework. Their paper focused on an application of modeling on extreme temperatures in Switzerland.

Valeri Natanelov, Andrew M. McKenzie, and Guido Van Huylenbroeck (2013) examined the relationships between ethanol, crude oil and corn prices during the period between 2006 and 2011 by using a holistic mapping of the present market situation and a contextual analytical design.

The results showed that the corn and crude oil markets have a strong relationship on one side, and the ethanol and crude oil markets on the other. Moreover, the price relationship between ethanol and corn is driven by the U.S. government fuel policy. Their analysis indicates that the corn market fluctuates in tandem with the levels of ethanol production. Therefore, when crude oil and/or corn prices are high, the situation leads to a competitive market for ethanol.

Chapter 3

Methodology

3.1 Data

The data have been gathered from the Chicago Ethanol Spot data (USD per barrel) and the North Sea (Forties) spot Crude Oil (USD per barrel). The data are 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. The daily return was computed as $R_{i,t} = \ln(p_{i,t} / p_{i,t-1})$, where $P_{i,t}$ and $P_{i,t-1}$ are the daily spot prices for days "t" and "t-1" for market i.

3.2 Conceptual Framework

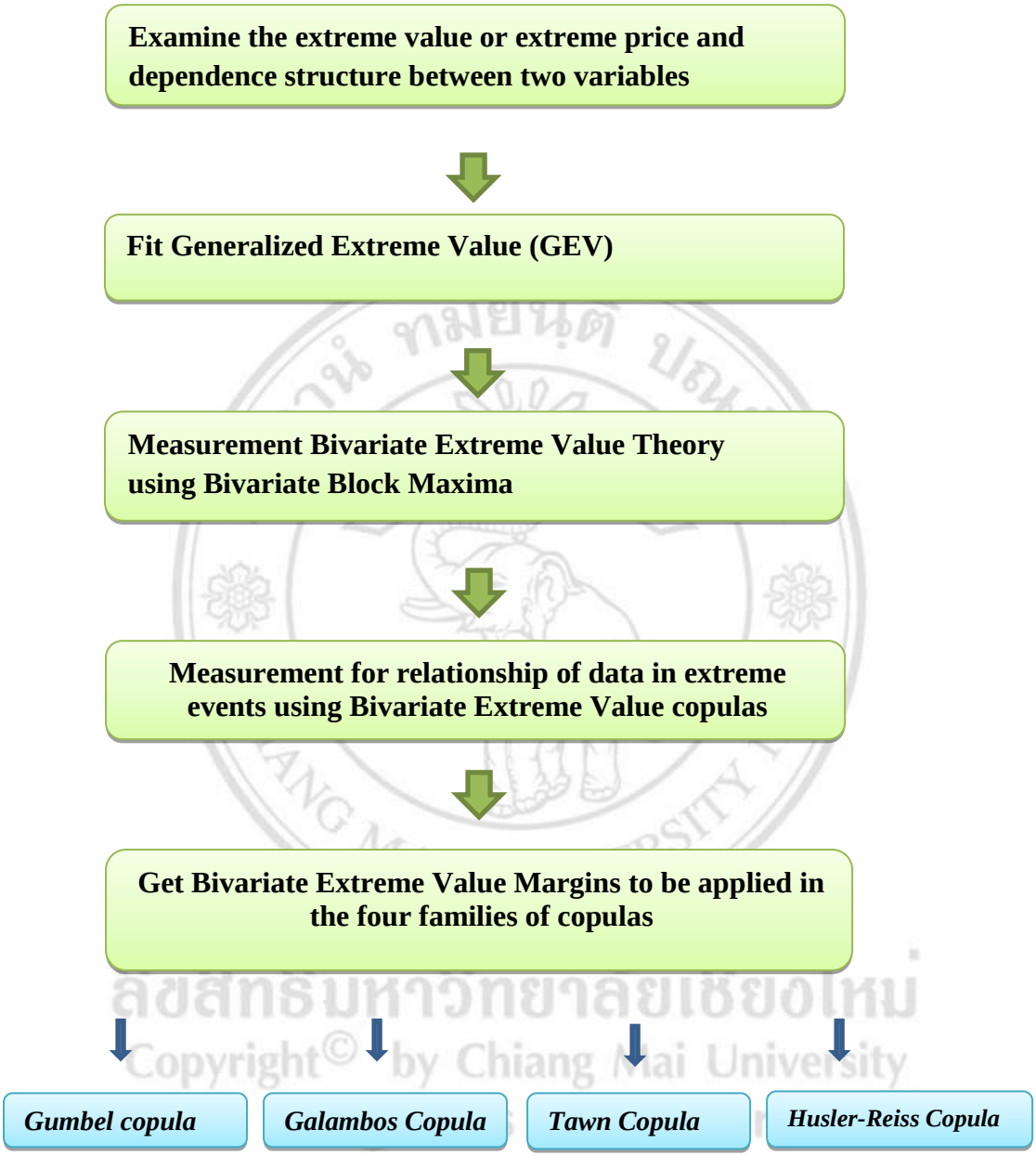

Figure 3.1 The conceptual framework

3.3 Research Methodology

3.3.1 Generalized Extreme Value (GEV) distribution

For a single margin, M_i is the maxima sequence, which is the same as defined before, and "i" is the number of blocks. F is the general price distribution, and G is the asymptotic extreme value distribution. The EVT shows that by founding a series of a_n and b_n, the maxima can be converted to the general extreme value distribution (GEV) G (Coles, 2001; Beirlant, 2004), given as follows:

$$G(x; b, a, \xi) = exp\left\{-\left[1 + \xi\left(\frac{x-b}{a}\right)\right]^{-1/\xi}\right\}. \quad (3.1)$$

Where ξ is the shape parameter explaining the behavior of the tail of the distribution. When $\xi < 0$ the distribution is the Weibull, $\xi > 0$ the Fréchet, and $\xi = 0$ the Gumbel.

3.3.2 Bivariate block maxima

The bivariate block maxima model is investigated with non-parametric and parametric cases. The parametric models that can summarize the bivariate BM are provided below (Chuangchid et al, 2012):

$$G(x, y) = exp\left\{\log\left(G_1(x)G_2(y)\right) A\left(\frac{\log(G_2(y))}{\log(G_1(x)G_2(y))}\right)\right\}, \quad (3.2)$$

where x = ethanol price, y = crude oil price

G_1 = margin of ethanol price

G_2 = margin of crude oil price

A(t) = dependence structure between the margins of ethanol price and crude oil price, which is as follows:

1) A(t) is convex:

2) $max\{(1-t), t\} \leq A(t) \leq t$; and

3) A(0) = A(1) = 1.

The second property shows that the lower bound corresponds to the complete dependence $G(x,y) = \min\big(G_1(x)G_2(y)\big)$, whereas the upper bound corresponds to (complete) independence $G(x,y) = \big(G_1(x)G_2(y)\big)$.

For A(t), this paper chose one parametric model from nine models, using minimum Akaike Information Criterion (AIC) in the bivariate block maxima case. The nine parametric models are given in the following discussion, where "x" is the ethanol price, "y" is crude oil price, and "r" is the parameter of dependence between the ethanol price and the crude oil price (Stephenson, 2011).

1. Model Number 1 = "log" (Gumbel, 1960).

$$G(x,y) = \exp\left[-\left(x^{\frac{1}{r}} + y^{\frac{1}{r}}\right)^r\right], \quad (3.3)$$

where $0 < r \leq 1$. Complete independence is obtained when r = 1. Complete dependence is when $r \to 0$.

2. Model Number 2 = "alog" (Tawn, 1988)

$$G(x,y) = \exp\{-(1-t_1)x - (1-t_2)y - [(t_1x)^{1/r} + (t_2y)^{1/r}]^r\}, \quad (3.4)$$

where $0 < r < 1$ and $0 \leq t_1, t_2 \leq 1$. When $t_1 = t_2 = 1$, the asymmetric logistic model becomes equivalent to the logistic model. When r = 1, and either $t_1 = 0$ or $t_2 = 0$, there is said to be complete independence. When $t_1 = t_2 = 1$ and, $r \to 0$, there is said to be complete dependence.

3. Model Number 3 = "hr" (Husler and Reiss, 1989)

$$G(x,y) = \exp\left(-y_1\Phi\left\{r^{-1} + \tfrac{1}{2}r[log(x/y)]\right\} - y_2\Phi\left\{r^{-1} + \tfrac{1}{2}r[log(y/x)]\right\}\right) \quad (3.5)$$

$\Phi(\cdot)$ is the standard normal distribution function and r > 0.

When r reaches zero ($r \to 0$), there is said to be independence.

When r moves to infinity, it can be said that there is complete dependence.

4. Model Number 4 = "neglog" (Galambos, 1975)

$$G(x,y) = \exp\left[-(x - y + [x^{-r} + y^{-r}])^{-1/r}\right], \tag{3.6}$$

where r > 0. In the limit, as $r \to 0$, it denotes complete independence.

When r moves to infinity, there is said to be complete dependence.

5. Model Number 5 = "aneglog" (Joe, 1990)

$$G(x,y) = \exp\left[-x - y + [(t_1x)^{-r} + (t_2y)^{-r}]^{-1/r}\right] \tag{3.7}$$

where r > 0 and $0 < t_1, t_2 \leq 1$. When either t_1= 0 or t_2 =0, and r reaches 1, there is said to be complete independence. When $t_1 = t_2 = 1$ and r moves to infinity, it can be said that there is complete dependence. When t_1 and t_2 = are fixed, and r moves to infinity, then these are different limits.

6. Model Number 6 = "bilog" (Smith, 1990)

The equation foe the parameters α and β is

$$G(x,y) = \exp\{-xq^{1-\alpha} - y(1-q)^{1-\beta}\}, \tag{3.8}$$

where$q = q(x,y;\ \alpha,\beta)$ is the root of the equation

$$(1-\alpha)x(1-q)^{\beta} - (1-\beta)yq^{\alpha} = 0, \tag{3.9}$$

and $0 < \alpha, \beta < 1$. When $\alpha = \beta$, the bilogistic model equals the logistic model with the dependence parameter, dependence $= \alpha = \beta$. When $\alpha = \beta$ reaches 0, there is said to be complete dependence. When one of α, β is fixed and the other reaches 1, difference limits are said to happen. Independence is obtained as $\alpha = \beta$ approaches 1.

7. Model Number 7 = "negbilog" (Coles and Tawn, 1994)

The equation for α and β is

$$G(x,y) = \exp\{-x - y + xq^{1+\alpha} + y(1-q)^{1+\beta}\}, \quad (3.10)$$

where $q = q(x,y;\ \alpha,\beta)$ is the root of the equation

$$(1+\alpha)xq^{\alpha} - (1+\beta)y(1-q)^{\beta} = 0, \quad (3.11)$$

and $\alpha > 0$ and $\beta > 0$. When $\alpha = \beta$, the negative bilogistic model equals the negative logistic model with dependence parameter = $1/\alpha = 1/\beta$. In the limit, as $\alpha = \beta$ reaches 0, there is said to complete dependence. When $\alpha = \beta$ moves to infinity, and when one of α, β is fixed and the other moves to infinity, it can be said that there is independence.

8. Model Number 8 = "ct" (Coles and Tawn, 1994)

Let the parameters be $\alpha > 0$ and $\beta > 0$

$$G(x,y) = \exp\big[-x[1 - Be(q;\alpha+1,\beta)] - y[1 - Be(q;\alpha+\beta,1)]\big], \quad (3.12)$$

where $q = \alpha y/(\alpha y + \beta x)$ and $Be(q;\alpha,\beta)$ is the beta distribution function evaluated at q with shape 1 = α and shape 2 = β. In the limit, as $\alpha = \beta$ moves to infinity, there is said to be complete dependence. When $\alpha = \beta$ reaches zero, and when one of α, β is fixed and the other reaches 0, it can be said that there is independence.

9. Model Number 9 = "amix" (Tawn, 1988)

Let the parameters α and β have a dependence function in the following cubic polynomial form:

$$A(t) = 1 - (\alpha + \beta)t + \alpha t^2 + \beta t^3, \tag{3.13}$$

where $\alpha \geq 0$ and $(\alpha + 3\beta) \geq 0, (\alpha + \beta) \leq 1$ and $(\alpha + 2\beta) \leq 1$. The beta then lies in the interval [-0.5, 0.5] and the alpha in [0, 1.5]. The alpha could be larger than 1 if $\beta < 0$. When both the parameters are zero, it can be said that there is independence.

3.3.3 Parametric models of copulas

3.3.3.1 Gumbel copula (logistic copula)

Invented by Gumbel (1960), the Gumbel or logistic, copula is the oldest of the EVC models. It belongs to both the Archimedean and the extreme value copulas. The dependence function A(w) is given as follows:

$$A(w) = [(1-w)^r + w^r]^{1/r}, \tag{3.14}$$

where $r \geq 1$. The parameter r measures the degree of dependence, ranging from complete independence ($r = 1$) to complete dependence ($r = \infty$). Therefore, the Gumbel extreme value copula is given as

$$C(u_1, u_2) = \exp\left\{-[(-\ln u_1)^r + (-\ln u_2)^r)^{1/r}\right\}. \tag{3.15}$$

3.3.3.2 Galambos copula (negative Logistic Model)

Let, $\hat{C}_\phi$ be the distribution of the (1-U1,…, 1-Ud) random vector. The tail dependence function could be written as follow:

$$C_*(u_1,\dots,u_k) = exp\left[-\sum_{\substack{J\subset\{1,\dots,k\}\\ |J|\geq 2}}(-1)^{|J|}\left\{\sum_{j\in J}(-logu_j)^{-\alpha}\right\}^{-1/\alpha}\right]\prod_{j=1}^{k}u_{j,}\quad \alpha>0. \tag{3.16}$$

3.3.3.3 Tawn copula (asymmetric logistic copula)

The Tawn copula, or (asymmetric logistic copula), is much more flexible and combine several existing models such as the logistic model ($\emptyset = \theta = 1$), and a mixture of logistic and independence models. Complete dependence corresponds to $\emptyset = \theta = 1$ and $r = \infty$, whereas complete independence corresponds to $\emptyset = 0$ or $\theta = 0$ or r=1. The dependence function is as follows:

$$A(w) = [\theta^r(1-w)^r + \emptyset^r w^r]^{1/r} + (0-\emptyset)w + 1 - \theta, \tag{3.17}$$

with $\emptyset \leq 1$ or $\theta \geq 0$ and $r \geq 1$, and the copula function

$$C(u_1,u_2) = \exp\left\{\ln u_1^{1-\theta} + \ln u_2^{1-\phi} - [(-\theta\ln u_1)^r + (-\phi\ln u_2)^r]^{1/r}\right\}. \tag{3.18}$$

3.3.3.4 Husler-Reiss (HR) copula

The drawbacks of the logistic and the negative logistic copulas are that they are too limited for large dimensional problems since the dependence is described only by a single parameter θ. However, the HR copula does not have this problem; we give the corresponding distribution of the bivariate case:

$$C_*(u_1,u_2) = exp\left[\Phi\left\{\frac{a}{2}+\frac{1}{a}\log\left(\frac{logu_2}{logu_1}\right)\right\}\log u_1 + \Phi\left\{\frac{a}{2}+\frac{1}{a}\log\left(\frac{\log u_1}{\log u_2}\right)\right\}\log u_2\right], \tag{3.19}$$

where Φ is the standard normal cumulative distribution function.

In our case, specifically, let u1 be the ethanol price return marginal and "v" be the crude oil price marginal. We apply from the above mentioned discussion the four EV copulas to calculate the dependence of the two energy prices.

3.3.4 Kendall tau Dependence Measure

The Kendall tau can be expressed uniquely in terms of the copula; it is in the range [-1, 1].

$$\tau = 4 \int_0^1 \int_0^1 C(u, v)\, dC(u, v) - 1. \tag{3.20}$$

Especially, in terms of the dependence function A, the particular Kendall tau is given as follows:

$$\tau = \int_0^1 \frac{t(1-t)}{A(t)} A''(t) dt. \tag{3.21}$$

3.3.5 Extreme value copulas

Extreme value copulas could be analyzed to find suitable models to obtain the dependence structure of the extreme values, with the presence of the component wise maxima. Here, we consider the bivariate case for our specific problem. Let $X_i = (X_{i1}, X_{i2}), i \in \{1, ..., n\}$ be an i.i.d. sample random vectors with general distribution function F, margins F_1, F_2, and copula C_F. F is assumed to be continuous. Consider the vector of the component wise maxima:

$$M_n = (M_{n,1}, M_{n,2}), \quad where\ M_{n,j} = \bigvee_{i=1}^{n} X_{ij}, \tag{3.22}$$

Because the joint functions of M_n are given by F^n, and the marginal distributions are expressed by F_1^n and F_2^n, the copula is C_n of M_n:

$$C_n(u_1, u_2) = C_F(u_1^{1/n}, u_2^{1/n})^n. \tag{3.23}$$

It is clear that the extreme value copula is the same as the Generalized Extreme Value (GEV) distribution, which shares the max-stable property (Gudendorf and Segers, 2009). Therefore, the simple of extreme- value copulas could be obtained by employing the max-stability. Also, we can see from the literature studies that copula is max-stable if and only if it is an extreme- value copula. The understanding of extreme value copula is when we know the maxima distribution; here, we know the joint maxima distribution. This is the point at which the extreme value copula is different from other copulas, and also gives the evidence to use the GEV as the margin.

Chapter 4

Empirical Results

4.1 Statistical Summary

Figure 4.1 shows the close relationship between the changes in ethanol prices and the changes in crude oil prices from late 2005 through 2009, when rapid expansion of the ethanol industry was taking place. In 2008, international crude oil price registered an incidence of extreme volatility and became a hot issue because the price had risen up to more than 100 dollars per barrel. In the second half of 2008, the crude oil price came tumbling down from the peak to just 33 dollars per barrel due to the severe financial crisis and economic recession that was caused by the American subprime crisis. Since we used the block maxima method, in which the block length is a calendar month (around 22 days), we received 38 maxima. Table 4.1 shows the descriptive statistics of the two energy commodity prices returns maxima.

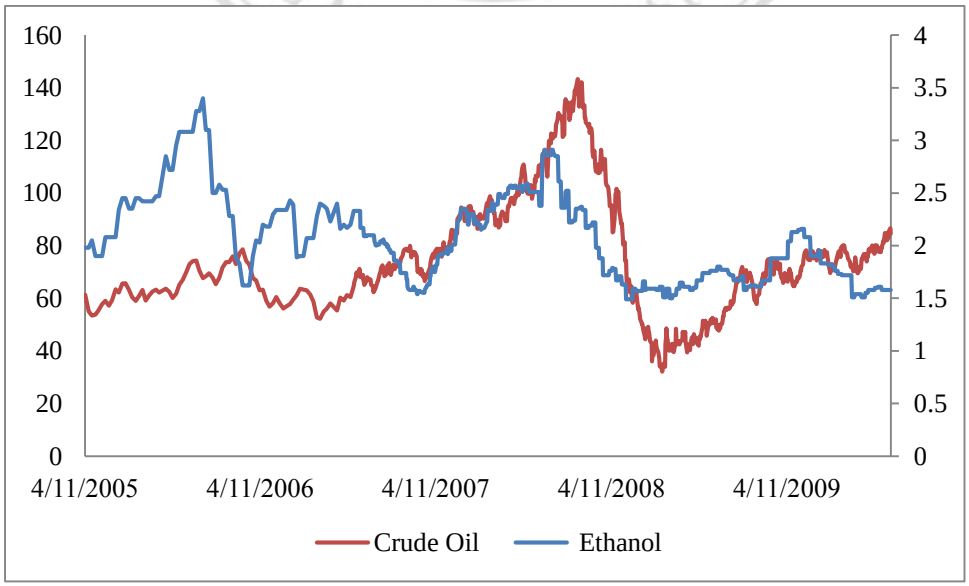

Figure 4.1 The co-movement of crude oil and ethanol price

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

Table 4.1 Statistical Summary of Ethanol Price and Crude Oil Price Returns

	Ethanol	Crude Oil
Minimum	-0.234	-0.180
Median	0.000	0.001
Mean	0.000	0.000
Maximum	0.159	0.220
Std. Dev.	0.026	0.030
Skewness	-1.751	0.064
Kurtosis	22.638	5.512
Jarque-Bera	18443.560	1070.874
Probability	0.000	0.000
Observation	839	839

The descriptive statistics test (see Table 4.1) showed that the returns of the ethanol prices are skewed to the right tail while the returns of the crude oil prices are almost symmetric, and that the excess Kurtosis is larger than zero. Therefore, the two distributions are in a higher peak when they are compared to the normal distribution. By using the Jarque-Bera test, we rejected the null hypothesis of a normal distribution at the 5% level for both the distributions. Therefore, we concluded that using an extreme value distribution was suitable for our study. The correlation between the two spot price returns is -0.035, which is very weak. But the dependence may be greater when we measure the dependence in the tail.

4.2 Empirical Results

The empirical results can be checked in Table 4.2. In the margin estimation, as we all know, the shape parameter ξ governs the tail behavior of the distribution. The sub-families defined by $\xi = 0$, $\xi > 0$, and $\xi < 0$ correspond, respectively, to the Gumbel, Fréchet, and Weibull families. In our case, the shape parameters are both greater than zero; therefore, the two margins are heavy-tailed: this again justifies the usefulness of the GEV distribution. In the dependence part, we compared the four copulas by using the AIC criterion. The HR copula is the best among them. The dependence parameter

is equal to 0.465 and also significant. The dependence structure can be seen in Figure 4.2.

Table 4.2 The Estimation Results of Four Extreme Value Copulas

	Gumbel Copula		Galambos Copula		Tawn Copula		Husler-Reiss Copula	
	Ethanol	Oil	Ethanol	Oil	Ethanol	Oil	Ethanol	Oil
μ	0.034	0.042	0.034	0.041	0.034	0.042	0.034	0.042
	(0.005)***	(0.003)***	(0.005)***	(0.003)***	(0.005)***	(0.003)***	(0.005)***	(0.003)***
σ	0.029	0.0159	0.029	0.0159	0.029	0.016	0.029	0.015
	(0.005)***	(0.003)***	(0.005)***	(0.003)***	(0.005)***	(0.003)***	(0.005)***	(0.003)***
ξ	0.433	0.39	0.432	0.378	0.415	0.409	0.426	0.371
	(0.147)***	(0.194)***	(0.158)***	(0.195)***	(0.139)**	(0.203)**	(0.171)***	(0.193)**
r	1.076(0.157)**		0.239(0.33)		0.246(0.352)		0.465(0.164)***	
AIC	325.978		325.778		325.902		325.738	

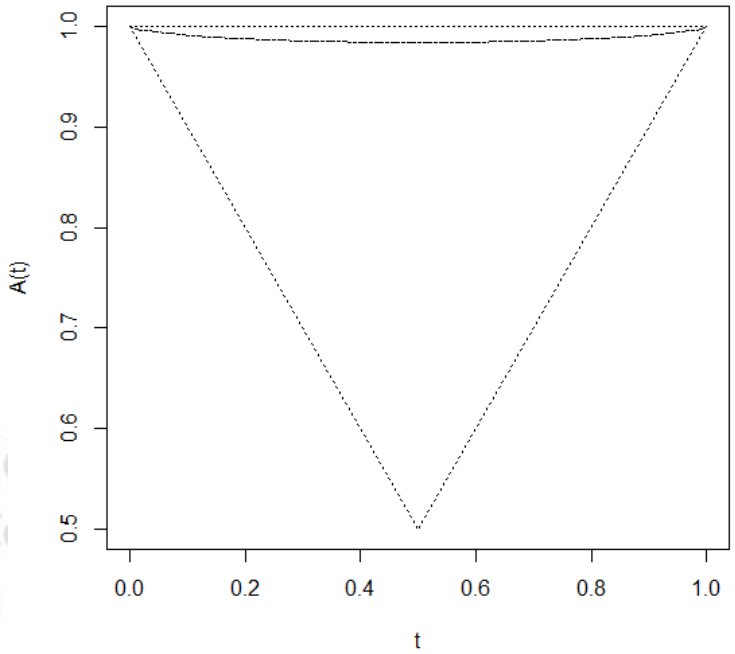

Figure 4.2 The dependence function of the returns between ethanol price return and crude oil price return, using the HR copula.

The dependence function of A(t) of the HR copula is presented in Figure 4.2. Based on the table, we see that the results are consistent with the Kendall tau measure (= 0.02), which we have calculated and presented in Table 4.2. The dependence is close

to the upper bound of A(t), and the dependence structure between the oil price and the ethanol price is weak, as we expected.

4.3 Goodness of Fit of Extreme Value Copula

For this part of the study, we used the Cramér–von Mises statistics to test whether or not our data were fit for the selected EV copula: the details of the statistics can be found in the work by Genest, Kojadinovic, G. Nešlehová, and Yan (2010). The statistic is as follows:

$$S_n = \int_0^1 n|A_n(t) - A_{\theta n}(t)|^2 \, dt. \quad (12)$$

The results are demonstrated in Table 4.2. Since the null hypothesis of Cramér–von Mises is the data fit for the specific copulas, all of the copula, except for the Tawn copula, do not reject the null hypothesis.

Table 4.3 Cramér–von Mises Statistics

	Gumbel Copula	Galambos Copula	Tawn Copula	Husler-Reiss Copula
the statistics	0.042	0.029	0.150	0.023
p-value	0.348	0.462	0.016	0.490

Note: The p-value was obtained by using a boots tapping process.

Chapter 5

Conclusions

5.1 Conclusion

It is important to know the dependence structure of the dependence between the two energy spot prices since that structure can have an impact on both current energy policy and future policies. Our empirical results show that after 2009, the dependence relationship between oil and ethanol prices in the U.S. was weak. There are several reasons for using the extreme value copula to characterize the dependence between the two variables: First, using the copula makes it possible to avoid the unsatisfying assumption of independence; this method can capture nonlinear relationship. Second, the extreme value copula provides for modeling the dependence between the constitutive relation parameters of a random couple which illustrate the greatest values of two properties considered over the same period of time. This is an important issue in our study because the extreme tail dependence and co-movement of prices of traditional energy and new energy is a subject matter that calls for close attention and analysis.

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Appendices

Appendix A

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."

	ew:usa25845			ew:com21105	
	United States, Energy, Bio-fuel, Ethanol, Spot Chicago, USD			World, Energy, Oil, Crude Oil - North Sea (Forties), Spot, Close, USD	
	Etanol Price ($P_{i,t}$)	Return of Ethanol price ($P_{i,t-1}$)		Crude oil Price ($P_{i,t}$)	Return of Crude oil price ($P_{i,t-1}$)
11/4/2005	1.98	Ethanol	11/4/2005	61.38	Crude oil
11/11/2005	1.98	0	11/11/2005	54.95	-0.11066
11/18/2005	2.05	0.034743	11/18/2005	53.44	-0.02786
11/25/2005	1.9	-0.07599	11/25/2005	53.75	0.005784
12/2/2005	1.9	0	12/2/2005	55.51	0.03222
12/9/2005	1.9	0	12/9/2005	57.83	0.040944
12/16/2005	2.08	0.090514	12/16/2005	59.06	0.021046
12/23/2005	2.08	0	12/23/2005	57.23	-0.03148
12/30/2005	2.08	0	12/30/2005	59.29	0.035362
1/6/2006	2.08	0	1/6/2006	63.38	0.066708
1/13/2006	2.34	0.117783	1/13/2006	62.13	-0.01992

1/20/2006	2.45	0.045937	1/20/2006	65.62	0.054652
1/27/2006	2.45	0	1/27/2006	65.65	0.000457
2/3/2006	2.35	-0.04167	2/3/2006	63.19	-0.03819
2/10/2006	2.35	0	2/10/2006	60.31	-0.04665
2/17/2006	2.45	0.041673	2/17/2006	58.99	-0.02213
2/24/2006	2.45	0	2/24/2006	60.78	0.029893
3/3/2006	2.42	-0.01232	3/3/2006	63.09	0.037301
3/10/2006	2.42	0	3/10/2006	59.19	-0.06381
3/17/2006	2.42	0	3/17/2006	61.14	0.032414
3/24/2006	2.42	0	3/24/2006	62.54	0.02264
3/31/2006	2.47	0.020451	3/31/2006	63.27	0.011605
4/7/2006	2.47	0	4/7/2006	62.22	-0.01673
4/21/2006	2.85	0.143101	4/21/2006	63.69	0.023351
4/28/2006	2.72	-0.04669	4/28/2006	62.45	-0.01966
5/5/2006	2.72	0	5/5/2006	60.11	-0.03819
5/12/2006	2.95	0.081173	5/12/2006	61.63	0.024973
5/19/2006	3.08	0.043124	5/19/2006	65.13	0.055237
5/26/2006	3.08	0	5/26/2006	66.99	0.028158
6/2/2006	3.08	0	6/2/2006	69.74	0.040231
6/9/2006	3.08	0	6/9/2006	73.04	0.046233
6/16/2006	3.08	0	6/16/2006	74.04	0.013598
6/23/2006	3.28	0.062914	6/23/2006	74.31	0.00364
6/30/2006	3.28	0	6/30/2006	70.41	-0.05391
7/7/2006	3.4	0.035932	7/7/2006	67.67	-0.03969
7/13/2006	3.1	-0.09237	7/13/2006	68.32	0.00956
7/20/2006	3.1	0	7/20/2006	69.47	0.016692
7/27/2006	2.5	-0.21511	7/27/2006	67.9	-0.02286
8/3/2006	2.5	0	8/3/2006	65.32	-0.03874
8/10/2006	2.58	0.031499	8/10/2006	67.72	0.036083
8/17/2006	2.53	-0.01957	8/17/2006	71.71	0.057249
8/24/2006	2.53	0	8/24/2006	73.72	0.027644
8/31/2006	2.28	-0.10404	8/31/2006	73.69	-0.00041
9/7/2006	2.28	0	9/7/2006	75.87	0.029154
9/14/2006	1.88	-0.1929	9/14/2006	73.04	-0.03801
9/21/2006	1.83	-0.02696	9/21/2006	77.04	0.053318

9/28/2006	1.62	-0.12189	9/28/2006	78.58	0.019792
10/5/2006	1.62	0	10/5/2006	74.22	-0.05708
10/12/2006	1.62	0	10/12/2006	72.71	-0.02055
10/19/2006	1.9	0.159428	10/19/2006	67.66	-0.07198
10/26/2006	2.05	0.075986	10/26/2006	66.79	-0.01294
11/2/2006	2.03	-0.0098	11/2/2006	62.98	-0.05874
11/9/2006	2.2	0.080422	11/9/2006	63.27	0.004594
11/16/2006	2.18	-0.00913	11/16/2006	59.03	-0.06937
11/23/2006	2.18	0	11/23/2006	56.78	-0.03886
11/30/2006	2.3	0.053584	11/30/2006	58.15	0.023842
12/7/2006	2.34	0.017242	12/7/2006	60.48	0.039287
12/14/2006	2.34	0	12/14/2006	58	-0.04187
12/21/2006	2.34	0	12/21/2006	56.08	-0.03366
12/28/2006	2.34	0	12/28/2006	56.94	0.015219
1/4/2007	2.43	0.03774	1/4/2007	57.85	0.015855
1/11/2007	2.39	-0.0166	1/11/2007	59.48	0.027787
1/18/2007	1.89	-0.23472	1/18/2007	61.17	0.028017
1/25/2007	1.9	0.005277	1/25/2007	63.6	0.038957
2/1/2007	1.9	0	2/1/2007	63.23	-0.00583
2/8/2007	2.07	0.085695	2/8/2007	63.06	-0.00269
2/15/2007	2.07	0	2/15/2007	61.42	-0.02635
2/22/2007	2.07	0	2/22/2007	58.74	-0.04461
3/1/2007	2.28	0.096627	3/1/2007	52.68	-0.10889
3/8/2007	2.4	0.051293	3/8/2007	52.23	-0.00858
3/15/2007	2.38	-0.00837	3/15/2007	54.88	0.049492
3/22/2007	2.35	-0.01269	3/22/2007	56.11	0.022165
3/29/2007	2.23	-0.05241	3/29/2007	58.04	0.033818
4/12/2007	2.4	0.073467	4/12/2007	55.36	-0.04728
4/19/2007	2.16	-0.10536	4/19/2007	60.23	0.084313
4/26/2007	2.2	0.018349	4/26/2007	59.18	-0.01759
5/3/2007	2.17	-0.01373	5/3/2007	61.18	0.033237
5/10/2007	2.2	0.01373	5/10/2007	60.46	-0.01184
5/17/2007	2.33	0.057411	5/17/2007	64.6	0.066232
5/18/2007	2.33	0	5/18/2007	66.25	0.025221
5/21/2007	2.33	0	5/21/2007	67.59	0.020025

5/22/2007	2.33	0	5/22/2007	68.87	0.018761
5/23/2007	2.33	0	5/23/2007	69.84	0.013986
5/24/2007	2.33	0	5/24/2007	68.45	-0.0201
5/28/2007	2.33	0	5/28/2007	69.6	0.016661
5/29/2007	2.33	0	5/29/2007	71.21	0.022869
5/30/2007	2.33	0	5/30/2007	69.42	-0.02546
5/31/2007	2.17	-0.07114	5/31/2007	67.97	-0.02111
6/1/2007	2.17	0	6/1/2007	68.68	0.010392
6/4/2007	2.17	0	6/4/2007	67.87	-0.01186
6/5/2007	2.17	0	6/5/2007	68.86	0.014481
6/6/2007	2.17	0	6/6/2007	66.92	-0.02858
6/7/2007	2.09	-0.03756	6/7/2007	66.16	-0.01142
6/8/2007	2.09	0	6/8/2007	65.09	-0.01631
6/11/2007	2.09	0	6/11/2007	66.37	0.019474
6/12/2007	2.09	0	6/12/2007	66.54	0.002558
6/13/2007	2.1	0.004773	6/13/2007	66.63	0.001352
6/14/2007	2.1	0	6/14/2007	68	0.020353
6/15/2007	2.1	0	6/15/2007	67.32	-0.01005
6/18/2007	2.1	0	6/18/2007	67.39	0.001039
6/19/2007	2.1	0	6/19/2007	67.23	-0.00238
6/20/2007	2.1	0	6/20/2007	67.18	-0.00074
6/21/2007	2.1	0	6/21/2007	67.05	-0.00194
6/22/2007	2.1	0	6/22/2007	65.22	-0.02767
6/25/2007	2.1	0	6/25/2007	64.5	-0.0111
6/26/2007	2.1	0	6/26/2007	64.79	0.004486
6/27/2007	2.1	0	6/27/2007	62.35	-0.03839
6/28/2007	2.1	0	6/28/2007	63.2	0.013541
6/29/2007	2.04	-0.02899	6/29/2007	62.95	-0.00396
7/2/2007	2	-0.0198	7/2/2007	64.08	0.017792
7/4/2007	2	0	7/4/2007	65.31	0.019013
7/5/2007	2.01	0.004988	7/5/2007	66.24	0.014139
7/6/2007	2.01	0	7/6/2007	66.33	0.001358
7/9/2007	2.01	0	7/9/2007	68.58	0.033359
7/10/2007	2.02	0.004963	7/10/2007	69.31	0.010588
7/11/2007	2.04	0.009852	7/11/2007	69.61	0.004319

7/12/2007	2.04	0	7/12/2007	70.45	0.011995
7/13/2007	2.04	0	7/13/2007	71.61	0.016331
7/16/2007	2.05	0.00489	7/16/2007	72.56	0.013179
7/17/2007	2.05	0	7/17/2007	71.32	-0.01724
7/18/2007	2.06	0.004866	7/18/2007	70.04	-0.01811
7/19/2007	2.02	-0.01961	7/19/2007	70.01	-0.00043
7/20/2007	2.02	0	7/20/2007	68.41	-0.02312
7/23/2007	2.02	0	7/23/2007	68.93	0.007572
7/24/2007	2.02	0	7/24/2007	69.4	0.006795
7/25/2007	1.99	-0.01496	7/25/2007	71.65	0.031906
7/26/2007	2	0.005013	7/26/2007	72.36	0.009861
7/27/2007	2	0	7/27/2007	72.5	0.001933
7/30/2007	1.96	-0.0202	7/30/2007	73.36	0.011792
7/31/2007	1.96	0	7/31/2007	70.39	-0.04133
8/1/2007	1.96	0	8/1/2007	69.2	-0.01705
8/2/2007	1.93	-0.01542	8/2/2007	68.84	-0.00522
8/3/2007	1.93	0	8/3/2007	69.52	0.00983
8/6/2007	1.93	0	8/6/2007	71.68	0.030597
8/7/2007	1.93	0	8/7/2007	72.13	0.006258
8/8/2007	1.93	0	8/8/2007	72.83	0.009658
8/9/2007	1.86	-0.03694	8/9/2007	72.67	-0.0022
8/10/2007	1.86	0	8/10/2007	71.05	-0.02254
8/13/2007	1.86	0	8/13/2007	72.26	0.016887
8/14/2007	1.86	0	8/14/2007	72.49	0.003178
8/15/2007	1.86	0	8/15/2007	72.21	-0.00387
8/16/2007	1.84	-0.01081	8/16/2007	72.26	0.000692
8/17/2007	1.84	0	8/17/2007	72.69	0.005933
8/20/2007	1.84	0	8/20/2007	72.81	0.001649
8/21/2007	1.84	0	8/21/2007	73.07	0.003565
8/22/2007	1.74	-0.05588	8/22/2007	73.75	0.009263
8/23/2007	1.74	0	8/23/2007	75.11	0.018273
8/24/2007	1.74	0	8/24/2007	75.26	0.001995
8/27/2007	1.74	0	8/27/2007	76.25	0.013069
8/28/2007	1.74	0	8/28/2007	77.43	0.015357
8/29/2007	1.74	0	8/29/2007	77.95	0.006693

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9/3/2007	1.74	0	9/3/2007	78.84	0.004577
9/4/2007	1.68	-0.03509	9/4/2007	78.72	-0.00152
9/5/2007	1.68	0	9/5/2007	78.74	0.000254
9/6/2007	1.61	-0.04256	9/6/2007	78.16	-0.00739
9/7/2007	1.59	-0.0125	9/7/2007	77.98	-0.00231
9/10/2007	1.58	-0.00631	9/10/2007	78.35	0.004734
9/11/2007	1.58	0	9/11/2007	79.94	0.02009
9/12/2007	1.58	0	9/12/2007	79.21	-0.00917
9/13/2007	1.58	0	9/13/2007	76.63	-0.03311
9/14/2007	1.58	0	9/14/2007	75.61	-0.0134
9/17/2007	1.58	0	9/17/2007	77.68	0.027009
9/18/2007	1.61	0.018809	9/18/2007	76.98	-0.00905
9/19/2007	1.61	0	9/19/2007	76.47	-0.00665
9/20/2007	1.6	-0.00623	9/20/2007	77.41	0.012217
9/21/2007	1.58	-0.01258	9/21/2007	77.56	0.001936
9/24/2007	1.58	0	9/24/2007	76.54	-0.01324
9/25/2007	1.56	-0.01274	9/25/2007	75.76	-0.01024
9/26/2007	1.54	-0.0129	9/26/2007	73.09	-0.03588
9/27/2007	1.54	0	9/27/2007	70.02	-0.04291
9/28/2007	1.57	0.019293	9/28/2007	70.88	0.012207
10/1/2007	1.57	0	10/1/2007	70.23	-0.00921
10/2/2007	1.56	-0.00639	10/2/2007	69.47	-0.01088
10/3/2007	1.56	0	10/3/2007	71.1	0.023192
10/4/2007	1.56	0	10/4/2007	69.09	-0.02868
10/5/2007	1.56	0	10/5/2007	70.9	0.02586
10/8/2007	1.55	-0.00643	10/8/2007	68.37	-0.03634
10/9/2007	1.55	0	10/9/2007	69.4	0.014953
10/10/2007	1.55	0	10/10/2007	67.87	-0.02229
10/11/2007	1.55	0	10/11/2007	67.43	-0.0065
10/12/2007	1.58	0.01917	10/12/2007	66.53	-0.01344
10/15/2007	1.61	0.018809	10/15/2007	68.13	0.023765
10/16/2007	1.61	0	10/16/2007	68.89	0.011093
10/17/2007	1.63	0.012346	10/17/2007	68.17	-0.01051
10/18/2007	1.63	0	10/18/2007	69.11	0.013695

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10/22/2007	1.63	0	10/22/2007	71.13	0.017014
10/23/2007	1.71	0.047913	10/23/2007	71.96	0.011601
10/24/2007	1.71	0	10/24/2007	73.59	0.022399
10/25/2007	1.76	0.02882	10/25/2007	74.62	0.013899
10/26/2007	1.77	0.005666	10/26/2007	75.42	0.010664
10/29/2007	1.8	0.016807	10/29/2007	76.91	0.019563
10/30/2007	1.8	0	10/30/2007	75.51	-0.01837
10/31/2007	1.75	-0.02817	10/31/2007	75.4	-0.00146
11/1/2007	1.75	0	11/1/2007	77.06	0.021777
11/2/2007	1.75	0	11/2/2007	77.75	0.008914
11/5/2007	1.82	0.039221	11/5/2007	78.44	0.008835
11/6/2007	1.82	0	11/6/2007	78.87	0.005467
11/7/2007	1.82	0	11/7/2007	78.59	-0.00356
11/8/2007	1.9	0.043017	11/8/2007	76.7	-0.02434
11/9/2007	1.9	0	11/9/2007	78.72	0.025996
11/12/2007	1.9	0	11/12/2007	78.73	0.000127
11/13/2007	1.91	0.005249	11/13/2007	78.86	0.00165
11/14/2007	1.91	0	11/14/2007	77.34	-0.01946
11/15/2007	1.92	0.005222	11/15/2007	76.42	-0.01197
11/16/2007	1.92	0	11/16/2007	75.81	-0.00801
11/19/2007	1.92	0	11/19/2007	78.93	0.040331
11/20/2007	1.93	0.005195	11/20/2007	81.22	0.0286
11/22/2007	1.93	0	11/22/2007	77.12	-0.0518
11/23/2007	1.93	0	11/23/2007	78.05	0.011987
11/26/2007	1.93	0	11/26/2007	78.29	0.00307
11/27/2007	1.93	0	11/27/2007	79.5	0.015337
11/28/2007	1.98	0.025577	11/28/2007	77.24	-0.02884
11/29/2007	1.92	-0.03077	11/29/2007	78.17	0.011968
11/30/2007	1.93	0.005195	11/30/2007	78.25	0.001023
12/3/2007	1.98	0.025577	12/3/2007	81.53	0.041062
12/4/2007	1.98	0	12/4/2007	81.32	-0.00258
12/5/2007	1.98	0	12/5/2007	83.3	0.024057
12/6/2007	1.95	-0.01527	12/6/2007	85.23	0.022905
12/7/2007	2	0.025318	12/7/2007	85.99	0.008878

12/10/2007	2.01	0.004988	12/10/2007	85.78	-0.00245
12/11/2007	2.01	0	12/11/2007	84.65	-0.01326
12/12/2007	2.01	0	12/12/2007	83.12	-0.01824
12/13/2007	2.01	0	12/13/2007	82.31	-0.00979
12/14/2007	2.01	0	12/14/2007	83.32	0.012196
12/17/2007	2.16	0.071973	12/17/2007	85.25	0.022899
12/18/2007	2.16	0	12/18/2007	84.56	-0.00813
12/19/2007	2.22	0.027399	12/19/2007	90.02	0.062571
12/25/2007	2.26	0.017858	12/25/2007	92.01	0.021865
12/26/2007	2.35	0.039051	12/26/2007	92.71	0.007579
12/27/2007	2.35	0	12/27/2007	94.54	0.019547
1/1/2008	2.35	0	1/1/2008	92.67	-0.01998
1/2/2008	2.35	0	1/2/2008	91.91	-0.00823
1/3/2008	2.35	0	1/3/2008	89.34	-0.02836
1/4/2008	2.35	0	1/4/2008	90.93	0.017641
1/7/2008	2.34	-0.00426	1/7/2008	90.52	-0.00452
1/8/2008	2.27	-0.03037	1/8/2008	92.19	0.018281
1/9/2008	2.22	-0.02227	1/9/2008	91.44	-0.00817
1/10/2008	2.2	-0.00905	1/10/2008	93.68	0.024202
1/11/2008	2.2	0	1/11/2008	94.87	0.012623
1/14/2008	2.3	0.044452	1/14/2008	94.5	-0.00391
1/15/2008	2.3	0	1/15/2008	94.98	0.005067
1/16/2008	2.3	0	1/16/2008	94.53	-0.00475
1/17/2008	2.3	0	1/17/2008	92.88	-0.01761
1/21/2008	2.3	0	1/21/2008	92.88	0
1/22/2008	2.29	-0.00436	1/22/2008	89.18	-0.04065
1/23/2008	2.21	-0.03556	1/23/2008	88.03	-0.01298
1/24/2008	2.21	0	1/24/2008	90.32	0.025681
1/25/2008	2.21	0	1/25/2008	91.05	0.00805
1/28/2008	2.24	0.013483	1/28/2008	88.46	-0.02886
1/29/2008	2.24	0	1/29/2008	88.01	-0.0051
1/30/2008	2.2	-0.01802	1/30/2008	86.38	-0.01869
1/31/2008	2.2	0	1/31/2008	87.02	0.007382
2/1/2008	2.2	0	2/1/2008	91.14	0.046259
2/4/2008	2.2	0	2/4/2008	92.02	0.009609

2/5/2008	2.2	0	2/5/2008	91.46	-0.0061
2/6/2008	2.15	-0.02299	2/6/2008	90.1	-0.01498
2/7/2008	2.16	0.00464	2/7/2008	90.49	0.004319
2/8/2008	2.16	0	2/8/2008	90.76	0.002979
2/11/2008	2.17	0.004619	2/11/2008	90.46	-0.00331
2/12/2008	2.17	0	2/12/2008	90.26	-0.00221
2/13/2008	2.17	0	2/13/2008	90.82	0.006185
2/18/2008	2.23	0.027274	2/18/2008	96.03	0.055781
2/19/2008	2.23	0	2/19/2008	96.17	0.001457
2/20/2008	2.34	0.048149	2/20/2008	93.93	-0.02357
2/22/2008	2.34	0	2/22/2008	97.26	0.034838
2/25/2008	2.34	0	2/25/2008	98.8	0.01571
2/26/2008	2.33	-0.00428	2/26/2008	97.17	-0.01664
2/27/2008	2.33	0	2/27/2008	94.39	-0.02903
2/28/2008	2.37	0.017022	2/28/2008	96.72	0.024385
2/29/2008	2.41	0.016737	2/29/2008	97.16	0.004539
3/3/2008	2.33	-0.03376	3/3/2008	93.2	-0.04161
3/4/2008	2.33	0	3/4/2008	92.26	-0.01014
3/5/2008	2.39	0.025425	3/5/2008	92.61	0.003786
3/6/2008	2.39	0	3/6/2008	90.87	-0.01897
3/7/2008	2.39	0	3/7/2008	87.75	-0.03494
3/10/2008	2.39	0	3/10/2008	88.96	0.013695
3/11/2008	2.39	0	3/11/2008	89.76	0.008953
3/12/2008	2.39	0	3/12/2008	88.13	-0.01833
3/13/2008	2.49	0.040989	3/13/2008	88.21	0.000907
3/14/2008	2.49	0	3/14/2008	86.86	-0.01542
3/17/2008	2.49	0	3/17/2008	87.84	0.011219
3/18/2008	2.47	-0.00806	3/18/2008	91.11	0.036551
3/21/2008	2.45	-0.00813	3/21/2008	93.01	0.020639
3/24/2008	2.46	0.004073	3/24/2008	92.18	-0.00896
3/25/2008	2.45	-0.00407	3/25/2008	91.91	-0.00293
3/26/2008	2.45	0	3/26/2008	91.74	-0.00185
3/27/2008	2.49	0.016195	3/27/2008	90.25	-0.01637
3/28/2008	2.49	0	3/28/2008	89.28	-0.01081
3/31/2008	2.49	0	3/31/2008	89.3	0.000224

4/1/2008	2.49	0	4/1/2008	92.2	0.031959
4/2/2008	2.49	0	4/2/2008	94.68	0.026543
4/3/2008	2.55	0.023811	4/3/2008	95.08	0.004216
4/4/2008	2.55	0	4/4/2008	94.72	-0.00379
4/7/2008	2.57	0.007813	4/7/2008	96.82	0.021928
4/8/2008	2.57	0	4/8/2008	98.06	0.012726
4/9/2008	2.57	0	4/9/2008	97.38	-0.00696
4/10/2008	2.57	0	4/10/2008	97.43	0.000513
4/11/2008	2.55	-0.00781	4/11/2008	98.08	0.006649
4/14/2008	2.55	0	4/14/2008	97.22	-0.00881
4/15/2008	2.56	0.003914	4/15/2008	95.77	-0.01503
4/16/2008	2.57	0.003899	4/16/2008	97.18	0.014615
4/17/2008	2.57	0	4/17/2008	98.8	0.016533
4/18/2008	2.57	0	4/18/2008	98.03	-0.00782
4/21/2008	2.54	-0.01174	4/21/2008	99.98	0.019697
4/22/2008	2.54	0	4/22/2008	101.05	0.010645
4/23/2008	2.55	0.003929	4/23/2008	101.98	0.009161
4/24/2008	2.55	0	4/24/2008	99.2	-0.02764
4/25/2008	2.55	0	4/25/2008	101.55	0.023413
4/28/2008	2.57	0.007813	4/28/2008	104.32	0.026912
4/29/2008	2.57	0	4/29/2008	105.51	0.011343
4/30/2008	2.57	0	4/30/2008	106.23	0.006801
5/1/2008	2.57	0	5/1/2008	108.08	0.017265
5/2/2008	2.51	-0.02362	5/2/2008	109.69	0.014787
5/5/2008	2.53	0.007937	5/5/2008	110.88	0.01079
5/8/2008	2.57	0.015687	5/8/2008	106	-0.04501
5/9/2008	2.57	0	5/9/2008	103.3	-0.0258
5/12/2008	2.59	0.007752	5/12/2008	100.08	-0.03167
5/13/2008	2.59	0	5/13/2008	100.08	0
5/15/2008	2.55	-0.01556	5/15/2008	99.61	-0.00471
5/16/2008	2.51	-0.01581	5/16/2008	102.13	0.024984
5/19/2008	2.51	0	5/19/2008	103.09	0.009356
5/20/2008	2.51	0	5/20/2008	101.88	-0.01181
5/21/2008	2.51	0	5/21/2008	101.18	-0.00689
5/22/2008	2.51	0	5/22/2008	97.84	-0.03357

5/26/2008	2.51	0	5/26/2008	101.56	0.037316
5/27/2008	2.51	0	5/27/2008	101.46	-0.00099
5/28/2008	2.51	0	5/28/2008	105.23	0.036484
5/29/2008	2.51	0	5/29/2008	104.1	-0.0108
5/30/2008	2.51	0	5/30/2008	106.56	0.023356
6/2/2008	2.51	0	6/2/2008	106.47	-0.00084
6/3/2008	2.51	0	6/3/2008	106.25	-0.00207
6/4/2008	2.51	0	6/4/2008	107.97	0.016059
6/5/2008	2.51	0	6/5/2008	110.29	0.02126
6/6/2008	2.38	-0.05318	6/6/2008	110.4	0.000997
6/9/2008	2.38	0	6/9/2008	110.89	0.004429
6/10/2008	2.38	0	6/10/2008	110.22	-0.00606
6/11/2008	2.38	0	6/11/2008	110.2	-0.00018
6/12/2008	2.7	0.126151	6/12/2008	112.39	0.019678
6/13/2008	2.86	0.05757	6/13/2008	114.79	0.021129
6/16/2008	2.89	0.010435	6/16/2008	114.3	-0.00428
6/17/2008	2.91	0.006897	6/17/2008	116.17	0.016228
6/18/2008	2.91	0	6/18/2008	114.85	-0.01143
6/19/2008	2.91	0	6/19/2008	113.51	-0.01174
6/20/2008	2.86	-0.01733	6/20/2008	110.77	-0.02443
6/23/2008	2.86	0	6/23/2008	106.15	-0.0426
6/24/2008	2.86	0	6/24/2008	110.57	0.040796
6/25/2008	2.86	0	6/25/2008	114.33	0.03344
6/26/2008	2.86	0	6/26/2008	119.53	0.044478
6/27/2008	2.86	0	6/27/2008	119.92	0.003257
6/30/2008	2.86	0	6/30/2008	118.9	-0.00854
7/1/2008	2.91	0.017331	7/1/2008	122.69	0.031378
7/2/2008	2.91	0	7/2/2008	122.34	-0.00286
7/4/2008	2.91	0	7/4/2008	120.63	-0.01408
7/7/2008	2.86	-0.01733	7/7/2008	122.21	0.013013
7/8/2008	2.86	0	7/8/2008	122.23	0.000164
7/9/2008	2.86	0	7/9/2008	121.59	-0.00525
7/10/2008	2.85	-0.0035	7/10/2008	123.17	0.012911
7/11/2008	2.85	0	7/11/2008	125.78	0.020969
7/14/2008	2.85	0	7/14/2008	127.89	0.016636

7/15/2008	2.85	0	7/15/2008	128.97	0.008409
7/16/2008	2.61	-0.08797	7/16/2008	130.4	0.011027
7/17/2008	2.61	0	7/17/2008	128.47	-0.01491
7/18/2008	2.61	0	7/18/2008	128.93	0.003574
7/21/2008	2.61	0	7/21/2008	129.28	0.002711
7/22/2008	2.36	-0.10069	7/22/2008	128.1	-0.00917
7/23/2008	2.36	0	7/23/2008	128.75	0.005061
7/24/2008	2.36	0	7/24/2008	126.38	-0.01858
7/25/2008	2.36	0	7/25/2008	121.32	-0.04086
7/28/2008	2.36	0	7/28/2008	122.11	0.006491
7/29/2008	2.36	0	7/29/2008	132.56	0.082113
7/30/2008	2.36	0	7/30/2008	134.63	0.015495
7/31/2008	2.51	0.061621	7/31/2008	135.59	0.007105
8/1/2008	2.52	0.003976	8/1/2008	134.67	-0.00681
8/4/2008	2.52	0	8/4/2008	132.26	-0.01806
8/5/2008	2.52	0	8/5/2008	134.44	0.016348
8/6/2008	2.52	0	8/6/2008	132.8	-0.01227
8/7/2008	2.22	-0.12675	8/7/2008	130.17	-0.02
8/8/2008	2.22	0	8/8/2008	127.72	-0.019
8/11/2008	2.22	0	8/11/2008	130.99	0.025281
8/12/2008	2.22	0	8/12/2008	133.43	0.018456
8/13/2008	2.22	0	8/13/2008	133.69	0.001947
8/14/2008	2.22	0	8/14/2008	134.82	0.008417
8/15/2008	2.24	0.008969	8/15/2008	131.14	-0.02768
8/18/2008	2.24	0	8/18/2008	136.37	0.039106
8/19/2008	2.24	0	8/19/2008	138.93	0.018598
8/20/2008	2.24	0	8/20/2008	137.55	-0.00998
8/21/2008	2.35	0.047939	8/21/2008	139.72	0.015653
8/22/2008	2.35	0	8/22/2008	140.29	0.004071
8/25/2008	2.35	0	8/25/2008	143.3	0.021229
8/26/2008	2.35	0	8/26/2008	142.99	-0.00217
8/27/2008	2.35	0	8/27/2008	138.27	-0.03357
8/28/2008	2.35	0	8/28/2008	132.8	-0.04036
9/1/2008	2.37	0.008475	9/1/2008	134.16	0.010189
9/2/2008	2.37	0	9/2/2008	142.13	0.057709

9/3/2008	2.37	0	9/3/2008	141.36	-0.00543
9/4/2008	2.34	-0.01274	9/4/2008	134.93	-0.04655
9/5/2008	2.34	0	9/5/2008	132.46	-0.01848
9/8/2008	2.34	0	9/8/2008	133.31	0.006397
9/9/2008	2.34	0	9/9/2008	128.59	-0.03605
9/10/2008	2.34	0	9/10/2008	128.69	0.000777
9/11/2008	2.17	-0.07542	9/11/2008	126.83	-0.01456
9/12/2008	2.17	0	9/12/2008	126.51	-0.00253
9/15/2008	2.17	0	9/15/2008	125.88	-0.00499
9/16/2008	2.17	0	9/16/2008	125.15	-0.00582
9/17/2008	2.17	0	9/17/2008	126.12	0.007721
9/18/2008	2.19	0.009174	9/18/2008	126.22	0.000793
9/19/2008	2.19	0	9/19/2008	122.91	-0.02657
9/22/2008	2.19	0	9/22/2008	124.55	0.013255
9/23/2008	2.19	0	9/23/2008	124.06	-0.00394
9/24/2008	2.19	0	9/24/2008	121.77	-0.01863
9/25/2008	2.22	0.013606	9/25/2008	116.05	-0.04811
9/26/2008	2.22	0	9/26/2008	113.72	-0.02028
9/29/2008	2.22	0	9/29/2008	116.04	0.020196
9/30/2008	2.22	0	9/30/2008	112.13	-0.03428
10/1/2008	2.22	0	10/1/2008	109.74	-0.02154
10/2/2008	1.98	-0.11441	10/2/2008	108.18	-0.01432
10/3/2008	1.98	0	10/3/2008	109.93	0.016047
10/6/2008	1.98	0	10/6/2008	110.87	0.008515
10/7/2008	1.98	0	10/7/2008	107.6	-0.02994
10/8/2008	1.98	0	10/8/2008	108.13	0.004914
10/9/2008	1.88	-0.05183	10/9/2008	108.22	0.000832
10/10/2008	1.88	0	10/10/2008	107.82	-0.0037
10/13/2008	1.88	0	10/13/2008	116.44	0.076913
10/14/2008	1.88	0	10/14/2008	113.19	-0.02831
10/15/2008	1.88	0	10/15/2008	108.94	-0.03827
10/16/2008	1.88	0	10/16/2008	111.35	0.021881
10/17/2008	1.72	-0.08895	10/17/2008	112.2	0.007605
10/20/2008	1.72	0	10/20/2008	112.89	0.006131
10/21/2008	1.72	0	10/21/2008	112.84	-0.00044

10/22/2008	1.72	0	10/22/2008	106.7	-0.05595
10/23/2008	1.72	0	10/23/2008	103.99	-0.02573
10/24/2008	1.72	0	10/24/2008	102.93	-0.01025
10/27/2008	1.72	0	10/27/2008	102.46	-0.00458
10/28/2008	1.72	0	10/28/2008	101.56	-0.00882
10/29/2008	1.72	0	10/29/2008	99.96	-0.01588
10/30/2008	1.76	0.02299	10/30/2008	97.82	-0.02164
10/31/2008	1.76	0	10/31/2008	95	-0.02925
11/3/2008	1.76	0	11/3/2008	95.36	0.003782
11/4/2008	1.76	0	11/4/2008	93.72	-0.01735
11/5/2008	1.79	0.016902	11/5/2008	89.7	-0.04384
11/6/2008	1.79	0	11/6/2008	85.1	-0.05264
11/7/2008	1.78	-0.0056	11/7/2008	85.34	0.002816
11/10/2008	1.78	0	11/10/2008	90.09	0.054166
11/11/2008	1.78	0	11/11/2008	95.77	0.06114
11/12/2008	1.78	0	11/12/2008	99.63	0.039514
11/13/2008	1.67	-0.06379	11/13/2008	99.92	0.002907
11/14/2008	1.67	0	11/14/2008	101.54	0.016083
11/17/2008	1.67	0	11/17/2008	100.05	-0.01478
11/18/2008	1.67	0	11/18/2008	100.48	0.004289
11/19/2008	1.71	0.02367	11/19/2008	95.51	-0.05073
11/20/2008	1.71	0	11/20/2008	92.87	-0.02803
11/21/2008	1.71	0	11/21/2008	91.55	-0.01432
11/24/2008	1.71	0	11/24/2008	88.19	-0.03739
11/25/2008	1.63	-0.04791	11/25/2008	88.4	0.002378
11/27/2008	1.63	0	11/27/2008	82.83	-0.06508
11/28/2008	1.63	0	11/28/2008	80.42	-0.02953
12/1/2008	1.63	0	12/1/2008	81.31	0.011006
12/2/2008	1.63	0	12/2/2008	74.23	-0.0911
12/3/2008	1.63	0	12/3/2008	73.93	-0.00405
12/4/2008	1.49	-0.0898	12/4/2008	74.34	0.00553
12/5/2008	1.49	0	12/5/2008	66.22	-0.11567
12/8/2008	1.49	0	12/8/2008	63.5	-0.04194
12/9/2008	1.49	0	12/9/2008	65.7	0.034059
12/10/2008	1.49	0	12/10/2008	67.11	0.021234

12/11/2008	1.49	0	12/11/2008	65.25	-0.02811
12/12/2008	1.49	0	12/12/2008	62.31	-0.0461
12/15/2008	1.49	0	12/15/2008	64.52	0.034853
12/16/2008	1.49	0	12/16/2008	60.02	-0.0723
12/17/2008	1.49	0	12/17/2008	58.8	-0.02054
12/18/2008	1.59	0.064958	12/18/2008	58.33	-0.00803
12/19/2008	1.59	0	12/19/2008	63.46	0.084293
12/22/2008	1.59	0	12/22/2008	60.62	-0.04578
12/23/2008	1.59	0	12/23/2008	59.62	-0.01663
12/25/2008	1.57	-0.01266	12/25/2008	62.24	0.043007
12/26/2008	1.57	0	12/26/2008	60.85	-0.02259
12/29/2008	1.57	0	12/29/2008	55.75	-0.08753
12/30/2008	1.57	0	12/30/2008	56.44	0.012301
1/1/2009	1.57	0	1/1/2009	54.37	-0.03737
1/2/2009	1.57	0	1/2/2009	52.03	-0.04399
1/5/2009	1.57	0	1/5/2009	50.87	-0.02255
1/6/2009	1.57	0	1/6/2009	50.15	-0.01425
1/7/2009	1.57	0	1/7/2009	50.28	0.002589
1/8/2009	1.66	0.055742	1/8/2009	48.56	-0.03481
1/9/2009	1.66	0	1/9/2009	47.81	-0.01557
1/12/2009	1.66	0	1/12/2009	45.35	-0.05282
1/13/2009	1.58	-0.04939	1/13/2009	44.46	-0.01982
1/14/2009	1.58	0	1/14/2009	48.57	0.088416
1/15/2009	1.59	0.006309	1/15/2009	46.57	-0.04205
1/19/2009	1.59	0	1/19/2009	49.21	0.05514
1/20/2009	1.59	0	1/20/2009	46.87	-0.04872
1/21/2009	1.59	0	1/21/2009	46.83	-0.00085
1/22/2009	1.59	0	1/22/2009	44.9	-0.04209
1/23/2009	1.59	0	1/23/2009	43.65	-0.02823
1/26/2009	1.59	0	1/26/2009	43.09	-0.01291
1/27/2009	1.59	0	1/27/2009	35.99	-0.18005
1/28/2009	1.59	0	1/28/2009	38.98	0.079808
1/29/2009	1.59	0	1/29/2009	38.73	-0.00643
1/30/2009	1.59	0	1/30/2009	38.3	-0.01116
2/2/2009	1.59	0	2/2/2009	42.5	0.104054

2/3/2009	1.59	0	2/3/2009	41.33	-0.02792
2/4/2009	1.59	0	2/4/2009	43.98	0.062146
2/5/2009	1.58	-0.00631	2/5/2009	41.16	-0.06627
2/6/2009	1.58	0	2/6/2009	41	-0.00389
2/9/2009	1.58	0	2/9/2009	39.35	-0.04108
2/10/2009	1.58	0	2/10/2009	38.52	-0.02132
2/11/2009	1.58	0	2/11/2009	37.04	-0.03918
2/12/2009	1.61	0.018809	2/12/2009	34.23	-0.0789
2/16/2009	1.61	0	2/16/2009	33.68	-0.0162
2/17/2009	1.61	0	2/17/2009	32.18	-0.04556
2/18/2009	1.61	0	2/18/2009	32.92	0.022735
2/19/2009	1.51	-0.06412	2/19/2009	34.58	0.049195
2/20/2009	1.51	0	2/20/2009	35.17	0.016918
2/23/2009	1.51	0	2/23/2009	33.93	-0.03589
2/24/2009	1.51	0	2/24/2009	42.29	0.220251
2/25/2009	1.51	0	2/25/2009	45.35	0.06986
2/26/2009	1.59	0.051624	2/26/2009	48.55	0.068184
2/27/2009	1.59	0	2/27/2009	45.51	-0.06466
3/2/2009	1.59	0	3/2/2009	42.22	-0.07504
3/3/2009	1.59	0	3/3/2009	41.79	-0.01024
3/4/2009	1.59	0	3/4/2009	40.06	-0.04228
3/5/2009	1.5	-0.05827	3/5/2009	42.25	0.053226
3/6/2009	1.5	0	3/6/2009	41.47	-0.01863
3/9/2009	1.5	0	3/9/2009	41.62	0.003611
3/10/2009	1.5	0	3/10/2009	42.77	0.027256
3/11/2009	1.53	0.019803	3/11/2009	39.87	-0.07021
3/12/2009	1.53	0	3/12/2009	40.92	0.025995
3/13/2009	1.53	0	3/13/2009	39.6	-0.03279
3/16/2009	1.53	0	3/16/2009	42.07	0.060506
3/17/2009	1.53	0	3/17/2009	43.53	0.034115
3/18/2009	1.53	0	3/18/2009	48.4	0.106049
3/19/2009	1.59	0.038466	3/19/2009	42.41	-0.13212
3/20/2009	1.59	0	3/20/2009	42.41	0
3/23/2009	1.59	0	3/23/2009	42.68	0.006346
3/24/2009	1.59	0	3/24/2009	43.72	0.024075

3/25/2009	1.59	0	3/25/2009	42.51	-0.02807
3/26/2009	1.65	0.037041	3/26/2009	42.96	0.01053
3/27/2009	1.65	0	3/27/2009	43.74	0.017994
3/30/2009	1.65	0	3/30/2009	43.98	0.005472
3/31/2009	1.65	0	3/31/2009	44.04	0.001363
4/1/2009	1.65	0	4/1/2009	47.18	0.068872
4/2/2009	1.61	-0.02454	4/2/2009	45.88	-0.02794
4/3/2009	1.61	0	4/3/2009	44.24	-0.0364
4/6/2009	1.61	0	4/6/2009	47.23	0.0654
4/7/2009	1.61	0	4/7/2009	43.36	-0.08549
4/8/2009	1.61	0	4/8/2009	41.79	-0.03688
4/10/2009	1.61	0	4/10/2009	39.41	-0.05864
4/13/2009	1.61	0	4/13/2009	42.51	0.07572
4/14/2009	1.61	0	4/14/2009	42.34	-0.00401
4/15/2009	1.61	0	4/15/2009	41.22	-0.02681
4/16/2009	1.58	-0.01881	4/16/2009	40.23	-0.02431
4/17/2009	1.58	0	4/17/2009	42.33	0.050883
4/20/2009	1.58	0	4/20/2009	45.11	0.063608
4/21/2009	1.58	0	4/21/2009	44.46	-0.01451
4/22/2009	1.58	0	4/22/2009	42.65	-0.04156
4/23/2009	1.6	0.012579	4/23/2009	42.97	0.007475
4/24/2009	1.6	0	4/24/2009	46.32	0.075072
4/27/2009	1.6	0	4/27/2009	44.7	-0.0356
4/28/2009	1.6	0	4/28/2009	43.73	-0.02194
4/29/2009	1.6	0	4/29/2009	44.45	0.016331
4/30/2009	1.67	0.04282	4/30/2009	44.66	0.004713
5/1/2009	1.67	0	5/1/2009	42.87	-0.04091
5/4/2009	1.67	0	5/4/2009	42.04	-0.01955
5/5/2009	1.67	0	5/5/2009	44.97	0.067374
5/6/2009	1.67	0	5/6/2009	44.12	-0.01908
5/7/2009	1.67	0	5/7/2009	45.53	0.031458
5/8/2009	1.67	0	5/8/2009	45.17	-0.00794
5/11/2009	1.67	0	5/11/2009	47.93	0.059308
5/12/2009	1.74	0.041061	5/12/2009	49.17	0.025542
5/13/2009	1.74	0	5/13/2009	51.5	0.046298

5/14/2009	1.74	0	5/14/2009	51.02	-0.00936
5/15/2009	1.74	0	5/15/2009	51.08	0.001175
5/18/2009	1.74	0	5/18/2009	51.51	0.008383
5/19/2009	1.74	0	5/19/2009	50.46	-0.0206
5/20/2009	1.74	0	5/20/2009	48.71	-0.0353
5/21/2009	1.74	0	5/21/2009	45.79	-0.06182
5/25/2009	1.74	0	5/25/2009	50.44	0.096719
5/26/2009	1.74	0	5/26/2009	49.93	-0.01016
5/27/2009	1.74	0	5/27/2009	50.56	0.012539
5/28/2009	1.76	0.011429	5/28/2009	50.27	-0.00575
5/29/2009	1.76	0	5/29/2009	51.86	0.031139
6/1/2009	1.76	0	6/1/2009	52.13	0.005193
6/2/2009	1.76	0	6/2/2009	52.61	0.009166
6/3/2009	1.76	0	6/3/2009	50.53	-0.04034
6/4/2009	1.76	0	6/4/2009	51.91	0.026944
6/5/2009	1.76	0	6/5/2009	51.16	-0.01455
6/8/2009	1.76	0	6/8/2009	51.78	0.012046
6/9/2009	1.76	0	6/9/2009	51.97	0.003663
6/10/2009	1.76	0	6/10/2009	48.95	-0.05987
6/11/2009	1.76	0	6/11/2009	48.55	-0.00821
6/12/2009	1.8	0.022473	6/12/2009	48.36	-0.00392
6/15/2009	1.8	0	6/15/2009	47.75	-0.01269
6/16/2009	1.8	0	6/16/2009	49.74	0.04083
6/18/2009	1.8	0	6/18/2009	48.6	-0.02319
6/19/2009	1.77	-0.01681	6/19/2009	50.21	0.032591
6/22/2009	1.77	0	6/22/2009	50.29	0.001592
6/23/2009	1.77	0	6/23/2009	51.73	0.028232
6/24/2009	1.77	0	6/24/2009	53.22	0.028396
6/25/2009	1.77	0	6/25/2009	53.11	-0.00207
6/26/2009	1.77	0	6/26/2009	54.82	0.03169
6/29/2009	1.77	0	6/29/2009	56.39	0.028237
6/30/2009	1.77	0	6/30/2009	55.57	-0.01465
7/1/2009	1.77	0	7/1/2009	55.54	-0.00054
7/2/2009	1.77	0	7/2/2009	56.07	0.009497
7/3/2009	1.77	0	7/3/2009	56.49	0.007463

7/6/2009	1.73	-0.02286	7/6/2009	56	-0.00871
7/7/2009	1.73	0	7/7/2009	56.08	0.001428
7/8/2009	1.73	0	7/8/2009	56.26	0.003205
7/9/2009	1.72	-0.0058	7/9/2009	56.87	0.010784
7/10/2009	1.72	0	7/10/2009	58.85	0.034224
7/13/2009	1.72	0	7/13/2009	57.67	-0.02025
7/14/2009	1.72	0	7/14/2009	58.35	0.011722
7/15/2009	1.72	0	7/15/2009	58.51	0.002738
7/16/2009	1.67	-0.0295	7/16/2009	58.6	0.001537
7/17/2009	1.67	0	7/17/2009	61.33	0.045534
7/20/2009	1.67	0	7/20/2009	63.52	0.035086
7/21/2009	1.67	0	7/21/2009	65.18	0.025798
7/22/2009	1.67	0	7/22/2009	66.8	0.02455
7/23/2009	1.67	0	7/23/2009	67.58	0.011609
7/24/2009	1.67	0	7/24/2009	66.06	-0.02275
7/27/2009	1.67	0	7/27/2009	67.53	0.022009
7/28/2009	1.67	0	7/28/2009	67.72	0.00281
7/29/2009	1.67	0	7/29/2009	67.56	-0.00237
7/30/2009	1.67	0	7/30/2009	68.89	0.019495
7/31/2009	1.71	0.02367	7/31/2009	70.47	0.022676
8/3/2009	1.71	0	8/3/2009	71.89	0.01995
8/4/2009	1.71	0	8/4/2009	70.17	-0.02422
8/5/2009	1.71	0	8/5/2009	68.3	-0.02701
8/6/2009	1.58	-0.07907	8/6/2009	70.33	0.029289
8/7/2009	1.58	0	8/7/2009	68.95	-0.01982
8/11/2009	1.58	0	8/11/2009	70.68	0.024781
8/12/2009	1.58	0	8/12/2009	66.33	-0.06352
8/13/2009	1.61	0.018809	8/13/2009	66.22	-0.00166
8/14/2009	1.61	0	8/14/2009	68.33	0.031366
8/17/2009	1.61	0	8/17/2009	68.67	0.004964
8/18/2009	1.61	0	8/18/2009	68.05	-0.00907
8/19/2009	1.61	0	8/19/2009	69.71	0.024101
8/20/2009	1.62	0.006192	8/20/2009	68.07	-0.02381
8/21/2009	1.62	0	8/21/2009	68.37	0.004398
8/24/2009	1.62	0	8/24/2009	65.59	-0.04151

8/25/2009	1.62	0	8/25/2009	64.7	-0.01366
8/26/2009	1.62	0	8/26/2009	62.77	-0.03028
8/27/2009	1.62	0	8/27/2009	61.29	-0.02386
8/28/2009	1.62	0	8/28/2009	59.41	-0.03115
8/31/2009	1.62	0	8/31/2009	58.72	-0.01168
9/1/2009	1.61	-0.00619	9/1/2009	57.98	-0.01268
9/2/2009	1.61	0	9/2/2009	57.8	-0.00311
9/3/2009	1.61	0	9/3/2009	60.8	0.050601
9/7/2009	1.61	0	9/7/2009	61.62	0.013397
9/8/2009	1.61	0	9/8/2009	63.14	0.024368
9/9/2009	1.61	0	9/9/2009	64.25	0.017427
9/10/2009	1.61	0	9/10/2009	65.63	0.021251
9/11/2009	1.61	0	9/11/2009	65.06	-0.00872
9/14/2009	1.67	0.036589	9/14/2009	67.76	0.040662
9/15/2009	1.67	0	9/15/2009	68.52	0.011154
9/16/2009	1.67	0	9/16/2009	69.53	0.014633
9/17/2009	1.67	0	9/17/2009	68.18	-0.01961
9/18/2009	1.67	0	9/18/2009	65.44	-0.04102
9/21/2009	1.67	0	9/21/2009	68.47	0.045262
9/22/2009	1.67	0	9/22/2009	69.98	0.021814
9/23/2009	1.67	0	9/23/2009	72.76	0.038957
9/24/2009	1.67	0	9/24/2009	74.08	0.017979
9/25/2009	1.67	0	9/25/2009	74.65	0.007665
9/28/2009	1.67	0	9/28/2009	74.97	0.004278
9/29/2009	1.67	0	9/29/2009	74.56	-0.00548
9/30/2009	1.67	0	9/30/2009	74.15	-0.00551
10/1/2009	1.88	0.118448	10/1/2009	71.64	-0.03444
10/2/2009	1.88	0	10/2/2009	74.14	0.034302
10/5/2009	1.88	0	10/5/2009	73.72	-0.00568
10/6/2009	1.88	0	10/6/2009	71.63	-0.02876
10/7/2009	1.88	0	10/7/2009	68.96	-0.03799
10/8/2009	1.88	0	10/8/2009	69.97	0.01454
10/9/2009	1.88	0	10/9/2009	73.14	0.044309
10/12/2009	1.88	0	10/12/2009	74.01	0.011825
10/13/2009	1.88	0	10/13/2009	74.06	0.000675

10/14/2009	1.88	0	10/14/2009	74.7	0.008605
10/15/2009	1.88	0	10/15/2009	73.46	-0.01674
10/16/2009	1.88	0	10/16/2009	71.1	-0.03265
10/19/2009	1.88	0	10/19/2009	71.03	-0.00099
10/20/2009	1.88	0	10/20/2009	73.15	0.02941
10/21/2009	1.88	0	10/21/2009	69.23	-0.05508
10/22/2009	1.88	0	10/22/2009	69.08	-0.00217
10/23/2009	1.88	0	10/23/2009	67.9	-0.01723
10/26/2009	1.88	0	10/26/2009	66.78	-0.01663
10/27/2009	1.88	0	10/27/2009	65.84	-0.01418
10/28/2009	1.88	0	10/28/2009	66.69	0.012827
10/29/2009	1.88	0	10/29/2009	69	0.034051
10/30/2009	1.88	0	10/30/2009	69.56	0.008083
11/2/2009	1.88	0	11/2/2009	68.76	-0.01157
11/3/2009	1.88	0	11/3/2009	68.56	-0.00291
11/4/2009	1.88	0	11/4/2009	66.52	-0.03021
11/5/2009	1.88	0	11/5/2009	66.29	-0.00346
11/6/2009	2.04	0.081678	11/6/2009	68.12	0.027232
11/9/2009	2.04	0	11/9/2009	71.22	0.044503
11/10/2009	2.04	0	11/10/2009	70.37	-0.01201
11/11/2009	2.04	0	11/11/2009	68.07	-0.03323
11/12/2009	2.04	0	11/12/2009	69.76	0.024524
11/13/2009	2.13	0.043172	11/13/2009	67.54	-0.03234
11/16/2009	2.13	0	11/16/2009	65.05	-0.03756
11/17/2009	2.13	0	11/17/2009	64.65	-0.00617
11/18/2009	2.13	0	11/18/2009	65.44	0.012146
11/19/2009	2.13	0	11/19/2009	64.63	-0.01245
11/20/2009	2.13	0	11/20/2009	65.63	0.015354
11/23/2009	2.13	0	11/23/2009	66.72	0.016472
11/24/2009	2.13	0	11/24/2009	66.1	-0.00934
11/26/2009	2.13	0	11/26/2009	68.12	0.030102
11/27/2009	2.15	0.009346	11/27/2009	67.35	-0.01137
11/30/2009	2.15	0	11/30/2009	68.17	0.012102
12/1/2009	2.15	0	12/1/2009	69.25	0.015719
12/2/2009	2.15	0	12/2/2009	70.56	0.01874

12/3/2009	2.15	0	12/3/2009	70.51	-0.00071
12/4/2009	2.16	0.00464	12/4/2009	71.87	0.019104
12/7/2009	2.16	0	12/7/2009	72.85	0.013544
12/8/2009	2.16	0	12/8/2009	74.28	0.019439
12/9/2009	2.16	0	12/9/2009	75.82	0.02052
12/10/2009	2.08	-0.03774	12/10/2009	76.67	0.011148
12/11/2009	2.08	0	12/11/2009	77.65	0.012701
12/14/2009	2.08	0	12/14/2009	78.26	0.007825
12/15/2009	2.08	0	12/15/2009	77.67	-0.00757
12/16/2009	2.08	0	12/16/2009	76.25	-0.01845
12/17/2009	2.08	0	12/17/2009	76.26	0.000131
12/18/2009	2.08	0	12/18/2009	74.68	-0.02094
12/21/2009	2.08	0	12/21/2009	76.73	0.02708
12/22/2009	2.08	0	12/22/2009	74.46	-0.03003
12/23/2009	1.9	-0.09051	12/23/2009	75.16	0.009357
12/25/2009	1.9	0	12/25/2009	77.96	0.036577
12/28/2009	1.9	0	12/28/2009	77.77	-0.00244
12/29/2009	1.9	0	12/29/2009	75.13	-0.03454
12/30/2009	1.9	0	12/30/2009	76.8	0.021985
1/1/2010	1.9	0	1/1/2010	76.6	-0.00261
1/4/2010	1.9	0	1/4/2010	74.78	-0.02405
1/5/2010	1.9	0	1/5/2010	74.36	-0.00563
1/6/2010	1.9	0	1/6/2010	76.79	0.032156
1/7/2010	1.9	0	1/7/2010	77.11	0.004159
1/8/2010	1.95	0.025975	1/8/2010	78.39	0.016463
1/11/2010	1.95	0	1/11/2010	76.21	-0.0282
1/12/2010	1.95	0	1/12/2010	75.36	-0.01122
1/13/2010	1.83	-0.06351	1/13/2010	77.94	0.033663
1/14/2010	1.83	0	1/14/2010	75.28	-0.03472
1/18/2010	1.83	0	1/18/2010	76.18	0.011884
1/19/2010	1.83	0	1/19/2010	75.75	-0.00566
1/20/2010	1.83	0	1/20/2010	77.48	0.022581
1/21/2010	1.83	0	1/21/2010	78.39	0.011677
1/22/2010	1.83	0	1/22/2010	76.66	-0.02232
1/25/2010	1.83	0	1/25/2010	77.46	0.010382

1/26/2010	1.83	0	1/26/2010	77.49	0.000387
1/27/2010	1.83	0	1/27/2010	75.88	-0.021
1/28/2010	1.82	-0.00548	1/28/2010	74.63	-0.01661
1/29/2010	1.82	0	1/29/2010	73.13	-0.0203
2/1/2010	1.82	0	2/1/2010	70.41	-0.0379
2/2/2010	1.82	0	2/2/2010	69.57	-0.012
2/3/2010	1.82	0	2/3/2010	70.59	0.014555
2/4/2010	1.81	-0.00551	2/4/2010	70.73	0.001981
2/5/2010	1.81	0	2/5/2010	72.99	0.031453
2/8/2010	1.81	0	2/8/2010	70.93	-0.02863
2/9/2010	1.81	0	2/9/2010	71.52	0.008284
2/10/2010	1.81	0	2/10/2010	72.49	0.013471
2/11/2010	1.76	-0.02801	2/11/2010	71.5	-0.01375
2/15/2010	1.76	0	2/15/2010	75.1	0.049123
2/16/2010	1.76	0	2/16/2010	75.1	0
2/17/2010	1.76	0	2/17/2010	76.54	0.018993
2/18/2010	1.73	-0.01719	2/18/2010	76.8	0.003391
2/19/2010	1.73	0	2/19/2010	77.77	0.012551
2/22/2010	1.73	0	2/22/2010	77.81	0.000514
2/23/2010	1.73	0	2/23/2010	75.71	-0.02736
2/24/2010	1.73	0	2/24/2010	78.96	0.042031
2/25/2010	1.73	0	2/25/2010	78.82	-0.00177
2/26/2010	1.72	-0.0058	2/26/2010	79.69	0.010977
3/1/2010	1.72	0	3/1/2010	80.12	0.005381
3/2/2010	1.72	0	3/2/2010	79.71	-0.00513
3/3/2010	1.72	0	3/3/2010	79.89	0.002256
3/4/2010	1.72	0	3/4/2010	79.13	-0.00956
3/5/2010	1.72	0	3/5/2010	77.33	-0.02301
3/8/2010	1.72	0	3/8/2010	77.41	0.001034
3/9/2010	1.72	0	3/9/2010	76.7	-0.00921
3/10/2010	1.72	0	3/10/2010	75.96	-0.00969
3/11/2010	1.72	0	3/11/2010	74.94	-0.01352
3/12/2010	1.72	0	3/12/2010	74.85	-0.0012
3/15/2010	1.72	0	3/15/2010	73.73	-0.01508
3/16/2010	1.72	0	3/16/2010	72.38	-0.01848

3/17/2010	1.72	0	3/17/2010	71.83	-0.00763
3/18/2010	1.72	0	3/18/2010	72.48	0.009008
3/19/2010	1.51	-0.13021	3/19/2010	72.6	0.001654
3/22/2010	1.51	0	3/22/2010	70.25	-0.0329
3/23/2010	1.51	0	3/23/2010	70.75	0.007092
3/24/2010	1.51	0	3/24/2010	71.23	0.006762
3/25/2010	1.54	0.019673	3/25/2010	73.74	0.034631
3/26/2010	1.54	0	3/26/2010	75.57	0.024514
3/29/2010	1.54	0	3/29/2010	71.15	-0.06027
3/30/2010	1.54	0	3/30/2010	69.96	-0.01687
3/31/2010	1.54	0	3/31/2010	69.47	-0.00703
4/2/2010	1.54	0	4/2/2010	70.05	0.008314
4/5/2010	1.54	0	4/5/2010	72.05	0.028151
4/6/2010	1.54	0	4/6/2010	71.19	-0.01201
4/7/2010	1.54	0	4/7/2010	71.18	-0.00014
4/8/2010	1.51	-0.01967	4/8/2010	74.77	0.049205
4/9/2010	1.51	0	4/9/2010	74.84	0.000936
4/12/2010	1.51	0	4/12/2010	76.51	0.022069
4/13/2010	1.51	0	4/13/2010	76.73	0.002871
4/14/2010	1.51	0	4/14/2010	76.8	0.000912
4/15/2010	1.51	0	4/15/2010	76.24	-0.00732
4/16/2010	1.55	0.026145	4/16/2010	76.8	0.007318
4/19/2010	1.55	0	4/19/2010	74.03	-0.03673
4/20/2010	1.55	0	4/20/2010	76.02	0.026526
4/21/2010	1.55	0	4/21/2010	75.73	-0.00382
4/22/2010	1.58	0.01917	4/22/2010	77.41	0.021942
4/23/2010	1.58	0	4/23/2010	78.57	0.014874
4/26/2010	1.58	0	4/26/2010	77.79	-0.00998
4/27/2010	1.58	0	4/27/2010	79.1	0.0167
4/28/2010	1.58	0	4/28/2010	78.75	-0.00443
4/29/2010	1.58	0	4/29/2010	78.58	-0.00216
4/30/2010	1.58	0	4/30/2010	80.1	0.019159
5/3/2010	1.58	0	5/3/2010	79.25	-0.01067
5/4/2010	1.58	0	5/4/2010	79.13	-0.00152
5/5/2010	1.58	0	5/5/2010	76.94	-0.02807

5/6/2010	1.6	0.012579	5/6/2010	79.31	0.030338
5/7/2010	1.6	0	5/7/2010	80.14	0.010411
5/10/2010	1.6	0	5/10/2010	80	-0.00175
5/11/2010	1.6	0	5/11/2010	78.27	-0.02186
5/12/2010	1.6	0	5/12/2010	78	-0.00346
5/13/2010	1.61	0.006231	5/13/2010	79.08	0.013751
5/14/2010	1.61	0	5/14/2010	77.59	-0.01902
5/17/2010	1.61	0	5/17/2010	78.2	0.007831
5/18/2010	1.61	0	5/18/2010	77.53	-0.0086
5/19/2010	1.61	0	5/19/2010	79.24	0.021816
5/20/2010	1.58	-0.01881	5/20/2010	79.01	-0.00291
5/21/2010	1.58	0	5/21/2010	79.83	0.010325
5/24/2010	1.58	0	5/24/2010	82.09	0.027917
5/25/2010	1.58	0	5/25/2010	81.31	-0.00955
5/26/2010	1.58	0	5/26/2010	83.93	0.031714
5/27/2010	1.58	0	5/27/2010	84.81	0.01043
5/31/2010	1.58	0	5/31/2010	82.03	-0.03333
6/1/2010	1.58	0	6/1/2010	82.27	0.002921
6/2/2010	1.58	0	6/2/2010	84.76	0.029817
6/3/2010	1.58	0	6/3/2010	83.09	-0.0199
6/4/2010	1.58	0	6/4/2010	85.46	0.028124
6/7/2010	1.58	0	6/7/2010	86.65	0.013829
6/8/2010	1.58	0	6/8/2010	84.61	-0.02382
6/9/2010	1.58	0	6/9/2010	83.04	-0.01873
6/10/2010	1.58	0	6/10/2010	84.93	0.022505
6/11/2010	1.6	0.012579	6/11/2010	84.75	-0.00212
6/14/2010	1.6	0	6/14/2010	84.78	0.000354
6/15/2010	1.6	0	6/15/2010	86.31	0.017886
6/16/2010	1.6	0	6/16/2010	87.07	0.008767
6/18/2010	1.6	0	6/18/2010	84.79	-0.02653
6/21/2010	1.6	0	6/21/2010	86.67	0.02193
6/22/2010	1.6	0	6/22/2010	86.04	-0.0073
6/23/2010	1.6	0	6/23/2010	87.94	0.021842
6/24/2010	1.6	0	6/24/2010	85.24	-0.03118
6/28/2010	1.54	-0.03822	6/28/2010	79.76	-0.06645

6/29/2010	1.54	0	6/29/2010	75.79	-0.05106
6/30/2010	1.54	0	6/30/2010	77.18	0.018174
7/1/2010	1.54	0	7/1/2010	78.3	0.014407
7/5/2010	1.54	0	7/5/2010	78.66	0.004587
7/6/2010	1.54	0	7/6/2010	75.68	-0.03862
7/7/2010	1.54	0	7/7/2010	73.03	-0.03564
7/8/2010	1.6	0.038221	7/8/2010	74.33	0.017644
7/9/2010	1.6	0	7/9/2010	71.4	-0.04022
7/12/2010	1.6	0	7/12/2010	69.02	-0.0339
7/13/2010	1.6	0	7/13/2010	69.9	0.012669
7/14/2010	1.6	0	7/14/2010	69.08	-0.0118
7/15/2010	1.63	0.018576	7/15/2010	66.44	-0.03897
7/16/2010	1.63	0	7/16/2010	70.05	0.05291
7/19/2010	1.63	0	7/19/2010	73.02	0.041524
7/20/2010	1.63	0	7/20/2010	72.4	-0.00853
7/21/2010	1.63	0	7/21/2010	72.6	0.002759
7/22/2010	1.64	0.006116	7/22/2010	72.49	-0.00152
7/23/2010	1.64	0	7/23/2010	72.24	-0.00345
7/26/2010	1.64	0	7/26/2010	72.58	0.004695
7/27/2010	1.64	0	7/27/2010	71.49	-0.01513
7/28/2010	1.64	0	7/28/2010	70.65	-0.01182
7/29/2010	1.69	0.030032	7/29/2010	71.14	0.006912
7/30/2010	1.69	0	7/30/2010	73.39	0.031138
8/2/2010	1.69	0	8/2/2010	73.89	0.00679
8/3/2010	1.69	0	8/3/2010	72.91	-0.01335
8/4/2010	1.69	0	8/4/2010	74.74	0.02479
8/5/2010	1.74	0.029157	8/5/2010	74.92	0.002405
8/6/2010	1.74	0	8/6/2010	75.87	0.0126
8/9/2010	1.74	0	8/9/2010	77.22	0.017637
8/10/2010	1.74	0	8/10/2010	76.75	-0.00611
8/11/2010	1.74	0	8/11/2010	78.33	0.020377
8/12/2010	2	0.139262	8/12/2010	77.88	-0.00576
8/13/2010	2	0	8/13/2010	74.82	-0.04008
8/16/2010	2	0	8/16/2010	75.12	0.004002
8/17/2010	2	0	8/17/2010	76.16	0.01375

8/18/2010	2	0	8/18/2010	76.61	0.005891
8/19/2010	1.95	-0.02532	8/19/2010	74.21	-0.03183
8/20/2010	1.95	0	8/20/2010	74.95	0.009922
8/23/2010	1.95	0	8/23/2010	71.73	-0.04391
8/24/2010	1.95	0	8/24/2010	71.95	0.003062
8/25/2010	1.95	0	8/25/2010	71.86	-0.00125
8/26/2010	2.02	0.035268	8/26/2010	73.48	0.022293
8/27/2010	2.02	0	8/27/2010	73.37	-0.0015
8/30/2010	2.02	0	8/30/2010	74.91	0.020772
8/31/2010	2.02	0	8/31/2010	75.55	0.008507
9/1/2010	2.02	0	9/1/2010	74.7	-0.01131
9/2/2010	1.99	-0.01496	9/2/2010	76.8	0.027725
9/6/2010	1.99	0	9/6/2010	75.97	-0.01087
9/7/2010	1.99	0	9/7/2010	76.1	0.00171
9/8/2010	1.99	0	9/8/2010	76.77	0.008766
9/9/2010	2.05	0.029705	9/9/2010	76.84	0.000911
9/10/2010	2.05	0	9/10/2010	76.28	-0.00731
9/13/2010	2.05	0	9/13/2010	78.12	0.023835
9/14/2010	2.05	0	9/14/2010	77.8	-0.0041
9/15/2010	2.05	0	9/15/2010	78.55	0.009594
9/16/2010	2.35	0.136576	9/16/2010	76.57	-0.02553
9/17/2010	2.35	0	9/17/2010	77.86	0.016707
9/20/2010	2.35	0	9/20/2010	79.89	0.025738
9/21/2010	2.35	0	9/21/2010	78.75	-0.01437
9/22/2010	2.35	0	9/22/2010	83.23	0.05533
9/23/2010	2.35	0	9/23/2010	84.85	0.019277
9/24/2010	2.14	-0.09361	9/24/2010	85.01	0.001884
9/27/2010	2.14	0	9/27/2010	84.15	-0.01017
9/28/2010	2.14	0	9/28/2010	82.03	-0.02552
9/29/2010	2.14	0	9/29/2010	82.29	0.003165
9/30/2010	2.07	-0.03326	9/30/2010	80.44	-0.02274
10/1/2010	2.07	0	10/1/2010	78.38	-0.02594
10/4/2010	2.07	0	10/4/2010	77.18	-0.01543
10/5/2010	2.07	0	10/5/2010	75.69	-0.01949
10/6/2010	2.07	0	10/6/2010	74.56	-0.01504

10/7/2010	2.15	0.037919	10/7/2010	76.74	0.028819
10/11/2010	2.33	0.0804	10/11/2010	74.94	-0.02374
10/12/2010	2.33	0	10/12/2010	73.53	-0.01899
10/13/2010	2.33	0	10/13/2010	72.88	-0.00888
10/14/2010	2.36	0.012793	10/14/2010	69.46	-0.04806
10/15/2010	2.36	0	10/15/2010	69.59	0.00187
10/18/2010	2.36	0	10/18/2010	74.5	0.068178
10/19/2010	2.36	0	10/19/2010	75.16	0.00882
10/20/2010	2.36	0	10/20/2010	76.1	0.012429
10/21/2010	2.36	0	10/21/2010	75.56	-0.00712
10/22/2010	2.36	0	10/22/2010	75.68	0.001587
10/25/2010	2.45	0.037426	10/25/2010	75.08	-0.00796
10/26/2010	2.45	0	10/26/2010	75.23	0.001996
10/27/2010	2.45	0	10/27/2010	76.4	0.015433
10/28/2010	2.45	0	10/28/2010	75.93	-0.00617
10/29/2010	2.44	-0.00409	10/29/2010	77.53	0.020853
11/1/2010	2.44	0	11/1/2010	77.92	0.005018
11/2/2010	2.44	0	11/2/2010	77.54	-0.00489
11/3/2010	2.44	0	11/3/2010	78.52	0.012559
11/4/2010	2.48	0.016261	11/4/2010	78.94	0.005335
11/5/2010	2.49	0.004024	11/5/2010	78.51	-0.00546
11/8/2010	2.49	0	11/8/2010	79.04	0.006728
11/9/2010	2.49	0	11/9/2010	77.58	-0.01864
11/10/2010	2.49	0	11/10/2010	79.67	0.026583
11/11/2010	2.41	-0.03266	11/11/2010	79.06	-0.00769
11/12/2010	2.41	0	11/12/2010	77.44	-0.0207
11/15/2010	2.41	0	11/15/2010	77.84	0.005152
11/16/2010	2.41	0	11/16/2010	78.88	0.013272
11/17/2010	2.41	0	11/17/2010	77.86	-0.01302
11/18/2010	2.26	-0.06426	11/18/2010	79.29	0.0182
11/19/2010	2.26	0	11/19/2010	78.87	-0.00531
11/22/2010	2.26	0	11/22/2010	80.86	0.024918
11/23/2010	2.16	-0.04526	11/23/2010	82.64	0.021775
11/25/2010	2.16	0	11/25/2010	83.35	0.008555
11/26/2010	2.16	0	11/26/2010	84.96	0.019132

11/29/2010	2.16	0	11/29/2010	83.62	-0.0159
11/30/2010	2.16	0	11/30/2010	83.83	0.002508
12/1/2010	2.16	0	12/1/2010	82.93	-0.01079
12/2/2010	2.07	-0.04256	12/2/2010	82.69	-0.0029
12/3/2010	2.07	0	12/3/2010	83.56	0.010466
12/6/2010	2.07	0	12/6/2010	83.1	-0.00552
12/7/2010	2.07	0	12/7/2010	81.49	-0.01956
12/8/2010	2.07	0	12/8/2010	81.8	0.003797
12/9/2010	2.07	0	12/9/2010	80.62	-0.01453
12/10/2010	2.07	0	12/10/2010	81.23	0.007538
12/13/2010	2.13	0.028573	12/13/2010	80.63	-0.00741
12/14/2010	2.13	0	12/14/2010	80.15	-0.00597
12/15/2010	2.13	0	12/15/2010	81.22	0.013262
12/16/2010	2.2	0.032335	12/16/2010	82.28	0.012967
12/17/2010	2.2	0	12/17/2010	81.13	-0.01408
12/20/2010	2.2	0	12/20/2010	82.83	0.020738
12/21/2010	2.2	0	12/21/2010	82.32	-0.00618
12/22/2010	2.33	0.057411	12/22/2010	83.82	0.018058
12/24/2010	2.33	0	12/24/2010	85.19	0.016212
12/27/2010	2.33	0	12/27/2010	86.64	0.016878
12/28/2010	2.33	0	12/28/2010	86.95	0.003572
12/29/2010	2.44	0.04613	12/29/2010	87.06	0.001264
12/30/2010	2.41	-0.01237	12/30/2010	87.69	0.00721
12/31/2010	2.41	0	12/31/2010	87.67	-0.00023
1/3/2011	2.38	-0.01253	1/3/2011	87.71	0.000456
1/4/2011	2.38	0	1/4/2011	85.69	-0.0233
1/5/2011	2.38	0	1/5/2011	85.05	-0.0075
1/6/2011	2.31	-0.02985	1/6/2011	83.54	-0.01791
1/7/2011	2.31	0	1/7/2011	82.92	-0.00745
1/10/2011	2.31	0	1/10/2011	83.19	0.003251
1/11/2011	2.31	0	1/11/2011	82.67	-0.00627
1/12/2011	2.31	0	1/12/2011	81.85	-0.00997
1/13/2011	2.34	0.012903	1/13/2011	82.23	0.004632
1/17/2011	2.34	0	1/17/2011	85	0.033131
1/18/2011	2.34	0	1/18/2011	84.53	-0.00554

1/19/2011	2.34	0	1/19/2011	85.66	0.013279
1/20/2011	2.34	0	1/20/2011	85.65	-0.00012
1/21/2011	2.3	-0.01724	1/21/2011	86.79	0.013222
1/24/2011	2.3	0	1/24/2011	89.26	0.028062
1/25/2011	2.3	0	1/25/2011	90.8	0.017106
1/26/2011	2.3	0	1/26/2011	91.56	0.008335
1/27/2011	2.3	0	1/27/2011	91.19	-0.00405
1/28/2011	2.3	0	1/28/2011	89.74	-0.01603
1/31/2011	2.3	0	1/31/2011	89.6	-0.00156
2/1/2011	2.3	0	2/1/2011	89.2	-0.00447
2/2/2011	2.3	0	2/2/2011	90.07	0.009706
2/3/2011	2.33	0.012959	2/3/2011	90.23	0.001775
2/4/2011	2.33	0	2/4/2011	90.93	0.007728
2/7/2011	2.33	0	2/7/2011	90.8	-0.00143
2/8/2011	2.33	0	2/8/2011	90.97	0.00187
2/9/2011	2.33	0	2/9/2011	91.25	0.003073
2/10/2011	2.44	0.04613	2/10/2011	93.01	0.019104
2/11/2011	2.44	0	2/11/2011	93.53	0.005575
2/14/2011	2.44	0	2/14/2011	94.08	0.005863
2/15/2011	2.44	0	2/15/2011	93.18	-0.00961
2/16/2011	2.44	0	2/16/2011	93.24	0.000644
2/17/2011	2.48	0.016261	2/17/2011	93.69	0.004815
2/21/2011	2.48	0	2/21/2011	92.53	-0.01246
2/22/2011	2.48	0	2/22/2011	93.53	0.010749
2/23/2011	2.48	0	2/23/2011	96.14	0.027523
2/24/2011	2.47	-0.00404	2/24/2011	93.79	-0.02475
2/25/2011	2.47	0	2/25/2011	95.35	0.016496
2/28/2011	2.47	0	2/28/2011	95.57	0.002305
3/1/2011	2.47	0	3/1/2011	94.71	-0.00904
3/2/2011	2.47	0	3/2/2011	96.06	0.014153
3/3/2011	2.57	0.039688	3/3/2011	96.95	0.009222
3/4/2011	2.57	0	3/4/2011	97.97	0.010466
3/7/2011	2.57	0	3/7/2011	97.81	-0.00163
3/8/2011	2.57	0	3/8/2011	99	0.012093
3/9/2011	2.57	0	3/9/2011	98.03	-0.00985

3/10/2011	2.54	-0.01174	3/10/2011	98.21	0.001834
3/11/2011	2.54	0	3/11/2011	98.64	0.004369
3/14/2011	2.54	0	3/14/2011	96.87	-0.01811
3/15/2011	2.54	0	3/15/2011	97.3	0.004429
3/16/2011	2.54	0	3/16/2011	97.5	0.002053
3/17/2011	2.4	-0.0567	3/17/2011	94.05	-0.03603
3/18/2011	2.4	0	3/18/2011	95.18	0.011943
3/21/2011	2.4	0	3/21/2011	96.4	0.012736
3/22/2011	2.4	0	3/22/2011	97.25	0.008779
3/23/2011	2.4	0	3/23/2011	98.12	0.008906
3/24/2011	2.5	0.040822	3/24/2011	99.8	0.016977
3/25/2011	2.5	0	3/25/2011	101.29	0.01482
3/28/2011	2.5	0	3/28/2011	101.21	-0.00079
3/29/2011	2.5	0	3/29/2011	99.24	-0.01966
3/30/2011	2.5	0	3/30/2011	98.89	-0.00353
3/31/2011	2.63	0.050693	3/31/2011	98.87	-0.0002
4/1/2011	2.63	0	4/1/2011	99.71	0.00846
4/4/2011	2.63	0	4/4/2011	100.42	0.007095
4/5/2011	2.63	0	4/5/2011	99.71	-0.0071
4/6/2011	2.63	0	4/6/2011	102.33	0.025937
4/7/2011	2.68	0.018833	4/7/2011	102.26	-0.00068
4/8/2011	2.68	0	4/8/2011	102.44	0.001759
4/11/2011	2.68	0	4/11/2011	103.74	0.012611
4/12/2011	2.68	0	4/12/2011	102.3	-0.01398
4/13/2011	2.68	0	4/13/2011	104.21	0.018498
4/14/2011	2.62	-0.02264	4/14/2011	105.94	0.016465
4/28/2011	2.61	-0.00382	4/28/2011	113.26	0.066813
5/5/2011	2.72	0.041282	5/5/2011	111.3	-0.01746
5/12/2011	2.5	-0.08434	5/12/2011	115.24	0.034788
5/19/2011	2.6	0.039221	5/19/2011	115.82	0.00502
6/2/2011	2.6	0	6/2/2011	122.4	0.055257
6/9/2011	2.74	0.052446	6/9/2011	121.8	-0.00491
6/16/2011	2.67	-0.02588	6/16/2011	124.91	0.025213
6/23/2011	2.68	0.003738	6/23/2011	124.7	-0.00168
6/30/2011	2.78	0.036634	6/30/2011	118.31	-0.0526

7/7/2011	2.74	-0.01449	7/7/2011	109.89	-0.07383
7/14/2011	2.88	0.049832	7/14/2011	112.9	0.027023
7/21/2011	3.04	0.054067	7/21/2011	117.38	0.038914
7/28/2011	3.07	0.00982	7/28/2011	116.79	-0.00504
8/4/2011	2.79	-0.09564	8/4/2011	121.45	0.039125
8/11/2011	2.82	0.010695	8/11/2011	111.97	-0.08127
8/18/2011	2.82	0	8/18/2011	107.22	-0.04335
8/25/2011	2.92	0.034847	8/25/2011	113.41	0.056127
9/1/2011	2.9	-0.00687	9/1/2011	118.06	0.040183
9/8/2011	2.9	0	9/8/2011	118.83	0.006501
9/15/2011	2.9	0	9/15/2011	118.19	-0.0054
9/22/2011	2.69	-0.07517	9/22/2011	116.07	-0.0181
9/29/2011	2.57	-0.04564	9/29/2011	103.28	-0.11675
10/6/2011	2.57	0	10/6/2011	110.09	0.063854
10/13/2011	2.68	0.041911	10/13/2011	110.75	0.005977
10/20/2011	2.7	0.007435	10/20/2011	116.79	0.053102
10/27/2011	2.74	0.014706	10/27/2011	114.99	-0.01553
11/3/2011	2.83	0.032319	11/3/2011	115.93	0.008141
11/10/2011	2.85	0.007042	11/10/2011	116.44	0.00439
11/17/2011	3	0.051293	11/17/2011	111.44	-0.04389
11/24/2011	2.82	-0.06188	11/24/2011	103.34	-0.07546
12/1/2011	2.68	-0.05092	12/1/2011	109.72	0.059907
12/8/2011	2.31	-0.14857	12/8/2011	111.39	0.015106
12/15/2011	2.12	-0.08583	12/15/2011	112.56	0.010449
12/22/2011	2.21	0.041576	12/22/2011	106.72	-0.05328
12/29/2011	2.24	0.013483	12/29/2011	115.99	0.083295
1/5/2012	2.35	0.047939	1/5/2012	112.2	-0.03322
1/12/2012	2.12	-0.103	1/12/2012	107.52	-0.04261
1/19/2012	2.11	-0.00473	1/19/2012	111.7	0.03814
1/26/2012	2.16	0.02342	1/26/2012	110.36	-0.01207
2/2/2012	2.12	-0.01869	2/2/2012	109	-0.0124
2/9/2012	2.17	0.023311	2/9/2012	108.4	-0.00552
2/23/2012	2.17	0	2/23/2012	111.85	0.031331
3/1/2012	2.23	0.027274	3/1/2012	112.8	0.008458
3/8/2012	2.25	0.008929	3/8/2012	110	-0.02514

3/15/2012	2.33	0.034938	3/15/2012	107.68	-0.02132
3/22/2012	2.26	-0.0305	3/22/2012	110.11	0.022316
3/29/2012	2.23	-0.01336	3/29/2012	117.26	0.062914
4/5/2012	2.26	0.013363	4/5/2012	119.2	0.016409
4/12/2012	2.19	-0.03146	4/12/2012	121.55	0.019523
4/19/2012	2.13	-0.02778	4/19/2012	124.72	0.025746
4/26/2012	2.18	0.023203	4/26/2012	126.73	0.015988
5/3/2012	2.17	-0.0046	5/3/2012	129.19	0.019225
5/10/2012	2.08	-0.04236	5/10/2012	124.18	-0.03955
5/17/2012	2.18	0.046957	5/17/2012	125.25	0.00858
5/24/2012	2.06	-0.05662	5/24/2012	126.06	0.006446
5/31/2012	2.01	-0.02457	5/31/2012	122.39	-0.02955
6/7/2012	2.02	0.004963	6/7/2012	116.71	-0.04752
6/14/2012	2.03	0.004938	6/14/2012	117.29	0.004957
6/21/2012	2.03	0	6/21/2012	119.22	0.016321
6/28/2012	2.16	0.062072	6/28/2012	110.08	-0.07976
7/5/2012	2.32	0.071459	7/5/2012	111.57	0.013445
7/12/2012	2.49	0.070716	7/12/2012	110.17	-0.01263
7/19/2012	2.68	0.073534	7/19/2012	107.71	-0.02258
7/26/2012	2.5	-0.06953	7/26/2012	98.56	-0.08878
8/2/2012	2.56	0.023717	8/2/2012	96.25	-0.02372
8/9/2012	2.61	0.019343	8/9/2012	94.7	-0.01623
8/16/2012	2.56	-0.01934	8/16/2012	89.6	-0.05536
8/23/2012	2.56	0	8/23/2012	99.69	0.10671
8/30/2012	2.58	0.007782	8/30/2012	99.56	-0.0013
9/6/2012	2.54	-0.01563	9/6/2012	104.47	0.048139
9/13/2012	2.42	-0.0484	9/13/2012	103.33	-0.01097
9/20/2012	2.25	-0.07284	9/20/2012	106.04	0.025889
9/27/2012	2.29	0.017622	9/27/2012	113	0.063571
10/4/2012	2.41	0.051075	10/4/2012	114.11	0.009775
10/11/2012	2.47	0.024591	10/11/2012	116.34	0.019354
10/18/2012	2.43	-0.01633	10/18/2012	112.73	-0.03152
10/25/2012	2.43	0	10/25/2012	114.98	0.019763
11/1/2012	2.43	0	11/1/2012	114.81	-0.00148
11/8/2012	2.37	-0.025	11/8/2012	113	-0.01589

11/15/2012	2.36	-0.00423	11/15/2012	110.47	-0.02264
11/22/2012	2.4	0.016807	11/22/2012	112.84	0.021227
11/29/2012	2.43	0.012423	11/29/2012	115.16	0.020352
12/6/2012	2.41	-0.00826	12/6/2012	116.18	0.008818
12/13/2012	2.33	-0.03376	12/13/2012	107.33	-0.07923
12/20/2012	2.25	-0.03494	12/20/2012	109.66	0.021476
12/27/2012	2.25	0	12/27/2012	109.58	-0.00073
1/3/2013	2.17	-0.0362	1/3/2013	108.88	-0.00641
1/10/2013	2.2	0.01373	1/10/2013	109.87	0.009051
1/17/2013	2.31	0.04879	1/17/2013	108.84	-0.00942
1/24/2013	2.37	0.025642	1/24/2013	110.6	0.016041
1/31/2013	2.44	0.029108	1/31/2013	108.01	-0.0237
2/7/2013	2.44	0	2/7/2013	110.81	0.025593
2/28/2013	2.36	-0.03334	2/28/2013	114.59	0.033544
3/7/2013	2.42	0.025106	3/7/2013	112.43	-0.01903
3/14/2013	2.59	0.06789	3/14/2013	113.23	0.00709
3/21/2013	2.66	0.026668	3/21/2013	116.03	0.024428
3/28/2013	2.57	-0.03442	3/28/2013	117.59	0.013355
4/4/2013	2.57	0	4/4/2013	118.35	0.006442
4/11/2013	2.49	-0.03162	4/11/2013	117.09	-0.0107
4/18/2013	2.52	0.011976	4/18/2013	112.73	-0.03795
4/25/2013	2.47	-0.02004	4/25/2013	110.52	-0.0198
5/2/2013	2.59	0.04744	5/2/2013	107.69	-0.02594
5/9/2013	2.69	0.037883	5/9/2013	107.18	-0.00475
5/16/2013	2.69	0	5/16/2013	106.51	-0.00627
5/23/2013	2.69	0	5/23/2013	109.32	0.02604
5/30/2013	2.73	0.01476	5/30/2013	103.84	-0.05143
6/6/2013	2.67	-0.02222	6/6/2013	97.31	-0.06495
6/13/2013	2.53	-0.05386	6/13/2013	99.06	0.017824
6/20/2013	2.5	-0.01193	6/20/2013	101.19	0.021274
6/27/2013	2.48	-0.00803	6/27/2013	105.84	0.044929
7/4/2013	2.41	-0.02863	7/4/2013	102.85	-0.02866
7/11/2013	2.52	0.044632	7/11/2013	102.9	0.000486
7/18/2013	2.57	0.019647	7/18/2013	103.67	0.007455
7/25/2013	2.53	-0.01569	7/25/2013	102.04	-0.01585

8/1/2013	2.28	-0.10404	8/1/2013	101	-0.01024
8/8/2013	2.27	-0.0044	8/8/2013	105.31	0.041788
8/15/2013	2.4	0.055689	8/15/2013	101.56	-0.03626
8/22/2013	2.4	0	8/22/2013	104.31	0.026717
8/29/2013	2.34	-0.02532	8/29/2013	108.35	0.037999
9/5/2013	2.92	0.221433	9/5/2013	110.04	0.015477
9/12/2013	2.1	-0.32965	9/12/2013	109.97	-0.00064
9/19/2013	2.14	0.018868	9/19/2013	108.17	-0.0165
9/26/2013	2.18	0.018519	9/26/2013	109.82	0.015139
10/3/2013	1.9	-0.13747	10/3/2013	111.94	0.01912
10/10/2013	1.9	0	10/10/2013	111.39	-0.00493
10/17/2013	2.1	0.100083	10/17/2013	115.91	0.039776
10/24/2013	2.1	0	10/24/2013	116.09	0.001552
10/31/2013	0.82	-0.94039	10/31/2013	113.1	-0.02609
11/7/2013	0.82	0	11/7/2013	109.91	-0.02861
11/14/2013	2.1	0.940388	11/14/2013	107.43	-0.02282
11/21/2013	2.64	0.228842	11/21/2013	107.55	0.001116
11/28/2013	2.42	-0.08701	11/28/2013	110.86	0.030312
12/5/2013	2.46	0.016394	12/5/2013	110.92	0.000541
12/12/2013	2.12	-0.14875	12/12/2013	109.93	-0.00897
12/19/2013	2.29	0.077136	12/19/2013	107.49	-0.02245
12/26/2013	2.29	0	12/26/2013	104.54	-0.02783

Appendix B

Results from R software

```
Margin1 is ethanol.
Margin 2 is crude oil.
Both margins are log return.
```

Copula: Husler-Reiss

```
> print(fit.hr)
The Maximum Likelihood estimation is based on 40 observations.
Margin 1 :
          Estimate Std. Error
m1.shape  0.42606      0.171
m1.loc    0.03452      0.005
m1.scale  0.02988      0.005
Margin 2 :
          Estimate Std. Error
m2.shape  0.37162      0.193
m2.loc    0.04197      0.003
m2.scale  0.01585      0.003
Copula:
      Estimate Std. Error
param    0.465      0.614
The maximized loglikelihood is 162.716
Optimization converged
Number of loglikelihood evaluations:
function gradient
     252       39
```

Copula: Galambos

```
> print(fit.galambos)
The Maximum Likelihood estimation is based on 40 observations.
Margin 1 :
          Estimate Std. Error
m1.shape  0.43239      0.158
m1.loc    0.03444      0.005
m1.scale  0.02995      0.005
```

```
Margin 2 :
         Estimate Std. Error
m2.shape  0.37823      0.195
m2.loc    0.04197      0.003
m2.scale  0.01591      0.003
Copula:
      Estimate Std. Error
param   0.2395       0.33
The maximized loglikelihood is 162.7305
Optimization converged
```

Copula: Tawn

```
> print(fit.tawn)
The Maximum Likelihood estimation is based on 40 observations.
Margin 1 :
         Estimate Std. Error
m1.shape  0.41579      0.139
m1.loc    0.03419      0.005
m1.scale  0.02957      0.005
Margin 2 :
         Estimate Std. Error
m2.shape  0.40935      0.203
m2.loc    0.04197      0.003
m2.scale  0.01608      0.003
Copula:
      Estimate Std. Error
param   0.2465      0.352
The maximized loglikelihood is 162.9222
Optimization converged
```


Copula: Gumbel

```
> print(fit.gumbel)
The Maximum Likelihood estimation is based on 40 observations.
Margin 1 :
         Estimate Std. Error
m1.shape  0.43375      0.147
m1.loc    0.03424      0.005
m1.scale  0.02980      0.005
```

```
Margin 2 :
         Estimate Std. Error
m2.shape  0.39006      0.194
m2.loc    0.04204      0.003
m2.scale  0.01598      0.003
Copula:
      Estimate Std. Error
param    1.076      0.157
The maximized loglikelihood is 162.8337
Optimization converged
```

CURRICULUM VITAE

Author's Name	Miss Aujcharapran Rojmaneebunpot
Date of Birth	26 July 1987
Educational Background	2010 Bachelor of Business (Financial), Chiang Mai University, Thailand
Experience	2011 Work at Bank of Thailand, Northern Region Office as a trainee in Economic Research Division 2009 Work at The Stock Exchange of Thailand as a trainee in Customer Service Unit, Professional Education Department