A WEAK-FORM EFFICIENCY TEST OF FUTURES MARKET IN CHINA: A CASE OF SOYBEAN

By

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ABSTRACT

Soybean No.1 contract in DCE on behalf of the domestic soybean prices, reflecting characteristics of the domestic soybean quality, DCE is the price discovery center of domestic non-genetically modified soybean, and soybean No.1 is also the world's largest non-genetically modified soybean futures varieties. On the international market, the price of soybean futures on the Dalian Commodity Exchange has become an indicator of the market price of soybeans. The study of market efficiency in futures markets is important. The aim of this paper is to test the efficiency of soybean futures market in China during January 2009 to July 2013 by using Johansen’s cointegration approach. It identifies the long-term equilibrium relationship between futures and cash market.

The futures prices from China Dalian Commodity Exchange are taken five forecasting horizons, separately at one week, two weeks, two months, four months and six months prior to the maturity of each contract. And the cash prices, the national soybean acquisition price, are taken at the third week of each maturity month of the futures contracts, and are obtained from CNgrain online database.

The results show that a long-term equilibrium relationship between the futures price and cash price for soybeans has been established. A weak-form efficiency of the soybean futures market is revealed.

This paper provides benefit to Chinese farmers, soybean crushers, domestic traders and importers to help them to watch soybean futures prices on the Dalian exchange and then act accordingly. The studies of efficiency test in Chinese spot-futures markets are very important and necessary to both the government and the producers/marketers in China.
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CHAPTER I

GENERALITIES OF THE STUDY

1.1 Background of the Study

Futures market is used for arbitrage, operational, and anticipatory hedging in an attempt to manage price risks inherent in commodity ownership. The futures market efficiency is the premise and foundation of risk management and price discovery. When a futures market has a high effectiveness, the whole market would be balanced, hedgers and speculators can take what we need, mutual trade and transfer risks. However, if the lack of efficiency for the futures market, then the market price will out of rational pricing ranges, so as to have an impact on the safety, stable operation of the market, and even the entire macro-economy operation. The studies of efficiency test in Chinese spot-futures markets are very important and necessary to the Chinese farmers, importers, domestic traders. And futures market efficiency is one of the most important indicators to measure maturity of the market. The futures market efficiency is really worthy of our attention.

There are many studies conducted to research on the Chinese commodities futures market efficiency, such as H. H. Wang and Ke (2003), H. H. Wang and Ke (2005), Chen and Firth (2006), Liu and Wang (2006), Xin, Chen, and Firth (2006), Chongfeng (2007), testing the equilibrium relationship between spot and futures prices, to reveal whether the futures market is efficient or inefficient based on the analysis results. In an inefficient futures market, the prices have “fully reflect” all the available information, no traders can arbitrage in the efficient commodity futures market. It also means that an efficient commodity futures market is a signal of the spot price. The equilibrium price for suppliers and demanders will also be reflected in efficient market. If the futures market is inefficient, risk premium and/or transportation cost will exist, and the price of futures
market would predict the price on the related cash market. Fama (1991) analyzed the price spreads between different contracts of CZCE, founding that the sign of inefficiency is arbitrage.

Why DCE? There are three commodity futures exchanges and only one security futures exchange: Zhengzhou Commodity Exchange (CZCE, 1993), the Shanghai Future Exchange (SFE, 1999), the Dalian Commodity Exchange (DCE, 1993), and Financial Futures Exchange (CFFEX, 2006) in China. The CZCE and the DCE exchanges mainly trade agricultural commodities. According to trade volume of futures and options, the three biggest commodity exchange of mainland China all ranked top 20 in the global 52 exchanges at the end of 2008. The trading volume of mainland China futures market has shared 1/3 of the global commodity futures market. DCE has become the second largest commodity futures market in the world as the trading volume in DCE is 3.8 times higher than that in Chicago Board of Trade (CBOT) (Food China, 2001).

Why choose soybeans? Agricultural commodities have added risk, as they are typically seasonal; tend to attract lower prices during the harvest season. The seasonal storage of an agricultural commodity and the use of futures markets to secure a return to storage through a predictable change in relation between cash and futures prices. Soybean futures are the major agricultural futures varieties in the world. The production amount in China can’t capture its consumption even China is the fourth-largest soybean (Figure 1.1). The United States is the largest soybeans supplier and the leading exporter in the world (Figure 1.2). China has become the biggest soybean importer in the international soybean market, exceeding corn and wheat, due to limited land resources, income growth, increasing population, urbanization and recent policy changes (Zhao, Yang, Zhang, & Qi, 2010) (Figure 1.3). Import volume and prices of China have great influence on the domestic market soybean prices. But the large contract volume is not the standard of market maturity but the market brisk. We can test market maturity by testing its efficiency.
Figure 1.1: Volume domestic soybean imports (Red line)

Note: Yellow bar chart: Domestic soybean productions (Ten thousand tons)
Source: www.cngrain.com

Figure 1.2: Leading US bulk exports during 1990-2002.

Figure 1.3: China’s leading imports during 1990 to 2002.

Source: Food and Agriculture Organization of United Nations (FAO) database, 2003

Why Soybean No.1? There are Soybean No.1 and Soybean No.2 two soybean products in DCE. However, the trading volume of Soybean No.1 takes a great large percent compared to Soybean No.2 (Figure 1.2). Soybean No.1 contract in CDE on behalf of the domestic soybean prices, reflecting characteristics of the domestic soybean quality, CDE is the price discovery center of domestic non-genetically modified soybean, and soybean No.1 is the largest non-genetically modified soybean futures varieties in the world. On the international market, the price of soybean futures on the Dalian Commodity Exchange has become an indicator of the market price of soybeans and an important factor to format the world soybean prices.
The price index of soybean No.1 during 2009-2013 is very fluctuated (Figure 1.5). The spread between futures price and spot price is also fluctuated (Figure 1.6). It caused of the decline in commodity transactions. Changes in commodity prices originate in shocks to demand and supply. It has generally been supposed that price volatility for food crops owes more to supply shocks while volatility for industrially consumed commodities is driven primarily by demand shocks. Agricultural commodities price is an ongoing concern. Cashin & McDermott (2002), Deaton & Laroque (1992) for instance have tended to focus on the behavior of commodity prices. Some authors have already tried to measure agricultural price fluctuation. Gilbert (2006) showed that agricultural price volatility was fluctuated between 1960s and 1990s. Gilbert & Morgan (2010) found that volatility has generally been lower of 19 commodities prices during the period 1970-2009 than previously, except for
Balcombe (2009) finds a persistent volatility in agricultural price series. Sumner (2009) who studied price data for wheat and maize over an extended period from 1866-2008, found that the price is also fluctuated. A number of studies have researched the factors which may explain the evolution of recent price changes (Abbott & de Battisti, 2011; Gilbert, 2010; Gilbert & Morgan, 2010).

The reason for price fluctuations is economic cycles, including domestic price instability, therefore the instability lead to speculation, unstable international prices and unstable commodity exports. The future contracts can be considered to be an efficient risk minimizing tool which insulate traders from the unexpected changes in future prices. The DCE formed a perfect breed arbitrage system for arbitrage investors to lower risk and stable income arbitrage. All participants need to hedge and investment as existing factors such as price volatility, long industrial chain, many participating companies and wide range of influence. These contracts enable farmer, producer, anticipatory to lock-in the prices of the products well in advance. Therefore, it is very helpful for producers, buyers, and investors in agricultural produce to consider the effectiveness of Chinese agricultural futures prices using soybean futures on the Dalian Commodity Exchange.

**Figure 1.5: National Soybean acquisition price**

Source: www.cngrain.com
Why test weak-form efficiency? The Efficient market hypothesis (EMH) mentions that the futures market price has fully reflected all information available. No traders can arbitrage in this market. There are forms of efficiency, defined as Strong-form efficiency, Semi-strong efficiency and Weak-form efficiency (Malkiel & Fama, 1970). If investors can earn abnormal returns based on past price, the market is regarded as Weak-form efficient market. If prices also reflect new publicly available information, the market is Semi-strong efficient; and except past price, public price, if also contain available publicly or privately, the market is Strong-form efficient. In this paper, we will test weak-form EMH as we want to know whether the past price data can predict future price changes. If we test the market is semi-strong weak-form or not, we still need further test, such as calendar effect and event effect.

According to the above information, this paper interests to study that when China bring soybean No.1 into the futures market, it will help to reduce the risk on price fluctuated and it corresponded to the objective on the market efficient.
1.2 Statement of the Problem

A large number of papers regarding testing on efficiency of futures market were reported, that may be different on futures market chosen, commodities chosen development, horizon chosen, or methodology chosen. For different objectives, Lean, McAleer, and Wong (2010) researched the efficiency of the oil commodity futures market by using mean-variance (MV) and stochastic dominance (SD) methodologies during 1989-2008, finally denominated futures oil markets are efficient. Miclăuş, Lupu, Dumitrescu, and Bobircă (2008) examined the European futures market efficiency of the Carbon using Event-Study methodology, and found that futures markets are not efficient. For form of EMH, semi-strong form test of efficiency was examined for livestock futures market, utilizing alternative methods of evaluation, and an inefficient market was proved (Leuthold & Hartmann, 1979). For methodology, most of people adopt traditional econometric model. Their conclusions are different. For example, Bigman, Goldfarb, & Schechtman (1983) use a simple linear regression model to test the CBOT market efficiency. The results of F tests show that the futures prices provide inefficient signal to spot price. However, few years later, researches showed that the result is invalid. Such as, Maberly (1985), Elam & Dixon (1988), Shen & Wang (1990) find different results as different results of F tests.

In the context of China, there are many studies that test weak-form efficiency of futures market for soybeans. H. H. Wang and Ke (2005) studied the Chinese futures market efficiency of wheat and soybean with Johansen's cointegration approach, the futures forecasting horizons ranging from 1 week to 4 months, and concluded that the soybeans futures market is weak-form efficient, however the wheat futures market is inefficient.

When people classify whether the market is efficiency or inefficiency, assessment of the degree is also important, which is also a limitation. From results of the foreign researches, the efficiency of the futures market at different time period will
exhibit different characteristics, which can reflect the market gradually maturing process. Therefore, this paper intends to investigate the soybean market efficiency with updated data from January 2009 to July 2013, and larger horizons ranging from 1 week to 6 months.

1.3 Research Objective

The objective of this research is to test whether Chinese soybean futures market is weak-form efficient or not.

1.4 Research Question

Is China’s soybean futures market weak-form efficient?

1.5 Scope of the Research

In this paper, a Johansen cointegration methodology is adapted to research the Chinese soybean futures market efficiency during January 2009 to July 2013. The prices of soybean No.1 are regarded as prices of soybean product in this paper. The futures contract months in DCE are Jan, Mar, May, Jul, Sep, and Nov. The weekly futures price data is obtained from DCE website. The futures prices are taken five forecasting horizons. They are one-week before maturity, two-week before maturity, two-month before maturity, four-month before maturity, and six-month before maturity respectively. And the cash prices are the national soybean acquisition prices collected from CNgrain online database are the third-week prices of contract in related maturity month. The observations are 168 in total.

1.6 Limitations of the Research

1) Proper statistical model
If we want to test the futures market efficiency, a proper model is very important. The statistical model chosen suitable or not can affect the test results directly. What’s more, some models have limitation. For example, Grossman & Stiglitz (1980) point out that Fama’s efficient market can’t exist if no sophisticated marketers or producers. Otherwise, the result will present inefficient even it is efficient. Furthermore, Durham & Si (1999) researched the DCE and the CBOT efficiency and their relationship by using law of one-price models, the results show that the relationship may cannot be well represented by only one single model.

2) Data consequence

In DCE, the futures contracts are not consequence, data collection methods are different in different literatures. It affects the results directly. As method to match futures price and spot price, it’s still a problem. In DCE, there are six futures contracts in each year: January, March, May, July, September and November. How to get a consequence series data is still a limitation.

1.7 Significance of the Research

The futures market of China has become the first biggest agricultural futures market and the second largest commodity futures market of the world. It’s important to study the futures market efficiency both for Chinese and foreign investors who are interested in investment on futures market knowing the way to do investment. Farmer, producer, anticipatory can lock-in the prices of the products by signing futures contracts, in order to hedge risk or arbitrage in the market. Investors who are searching market profits can handle new information and act thorough analyses. If the price of soybean futures on the DCE provides a reliable forecast of spot prices, producers would control their risks in the production and trading process effectively. What’s more, in international market, foreign countries export the major grain commodities to China.
This aim of this paper is to provide information to international exporters or importers that the relationship between agricultural futures market and spot market.

1.8 Definition of Terms

**DCE**
DCE is stand for Dalian Commodity Exchange which is established in 1993 and located in Northeast of China. DCE belongs to the four futures exchanges in China. It is approved by the China Securities Regulatory Commission (CSRC). (Dalian Commodity Exchange, 2013)

**EMH**
Basic theory of the behavior of efficient markets. The information is available and free to all knowledgeable investors who react quickly, and prices can adjust quickly and on average.(Gitman & Joehnk, 2008)

**Random Walk Theory**
The theory that stock price are unpredictable, participates can’t know where prices are headed(Gitman & Joehnk, 2008). And is also mentioned that price changes are independent of each other(R. A. Brealey, Myers, & Allen, 2005).

**Semi-strong Efficiency**
Form of EMH. Traders cannot arbitrage using publicly available information.(Dimson & Mussavian, 2000)

**Soybean No.1**
Non-genetically modified soybean futures in DCE. No. 1 soybeans are defined by the FGIS Grading standards for soybeans. Soybean No. 1 (non-genetically modified) contracts began trading from 2002 in the DCE. Soybeans traded at the DCE named “Soybeans” in prior. (Dalian Commodity Exchange, 2013)

**Soybean No.2**
Modified soybean futures in DCE. No. 2 Soybean contracts
traded at the DCE in 2004. It was previously traded under the general heading “Soybeans”. (Dalian Commodity Exchange, 2013)

Strong-form Efficiency  Form of EMH. Abnormal profits cannot be earned using information, public and private. (Dimson & Mussavian, 2000)

Weak-form Efficiency  Form of EMH. There is no use for past price data on stock prices to predict future prices. Price on weak form efficient market has fully reflected all the historic price information, including trading price and volume. The prices change randomly with the information arrives randomly. (Fama, 1991).

CHAPTER II

REVIEW OF RELATED LITERATURE

2.1 Theories Related to the Study
1) Law of one price

The law of one price (LOP) stated that all identical goods have only one price in an efficient market and LOP exists due to arbitrage opportunities. The different price of securities and commodities in two different markets will lead to an arbitrage, which is buy at low price in one market and sell at high price in the other market. The law of one price constitutes the basis of the theory of purchasing power parity and is derived from the no arbitrage assumption. Encyclopedias and dictionaries noted that arbitrage is the mechanism behind the LOP. J. Pippenger & N. Phillips (2009) show how cointegration tests is used to reject the LOP. However, it didn’t find reliable evidence that rejects the LOP.

Many studies are regarding LOP, such as Ardeni (1989) rejected LOP in research paper. What’s more, Isard (1977), Richardson (1978), Engel and Rogers (1999) find they can’t arbitrage between price index. Some people find some evidence of cointegration, such as Baffes (1991) and Vataja (2000) support for the LOP by cointegration test which is also proved by Lutz (2004) and Goldberg (2005). There is consistent support for the LOP if prices for identical products are from markets where arbitrage is possible. For example, Goodwin (1992), and Phillips & Pippenger (2005), Asplund & Friberg (2001), Haskel & Wolf (2001).

2) EMH theory

The efficient market hypothesis (EMH) was derived from the random walk theory of asset prices (Samuelson, 1965) and was first mentioned in 1970’s (Fama, 1965). EMH has been widely accepted and applied by academic financial economists. Before Fama formally proposed the concept of market efficiency, many foreign scholars have taken many empirical researches on it.

It’s a controversial topic for the ability of future markets to predict subsequent spot prices. Empirical research results are mixed. For example, Larson (2012) research the corn futures in US market by closing price during 1949-1958, and find that the corn
futures price is random walk. The results show a weak-form efficient market. But following researches by Stevenson & Bear (1970) examine the corn and soybean futures markets during 1951-1968, and find that investors can gain profit by making investment strategy, then denying the weak-form market efficiency hypothesis. In 1980s, Bigman (1983) research the corn, grain and soybean futures prices efficiency, the weak-form efficiency was proved again. The reason for differences is differences in the time periods analyzed and the method chosen for testing.

3) Random Walks theory

The random-walk theory hypothesis (RWH) was first stated and tested by Bachelier (1900). And the random-walk theory has a practical development mainly by Eugene Fama (1965) and Burton Malkiel (1973) in finance field. Proponents of random-walk theory are that the current market prices are independent and not related to the past history market price (Fama, 1995). The random-walk theory states that no serial correlation exists between past price trends and futures price change, and the price in future is impossible to predict. If current prices follow a random walk, then price changed over time are random. Today’s price change is unrelated to previous steps. Random-walk theory is consistent with the EMH and implies an efficient market where no systematic over-valuations or under-valuations of the stock. The presence of randomness in stock movements indicating the market is weak-form efficiency. No traders are able to predict future market price solely based on past price and gene profit.

A number of empirical literatures regarding the random walk theory have been tested. A. W. Lo and MacKinlay (1988) denominated that the random walk model is strongly rejected by testing the RWH of weekly stock market returns during 1962-1985. Urrutia (1995) examined the Latin American equity markets random walk and market efficiency during 1975-1911. The tests indicated that the RWH is rejected and the markets are weak-form efficient. Frennberg & Hansson (1993) researched the Swedish stock market during 1919-1990, the results showed that Swedish stock prices
did not followed a random walk.

4) Price Discovery Theory

Price discovery is one of the most important functions for futures markets. The price discovery function is that the new information is reflected first in changed futures prices or in changes cash prices (Hoffman, 1932). It commonly defined that people use futures price to forecast cash/spot market, and is very crucial to people in the market (Schroeder & Goodwin, 1991; Working, 1948). Price-discovery theory is considerable controversy against EMH d futures prices or in charged cash prices (A. Lo, 2007).

Large numbers of researches are on test of relationship between the futures prices and spot prices. However, majority of literatures proved that futures price lead to spot prices. For example, Kawaller, Koch, and Koch (1987) tested the lead-lag relationship between S&P 500 futures and index with three-stage least-squares regression. They concluded that futures price movements lead the index change. K. Chan (1992) investigated the lead-lag relationship between returns of cash index and returns of Index futures and S&P 500 futures, and found that futures index change leads the cash index change. Lead and lag relationship also be tested in the Nikkei Stock Average, and it concluded that lagged changes in the futures price affect the short-term adjustment in the spot index (Tse, 1995). Hernandez & Torero (2010) found that changes in futures prices lead changes in spot prices, by investigating the dynamic relationship between spot and futures prices of agricultural commodities with Granger causality method. Helbling, Huidrom, Kose, & Otrok (2011) used 10 commodity futures to assess relationship of the spot prices and futures prices. Silvapulle & Moosa (1999) researched the relationship between the spot and futures prices of WTI crude oil with linear causality methodology. The results showed futures prices lead spot prices. The research for Brooks, Rew, & Ritson (2001) examined the lead-lag relationship between the FTSE 100 index and index futures price during 1996-1997, it is found that futures price lagged changes which would help to predict spot price changes. Finding
from Asche & Guttormsen (2002) concluded that futures prices lead spot prices with Engle and Granger cointegration methodology.

2.2 Empirical Studies on Futures Market

In recent years, a large numbers of researches regarding futures market for varieties commodities in China or even in different markets.

1) Agricultural Commodities

Nicole (2011) studied the growth and impact of agricultural futures market traders. Three important and representative commodities: corn for field crops, live cattle for livestock, and coffee for soft commodities are selected, the dataspans from 2000 to mid-2009. The result showed that futures markets lack of risk premium. Randy (2005) studied the price determination of wheat, soybeans, corn, rice, and cotton in major U.S. agricultural commodity markets. For the onions markets, such as Hieronymus (1960), Working (1960), Gray (1963), and Cox (1976); for the wheat market, such as Hooker (1901), and Tomek (2012), for the cotton market, Emery (1896); for the cattle market, such as Powers (1970), Taylor & Leuthold (1974) and Cox (1976); Other authors find that there is no essential gain in stability: see, e.g., for the onions market, as Johnson (1973); for the hessian market, as Naik (1970). These are just a small sample of what has become a vast literature.

Williams, Peck, Park, & Rozelle (1998) analyzed efficiency of mungbean CZCE futures market in China, founding that condition for arbitrage existed on the CZCE. It’s is a sign of inefficiency. Zhao, Zhang, & Zou (2011) researched the Chinese soybean long-term markets, and the results showed that Chinese soybean futures market is not weak-form efficient.

Chen & He (2010) investigated the nonlinear dynamical relationship in China’s agricultural futures markets, and they found nontrivial multifractal spectra for
Hard Winter wheat, Strong Gluten wheat, Soybean meal, and Soybean No.1. He & Chen (2010a) applied MF-DFA method to study wheat, soybean, corn, and soybean meal futures markets. Their concluded that the futures markets above show multifractal properties except US soybean market (He & Chen, 2010b). Moreover, they performed a new statistical test to detect cross-correlations and applied an efficient algorithm. (He & Chen, 2011)

2) Other Industry Commodities

Chaoqun (et al. 2012) tested the inefficiency of China's stock index futures market, and the results show that this market is not efficient. Christos and Dimitrios (2006) examine the effect of future trading of the underlying spot market. It found that the FTSE/ASE-20 index futures trading have led to negative effect and FTSE/ASE Mid 40 index has led to positive effect. Many studies have indicated the departure from market efficiency. Pant and Bishnoi (2001) examined random walk hypothesis of Indian Stock market indices. The analysis conducted that the Indian stock market indices do not follow random walk. Brooks, Rew, and Ritson (2001) tested the lead-lag relationship of the FTSE 100 index futures market by using many time series models, the results is the futures lagged can predict spot price changes.

Table 2.1: Summary of the empirical evidences from the prior studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Product/Market</th>
<th>Published year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>[Bigman](corn, grain and soybean)</td>
<td>1983</td>
</tr>
<tr>
<td></td>
<td>[Urrutia](Lartin American equity markets.)</td>
<td>1995</td>
</tr>
</tbody>
</table>
### Inefficiency

<table>
<thead>
<tr>
<th>Author</th>
<th>Product/Market</th>
<th>Published year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stevenson &amp; Bear</td>
<td>Corn and Soybean</td>
<td>1970</td>
</tr>
<tr>
<td>Farrell &amp; Olszewski</td>
<td>S&amp;P 500</td>
<td>1993</td>
</tr>
<tr>
<td>Williams, Peck, Park, &amp; Rozelle</td>
<td>Mungbean</td>
<td>1998</td>
</tr>
<tr>
<td>H. H. Wang &amp; Ke</td>
<td>Wheat</td>
<td>2003</td>
</tr>
<tr>
<td>Miclăuş, Lupu, Dumitrescu, &amp; Bobircă</td>
<td>Carbon</td>
<td>2006</td>
</tr>
<tr>
<td>Yu &amp; Chunjie</td>
<td>Soybean</td>
<td>2010</td>
</tr>
<tr>
<td>Zhao, Zhang, &amp; Zou</td>
<td>Soybean</td>
<td>2011</td>
</tr>
</tbody>
</table>

### CHAPTER III

RESEARCH METHODOLOGY

The data collection, methodology, and hypotheses testing will be explained in this chapter.

3.1 Data Collection
3.1.1 The weekly futures price of soybean No.1

The weekly futures price data of soybeans in this case is collected from the DCE Database during the period from January 2009 to July 2013. There are six contracts each year: Jan, Mar, May, Jul, Sep, and Nov for contracts in DEC market (Table 3.1). Soybean No.1 (non-genetically modified) contract is the first trading contract and also the domain contract. Soybean was under the general title “Soybeans” before. The prices of soybean No.1 are regarded as prices of soybean product in this paper.

The futures prices are taken five forecasting horizons. They are one-week before maturity, two-week before maturity and two-month before maturity, four-month before maturity and six-month before maturity separately. Choosing closing price data of each trading month is in a continuous sequence of each trading futures. The advantages of selecting data like this are: Continuous futures contract data generated is close to the last trading day, and thus futures and spot prices will have various interval to help test forecast price for various maturity, but also can be overcome shortcomings like delivery month trading volume small, the data unstable.

<table>
<thead>
<tr>
<th>Contract</th>
<th>Open</th>
<th>High</th>
<th>Low</th>
<th>Close</th>
<th>Settle</th>
<th>Chg</th>
<th>Volume</th>
<th>OI</th>
<th>OI Chg</th>
<th>Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>a1001</td>
<td>4,107</td>
<td>4,108</td>
<td>4,107</td>
<td>4,107</td>
<td>4,107</td>
<td>38</td>
<td>10</td>
<td>0</td>
<td>-52</td>
<td>0.42</td>
</tr>
<tr>
<td>a1003</td>
<td>4,080</td>
<td>4,200</td>
<td>5,972</td>
<td>4,011</td>
<td>4,011</td>
<td>-94</td>
<td>498</td>
<td>20</td>
<td>-126</td>
<td>28.57</td>
</tr>
<tr>
<td>a1005</td>
<td>4,177</td>
<td>4,244</td>
<td>4,010</td>
<td>4,022</td>
<td>4,033</td>
<td>-109</td>
<td>98,498</td>
<td>38</td>
<td>348</td>
<td>-7.028</td>
</tr>
<tr>
<td>a1007</td>
<td>4,202</td>
<td>4,286</td>
<td>4,016</td>
<td>4,016</td>
<td>4,031</td>
<td>-187</td>
<td>2,424</td>
<td>1,226</td>
<td>-188</td>
<td>100.54</td>
</tr>
<tr>
<td>a1009</td>
<td>4,080</td>
<td>4,194</td>
<td>5,837</td>
<td>3,555</td>
<td>3,828</td>
<td>-179</td>
<td>7,629</td>
<td>284,650</td>
<td>-12,076</td>
<td>303,993,61</td>
</tr>
<tr>
<td>a1011</td>
<td>3,970</td>
<td>4,135</td>
<td>3,822</td>
<td>3,850</td>
<td>3,850</td>
<td>-127</td>
<td>1,150</td>
<td>252</td>
<td>90</td>
<td>45.62</td>
</tr>
</tbody>
</table>

Note:
(1) Price = RMB/ton
(2) Volume, OI(Open Interest) = contract(bilateral)
(3) Turnover = RMB millions(bilateral)
(4) Chg = Close - Prev Settle

Monthly prices are published every trading day after all settlements are complete, around 3:30PM Beijing Time. The system automatically extracts monthly data from a specified date. Historical data starts from May 8, 2000.

Source: Dalian Commodity Exchange, 2013

3.1.2 The weekly spot prices of soybean No.1

The sample of cash prices are the national soybean acquisition prices collected from CNgrain online database are the third week prices of the contract in each maturity month. The national average wholesale price stands for the cash market price index in this paper. Data used in the paper are returns of dominant contracts, which are used to reflect returns of representative contract in soybean futures markets.

3.2 Methodology

In this paper, Johansen cointegration techniques which contain maximum eigenvalue and trace tests are used to test relationships between futures and spot prices during January 2009 to July 2013. An Augmented Dickey-Fuller (ADF) unit root test should be tested first for time series variables as it’s the precondition of Johansen cointegration test. If the variables are stationary each other, then we can not go to the Johansen cointegration test. However, if spot prices and futures prices are both non-stationary, then we can go to Johansen cointegration test. After the unit root test, a test of restrictions on cointegration vectors should be used for biased test if the cointegration has been proved.
3.2.1 Conceptual frame work

Figure 3.1 Conceptual frame work

Time Series

Unit Root Tests

Stationary

Regression Test

Non-Stationary

First-order Differencing
3.2.2 Unit Root Tests

Unit root tests are used to classify series whether time series data are stationary or non-stationary. Dickey & Fuller (1979) tested for a unit root in timeseries previously. Unit root test is widely used in many literatures, such as Perron (1988), Dolado, Jenkinson, & Sosvilla - Rivero (1990), Holden & Perman (1994), Ayat & Burridge (2000), Enders (2008), and. In Elam & Dixon (1988)’s research, they find that financial price series are not stationary and contain a unit root.

The most popular of these tests are the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. These two methods are similar. PP test always show same
results with ADF test, but it’s more complex than ADF. The reason for starting with the Dickey-Fuller test is that it is simple and no better test than it.

This is the least restricted ADF model as following:

\[
\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha \sum_{i=1}^{m} \Delta Y_{t-i} + \epsilon_t
\]

(Eq.1)

At first, Spot prices data and futures prices data should be transformed to natural logarithms as they are both time series data. If unit root null hypothesis \((H_0: \pi = 0)\) is rejected, due to a significant \(\pi\), we can know that the time series does not contain a unit root, it means the log data is I (0) or stationary, then we may not use the Johansen cointegration test. However, if the results show that there is unit root (or log data is not stationary at level), we would go to the Johansen cointegration test to examine the long-run relationship between futures prices and spot prices. The alternative hypothesis is \(H_1: \pi < 0\), if \(H_1\) is not rejected, thus the data is stationary. Usually, the variables can be stationary after first difference. I (0). The time series are should be integrated the same order in order to make variables have long-term relationship.

### 3.2.3 Cointegration Test

The cointegration theory has developed more than twenty years, is first provided by Engle & Granger (1987). Central points of the efficiency tests are develop by Lai and Lai (1991). Following Engle and Granger (1987), Johansen (1991) and Johansen and Juselius (1990) test cointegration by using the maximum likelihood method. Cointegration is an appropriate model to test the long-run behavior of prices or expected returns by using short spans of high frequency data. Cointegration test is necessary when we check meaningful relationships modeling. Only if variables have the same trends, time series variables will keep a long-run equilibrium relationship.

We examine the efficiency of China futures market with Cointegration model in this paper. This cointegration between time series is a necessary condition to market
efficiency (Lai & Lai, 1991). If time series variables are non-stationary, the Johansen cointegration test can be used to test. Usually, three methods are used to test cointegration, they are Engle Granger, Engle and Yoo, and Johansen test. If variables are not cointegrated, the futures price would just provide little information about cash price. If $S_t$ and $F_{t-i}$ time series are cointegrated, or that the futures price provide a predictive signal for the cash price $i$ periods ahead, a specific linear combination of variables will be stationary. There will exist $a$ and $b$ such that $z_t$ is stationary with mean $0$:

$$ z_t = S_t - a - bF_{t-i}. \text{ (Eq.2)} $$

$S_t$ = the spot price at time $t$

$i$ = the number of time periods

$F_{t-i}$ = futures price which is $i$ periods before the contract maturity

$z_t$ = the error term

$a, b$ = coefficients

3.2.3.1 Johansen’s Methodology for Modeling Cointegration

The Johansen’s approach has been widely applied in many literatures (Fortenbery & Zapata, 1993; McKenzie & Holt, 1998; and Kellard, Newbold, Rayner, & Ennew, 1999) and used to test market efficiency in US by Johansen's approach. In this paper, we will examine cointegration relationship by Johansen’s maximum eigenvalue and trace test.

Here is the general $k_{th}$ order VAR model:

$$ \Delta Y_t = D + \Pi Y_{t-1} + \sum_{i=1}^{k-l} \Gamma_i \Delta Y_{t-i} + \epsilon_t \text{ (Eq.3)} $$

Where, $Y_t$ = an $(n \times 1)$ vector to be tested for cointegration, and $\Delta Y_t = Y_t - Y_{t-1}$;

$$ \Gamma_i = (I - \Pi \Gamma_i) - I_e \text{ D = The set of deterministic terms; } t = 1, \ldots, T \text{ and } \epsilon_t = a $$. 
Coefficient matrix $\Pi$ is stand for the number of cointegration vectors. We will examine the rank of $\Pi$ so as to test the cointegration relationship. If $\Pi=0$, it means the cointegration relationship not exist. $\Pi=\alpha \beta'$ is stationary. We test futures prices and spot prices, two time series variables $Y_t=(S_t,F_{t-i})'$, $n=2$, the cointegration relationship conducted only when $\Pi=1$ (Johansen and Juselius, 1990).

Johansen (1988) suggested two test statistics to test the null hypothesis that there are at most $r$ cointegration vectors. The null hypothesis can be equivalently stated as the rank of the coefficient matrix, $\Pi$, is at most $r$, for $r=0, 1, \ldots, n-1$.

The two test statistics are based on trace and maximum eigenvalues, respectively. The Trace test is a joint test, the hypothesis:

$H_0: r = r_0$

$H_1: r > r_0$

\[
\lambda_{\text{trace}} = -T \sum_{i=r+1}^{g} \ln(1 - \hat{\lambda}_i) \quad \text{(Eq.4)}
\]

The Maximal Eigenvalue test conducts separate tests on each eigenvalue. The hypothesis:

$H_0: r = r_0$

$H_1: r = r + 1$

\[
\lambda_{\text{max}}(r,r+1) \quad \text{(Eq.5)}
\]

As show above, the null hypothesis would be be rejected if $r = 0$, implies no cointegration exist. On the other hand, if $r = 1$ cannot be rejected but $r = 0$ is rejected, implies variables are stationary as full rank so acointegration relationship exist.
3.2.4 Tests of Restrictions on Cointegration Vectors

If the result shows it’s not cointegrated, we would conclude that the market is inefficiency. However, if it’s cointegrated, we would test restrictions on the cointegrating vector $\beta$ in (2), such that $Y_t^* = \beta' \epsilon_t$ is stationary, where in equation (1), $Y_t = (1, -b, -a)$ and $\epsilon_t = (St, Ft-t, 1)$. The restricted model is to test the elements of $\beta$ when testing market efficiency hypothesis. The tests of restrictions on cointegrating vectors whether relevant restrictions rejected or not can reduce the spurious rejection rate. And including testing on cointegration factors is a good econometric practice.

\[
L_r = T \sum_{i=1}^{r} \ln\{(1 - \hat{\beta}_i^*)/(1 - \hat{\beta}_i)\}
\]

(Eq.6)

Besides cointegration, the efficiency also requires the futures price to be an unbiased predictor of the cash price, $a = 0$ and $b = 1$ in equation (1). We will test the three hypotheses: $a = 0$ and $b = 1$ jointly, and each individually. If the null hypothesis $a = 0$ and $b = 1$ is rejected at the significant level, this means the soybean futures price is not an unbiased predictor for cash market. A non-zero risk premium or a transportation cost may exist between futures market and spot market. And then tests on $a = 0$ and $b = 1$ separately may give more contribution to the joint test hypothesis. If the null hypothesis cannot be rejected at the significant level, it concludes that the market should be efficient.

3.3 Research Hypothesis

The hypothesis of this paper as follows:

**Unit root hypothesis:**

Unit root hypothesis is to classify series as stationary and non-stationary.
H₀: The spot time series has a unit root  
H₁: The spot time series does not contain a unit root

H₀: ONEWEEK time series has a unit root  
H₁: ONEWEEK time series does not contain a unit root

H₀: TWOWEEK time series has a unit root  
H₁: TWOWEEK time series does not contain a unit root

H₀: TWOMONTH time series has a unit root  
H₁: TWOMONTH time series does not contain a unit root

H₀: FOURMONTH time series has a unit root  
H₁: FOURMONTH time series does not contain a unit root

H₀: SIXMONTH time series has a unit root  
H₁: SIXMONTH time series does not contain a unit root

**Cointegration hypothesis:**

In order to test whether there is a long-term relationship between spot and futures prices after checking time series, and then the next step is to test cointegration.

H₀: Long-run relation between spot prices and ONEWEEK futures prices.  
H₁: No long-run relation between spot prices and ONEWEEK futures prices.

H₀: Long-run relation between spot prices and TWOWEEK futures prices.  
H₁: No long-run relation between spot prices and TWOWEEK futures prices.

H₀: Long-run relation between spot prices and TWOMONTH futures prices.  
H₁: No long-run relation between spot prices and TWOMONTH futures prices.
$H_0$: Long-run relation between spot prices and FOURMONTH futures prices.
$H_1$: No long-run relation between spot prices and FOURMONTH futures prices.

$H_0$: Long-run relation between spot prices and SIXMONTH futures prices.
$H_1$: No long-run relation between spot prices and SIXMONTH futures prices.

**Tests of Restrictions on Cointegration Vectors Hypothesis**

$H_0$: a=0 and b=1

$H_0$: ONEWEEK futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: ONEWEEK futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: TWOWEEK futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: TWOWEEK futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: TWOMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: TWOMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: FOURMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: FOURMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: SIXMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: SIXMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: a=0

$H_0$: ONEWEEK futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: ONEWEEK futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: TWOWEEK futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: TWOWEEK futuresprice of Soybean is an unbiased predictor for spot prices
$H_0$: TWOMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: TWOMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: FOURMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: FOURMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: SIXMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: SIXMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: $b=1$

$H_0$: ONEWEEK futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: ONEWEEK futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: TWOWEEK futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: TWOWEEK futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: TWOMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: TWOMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: FOURMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: FOURMONTH futuresprice of Soybean is an unbiased predictor for spot prices

$H_0$: SIXMONTH futuresprice of Soybean is not an unbiased predictor for spot prices
$H_1$: SIXMONTH futuresprice of Soybean is an unbiased predictor for spot prices
CHAPTER IV
PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

Part 1 reports the results of ADF Unit root test. Part 2 displays the results of Johansen cointegration test. Part 3 discusses the results of Restrictions on Cointegration Vectors.

4.1 ADF test

All variables are taken logarithms first as they are time series data. The ADF test results show that all original variables contain unit root or are non-stationary. The unit root test results as showed in table.3, price series data are not stationary at the level. Therefore we can get the result that each of the price series is non-stationary, and then proceed to Johansen’s cointegration tests.

Table 4.1: ADF Unit Root Test results
4.2.1 One week

<table>
<thead>
<tr>
<th>ADF</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
<th>Prob.</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGSPOT</td>
<td>-0.650128</td>
<td>-3.699871</td>
<td>-2.976263</td>
<td>0.8429</td>
<td>Non-Stationary</td>
</tr>
<tr>
<td>LOGONEWEEK</td>
<td>-1.380421</td>
<td>-3.699871</td>
<td>-2.976263</td>
<td>0.5767</td>
<td>Non-Stationary</td>
</tr>
<tr>
<td>LOGTWOWEEK</td>
<td>-1.337940</td>
<td>-3.699871</td>
<td>-2.976263</td>
<td>0.5969</td>
<td>Non-Stationary</td>
</tr>
<tr>
<td>LOGTWOMONTH</td>
<td>-1.158627</td>
<td>-3.769597</td>
<td>-3.004861</td>
<td>0.9967</td>
<td>Non-Stationary</td>
</tr>
<tr>
<td>LOGFOURMONTH</td>
<td>-0.775636</td>
<td>-3.699871</td>
<td>-2.976263</td>
<td>0.8100</td>
<td>Non-Stationary</td>
</tr>
<tr>
<td>LOGSIXMONTH</td>
<td>-1.796923</td>
<td>-3.699871</td>
<td>-2.976263</td>
<td>0.3739</td>
<td>Non-Stationary</td>
</tr>
</tbody>
</table>

After testing cointegration between LOGSPOT and LOGONEWEEK the result is concluded in table 4.2. The null hypothesis $r = 0$ will not be rejected at a significant level 5% by both test statistic for each price series, while the corresponding hypothesis of $r = 1$ can be rejected. This concludes that the futures price one week before prior to its maturity is not cointegrated with spot price.
Table 4.2: Johensen Cointegration Test results between LOGSPOT and LOGONEWEEK

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.361918</td>
<td>11.83386</td>
<td>15.49471</td>
<td>0.1651</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.005842</td>
<td>0.152346</td>
<td>3.841466</td>
<td>0.6963</td>
</tr>
</tbody>
</table>

Note: Trace test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level ** MacKinnon-Haug-Michelis (1999) p-values

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.361918</td>
<td>11.68151</td>
<td>15.49471</td>
<td>0.1651</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.005842</td>
<td>0.152346</td>
<td>3.841466</td>
<td>0.6963</td>
</tr>
</tbody>
</table>

Notes: Max-eigenvalue test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level ** MacKinnon-Haug-Michelis (1999) p-values

4.2.2 Two weeks

After testing cointegration between LOGSPOT and LOGTWOWEEK the result is concluded in table 4.3 The null hypothesis $r = 0$ will not be rejected at a significant level 5% by both test statistic for each price series, while the corresponding hypothesis of $r = 1$ can be rejected. This concludes that the futures price two week before prior to its maturity is not cointegrated with spot price.

Table 4.3: Johensen Cointegration Test results between LOGSPOT and LOGTWOWEEK

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.302810</td>
<td>9.726049</td>
<td>15.49471</td>
<td>0.3024</td>
</tr>
</tbody>
</table>
4.2.3 Two months

After testing cointegration between LOGSPOT and LOGTWOMONTH the result is concluded in table 4.34. The null hypothesis $r = 0$ will not be rejected at a significant level 5% by both test statistic for each price series, while the corresponding hypothesis of $r = 1$ can be rejected. This concludes that the futures price two month before prior to its maturity is not cointegrated with spot price.

Table 4.4: Johansen Cointegration Test results between LOGSPOT and LOGTWOMONTH

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.290940</td>
<td>9.002426</td>
<td>15.49471</td>
<td>0.3651</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.002429</td>
<td>0.063237</td>
<td>3.841466</td>
<td>0.8014</td>
</tr>
</tbody>
</table>

Notes: Trace test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values
4.2.4 Four months

After testing cointegration between LOGSPOT and LOGTWOMONTH the result is concluded in table 4.34. The null hypothesis \( r = 0 \) will not be rejected at a significant level 5\% by both test statistic for each price series, while the corresponding hypothesis of \( r = 1 \) can be rejected. This concludes that the futures price four month before prior to its maturity is not cointegrated with spot price.

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.276453</td>
<td>8.518682</td>
<td>15.49471</td>
<td>0.4117</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.004044</td>
<td>0.105360</td>
<td>3.841466</td>
<td>0.7455</td>
</tr>
</tbody>
</table>

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Six months After testing cointegration between LOGSPOT and LOGTWOMONTH the result is concluded in table 4.34. The null hypothesis $r = 0$ will not be rejected at a significant level 5% by both test statistic for each price series, while the corresponding hypothesis of $r = 1$ can be rejected. This concludes that the futures price six month before prior to its maturity is not cointegrated with spot price.

Table 4.6: Johansen Cointegration Test results between LOGSPOT and LOGSIXMONTH

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.396632</td>
<td>13.17355</td>
<td>15.49471</td>
<td>0.1086</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.001446</td>
<td>0.037633</td>
<td>3.841466</td>
<td>0.8461</td>
</tr>
</tbody>
</table>

Notes: Trace test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.396632</td>
<td>13.13592</td>
<td>14.26460</td>
<td>0.0748</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.001446</td>
<td>0.037633</td>
<td>3.841466</td>
<td>0.8461</td>
</tr>
</tbody>
</table>

Notes: Max-eigenvalue test indicates no cointegration at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values
4.4 Discussion of Results

Results based on Johansen’s cointegration test suggest that there is no equilibrium relationship exists between soybean futures prices in DCE and the national average cash price published on CNgrain. This result can be concluded in all forecasting horizons. The soybean futures market is not cointegrated with soybean cash markets. Therefore an inefficiency market is concluded by the data for the soybean futures market in terms of predicting the price on the CNgrain as cointegration is the necessary condition for efficiency.

The reason for existence of market inefficiency is over-speculation problem or market manipulation and the government policy. As soybeans important strategic commodity, the Chinese government considers it by using government policies and regulations as it relates political stability and economic development. Government policy is a significant factor to influence price of soybean. Futures market plays an important role in allocating scarce resources effectively combined with the spot market. The price discovery function which can help investors to achieve hedging and speculation. The establishment of China's futures market is a little late, around twenty years only. There are still many deficiencies for operation mechanism in China's futures market compared to developed countries with matured futures market. What’s more, we don’t need to test the Restrictions on Cointegration Vectors after no cointegration exist proved. What’s more, soybeans commodity is largely rely on importing from international market. The world soybeans commodity markets and futures markets would decide the soybeans prices, so as to also affect performance of China’s soybean futures market. Furthermore, Chinese importers and traders may buy CBT futures to balance short futures contracts in China. The changes in policies should be considered to permit Chinese traders to utilize foreign futures markets for hedging and arbitrage. These activities would affect the efficiency of the Chinese market.
CHAPTER V

CONCLUSION, IMPLICATION AND FURTHER STUDY

5.1 Conclusion

The aim of this paper is to test the Chinese soybean futures market efficiency during January 2009 to July 2013 by using Johansen’s cointegration approach. The futures prices from China DCE are taken five forecasting horizons, separately at one week, two weeks, two months, four months and six months prior to the maturity of each contract. And the cash prices, the national soybean acquisition price, are taken at the third week of each maturity month of the futures contracts, and are obtained from CNgrain online database.

The results of Johansen cointegration shows that no equilibrium relationships exist between the soybean futures price and cash price in DCE. The inefficiency is proved by the data for the soybean futures market in terms of predicting the price on the cash market.

Results from the study may help producers or marketers to hedge, arbitrage,
operate in an attempt to manage price risks inherent in commodity ownership. Investors who are searching market profits can handle new information and act thorough analyses. If the price of soybean futures on the DCE provides a reliable forecast of spot prices in the future, producers can manage their risks in the production and trading effectively.

Stevenson & Bear (1970) examine the corn and soybean futures markets during 1951-1968, and find that investors can gain profit by making investment strategy, then denying the weak-form market efficiency hypothesis. Zhao, Zhang, & Zou (2011) show that the Chinese soybean futures market is not weak-form efficient. Yu & Chunjie (2010) proved the statement of "Chinese soybean futures market is efficient" is false and conclude that soybean futures market is not weak efficient either. This paper gets the same direction with previous studies. Yao (1998) examined the historical development of futures markets in China, and argued that China futures market is under control of government over many prices, it’s useless for futures market to determine prices, and much less hedge against price fluctuations.

However, where H. H. Wang & Ke (2003, 2005) also test the soybean futures market and suggest a long-term equilibrium relationship between the futures price and cash price for soybeans and proved the market is weak short-term efficient. Q. Liu & Zhang (2006) show that there is long equilibrium relationship between the futures price and the last delivery spot price futures prices in the soybean markets.

5.2 Implication

The results of the study benefit to Chinese farmers, domestic traders and importer, help them to watch soybean futures prices on the Dalian exchange and then act accordingly. After twenty years in operation, soybean futures trading in China developed quickly, the DCE has become one of the most significant commodity futures exchanges in China. The soybean futures price of DCE has become the most important price signal for China’s soybean farmers, soybean crushers, other soybean users,
importers and market participants.

5.3 Further Study

The follow up research would be recommended to solve the limitation of this study that is focusing only on soybean No.1 commodity in DCE, further study should be more consider to focus on other soybean products such as soybean No.2, soybean oil and soybean meal which will help to fulfill the more contribution on soybean market efficiency analysis. Furthermore, the time period spread should be larger as in this paper the data is just from 2009 to 2013, the number of observations would be larger, and thus the results would be more proved and reliable. For instance, even the futures market inefficiency has been tested, it can just prove that the history market is inefficient, and we can’t say that the present and future markets are not efficiency.
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