CRUDE OIL AND CRUDE OIL DERIVATIVES TRANSACTIONS

BY OIL AND GAS PRODUCERS

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This study attempts to resolve two important issues. First, it investigates the diversification benefit of crude oil for equities. Second, it examines whether or not crude oil derivatives transactions by oil and gas producers can change shareholders' wealth. With these two major goals in mind, I study the risk and return profile of crude oil, the value effect of crude oil derivatives transactions, and the systematic risk exposure effect of crude oil derivatives transactions.

In contrast with previous studies, this study applies the Goldman Sachs Commodity Index (GSCI) methodology to measure the risk and return profile of crude oil. The results show that crude oil is negatively correlated with stocks so adding crude oil into a portfolio with equities can provide significant diversification benefits for the portfolio.

Given the diversification benefit of crude oil mixed with equities, this study then examines the value effect of crude oil derivatives transactions by oil and gas producers. Differing from traditional corporate risk management literature, this study examines corporate derivatives transactions from the shareholders' portfolio perspective. The results show that crude oil derivatives transactions by oil and gas producers do impact value. If oil and gas producing companies stop shorting crude oil derivatives contracts, company stock prices increase significantly. In contrast, if oil and gas producing companies start shorting crude oil derivatives contracts, stock prices drop marginally significantly. Thus, hedging by producers is not necessarily good.
This paper, however, finds that changes in policy regarding crude oil derivatives transactions cannot significantly affect the beta of shareholders' portfolios. The value effect, therefore, cannot be attributed to any systematic risk exposure change of shareholders' portfolios. Market completeness, transaction costs, and economies of scale are identified as possible sources of value effect.

The following conclusions have been obtained in this study. Crude oil provides significant diversification benefits for equities. In the presence of market imperfections, crude oil derivatives transactions by oil and gas producers may change shareholders' wealth, even though crude oil derivatives transactions by oil and gas producers do not have significant effect on the systematic risk exposures of companies.
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CHAPTER 1
INTRODUCTION

Diversification Effects of Oil Mixed with Equities in a Portfolio

During recent years, energy commodities have been very attractive to investors. More and more investors are becoming interested in adding some energy commodities into their portfolios. Figure -1 illustrates that the prices and trading volumes of light crude oil futures contracts in NYMEX (New York Mercantile Exchange) have significantly increased recently. Traditional commodity investment studies\(^1\) also show that some commodities provide significant diversification benefits for a traditional portfolio consisting of stocks and bonds because commodities are usually zero or negatively correlated with stocks and bonds, but with rates of return not less than the risk free rate. None of the traditional literatures has applied the GSCI (Goldman Sachs Commodity Index)’s methodology to measure individual commodity returns. In contrast to previous studies, this study applies the GSCI return generation process to measure crude oil returns.

Most previous studies measure the risk and return profiles of commodities by taking the percentage change of futures prices as the rate of return of commodity.\(^1\) Dusak (1973) supports this methodology by explaining that futures price data is more readily available than spot price data, and that storage costs do not need to be directly estimated.

She also shows, however, that using this methodology may underestimate the spot commodity risk premium by a factor of \(1/(1+R_f)\), where \(R_f\) is risk free rate. If the return computation interval is not small enough, the bias will be significant.

Different from previous commodity investment literature, in Chapter 2 I directly estimate individual commodity return based on the GSCI return generation process. The
GSCI manual (2005) explains that the GSCI return represents the return that would be earned by holding only passive long positions in commodity futures with the long positions fully collateralized with T-bills. The GSCI return is a fully collateralized return, and thus is comparable to the returns of stocks and bonds. The GSCI commodity investment return comes from three sources: spot return from price changes in the underlying commodities; roll yield from rolling the nearest futures contracts to the next nearest futures contracts each month; and T-bill yield. Using the GSCI total return calculation methodology from the GSCI manual, this study constructs a portfolio consisting of a long position in light crude oil futures contracts plus the equivalent value of 91-day T-bills (thus “unlevering” the futures contract) and then calculates the total return of the constructed portfolio from 1987 to 2005 for light crude oil. The crude oil investment returns can then be extracted from the total returns of the constructed portfolios.

I find that the average rate of return on crude oil investments is almost the same as the average rate of return on stock investment represented by the Standard & Poor’s 500 Index and CRSP (Center for Research in Security Prices) Value-Weighted Market Index. The correlation coefficient between the rates of return of crude oil and the rates of return of Standard & Poor’s 500 index is significantly negative, and the correlation coefficient between the rates of return of crude oil and the rates of return of the CRSP Value-Weighted Market Index is negative but not significant. After I compare the Sharpe ratio of a portfolio consisting of 100% Standard & Poor’s 500 index and the Sharpe ratio of a portfolio consisting of 60% Standard & Poor’s 500 index and 40% crude oil, I conclude that crude oil provides very significant diversification benefits when included with equities in a portfolio.
The results in Chapter 2 imply that if crude oil is added into an investor’s equity portfolio, it is able to improve the risk and return profiles of the expanded portfolio. Given these findings, this study then examines the value effect of crude oil derivatives transactions by oil and gas producers.

Value Effects of Derivatives Transactions by Oil Producers

Dusak (1973) emphasizes that a long commodity futures contract is equivalent to a leveraged investment in the underlying spot commodity. Therefore, corporate derivatives transactions may be taken as leveraged purchases or sales of the underlying assets. Shareholders may add commodities into (or remove commodities from) their portfolios by taking long or short positions on commodity futures contract or including (or removing) the shares of firms that produce the commodities. If a firm has a long position in a commodity that is negatively correlated with equities, then derivatives transactions by the company can impact how well their shareholders’ portfolios are diversified.

Thus firms that short crude oil futures or forward contracts actually take the diversification benefits of crude oil away from shareholders’ portfolios, while firms that reduce or remove short transactions provide diversification benefits for shareholders’ portfolios. During the examined time period from 1996 to 2005 for company derivatives transactions in Chapter 3 and Chapter 4, crude oil provides very significant diversification benefits for stocks. Therefore, short transactions in the oil producing industry are expected to have negative effects on the risk and return profiles of shareholders’ portfolios, and vice versa.

According to Modigliani and Miller (1958), even if corporate derivatives transactions can improve the risk and return profiles of shareholders’ portfolios,
shareholders still may not value those transactions because in perfect markets shareholders themselves can enter into the same derivatives transactions as companies. Nonetheless, in the presence of market imperfections or poor diversification, there is a possibility that shareholders might not obtain the same risk and return profile as provided by corporate derivatives transactions. Shareholders then could have the motivation to value corporate derivatives transactions.

Traditional corporate risk management literature\(^2\) examines corporate derivatives transactions from the point of view of specific transactions and identifies some market imperfections that incur deadweight costs for firms. Expected financial distress costs, underinvestment problems, tax schedule convexity, managerial risk aversion, information asymmetry, contracting costs, transaction costs, economies of scale, and transaction limitations are all possible market imperfections that motivate companies to enter into derivatives transactions. They assume that all derivatives transactions reduce the volatility of expected operating cash flow and thus the volatility of individual firms. As a result of hedging activity, the deadweight costs caused by market imperfections are decreased. Companies need to keep less equity for possibly incurred deadweight costs. Consequently, companies have more equity for other valuable investment opportunities. In this sense, commodity derivatives transactions can increase firm value and shareholders' wealth.

Compared with previous studies, this study examines corporate derivatives transactions from the shareholders' portfolio perspective. According to previous studies, such transactions may increase firm value. In contrast, this study develops evidence that when oil and gas producers take a short position on crude oil derivatives contracts, the
risk and return profiles of shareholders’ portfolios are negatively affected even though the
volatility of the firm’s operating cash flows may be reduced. Since the objective of
corporate risk management is to increase shareholders’ wealth, the corporate risk
management issue should be examined from the point of view of shareholders’ portfolios.

Reasons for the Value Effect

In Chapter 3, I investigate the value effect of crude oil derivatives transactions by oil and gas producers. First of all, I examine whether or not corporate derivatives transactions can change the expected cash flow of shareholders’ portfolios. Of course, derivatives transactions do not incur cash flow by themselves. If there is a cash flow change, it must be a result of reduced market imperfections. Next, I examine the value effect by looking at whether corporate derivatives transactions can provide a more complete investment opportunity set for shareholders than the crude oil derivatives transactions entered by shareholders themselves. If shareholders cannot enter into the same derivatives transactions as companies can, then corporate derivatives transactions may have a value effect.

In terms of Nance, Smith, and Smithson (1993), Mian (1996), and Geczy, Minton, and Schrand (1997), transactions cost and economies of scale are possible sources of value effect. Corporate derivatives transactions save shareholders some amount of cash flow because firms incur lower transactions cost than shareholders, due to economies of scale. Shareholders can invest the saved cash flows to other investment opportunities with positive net present value. As a result, corporate derivatives transactions could increase shareholders’ wealth.

As far as the oil and gas producing industry is concerned, when producing firms
take short positions with derivatives, some part of the crude oil position in shareholders’ portfolios is taken out. The risk and return profiles of shareholders’ portfolios are negatively affected. Because of transactions costs, shareholders must spend additional cash to reverse the negative effect. The expected cash flow of shareholders’ portfolios decreases, therefore, the market value of shareholders’ portfolios decreases. When oil and gas producing firms stop hedging, the diversification benefit of crude oil is added into shareholders’ portfolios, and thus the risk and return profiles of shareholders’ portfolios are improved. Corporate transactions can save shareholders more cash flow than transactions entered by shareholders themselves. Consequently, corporate derivatives transactions increase shareholders’ wealth.

This study provides another motivation for shareholders to prefer corporate derivatives transactions. Petersen and Thiagarajan (2000) find that a gold loan is economically the same as a cash loan plus a forward contract. Rather than borrow cash, producing firms can borrow the underlying commodity from a dealer and sell it to fund their operations. When firms pay back loans, they return the principal plus interest in kind. The basis reflected in futures contracts includes this benefit of holding inventories. Therefore, when oil companies take long positions in crude oil derivatives contracts or remove short positions in crude oil derivatives contracts, they get more than the return from the crude oil investments; they also receive the interest from crude oil loans via the basis reflected in the futures contracts. When oil and gas producing companies take short transactions, the underlying crude oil positions are reduced, depriving shareholders of both the crude oil investment return and the crude oil loan interest return. Thus the market value of shareholders’ portfolios decreases.
Likewise, short hedging transactions in the oil and gas producing industry are expected to decrease shareholders’ wealth. When oil and gas producing companies remove short transactions, the underlying crude oil positions are enhanced. Shareholders do not only obtain the crude oil investment return but also the crude oil loan interest return. The cash flows of shareholders’ portfolios are increased, and thus the market value of shareholders’ portfolios increases. Removing short derivatives positions on crude oil by oil and gas producing companies is expected to increase shareholders’ wealth.

The availability of investments in oil via purchase of stock in oil producing companies enhances the completeness of available choices, and provides opportunities for improved diversification. Jarrow and O’Hara (1989) attribute market completeness as a possible explanation for the anomaly of primes and scores. If the market is reasonable free of imperfections, the price of the prime and score combination should be equal to the price of the underlying stock and corresponding stock option. Yet, Jarrow and O’Hara (1989) find that the price of the prime and score combination exceeds the price of the underlying stock and corresponding stock option significantly for the examined firms. They explain that if primes and scores provide a more complete set of investment opportunities than the underlying stock and corresponding stock option, then market completeness is the source of the value difference.

Chapter 2 shows that crude oil derivatives transactions by oil and gas producers can improve the completeness of shareholders’ portfolios. Nonetheless, according to Modigliani and Miller (1958), even if corporate derivatives transactions can improve the risk and return profiles of shareholders’ portfolios, shareholders still may not value those
transactions if shareholders themselves could enter the same derivatives transactions as companies can. This paper argues that in an imperfect market, transaction limitations make shareholders unable to obtain the same risk and return profiles as the companies provide. Consequently, shareholders have the motivation to value corporate derivatives transactions.

Barriers That Block Investors from Direct Holdings of Oil

Most institutional investors still concentrate on stocks and bonds. Because of the regulatory restrictions, insurance companies, mutual funds and other institutional investors have limited ability to invest directly in commodities. It was not until recently that some pension funds began to add commodities in their portfolios. In March 2007, CalPERS (California Public Employees Retirement System), the biggest U.S. pension fund, started tracking the GSCI. Doyle, Hill and Jack (2007) show that 75%-80% of the funds invested into GSCI-based products are from pension funds and the rest are from corporations. Doyle, Hill and Jack (2007) state that CalPERS current investment in commodities accounts for only 3% of its portfolio and many pension funds still do not invest in commodities at all. The reluctance for pension funds to invest into commodities may be due to high transactions cost. When pension funds invest into GSCI index, they need to rebalance commodity portfolio monthly, which incurs high transactions costs.

For individual investors, the exposure to commodities is also very limited. It is impractical for investors to buy and store crude oil. Because of high transaction costs and margin requirements, few individual investors can comfortably hold crude oil derivatives contracts. Hedge funds and commodity funds do provide an opportunity for investors; but high entrance requirements and fees, keep these funds available only to high net worth
investors rather than ordinary individual investors. Edwards and Ma (1988), Elton, Gruber, and Rentzler (1990), Irwin, Krukemyer and Zulauf (1993), and Fung and Hsieh (2000) showed that for publicly offered commodity funds, fees are substantially higher than those charged by hedge funds. Fung and Hsieh (2000) state that high management fees and transactions cost make commodity funds unpopular.

After the establishment of commodity ETFs (Exchange-Traded Funds) in 2006, individual investors have an easier way to get the exposure of commodities. In February 2006, the first commodity ETF - DBC (Deutsche Bank Commodity Index Tracking Fund) – was introduced on the AMEX (American Stock and Options Exchange). In July 2006, the second commodity ETF - GSG (iShares GSCI Commodity-Indexed Trust) was introduced on the NYSE (New York Stock Exchange). Commodity ETFs provide individual investors an easier way to get the exposure to commodities.

From the discussion mentioned above, the cheaper and easier way for investors to get exposure to crude oil is to own the equities of oil and gas producing companies. When oil and gas producers enter short transactions on crude oil derivatives contracts, these producers reduce shareholders’ exposure to crude oil. Shareholders’ portfolios then become less well diversified, and thus the market value of their portfolios decreases. When oil and gas producers remove short positions in crude oil derivatives contracts, shareholders of these producers regain the exposure to crude oil. Shareholders’ portfolios become better diversified, and thus shareholders’ wealth increases.

In conclusion, both diversification benefits and market imperfections are conditions on which corporate derivatives transactions have a value effect. Diversification benefits motivate shareholders to enter the same derivatives transactions as companies.
Transaction limitations, transaction costs and economies of scale hinder shareholders from obtaining the same diversification benefit via derivatives transactions.

Policy Shifts

To examine the value effect of crude oil derivatives transactions by oil and gas producers, I select oil and gas producing firms which have changed their derivatives policies. I calculate cumulative abnormal returns (CARs) around derivatives policy changes and investigate if there is a significant relationship between CARs and derivatives position changes measured by hedge ratio changes.

I find that when oil and gas producing companies stop shorting crude oil derivatives contracts, there is a very significant and negative relationship between CARs and hedge ratio changes. Since the hedge ratio of a short position is negative, this result implies that removing short positions is associated with higher CARs. Shareholders do not like oil and gas producing companies to hedge. They want these companies to stop hedging. When these companies stop hedging, the value effect is reflected in a stock price increase and shareholders’ wealth increase. This fact is consistent with our expectation that removing short positions on crude oil derivatives contracts by oil and gas producing companies has a value effect. When oil and gas producing companies start shorting crude oil contracts, I find negative and marginally significant market reactions. This result means that when oil and gas producing companies start shorting, shareholders do not value this hedging policy. Hedging by oil and gas producers has a negative effect on shareholders’ wealth. This result further shows that oil and gas producers should not hedge at all.
Then, I go further by investigating the relationship between cumulative abnormal returns and a proxy variable for market imperfections in order to investigate the possible sources of the value effect. The market imperfections include transaction costs and economies of scale (which according to Nance, Smith, and Smithson (1993) are represented by firm size). I take CARs as the dependent variable and take firm sizes and hedge ratio changes as independent variables to conduct a regression, and find a significant and positive relationship between CARs and firm sizes. This result suggests that transaction costs and economies of scale are possible sources of the value effect.

In conclusion, the value effect of crude oil derivatives transactions depends on the diversification benefit of crude oil and the existence of market imperfections that limit the means available for investors to obtain exposure to oil. If crude oil derivatives transactions by oil and gas producers improve the diversification of shareholders’ portfolios, market imperfections motivate shareholders to value these transactions. If crude oil derivatives transactions by oil and gas producers have a negative effect on the diversification of shareholders’ portfolios, however, market imperfections cause these transactions to have a negative value effect. Hedging by oil producers is not necessarily good.

Previous empirical studies get mixed results on the value effect of corporate risk management activities. One of the possible reasons is that they do not consider whether corporate derivatives transactions really provide diversification benefits for shareholders’ portfolios before examining the value effect. Empirical studies show that some commodities, foreign currency assets or interest rate assets have positive or zero correlations and other commodities have negative correlations with stocks. Therefore, studies focusing on different kinds of derivatives transactions may get different results.
Another contribution this study makes to the literature on corporate risk management is the improved methodology. Most previous studies apply cross-sectional methodology to examine whether derivative transactions are related to the proxy variables for market imperfections. They compare the market imperfections proxy variables of firms with derivatives transactions and the market imperfections proxy variables of firms without derivatives transactions to see if there are significant differences. Guay (1999) points out an endogenous problem in cross-sectional studies on hedging, i.e., it cannot be determined whether firms use derivatives to reduce risk or firms with higher risk are more likely to use derivatives. He recommends a time-series methodology to study the effect of hedging policy changes on the change in firms’ risk exposure (by “derivatives policy change”, I mean a change from having no derivatives positions to having derivatives positions or a change from having derivatives positions to having no derivatives positions). Allayannis and Weston (2001) also contend that we should examine the effect of hedging policy change on the change of firm value. This research applies event study methodology to examine the effect of changes in derivatives transactions on firm value change. This study tests whether there is a significant correlation relationship between cumulative abnormal stock returns around derivatives transactions policy change and derivatives position changes.

Hedging by Oil Producers Does Not Impact Systematic Risk

In Chapter 4, this paper investigates the systematic risk exposure effect of crude oil derivatives transactions by oil and gas producers to see if the value effect may also result from systematic risk change of shareholders’ portfolios. If the systematic risk of shareholders’ portfolios is decreased by corporate derivatives transactions, then the
required rate of return of shareholders portfolios will be decreased, and thus the shareholders’ wealth can possibly be increased.

I study the systematic risk exposure effect of corporate crude oil derivatives transactions by examining whether derivative transaction policy changes affect oil and gas producing firms’ betas. Beta is measured by the Single-Index Market Model, and the CRSP value-weighted index is taken as the market index in terms of traditional measurement of market portfolio. I find that when oil and gas producing firms start or stop short transactions, the betas do not change significantly (consequently, the betas of shareholders’ portfolios are not affected). Thus the value effect of corporate derivatives transactions cannot be attributed to systematic risk change of shareholders’ portfolios.

This study sheds light on the importance of corporate risk management activities. Risk management activities in the airline industry might possibly increase shareholders’ wealth since airline firms always enter long transactions on energy commodity derivatives. Southwest Airlines is a good example of the importance of corporate risk management. It keeps using derivatives and performs very well. In contrast, oil and gas producing firms should stop hedging because short transactions by these firms decrease shareholders’ wealth. Carter, Rogers, and Simkins (2006) report that 18 out 28 (64%) of airline companies have hedged during the period from 1992 to 2003. Nonetheless, this study finds that a low percentage of oil producing companies (around 20%) used derivatives during the period from 1996 to 2005. Our conclusion may provide some explanation why more than 60% of airline companies hedge while only about 20% of oil and gas producing firms hedge.

The results of this study also clarify whether corporations should be required to
report their derivatives positions at market value and whether companies should try to disclose their derivatives positions information earlier than their competitors.

Accounting for Derivatives Trading by Corporations

In March 1990, the Financial Accounting Standards Board (FASB) issued FAS 105 to require all firms to report the information about financial instruments with off-balance sheet risk (e.g., futures, forwards, options, and swaps) and financial instruments with concentrations of credit risk. It requires all entities to disclose the notional principal amount, nature, terms of derivatives contracts, the accounting loss the entity would incur if the payment is defaulted, the collateral on financial instruments, and significant concentrations of credit risk. It took effect for fiscal years ending after June 15, 1990. This statement makes the information on derivatives instruments available to the public. Since then, corporate risk management studies have begun to use available derivatives information to conduct empirical tests.

In October 1994, the FASB issued FAS 119 to require entities to disclose information about derivative financial instruments, including futures, forwards, options, swap, and other financial instruments with similar characteristics. It also requires entities to report the purposes of holding or issuing derivative financial instruments. If the entities hold or issue derivatives for trading purposes instead of hedging purposes, the average fair value of the derivatives positions and trading profits or loss need to be disclosed. It also encourages the disclosure of quantitative information about market risks inherent in derivatives and other financial instruments. There are three categories of market risk (e.g., interest rate risk, foreign currency exchange rate risk, and commodity price risk).
In June 1998, the FASB issued FAS 133 to urge corporations to recognize derivatives as assets or liabilities and to report the fair value of these derivatives in the financial statements. The FASB contends that investors can better evaluate the impact of derivatives transactions if companies report their derivatives transactions at fair value instead of at historical cost. FAS 133 also specifies the procedures for firms to report the gain or loss from derivatives transactions as earnings. FAS 133 initially was scheduled to take effect for all fiscal quarters of the fiscal years beginning after June 15, 1999, but in June 1999, the FASB issued FAS 137 to defer the effective date of FAS 133 until June 15, 2000. In June 2000, the FASB issued FAS 138 to address some implementation issues of FAS 133. In April 2003, the FASB issued FAS 149 as an amendment of FAS 133. In particular, FAS 149 clarifies one of the three derivative characteristics defined in FAS 133, (the meaning of “underlying asset”) and the characteristics of derivatives with financing components. Those changes enable entities to report contracts as either derivatives or hybrid instruments more consistently. FAS149 is effective for contracts after June 30, 2003.

The above review of hedge accounting rules shows that currently the FAS 133 is the main statement that governs disclosure. Guay (1999), however, points out a debate over FAS 133. If companies report the fair market value of their derivatives positions on their balance sheet, earnings volatility may be inappropriately increased, assets may be overestimated, and liabilities may be underestimated. Furthermore, sometimes it is very difficult for companies to decide the fair market value of derivatives. As a result, companies will be discouraged from using derivatives for beneficial risk management (e.g., The Wall Street Journal, 8/7/1997, p. B2). If some corporate derivatives
transactions do not have a value effect, it may not be worthwhile for companies to disclose their derivatives transactions at fair value and there is no value effect for companies to adopt hedge accounting rules earlier than their competitors.

This paper includes three sections. In Chapter 2, I examine the risk and return profile for crude oil using commodity futures price information and GSCI return generation methodology. I also show the diversification benefits of crude oil for equities. In Chapter 3, I examine the value effect of crude oil derivatives transactions by investigating whether cumulative abnormal returns around crude oil derivatives transactions policy changes of oil and gas producers are significantly related to crude oil derivatives positions changes. Also, I examine the sources of the value effect. In Chapter 4, I investigate the systematic risk exposure effect of crude oil derivatives transactions by testing if beta changes before and after oil and gas producers change their crude oil derivatives transactions policy.
CHAPTER 2
CRUDE OIL INVESTMENT

Literature Review

Before examining the value and systematic risk exposure effect of crude oil derivative transactions by oil and gas producers, I examine the diversification benefit of crude oil transactions for shareholders’ portfolios. The rates of return of crude oil derivatives contracts come from the rates of return of the underlying crude oil investment. Therefore, I first estimate the risk and return profile of crude oil investment and diversification benefit of crude oil for equities.

Dusak (1973) explains that futures price data is more accessible than spot price data and using futures prices avoids the need to estimate storage costs directly; hence, futures prices near maturity can be used as a proxy for spot price. Cost of carry theory also shows that futures prices tend to move together with underlying spot prices and that at maturity futures price should be equal to spot prices, or else there is risk-free arbitrage. As a result, most studies examine the systematic risk and returns of spot commodities through commodity futures markets. Black (1976) and Dusak (1973) state that futures contracts do not have value by themselves because net cash flow is zero when futures transactions occur. The returns of futures contracts only derive from the returns of the underlying commodities. Dusak (1973) contends that futures transactions are actually leveraged transactions of the underlying spot commodity. The systematic risk in future market comes entirely from the systematic risk of the underlying spot market. Following Dusak’s argument, extensive studies examine the systematic risk and return of commodity futures contracts to infer the systematic risk and return of spot commodities.
The methodologies used to calculate commodity returns are typically classified into four categories: the percentage change in the futures prices, the percentage change in the futures prices plus T-bill, a rollover strategy to measure futures return, and the GSCI (Goldman Sachs Commodity Index) style investment return. No matter what kind of methodology is used, most previous studies show that some commodities have zero or negative correlations with stocks and bonds.

Dusak (1973) applies the futures price near maturity to approximate underlying spot commodity price and the percentage change in the futures prices to approximate underlying spot commodity risk premium, and shows that systematic risk and mean returns of wheat, corn and soybean were near zero over the period 1952 to 1967. Fama and French (1987) also use futures prices of maturing contracts to measure spot prices. For the simple monthly returns, 5 out of 21 commodities are found to have significant and positive return; for the monthly logarithmic returns, 19 out of 21 commodities have zero return. Kolb (1992) uses the same methodology to derive the daily mean returns of 29 commodities and shows that currencies, financials, and precious metals rarely have positive returns. Kolb (1996) examines 4735 futures contracts on 45 commodities and also finds that there is no positive relation between systematic risk and realized return for futures contracts. Lee, Leuthold and Cordier (1985) examine the relationship between daily returns of the commodity futures market index and the Standard & Poor’s 500 Index over the period from 1972 to 1981 and find that they are independent of each other. Including commodity futures contracts in equity portfolios may reduce risk and improve portfolio performance. Kocagil (1997) applies the Monte Carlo Simulation method to find a negative relationship between stock market and gold and silver.
Bodie and Rosansky (1980) find that an equally weighted portfolio consisting of 23 commodities had almost the same return and standard deviation as an equally weighted common stock portfolio over the period between 1950 and 1976. They find that 15 out of 23 commodities had negative correlations with the stock market. They also find that the systematic risk exposures of commodities are inversely correlated with their mean returns. They apply two methodologies to measure commodity returns. One follows Dusak's (1973) method, while the other calculates commodity futures return as the simple rate of return on commodities futures plus the risk-free rate because commodity exchanges permit the posting of T-bills as margin and investors can earn interest on T-bills. Fortenbery and Hauser (1990) apply the same methodology to show there are very small correlation coefficients between commodity returns and stock returns.

De Roon, Nijman and Veld (2000) apply a rollover strategy to measure futures return. The rollover strategy is to roll the nearest contract to the next nearest contract on expiration month. The percentage change of futures contract prices is taken as futures return. They show that most futures contracts outside the financial groups are zero correlated with the stock market. Financial futures are positively correlated to the stock market, while gold and silver futures are negatively correlated to the stock market.

The fourth method is to calculate commodity investment return - GSCI style investment return. The GSCI manual (2005) explains that the GSCI return represents the return that would be earned by holding only passive long positions in commodity futures with the long positions fully collateralized with T-bills. The GSCI return represents a fully collateralized return, and thus is comparable to the returns of stocks and bonds. The GSCI investment return comes from three sources: spot return from price changes in the
underlying commodities; roll yield from rolling the nearest futures contracts to the next nearest futures contracts each month; and T-bill yield.

Donohue, Froot and Light (1992) show that by adding 5% of GSCI into a 60/40 stock/bond portfolio, the average returns over the 1970-1990 period would have increased from 9.6% to 9.8%, and the standard deviation of returns would have decreased from 12.1% to 11.5%. Ankrim and Hensel (1993) show that the monthly correlation of returns between the GSCI and the Standard & Poor’s 500 Index is -0.06, the monthly correlation between GSCI and the Ibbotson Intermediate Government Bonds Index is -0.11, and the correlation between the Standard & Poor’s 500 Index and the Ibbotson Intermediate Government Bonds Index is 0.25. Froot (1995) shows that from 1973 to 1993, most of the real assets returns provide diversification to a broadly diversified portfolio. The diversified portfolio is a 70/30 portfolio of stocks and government bonds, or a domestic/foreign portfolio of 75/25 in stocks and bonds. The real assets returns include inflation, commodity price changes, and real estate returns. Greer (2000) shows that total return from the GSCI index is comparable in magnitude and volatility to equity returns but is negatively correlated with stocks and bonds. Georgiev (2001) finds that over the period 1990 to 2001, GSCI returns had a correlation of -0.04 with the Standard & Poor’s 500, a correlation of 0.02 with the Lehman Government/Corporate Bond Index, a correlation of -0.03 with the MSCI World Index, and a correlation of 0.05 with the Lehman Global Bond Index.

Jensen, Mercer, and Johnson (2002) examine the diversification benefits of commodity futures for a traditional portfolio that consists of U.S. stocks, international stocks, corporate bonds, and Treasury bills over the period 1973 to 1999. Consistent with
previous results, commodity futures can enhance portfolio performance very significantly. Metals and agricultural commodities offer the most diversification benefits.

Gorton and Rouwenhorst (2005) construct an equally weighted commodity futures index and examine its monthly returns over the period from July 1959 to December 2004. The risk premium on the commodity index is shown to be as same as the risk premium on equities, but commodity returns are negatively correlated with equity and bond returns.

The above literature show that some spot commodities have zero or negative correlation with stocks and bonds but do not have return that are less than risk free rate. Adding these commodities into investors’ portfolios can bring diversification benefits and improve the completeness of investors’ portfolios. Crude oil is among these commodities. In this study, I examine the risk and return profile of crude oil investment.

Data and Sample

Figure - 2 tells us the monthly trading volumes of light crude oil futures contract on New York Mercantile Exchange (CL, NYMEX). Crude oil futures contract trading volumes before 1987 were not very significant. As a result, the price information of crude oil futures contract may not be very efficient. Therefore, daily crude oil futures contract closing prices are collected from Prophet Inc. and NYMEX over the period from 1987 to 2005. The Standard & Poor’s 500 Index and the CRSP (Center for Research in Stock Price) Value-Weighted Market Index are used to represent investment in stocks. The monthly returns of both indexes and monthly returns 91-day Treasury bill data are collected from the CRSP database.
Methodology

This study directly estimates the commodities buy and hold return based on the methodology of constructing the GSCI return. As far as I know, no study has followed GSCI methodology to construct a fully-collateralized portfolio for individual commodities and calculate individual commodity buy and hold return.

According to the GSCI Manual (2005), the quantity of each commodity in the index is determined by the average quantity of production during the last five years. The GSCI Total Return Index measures the return of a fully collateralized commodity investment that is rolled forward from the 5th to the 9th business day of each month. Using GSCI total return calculation methodology from the GSCI manual, this study constructs a portfolio consisting of a certain value of light crude oil futures contract and the equivalent value of 91-day T-bills and then calculates the return of the constructed portfolio from 1987 to 2005 monthly. The monthly return of the constructed portfolio consists of the monthly spot return of crude oil, return from rolling process, and monthly return from holding T-bills. On the rolling day, which is set to be the fifth business day of the rolling month, the roll yield is equal to ratio of the nearest futures contract closing price to the next nearest futures contract closing price minus one. Energy futures contracts mature every month; thus, the rolling process occurs on the fifth business day each month. Then, I use the following formula to calculate monthly total return of crude oil. Total return is the crude oil investment return.

\[
\text{Total return} = \text{spot return} + \text{roll yield} + \text{T- bill return}
\]

After deriving the buy and hold return estimation, I calculate the average monthly total return and standard deviation of total returns. I also calculate Pearson correlation
coefficients between monthly total returns of crude oil with correspondent returns on stocks. For crude oil the calculation period is a monthly observation rolling 3 years.

Based on the estimation of the risk and return profile of crude oil, I can decide whether crude oil provides diversification benefits for shareholders' portfolios. To illustrate the diversification benefit of crude oil for stocks, I calculate the risk and return profiles for portfolios with different combination of crude oil and Standard & Poor's 500 Index and find the compositions of minimum variance portfolio and optimal portfolio. Then, this study follows Georgiev (2001)'s method to measure the diversification benefit of crude oil by the Sharpe ratio change. The Sharpe ratio change is equal to the Sharpe ratio of the portfolio consisting of 60% Standard & Poor's 500 Index investment and 40% crude oil investment minus the Sharpe ratio of the portfolio consisting of 100% Standard & Poor's 500 Index investment. The more the Sharpe ratio increases, the more diversification benefit crude oil provides. Since the return data of crude oil is monthly, the Sharpe ratio calculation period for crude oil is monthly observations rolling 3 years.

Results

Table - 1 shows that the correlation coefficient between the monthly rates of return on crude oil investment and the monthly rates of return on Standard & Poor's 500 Index market index is -0.136, which is significant at 5% level. The correlation coefficient between the monthly rates of return on crude oil and the monthly rates of return on CRSP Value-Weighted Market Index is -0.106 and insignificant. The reason that I get two correlation coefficients with different significance levels may be because Standard & Poor's 500 Index represents the “old economy” and crude oil investment return should be more closely related to the “old economy”. Overall it is safe for us to say that crude oil
is negatively or zero correlated with the stock market. Table - 1 also shows that crude oil has approximately the same average monthly return and standard deviation as the overall stock market. Usually the commodities market is thought to be more volatile than the stock market. Investment in commodities incurs very high risk. Surprisingly, I find that crude oil has almost the same standard deviation as stocks. Crude oil has almost the same risk and return profile as stocks have, but is negatively correlated with stocks. Therefore, if crude oil is added into a portfolio consisting of equities, crude oil will be able to reduce portfolio risk and at same time keep or improve portfolio average rate of return. Crude oil can provide diversification benefit for equities.

From Figure - 3, I can see that most of the time crude oil is negatively correlated with stocks. When the stock market crashed on Monday, October 19, 1987, the crude oil market was not affected significantly. In 1990 Gulf War, there was a spike in crude oil market, but the stock market was sluggish. Before the Asian financial crisis, OPEC significantly increased the production of crude oil due to the economic developments of East Asian countries. Nonetheless, because of the Asian financial crisis, the demand for crude oil by East Asian countries suddenly declined in 1998. OPEC adjusted crude oil production level, and thus crude oil prices rose in 1999. At the same time, stock prices dropped significantly when Asian financial crisis occurred at the end of 1997 and recovered at the end of recession. The dotcom bubble in 2000 and 2001 moved investors’ money from the stock market to the commodity market. During 9-11 events, crude oil market also dropped significantly. Consequently, there was a spike of crude oil return at the end of 2001. Because of the Iraq War in 2003, crude oil returns rose when the stock market dropped. Figure - 3 shows that overall when crude oil returns rise, Standard
&Poor’s 500 Index returns decrease, and vice versa. Therefore, if I combine them together into one portfolio, the risk of constructed portfolio will be significantly smaller than the risk of each individual investment.

To further examine the correlation relationship between crude oil investment returns and stock returns, I calculate the rolling correlation coefficients from 1987 to 2005 with monthly observations and 3-year rolling period. Table - 2 gives us the results. The average 3-year correlation coefficient is -0.13 and significantly different from zero at the 1% level. Assuming investors apply a 3-year correlation coefficient as the ex ante expectation of the relationship between crude oil returns and stock returns, this result implies that the average expected correlation is significantly negative.

Figure - 4 illustrates correlation coefficients for all rolling time periods. I can see that most of the time, correlation coefficients fall below zero and the minimum is -0.6. Even when correlation coefficients are positive, the maximum is only 0.2. This evidence shows that crude oil and stocks are negatively correlated most of the time.

Table - 3 and Figure - 5 exemplifies the diversification benefit of crude oil for equities. I find that the portfolio consisting of 40% crude oil investment and 60% Standard &Poor’s 500 Index has the minimum variance and also is the optimal. I also apply the Sharpe ratio difference between portfolio 1 (100% Standard &Poor’s 500 Index) and portfolio 2 (60% Standard &Poor’s 500 Index and 40% crude oil) to statistically measure the diversification benefit of crude oil for stocks. Table - 4 shows the calculated Sharpe Ratios for portfolio 1 and for portfolio 2 from year 1987 to year 2005. I use monthly observations and 3-year rolling period to calculate the rolling Sharpe ratios. The average 3-year Sharpe ratio for a portfolio consisting of 100% stocks in the Standard &Poor’s 500
Index is 0.18. If I replace 40% of stocks in the Standard & Poor’s 500 Index with light crude oil investments, then the average 3-year Sharpe ratio of the new portfolio increases to 0.23. Both Wilcoxon Signed-rank test and two-sample t-test show that the average Sharpe ratio of portfolio 1 is significantly less than the average Sharpe ratio of portfolio 2, which means adding crude oil into stocks significantly increase the diversification profile of the equity portfolio.

Figure - 6 demonstrates the Sharpe ratio changes across time. From Figure - 6, I conclude that the portfolio including 60% of stocks in the Standard & Poor’s 500 Index and 40% crude oil has dominated the portfolio consisting of 100% stocks in the Standard & Poor’s 500 Index most of the years (2/3 of rolling time periods) from 1987 to 2005. For the time period from 1996 to 2005, crude oil provides very significant diversification benefits for equities.

Why does crude oil have almost the same average rate of return as stocks?

First of all, demand for energy products is increasing but the supply is limited. World economy development increases the demand for energy commodities. The resources for energy commodity are limited; hence, energy commodity prices keep going up.

Second of all, the energy commodity market is usually a backwardation market, and thus investors can obtain positive returns from rolling commodity futures contracts forward. In terms of cost of carry model, futures contract price is equal to spot price plus cost of storage plus interest expense minus dividend yield obtained from the underlying asset. Because of crude oil loans, crude oil can generate dividend yield, which is the crude oil loan rate of return. When crude oil loan interest rates are greater than costs of
storage and interest expenses, the futures price falls below the spot price. The market is a
backwardation market. Unlike other commodities markets, energy commodities market is
usually a backwardation market. As futures contracts go near to maturity, futures price go
up to approximate the spot price. If investors keep longing crude oil futures contracts, they
are able to capture a positive return from this approximation process.

Why is there a negative correlation between crude oil and stocks? The crude oil is
a real asset and its prices are determined by the supply and demand of crude oil. Stocks
are financial assets and stock prices reflect the whole economy. These two kinds of
assets can possibly show different patterns of price behavior.

Firstly, industrial transportation costs, material costs, and other operation costs are
very closely related to crude oil price. When oil price goes up, company operation costs,
such as, transportation costs increase. Therefore, crude oil price increases have negative
effects on the future outlook of the whole economy, and stock price drop correspondently.
Crude oil price increases also cause the costs of living to increase. Investors will reduce
their investment on stocks, and thus stock price decreases.

Secondly, commodity is a natural hedge for inflation. Becker and Finnerty (2000)
find that equity and debt typically lose value during periods of unexpected inflation.
Commodity investments rise with inflation, and thus commodity investment is negatively
correlated with equity.

Thirdly, Gorton and Rouwenhorst (2005) contend that commodities and equities
show different behaviors in business cycles. In the beginning of recession, stock prices
usually drop but commodities prices do not drop significantly. At the end of recession,
stock prices go up but commodities prices decrease.
Conclusions

The results in this chapter show that crude oil is negatively correlated with stocks but have almost the same rate of return as stocks. If crude oil is mixed with equities in a portfolio, the result is improved diversification that provides reduced risk along with greater return. Changes that offer improved means for gaining exposure to oil make the market more complete.

As far as the oil and gas producing industry is concerned, when crude oil is negatively correlated with equities, those oil producers that short crude oil futures or forwards contracts actually take the diversification benefits of crude oil away from shareholders’ portfolios, while oil producers that reduce or remove short transactions provide the diversification benefits for shareholders’ portfolios. When crude oil is added into or removed from shareholders’ portfolios through company derivatives transactions, the risk and return profiles of shareholders’ portfolios may change, and the market value of shareholders’ portfolios can possibly be affected. In the following chapters, this study goes further by examining whether company derivatives transactions can increase shareholders’ wealth and change the systematic risk of shareholders’ portfolios.
CHAPTER 3
VALUE EFFECT OF CRUDE OIL DERIVATIVES TRANSACTIONS BY OIL AND GAS
PRODUCERS

Literature Review

Modigliani and Miller (1958) conclude that hedging does not matter in an efficient market because shareholders can enter the same transactions to create their desired risk and return profiles. Modigliani and Miller’s (1958) assumptions include no taxes, no financial distress costs, no contraction costs, no information costs, and no other capital market imperfections and incompleteness. Based on their theory, corporate risk management can only create firm value by changing investment decisions or by reducing the costs of market imperfections, such as tax, transaction cost, contracting cost, etc. Therefore, corporate risk management literature tries to explain hedging motivations from the market imperfection perspective and provides several rationales for hedging.

1. Hedging reduces the expected costs of financial distress. In Modigliani and Miller’s (1958) world, it is assumed that there is no financial distress cost. Hence, altering the probability of financial distress does not affect firm value. However, in an imperfect market, financial distress is costly. Reducing the expected financial distress cost is an incentive for firms to hedge. Mayers and Smith (1982) and Smith and Stulz (1985) argue that a firm’s probability of financial distress depends on the volatility of expected cash flow and level of debt. Hedging can reduce the volatility of earnings, and thus the probability of bankruptcy and the expected costs of financial distress. Stulz (1996) states that hedging can increase firm value if the lower part of risk is reduced while the upper part of risk is maintained. Nance,

2. Hedging alleviates the underinvestment problem associated with costly external financing. Froot, Scharfstein, and Stein (1993) conclude that if external financing is more costly than internal financing, and fund inflows and outflows do not match, hedging can match the cash inflows with outflows better, and thus lower the needs for external financing. Reducing external financing cost adds firm value. Haushalter (2000) finds financing costs is a significant factor affecting hedging and the underinvestment problem is an important motivation for hedging.

3. Tax concern is also a rationale for hedging. Mayers and Smith (1982) and Smith and Stulz (1985) contend that if a firm has a linear effective marginal tax schedule, the firm’s expected after-tax profit is unaffected by the volatility of taxable income; if a firm has a convex tax schedule, the expected after-tax profit will have more concavities. Hedging reduces the volatility of taxable income and the firm’s expected tax liability. The reduction of expected tax liability increases firm value. Stulz (1996), Ross (1996), and Leland (1998) conclude that a reduction of cash flow volatility increases financial leverage level and generates higher tax shields. Tax shields add firm value. Nance, Smith, and Smithson (1993) find that firms with more convex tax functions are more likely to hedge. Graham & Smith (1999) use simulation methods to investigate tax convexity and find that, on average, tax
schedules are convex and for firms with convex tax schedules, the average tax savings are about 5.4% for a 5% taxable income volatility reduction.

4. Managerial risk aversion is another possible motivation for companies to hedge. Stulz (1984) and Smith & Stulz (1985) think that if managers’ utility functions are concave, and managers’ compensations are related to the earning or cash flow volatility, then managers want to reduce corporate volatility. If managers cannot effectively reduce corporate volatility by themselves, they will reduce volatility through corporate hedging activities. Nonetheless, if stock options are a significant part of managers’ compensation packages, managers are more willing to take risks instead of reducing volatility. Tufano (1996) conducts a detailed study on the gold mining industry. He finds that manager’s risk aversion is a motivation for hedging. Berkman and Bradbury (1996) find only a modest relationship between the managerial risk aversion and hedging. Geczy, Minton, and Schrand (1997) find that the managerial risk aversion is not related to hedging. Haushalter (2000) examines the oil and gas production industry, and does not support that managerial risk aversion is related to corporate hedging.

5. Hedging can be used to reduce contracting costs. One kind of agency problem between stockholders and bondholders is the “underinvestment problem” stated by Myers (1977). Shareholders may forego projects with positive net present value if a large portion of the net cash flow from the project is allocated to current bondholders. Bondholders know this potential conflict and demand compensation in the issuing price of the bond. The compensation for the underinvestment problem is one kind of agency cost. Mayers and Smith (1987) show that it is less
likely for shareholders to default on promised debt payments after hedging, so hedging reduces this kind of deadweight cost. Reducing this deadweight cost increases shareholders’ expected cash flow from a positive net present value project, and encourages shareholders to take more positive net present value projects. Nance, Smith, and Smithson (1993) find that firms with more growth options are more likely to hedge. Geczy, Minton, and Schrand (1997) conclude that the underinvestment problem is a motivation for hedging. Gay and Nam (1998) emphasize that company derivatives use is positively related to the underinvestment problem. Jensen and Meckling (1976) consider “asset substitution” as another kind of agency problem. Equity held by shareholders can be taken as a call option on the underlying assets of the firm. Shareholders have the motivation to transfer wealth from bondholders by taking risky projects. To prevent shareholders from transferring risk and wealth, bondholders demand a higher compensation or use debt covenants to restrict shareholders’ investment and financing policies. Hedging reduces the probability of default and the contracting cost associated with the asset substitution. Mian (1996) finds evidence mixed with respect to contracting costs. Leland (1998) believes that hedging benefits are greater when agency costs are low.

6. Economies of scale are another motivation for corporations to hedge. There are economies of scale both in getting information and tools on hedging strategies, and in the transaction costs of derivatives. Nance, Smith, and Smithson (1993) find that firms with larger sizes are more likely to hedge. Mian (1996) shows that risk management activities involve significant fixed costs. Geczy, Minton, and Schrand
(1997) also conclude that Economies of scale is a motivation for hedging.

7. Information asymmetry can be reduced by hedging. DeMarzo and Duffie (1991) argue that information asymmetry between managers and shareholders makes hedging an ideal way to signal private information to shareholders. This information cannot be conveyed to shareholders without cost. Because hedging reduces the volatility of a firm’s payoff, uninformed shareholders receive more information about risks and become more certain of the expected payoff.

8. Merton (2005) gives us a new perspective to understand corporation derivatives transactions. He emphasizes that a large amount of equity capital is used to cushion against non-value-adding risk, i.e., the risk which firms do not have a comparative advantage to manage. Corporate derivatives transactions can help firm strip out the risk for which firms do not have a comparative advantage. The equity capital used to cushion against the non-value-adding risk will be used to finance the value-adding risk. Having more value-adding investment opportunities than competitors creates value for firms. As a result of corporate risk management, firms can increase shareholder value without using new equity capital. Corporate derivatives transactions can reconstruct the company risk profile to make companies more concentrated on risk with comparative advantage.

As the noted above, if the market is imperfect, deadweight costs may be incurred. Most market imperfections incurring deadweight cost are related to firm operating cash flow volatility, earning volatility, or stock return volatility. Corporate commodity derivatives transactions are assumed to be able to reduce firm volatility, and thus the deadweight costs caused by market imperfections. By reducing deadweight costs, firms save the
amount of equity cushioned for deadweight costs. Hence, companies have more equity for valuable investment opportunities. In this sense, corporate commodity derivatives transactions can increase firm value.

Compared to previous studies, this study examines corporate derivatives transactions from another perspective - the shareholders’ portfolio perspective. This study identifies that when oil and gas producers take short position on crude oil derivatives contracts, the volatility of operating cash flows related to anticipated hedged transactions is reduced, while at the same time the risk and return profiles of shareholders’ portfolios are negatively affected. According to previous studies, these transactions may increase firm value. Nonetheless, in terms of this study these transactions may decrease shareholders’ wealth. Since the objective of corporate risk management is to increase shareholders’ wealth, I should examine corporate risk management issue from shareholders’ portfolio point of view. This paper examines the diversification benefits of crude oil derivatives transactions by oil and gas producers for shareholders’ portfolios before investigating their value effect. I improve the sample construction by differentiating those transactions with diversification benefits for shareholders’ portfolios from those without diversification benefits.

Dusak (1973) emphasizes that a long commodity futures contract is actually a leveraged investment in the underlying spot commodity. Therefore, corporate derivatives transactions may be taken as buying or selling the underlying assets on leverage. Shareholders can add commodities into or remove commodities from their portfolios through corporate commodity derivatives transactions. If firms long commodities with negative or zero correlation with stocks, then those commodities derivatives transactions
reduce the risk exposure of shareholders’ portfolios and are more likely to increase shareholders’ wealth. If firms long commodities with a positive correlation to stocks, then the derivatives transactions actually increase the risk exposure of shareholders’ portfolios and are more likely to decrease shareholders’ wealth. For short transactions, it is the opposite.

As far as the oil and gas producing industry is concerned, when crude oil is negatively or zero correlated with stocks and provides significant diversification benefits for a portfolio consisting of equities, firms shorting crude oil futures or forwards actually get rid of the underlying position of crude oil while firms that reduce or remove short transactions actually gain more of an underlying position of crude oil. During the examined time period for the value effect of corporate crude oil derivatives transactions, which is the period from 1996 to 2005, crude oil provides very significant diversification benefits for stocks. Therefore, short transactions in oil producing industries are expected to have negative effects on the diversification profiles of shareholders’ portfolios, while removing short transactions are anticipated to improve shareholders’ portfolios.

After identifying the diversification benefit of crude oil derivatives transactions by oil and gas producers, I examine their value effect. Firstly, I investigate the value effect of corporate crude oil derivatives transactions by looking at whether those transactions change the expected cash flow of shareholders’ portfolios.

In terms of Nance, Smith, and Smithson (1993), Mian (1996), and Geczy, Minton, and Schrand (1997), transaction costs and economies of scale are possible sources of value effect. Corporate derivatives transactions save shareholders some amount of cash flow because they incur less transactions cost than shareholders their own transactions.
Shareholders can invest the saved cash flows to other investment opportunities with positive net present values. As a result, corporate derivatives transactions can increase shareholders' wealth.

As far as the oil and gas producing industry is concerned, when oil and gas producing firms take short transactions, some part of the crude oil position in shareholders' portfolios is taken out. The risk and return profiles of shareholders' portfolios are negatively affected. Because of transactions costs, shareholders have to spend cash to get rid of the negative effect. The expected cash flow of shareholders' portfolios decreases, therefore the market value of shareholders' portfolios decreases. When oil and gas producing firms stop short transactions, the diversification benefit of crude oil is added into shareholders' portfolios, and thus the risk and return profiles of shareholders' portfolios are improved. These derivatives transactions save shareholders some amount of cash flow because they incur less transactions cost than shareholders their own transactions. Shareholders can invest the saved cash flow to other valuable investment opportunities, and thus shareholders' wealth is increased.

This study provides another motivation for shareholders to prefer corporate derivatives transactions. As we all know, there exist crude oil loans and gold loans. Petersen and Thiagarajan (2000) find that a gold loan is economically the same as a cash loan plus a forward contract. Gold mining firms can borrow gold and sell gold to fund their operations rather than borrow cash. When firms pay back loans, they just return a fixed amount of gold which is equal to principal plus interest. It is the same case for crude oil loans. Companies holding crude oil can lend crude oil to other companies to get interest on these loans. When companies take long positions in crude oil derivatives contract or
remove short position in crude oil derivatives contract, their long positions on crude oil increase. These companies do not only get returns from crude oil investment but also interest from crude oil loans. Nonetheless, if shareholders long crude oil forward or futures contract by themselves, they only get the return from crude oil investments. Removing short derivatives position on crude oil by oil and gas producing companies is expected to increase shareholders’ wealth. The cash flows of shareholders’ portfolios are increased, and thus the market value of shareholders’ portfolios increases.

Secondly, I examine the value effect by looking at whether crude oil derivatives transactions by oil and gas producers can improve the completeness of shareholders’ portfolios more than the crude oil derivatives transactions entered by shareholders themselves.

In terms of Jarrow and O’Hara (1989), corporate derivatives transactions that improve the completeness of shareholders’ portfolios should have a value effect. Jarrow and O’Hara (1989) attribute market completeness as a possible explanation on the primes and scores anomaly. If the market is efficient, the price of the prime and score combination should be equal to the price of the underlying stock and corresponding stock option. However, Jarrow and O’Hara (1989) find that the price of prime and score combination exceeds the price of the underlying stock and corresponding stock option significantly for the examined firms. They explain that if primes and scores provide a more complete set of investment opportunities than the underlying stock and corresponding stock option, then market completeness is the source of the value difference.

Chapter 2 shows that removing crude oil derivatives positions from oil and gas producers improves the completeness of shareholders’ portfolios. Nonetheless,
according to Modigliani and Miller (1958), even if corporate derivatives transactions can improve the completeness of shareholders’ portfolios, shareholders may still not value those transactions because shareholders themselves can enter into the same derivatives transactions as companies. This study contends that transaction limitations make shareholders unable to obtain the same risk and return profiles as the companies provide. Consequently, shareholders have motivation to value the derivatives transactions taken by companies.

Most institutional investors still concentrate on stocks and bonds. Because of the restrictive regulatory requirements, insurance companies, mutual funds and other institutional investors do not invest much into commodities. It was not until recently that some pension funds begin to add commodities in their portfolios. Doyle, Hill and Jack (2007) show that 75-80% of the funds invested into GSCI are from pension funds and the rest are from corporations. In March 2007, CalPERS (California Public Employees Retirement System), the biggest U.S. pension fund, started tracking the Goldman Sachs Commodity Index. Doyle, Hill and Jack (2007) state that CalPERS current investment in commodities accounts for only 3% of its portfolio, and that many pension funds still do not invest in commodities at all. When pension funds invest into GSCI index, they need to rebalance their portfolios monthly. High transaction costs may be one of the reasons that pension funds are reluctant to invest into commodities.

For individual investors, the exposure to commodities is also very limited. It is impractical for investors to buy and store crude oil. Because of high transaction costs and risk, few individual investors hold crude oil derivatives contracts by themselves. Hedge funds and commodity funds provide opportunity for investors to gain exposure to
commodities. Nonetheless, because of high entrance requirements and fees, most of these funds are only available to high net worth investors rather than common individual investors. Edwards and Ma (1988), Elton, Gruber, and Rentzler (1990), Irwin, Krukemyer and Zulauf (1993), and Fung and Hsieh (2000) showed that for publicly offered commodity funds, fees are substantially higher than those charged by hedge funds. Fung and Hsieh (2000) state that high management fees and transactions cost make commodity funds unpopular. After the establishment of commodity ETF (Exchange Traded Fund) in 2006, individual investors have a relatively easier way to get the exposure of commodities. In February 2006, the first commodity ETF – DBC (Deutsche Bank Commodity Index Tracking Fund) was traded on the AMEX (American Stock and Option Exchange). In July 2006, the second commodity ETF - GSG (iShares GSCI Commodity-Indexed Trust) was traded on the NYSE (New York Stock Exchange). By holding commodity ETFs, individual investors can get the exposure to commodities more easily.

The cheaper and easier way for investors to get the exposure to crude oil is to own the equities of oil and gas producing companies. When oil and gas producers enter short transactions on crude oil derivatives contracts, these producers reduce shareholders’ exposure to crude oil. Shareholders’ portfolios become less complete, and thus the market value of their portfolios decreases. When oil and gas producers remove short position on crude oil derivatives contracts, shareholders of these producers regain the exposure to crude oil. Shareholders’ portfolios become more complete, and thus the market value of shareholders’ portfolios increases.

In conclusion, both diversification benefits and market imperfections are conditions
on which corporate derivatives transactions have a value effect. Diversification benefits provided by corporate derivatives transactions motivate shareholders to enter the same derivatives transactions as companies. Because of transaction costs, economies of scale, and transaction limitations, shareholders are unable to or have to spend more to obtain the same diversification benefits as provided by corporate derivatives transactions. Hence, market imperfections make corporate derivatives transactions with diversification benefits for shareholders’ portfolios able to have a value effect, and vice versa.

The above discussion shows that in order for corporate commodity derivatives transactions to increase shareholders’ wealth, these transactions must provide diversification benefits for shareholders’ portfolios first. If corporate derivatives transactions do not diversify shareholders’ portfolios, shareholders will not value those transactions whether or not market imperfections are present. Therefore, market imperfections are not the only sufficient condition for the corporate derivatives transactions to increase shareholders’ wealth. The additional sufficient condition is that corporate derivatives transactions must provide diversification benefits for shareholders’ portfolios. In conclusion, I must examine the diversification benefit of the underlying commodity before investigating the value effect of commodity derivatives transactions.

Recently, several studies have directly tested the value effect of corporate derivatives transactions. Allayannis and Weston (2001) examine the relation between foreign currency hedging policy change and firm value change and conclude that foreign currency hedging is associated with higher firm value. Graham and Rogers (2002) document a positive relation between derivative use and debt capacity and argue that the tax benefits resulting from hedging increases firm value by 1.1%. Carter, Rogers and
Simkins (2003) investigate the fuel hedging behavior of firms in the US airline industry to examine whether such hedging is a source of value for these companies and show that jet fuel hedging is positively related to airline firm value. Guay and Kothari (2003) show that derivatives are a small piece of risk management for large U.S. firms, and that firm value changes only slightly compared to firm value change for large moves in the underlying prices and rates. Bartram, Brown & Fehle (2004) present international evidence on the hedging effect and find positive valuation effects primarily for firms using interest rate derivatives. Lookman (2004) focuses on oil and gas exploration and production firms. He finds that when commodity risk is a primary risk, hedging is associated with lower firm value; when commodity risk is not a primary risk, hedging is associated with higher firm value. When the factors of management quality are taken into consideration, the hedging effect becomes insignificant. Taken together, the effect of hedging on firm value, if any, is marginal. Jin and Jorion (2005) find that hedging reduces the oil and gas producers’ stock price sensitivity to oil and gas prices and hedging does not seem to affect firm value.

Previous empirical studies get mixed results. One of the possible reasons is that they do not consider whether corporate derivatives transactions really provide diversification benefits to shareholders’ portfolios before examining the value effect. From the shareholders’ portfolio perspective, the mixed empirical evidence can be explained. If firms long commodities with negative or zero correlation with stocks, then commodity derivative transactions improve the diversification of shareholders’ portfolios. Empirical studies show commodities, foreign currencies, or interest rate assets may have positive, zero, or negative correlations with stocks. Therefore, studies focusing on different kinds of derivatives transactions and on different time periods will get different results.
This study contributes to corporate risk management empirical literature not only by improving sample construction but also by improving methodology. Most previous studies apply cross-sectional methodology to examine whether derivative transactions are related to taxes, growth opportunities, managers’ risk aversion, bankruptcy costs, economies of scale, and other proxy variables. They compare market imperfections proxy variables of firms with and without derivatives transactions.

Guay (1999) shows an endogenous problem on cross-sectional studies on hedging, i.e., it cannot be determined whether firms use derivatives to reduce risk or whether firms with higher risk are more likely to use derivatives. He applies a time-series methodology to study the effect of hedging policy change on the risk exposure change of firms. Allayannis and Weston (2001) also examine the effect of hedging policy change on the change of firm value, measured by Tobin’s Q. This paper use event study methodology to examine the effect of derivatives transactions policy change on the firm stock return change. Market efficiency theory states that stock price reflect all the information about firm value and respond quickly to firm value information change. If shareholders value corporate commodity derivatives transactions, then the value effect should be reflected in the company stock price. This study applies an event study to investigate whether the cumulative abnormal returns around the announcements of crude oil derivatives positions change (CAR) is significantly related to crude oil derivatives positions change. I use hedge ratio changes to measure derivatives positions changes. It is forecasted that more short positions removed will cause higher stock prices around the announcements. Since the hedge ratio for short transactions is negative, it is expected that there is a significantly negative relationship between the cumulative abnormal returns
and hedge ratio changes when companies remove their short positions on crude oil derivatives, and vice versa. Two hypotheses are developed as follows:

H₁: There is a significantly positive relationship between CAR and hedge ratio change if companies announce to initiate short position on crude oil derivatives.

H₂: There is a significantly negative relationship between CAR and hedge ratio change if companies announce to remove short position on crude oil derivatives.

Usually the information on corporate derivatives transactions is publicly available when 10-Q or 10-K forms are disclosed by SEC. The effective day and announcement day of derivatives position are not same. In some cases, about one or two months before these accounting are reported, companies may already enter into derivatives transactions. In other cases, companies enter derivatives transactions one or two months after they disclose their derivatives positions. The effective dates are different from announcement date, and thus there may be information leakage before or after companies disclose their hedging policies publicly.

To examine whether there is information leakage, this study examines the relationship between cumulative abnormal returns and hedge ratio change around the effective date of derivatives position change. The hypotheses are as follows:

H₃: There is a significantly positive relationship between CAR and hedge ratio change if companies initiate crude oil derivatives short transactions.

H₄: There is a significantly negative relationship between CAR and hedge ratio changes if companies remove crude oil derivatives short transactions.

After finding the value effect of corporate commodity derivatives transactions, I continue to examine the source of value effect. Following Nance, Smith, and Smithson
(1993), firm size is used as a proxy variable for transaction cost and Economies of scale. The derivatives transactions policy changes by bigger firms should have more value effect because shareholders’ can save more cash flows on transactions costs. In addition, big companies have more of an advantage on information collection, doing research, and using derivatives transactions tools than small companies. Therefore, there should be a significantly positive relationship between cumulative abnormal returns around derivatives transactions policy changes and firm sizes. I find a significant value effect of corporate derivatives transactions when oil and gas producing firms remove short transactions of crude oil derivatives contracts. Therefore, I use new non-users as our sample group. The hypothesis is as follows:

H5: There is a significantly positive relationship between CARs and firm sizes if companies remove short positions on crude oil derivatives.

Data and Sample

Following Haushalter (2000), this paper constructs a database of oil and gas producers by selecting the companies with a primary SIC code of 1311.

Traditional studies select the sample in terms of the derivatives transactions reports in 10-Q forms, 10-K forms, and footnotes to accounting annual reports. If firms report the derivative transactions, then firms are selected as hedging firms; if firms do not report any derivatives transactions, then firms are selected as non-hedging firms. By doing this, traditional studies neglect some other strategies that may function as derivatives transactions. For example, a crude oil loan is equivalent to a cash loan plus a forward contract. This study also classifies this strategy and other hedging strategies stated in accounting annual reports and 10-K forms also as derivatives transactions.
Commodity derivatives transactions mainly include forwards, futures, options, and swaps. For the first two types of instruments, this study decides the transactions direction in terms of longing or shorting the underlying commodities. For options, the direction is decided according to call or put transactions. For swaps, this study follows Guay’s (1999) method to decide the direction of swap. A swap that obligates the firm to make fixed payments and receive floating payments is considered a long transaction, since the value of this swap is positively correlated with the underlying commodity price.

The sample selection process is as follows:

1. All oil and gas producing firms that have stock returns data in CRSP are collected. The examination period is from 1996 to 2005. SFAS 105 (FASB, 1990) requires all firms to report the information about financial instrument with off-balance sheet risk for the fiscal year ending after June 15, 1990, and the SEC website provides the electronic versions of annual reports starting from 1996.

2. Corporations with derivatives transactions are chosen in terms of 10-K forms, 10-Q forms, and footnotes to annual reports. All the forms are collected from the EDGAR database. Keywords search is used to collect firms that report crude oil and gas derivatives transactions and other relevant strategies equivalent to derivatives transactions from the EDGAR database. Following Jin and Jorion (2005), the searching keywords include: Item 7a, quantitative disclosure, risk management, hedge, off balance sheet, derivative, value-at-risk, earnings-at-risk, cash flow at risk, sensitivity analysis, commodity risk, price risk, market risk, option contract, futures contract, forward contract, swap, commodity futures, commodity contract, commodity option, notional, collar, crude oil loan.
3. After the corporations with derivatives transactions and corporations without derivatives transactions in each quarter or year are decided by keywords search, this paper reviews the quarterly and annual reports of each new user or each new non-user around its policy change period in case the changers are misidentified. Then this study lists the time periods during which the firm has transactions over the period from 1996 to 2005. By doing this, this paper can identify the time when companies start or stop commodity derivatives use. This study follows Guay’s (1999) procedure for the new users and new non-users. Firms that keep using commodity derivatives transactions and firms that keep not using commodity derivatives transactions from 1996 to 2005 will be separated from other firms. They are taken as users and non-users, respectively. All other firms are those that have changed their crude oil derivatives transactions policies during the period from 1996 to 2005, either initiating use (new users) or removing use (new non-users). The firms that have changed their derivatives transactions policies are divided into new users and new non-users. New users are those firms that have initiated derivative use during the period from 1996 to 2005. New non-users are those firms that have removed derivatives transactions during the period from 1996 to 2005. For firms that have changed their derivatives transactions policies more than once, I count them as both new users and new non-users. As a result, one firm may be in both new users sample and new non-users sample at the same time, and one firm may show up in either the new users sample group or the new non-users sample group more than once. There may be derivatives use increases or decreases. However, I just focus on the changes from use to non-use or from non-use to use.
There are also some cases in which firms show changes in derivatives positions because they are new or because they cease to exist due to mergers, acquisitions, bankruptcy, or other reasons. This study cannot find the annual reports for them from the EDGAR database, and drops these firms.

4. For each sample firm, this study specifies the announcement date of policy change and the effective date of policy change. Announcement date is the disclosure date of correspondent accounting report to SEC. The effective date is the effective date when derivatives contracts are initiated or removed. For the CARs around the announcement of derivatives positions changes, I use announcement dates as event dates. For the CARs around the actual derivatives positions changes, I take effective dates as event dates. The event day is defined as day 0.

5. This study uses hedge ratio changes to represent derivatives positions changes. I collect the information on the underlying positions of commodity derivatives transactions and the information on crude oil and gas production positions from 10-Q and 10-K forms. The commodity production in the quarter before event quarter is taken as the expected quarterly production. The ratio of future quarterly underlying positions covered by crude oil and gas derivatives contracts to the expected quarterly production is taken as the hedge ratio of new users. The ratio of quarterly underlying positions covered by crude oil and gas derivatives contracts to the quarterly crude oil and gas production before companies stop using crude oil and gas derivatives is taken as the hedge ratio of new non-users. Since oil and gas producers take short positions on crude oil and gas derivatives contracts, all hedge ratios obtained are negative.
The resulting sample is shown in Table - 5. Total number of companies in oil and gas producing industry is 887. Only 201 out of 887 (23%) firms have used oil and gas related derivatives contracts during the period from 1996 to 2005. This low percentage shows that firms are reluctant to short energy derivatives contracts. Only 344 firms out of 887 firms have stock returns data from CRSP. These 344 firms are divided into 4 groups: users, non-users, new users, and new non-users as defined above. 20 out of 344 oil and gas producing firms keep shorting energy commodity contracts, and 157 out of 344 do not hedge at all during the period from 1996 to 2005. During the sample time period, there are 120 firm/dates that start using crude oil and gas related derivatives contracts, and each firm/date is counted as one new user. Among these 120 sample new users, there are some cases in which firms change their derivatives policy also during the estimation window (-310,-61) or during 60 days around the event dates. For example, firm A announced to remove its entire commodity derivatives contract effectively on 07/01/1999 but again announced to initiate using commodity derivatives contracts on 04/01/2000. To get rid of the contaminating effect of the announcement of quitting on 07/01/1999, I exclude the announcement of Firm A on 04/01/2000 from our sample of new users. Also, I make sure that the selected new users have hedge ratios data. The final sample of new users includes 46 firm/dates. Using the same method, out of 344 sample firms I obtain 145 sample new non-users, which are firm/dates that announce to stop using crude oil and gas related derivatives contracts. After clearing the contaminating transactions and checking the availability of hedge ratios data, I get 31 new non-users for oil and gas producing industry. When the effect of policy change announcements on the stock prices is checked, announcement dates are event dates; when the effect of effective policy
changes on stock prices is examined, effective dates are event dates.

Table 6 shows the profiles of new users and new non-users across time. 7 out 10 years the number of new non-users exceeds the number of new users. Oil and gas producers seem to be more likely to stop using commodity derivatives.

Methodology

Most previous studies apply cross-sectional methodology to examine whether derivative transactions are related to the proxy variables for market imperfections. They compare the market imperfections proxy variables of firms with derivatives transactions and the market imperfections proxy variables of firms without derivatives transactions to see if there are significant differences. Guay (1999) points out an endogenous problem in cross-sectional studies on hedging, i.e., it cannot be determined whether firms use derivatives to reduce risk or whether firms with higher risk are more likely to use derivatives. He recommends a time-series methodology to study the effect of hedging policy changes on the changes in firms’ risk exposure. Allayannis and Weston (2001) also contend that I should examine the effect of hedging policy change on the change of firm value. They use Tobin’s Q as a proxy variable for firm value and examine whether there is a significant relationship between Tobin’s Q changes and hedging policy changes. All other studies on the value effect of hedging follow their methodology except Brown’s (2001) study.

Brown (2001) examines the value effect of foreign exchange rate risk management. Brown (2001) states that measuring the impact of foreign exchange rate risk management on firm value is challenging because although financial risk is eliminated by foreign exchange rate hedging activities, financial risk may not be priced by
the market. Therefore, it is difficult to measure the impact of foreign exchange risk management on stock market value. The author overcomes this problem by taking stock returns as the measurement of firm value to investigate the relationship between firm value and results of foreign exchange risk management activities. The sample companies' stock returns are taken as the dependent variable, and independent variables include market returns represented by CRSP value-weighted index returns, an industry stock index returns, foreign exchange rate changes, and the profit or loss of foreign exchange rate derivatives transactions. The coefficient of the fourth independent variable - “profit or loss of foreign exchange rate derivatives transactions” is used to isolate the impact of foreign exchange rate risk management on firm value.

Based on the studies mentioned above, this paper applies standard event study methodology to examine the effect of derivatives position changes on firm value changes. Market efficiency theory states that stock prices reflect all the information about firm value and respond quickly to firm value information change. In terms of market efficiency theory, this study tests if there is a significant relationship between cumulative abnormal stock returns around derivatives transactions policy change and hedge ratio changes. This study divides sample firms as new users and new nonusers, and then test whether the decision to initiate crude oil derivatives transactions or to quit crude oil derivatives transactions causes significant abnormal stock returns.

This study does not directly test whether the average of cumulative abnormal returns is significantly different from zero when firms change their derivatives transactions policies. The reason is that information on derivatives transactions policies is usually obtained by public shareholders from 10-Q and 10-K forms. These reports do not only
include derivatives policy information but also include many other kinds of information which may also have effect on CAR. Therefore, even if I detect that average CAR is significantly positive or negative I still cannot conclude that hedging policy change causes significant CAR. To solve this problem, I follow Brown’s (2001) study by conducting a regression between CARs and derivatives positions changes to examine whether there is a significant relationship between CARs and derivatives position changes.

Standard event study methodology is as follows:

1. The return generating process is from the single-index market model:

\[ R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt} \quad t = 1, \ldots, T; \ j = 1, \ldots, J \]  

(1)

where,

\[ R_{jt} = \text{return to stock } j \text{ at day } t, \]

\[ \alpha_j = \text{intercept}, \]

\[ \beta_j = \text{slope coefficient}, \]

\[ R_{mt} = \text{return to the value-weighted CRSP market index on day } t \]

\[ \varepsilon_{jt} = \text{error term of firm } j \text{ on day } t. \]

The derivative transaction announcement date or effective date is the event date, day 0, for each stock \( j \). The estimation period is defined as a 250-day non-event window starting on day -310 through day -61. Equation (1) is estimated with ordinary least squares, and the predicted residual for each day in the prediction interval is defined as follows:

\[ u_{jt} = R_{jt} - \hat{\alpha}_{jt} - \hat{\beta}_j R_{mt} \]  

(2)

where \( \hat{\alpha}_j \) and \( \hat{\beta}_j \) are the estimated OLS parameters from the estimation window, \( R_{jt} \) is the return of stock \( j \) at time \( t \), \( R_{mt} \) is the market return at time \( t \), and \( t \) is from the event window. The market return is the CRSP value weighted market index return.
2. Cumulative abnormal return (CAR) is generated by calculating the cumulative prediction residual for each security $j$ as a sum of the prediction errors over the event window. The event windows include (-30, 0), (0, 30), and (-30, 30). Window (-30, 0) is used to detect the market reaction before announcement of derivatives policy change or the effective derivatives policy change. Window (0, 30) is used to detect the market reaction after announcement of derivatives policy change or the effective derivatives policy change. Window (-30, 30) is used to detect the market reaction around announcement of derivatives policy change or the effective derivatives policy change. Hedging policy changes are identified quarterly according to quarterly 10-Q reports, and market reactions to hedging policy changes should reflect 3-month horizons. Also, shareholders could gradually buy or sell the stocks of hedging firms because after a hedging policy change, the new policy usually stays in the company for a while. Therefore, I choose relatively long event windows. During the CARs,

$$CAR_j = \sum_{t=t_1}^{t_2} u_{jt}$$  \hspace{1cm} (3)

3. After obtaining CAR for each sample firm, this study applies the Weighted Least Square (WLS) method to estimate the regression model and to test the relationship between CARs and hedge ratio changes. When event period cumulative abnormal returns are regressed on firm-specific variables, the assumption of OLS may be violated. Sefick & Tompson (1986) points out the cross-sectional and cross-correlation heteroscedasticity of the abnormal return are against the assumption of Ordinary Least Square (OLS). Karafiath (1994) and Impson (2000) also mention the cross-correlation of error terms and the possible change of variance of error terms. WLS (Weighted Least Square) model is applied to solve this problem. In this study, I use EVENTUS to conduct the WLS regression. CAR over the event windows (-30, 0), (0, 30), and (-30, 30) is taken as dependent variable respectively,
and the hedge ratio change is taken as independent variable. The regression model is as follows:

\[
CAR_j = a + b_1 * x_{ij} + \varepsilon_j
\]

where

- \( CAR_j \) = the cumulative abnormal return for security \( j \)
- \( a \) = the intercept
- \( b_1 \) = the coefficient of hedge ratio change
- \( x_{ij} \) = the hedge ratio change around event day
- \( \varepsilon_{jt} \) = error term

4. This study detects that when oil and gas producing companies remove derivatives transactions, there is a positive market reaction. The positive market reaction may be a result of reduction of market imperfections. This study continues to investigate the sources of value effect. Based on the possible market imperfections through which corporate derivatives transactions may increase shareholders' wealth, this study conducts another WLS regression to investigate the effect of transaction costs and economies of scale. This study uses cumulative abnormal return to represent the value effect of derivatives policy change. The identified market imperfections proxy variable is the independent variable. Following Nance, Smith, and Smithson (1993), this study chooses the firm size to proxy for the effect of transaction costs and economies of scale. The firm size is represented by the market capitalization, which is collected from the CRSP database. A larger company has advantages on economies
of scale, transaction costs, information costs of derivatives transaction, and tools of risk management activities. Therefore, when a larger company stops shorting crude oil contracts, the market reaction should be more significantly positive. The regression model is as follows:

\[
CAR_j = a + b_1 x_{1j} + b_2 x_{2j} + \varepsilon_j
\]

where

- \( CAR_j \) = the cumulative abnormal return for security \( j \)
- \( a \) = the intercept
- \( b_1 \) = the coefficient of hedge ratio change
- \( b_2 \) = the coefficient of firm size
- \( x_{1j} \) = the hedge ratio change around event day
- \( x_{2j} \) = the firm size before event day
- \( \varepsilon_j \) = error term

Results

For oil and gas producing companies that start shorting energy commodities derivatives, Table - 7 shows negative and significant market reactions, which is consistent with our forecast. The coefficients of hedge ratio change are 0.17, 0.12, and 0.29 for different event windows. For the event window (-30, 0) and (-30, 30), the coefficients are significant at the 10% level. The market reactions are not as significant as the market reactions when companies stop shorting derivatives contract. This result means that
when oil and gas producing companies start shorting, market reaction is marginally significant and negative. Shareholders do not want oil and gas producers to short. Oil and gas producing companies should not hedge at all.

For oil and gas producing companies which stop shorting crude oil and gas derivatives contracts, Table - 8 shows that there is a very significant and negative relationship between CARs and hedge ratio changes, which is also consistent with our expectation. The coefficients of hedge ratio change are -0.02, -0.18, and -0.2 for different event windows. For the event window (0, 30) and (-30, 30), the coefficients are significant at 1% level and 5% level respectively. Since hedge ratio of short position is negative, this result implies that if more short positions are removed, there will be more significant positive market reactions. After shareholders realize that oil and gas producers remove short transactions on crude oil and gas derivatives contracts, they will value these transactions very significantly. The F test also shows the whole regression relationship is very significant. Shareholders do not like oil and gas producers to hedge.

Our results may provide an explanation on why only about 20% of oil and gas producers use energy commodity derivatives. Producers usually take short positions to manage commodity risk. Short transactions on energy commodity futures contract is not valued by the market. Hedging is not necessarily good.

Our results also give some hint on why more than 60% airline firms hedge. For airline firms, which are the users of energy commodities, hedging may increase shareholders’ wealth. When airline companies hedge, they usually take a long position. Adding more energy commodities into shareholders portfolios has a value effect in the presence of market imperfections.
After examining the value effect around announcement days, I also investigate the value effect around effective days to see if there is information leakage. Table - 9 and Table - 10 tell us that there are no significant relationships between CARs around effective days and derivatives position changes for new users and new non-users. This result means that shareholders obtain the derivatives transactions information mainly from the publicly available sources, such as, 10-Q and 10 – K forms. Before the disclosure of these reports, derivatives transactions policy information is not publicly available.

I go further by investigating the source of the value effect to see if transaction costs and economies of scale are the causes of value effect. I conduct a regression between CARs and firm sizes using hedge ratio changes as the control variable, and find a significant and positive relationship between CARs and firm sizes. Table - 11 shows the coefficient of firm size is positive and significant at 5% level. When bigger oil and gas producers stop using oil and gas derivatives contracts, market reactions are more significantly positive. Reduction of transaction costs and Economies of scale are possible sources of value effect.

Conclusions

Crude oil is significantly negatively correlated with equities. Therefore, if crude oil is added into a portfolio with equities, it can provide significant diversification benefits for investors. Crude oil derivatives transactions by oil and gas producers cannot change the systematic risk of companies and shareholders’ portfolios. If oil and gas producers stop shorting crude oil derivatives contracts, stock prices of these companies rise, and thus shareholders’ wealth increases. If oil and gas producers start shorting crude oil derivatives contracts, stock prices of these companies drop, and thus shareholders’
wealth decreases. Economies of scale and transactions costs are identified as possible sources of the value effect.
According to Modigliani and Miller (1958), even if corporate derivatives transactions improve the diversification profile of shareholders’ portfolios, shareholders may still not value those transactions because shareholders themselves can enter the same derivatives transactions as companies can in an efficient market. Nonetheless, in the presence of market imperfections or poor diversification, there is a possibility that corporate derivatives transactions change the market value of shareholders’ portfolios. The value effect may come from the expected cash flow change on shareholders’ portfolios, from the improvement of the completeness of shareholders' portfolios, or from the required rate of return change on shareholders' portfolios. Therefore, I continue to investigate the systematic risk exposure effect in this chapter for crude oil derivatives transactions by oil and gas producers. If the systematic risk of shareholders’ portfolios is decreased by corporate crude oil derivatives transactions, then the required rate of return of shareholders portfolios will be decreased, and thus shareholders' wealth may be increased.

There are some empirical studies focusing on whether corporate derivatives transactions changes firm risk exposures. The risk exposures include total risk exposure, systematic risk exposure, and unsystematic risk exposure.

Donohue, Froot, and Jay (1992) compare the financial performances of a pair of gold mining companies. American Barrick is a gold-mining firm that kept hedging all of its
gold production until 1992; Homestake is a gold-mining firm that does not hedge at all.

Donohue et al (1992) point out that in the fourth quarter of 1992, American Barrick was suddenly exposed to the gold price risk because engineers found that its mined ore was richer in gold than originally expected. Therefore, starting from 1992 American Barrick became only partially hedged. According to the Value Line Investment Surveys (05/10/1991, 02/07/1992, 02/05/1993, 02/04/1994), the betas of American Barrick were 0.7, 0.65, 0.4, and 0.4 until those four points of time, respectively, while the betas of Homestake were 0.5, 0.45, 0.35, and 0.15 until those four points of time respectively. This result shows that the company that short gold derivatives actually had higher beta than the company that did not short gold derivatives at all. From the beta difference from 02/07/1992 to 02/04/1994, it can be concluded that American Barrick had a lower beta after it reduced the short gold transactions. This result shows that hedging does not necessarily reduce firm systematic risk.

Guay (1999) examines the relationship between changes in derivatives use and changes in risk of new derivatives users. He investigates the changes in interest-rate and foreign exchange rate exposures, total risk, firm-specific risk, and market risk. He concludes that firms that start using derivatives have an average reduction in firm total risk and firm specific risk, and an insignificant change of systematic risk.

Petersen and Thiagarajan (2000) also find that American Barrick has a higher beta than Homestake. They take excess returns of American Barrick and Homestake as dependent variables, and excess return on the market and excess gold return as independent variables. In addition, they find that derivatives use by American Barrick only reduces its equity return sensitivity to gold price marginally.
Hentschel and Kothari (2001) investigate whether firms systematically reduce or increase their risk with derivatives. They compare the risk exposure of firms with derivatives transactions with that of firms without derivatives transactions. They conclude that compared to derivatives nonusers, derivatives users only display marginal differences in equity return volatility associated with derivatives use. Their explanation is that since the cash flow associated with derivatives transactions only account for a small fraction of firm value, these derivatives transactions cannot significantly affect overall firm volatility. Nonetheless, they find that firms with derivatives have higher market betas than firms without derivatives.

Guay and Kothari (2003) examine the effect of derivatives use on 234 large non-financial firms. They report that if interest rates, foreign exchange rates, and commodity prices change by 3 standard deviations simultaneously, the cash flows and value generated by derivatives portfolio is not significant. They conclude that corporate derivative transactions cannot significantly change firm risk profile.

No previous study has examined whether crude oil derivatives transactions change the systematic risk of oil and gas producing companies. This study contributes to literature by investigating whether there is a firm beta shift around the crude oil derivatives policy change in the oil and gas producing industry.

Guay (1999) shows an endogenous problem on cross-sectional studies on hedging, i.e., it cannot be determined whether firms use derivatives to reduce risk or whether firms with higher risk are more likely to use derivatives. He applies a time-series methodology to study the effect of hedging policy change on the risk exposure change of firms. This study follows Guay’s (1999) methodology to see if firm systematic risk
changes around the derivatives transactions policy change. Two hypotheses are developed as follows:

H₆: Initiating short positions on crude oil derivatives changes oil producing firms’ betas.

H₇: Removing short positions on crude oil derivatives changes oil producing firms’ betas.

Data and Sample

I follow the same sample collection procedure in Chapter 3. Compared to the sample I obtain in Chapter 3 for the value effect study, Table - 12 shows that the number of selected new users and the number of selected new non-users are different. The number of selected new users changes from 46 to 33, and the number of selected new non-users changes from 31 to 21. The reason for these changes is due to the different selection process. In this chapter, the examined window for the systematic risk exposure effect is (-250,250). Among these 120 sample new users, there are some cases in which firms also change their derivatives policy 250 trading days before or after effective day. For example, firm A removed its entire commodity derivatives contract effectively on 07/01/1999 but again initiated using commodity derivatives contracts on 04/01/2000. To get rid of the contaminating effect of the quitting on 07/01/1999, I exclude the new use of Firm A on 04/01/2000 from our sample of new users. The final sample of new users for oil and gas producing industry includes 33 firm/dates. Using the same method, out of 344 sample firms I obtain 145 new non-users, which are firm/dates that stop using crude oil and gas related derivatives contracts. After clearing the contaminating transactions, I get 21 new non-users for oil and gas producing industry.
Methodology

Guay’s (1999) methodology is used to detect if firms’ beta shift is a result of crude oil derivatives transactions policy changes. Betas of firms are calculated in terms of Sholes and Williams (1977)’s model to overcome the non-synchronous trading problem. The CRSP NYSE/AMEX/NASDAQ Value-Weighted Market Index return is assumed to be the market return. Guay (1999) emphasizes that cross-sectional studies of derivatives use may have difficulty in overcoming the endogenous problem. He reduces this problem by applying time series methodology to examine the relation between derivatives use change and firm risk change. His examination windows include two- and four- year windows around the initiation of derivatives transactions. In this study, the examination window is 250 days around the initiation or the quitting of commodity derivatives transactions. New users are those firms which do not enter derivatives transactions in the window (-250,-1) and use crude oil derivatives in the window (1,250). New nonusers are those firms which keep using derivatives during the window (-250,-1) and do not use crude oil derivatives during the window (1,250). Day zero is the effective day of derivatives transactions initiated or removed. If the effective day cannot be specified, I use the beginning day of the event quarter as the effective date of new users and the beginning day of the quarter next to the event quarter as the effective date of new nonusers.

This study applies the Wilcoxon Signed - Rank test to see if the median of beta changes is significantly different from zero and the two sample t-statistics test to see if the mean of beta changes is significantly different from zero.
Results

Table - 13 shows that before oil and gas producing firms start shorting crude oil and gas derivatives contracts the average firm beta is 0.5 and that after they initiate using crude oil and gas derivatives contracts the average firm beta is 0.43. From the results of the Wilcoxon Signed - rank test and the two sample t - test, I can not tell if there is significant difference between the average beta of pre - effective day group and the average beta of post - effective day group. Initiating short transactions on crude oil derivatives contracts cannot significantly change the systematic risk exposure of firms, and thus the systematic risk exposure of shareholders' portfolios.

Table - 13 also shows that before oil and gas producing firms stop using crude oil derivatives contracts the average beta is 0.61 and that after they stop using crude oil derivatives contracts the average beta is 0.7. From the results of Wilcoxon Signed - rank test and the two sample t - test, I can not tell if there is significant difference between the average beta of pre - effective day group and the average beta of post - effective day group. Removing short transactions on crude oil derivatives contracts from firms cannot significantly change the systematic risk exposure of firms, and thus the systematic risk exposure of shareholders' portfolios either.

Conclusions

In conclusion, crude oil derivatives transactions policy changes do not have any systematic risk exposure effect. As a result, the required rates of return of shareholders' portfolios are not changed by corporate crude oil derivatives transactions. The value effect should not result from the required rate of return change of shareholders' portfolios.
Our findings imply that the value effect of corporate commodity derivatives transactions depends on the diversification benefit of the underlying commodities and the presence of market imperfections. If corporate commodity derivatives transactions improve the diversification profiles of shareholders' portfolios, market imperfections may motivate shareholders to value these transactions. If corporate commodity derivatives transactions cannot improve the diversification profiles of shareholders' portfolios, these transactions do not have significant value effect even if market imperfections exist. This study also suggests that hedging by oil producers is not necessarily good. In the case of firms whose hedging transactions provide diversification benefits for shareholders' portfolios, hedging may be good, but otherwise it may not be worthwhile for companies to hedge.

The ideas introduced in this study have implications for future studies on corporate risk management activities. I can extend this investigation by examining the optimal hedge ratio of companies based on the diversification benefit of crude oil. Further, I could apply our method to investigate the effectiveness of other kinds of derivatives transactions, such as interest rate derivatives transactions and foreign exchange rate derivatives transactions.

The value effect is shown to come from the reduction of market imperfections, such as transactions costs and economies of scale. It is also found that the value effect is not a result of the systematic risk change of shareholders' portfolios. Nonetheless, the systematic risk exposure of oil and gas producers is measured based on the CRSP
(Center for Research in Stock Prices) value weighted market index. This study shows that CRSP value weighted market index is not necessarily a good proxy for the market portfolio, since commodity investment should be added into the traditional benchmark of market portfolio. Future extensions could use a broader benchmark proxy for market portfolio to determine whether systematic risk changes when companies change their derivatives transactions policies.

Finally, the GSCI (Goldman Sachs Commodity Index) methodology could also be applied to examine the risk and return profiles of other individual commodities.
Table -1 Risk and Return Profiles of Crude Oil

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Correlation Coefficients with Crude Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Oil</td>
<td>1.02%</td>
<td>4.93%</td>
<td>1</td>
</tr>
<tr>
<td>Standard &amp;Poor's 500 Index</td>
<td>1.03%</td>
<td>4.39%</td>
<td>-0.136**</td>
</tr>
<tr>
<td>CRSP Value-Weighted Index</td>
<td>1%</td>
<td>4.45%</td>
<td>-0.106</td>
</tr>
</tbody>
</table>

** Statistically Significant at 5% Level (Two-Tailed Test)

Table - 2 Correlation Coefficients between Crude Oil and Standard &Poor's 500 Index

<table>
<thead>
<tr>
<th>Correlation Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/1987-12/1989</td>
</tr>
<tr>
<td>02/1987-01/1990</td>
</tr>
<tr>
<td>...</td>
</tr>
<tr>
<td>01/2003-12/2005</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
<tr>
<td>T - test</td>
</tr>
</tbody>
</table>

*** Statistically Significant at 1% Level (Two-Tailed Test)
Table - 3 Diversification Benefit of Crude Oil for Stocks

<table>
<thead>
<tr>
<th>Portfolio Composition</th>
<th>Rate of Return</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% of Crude Oil</td>
<td>0.0102</td>
<td>0.0493</td>
</tr>
<tr>
<td>90% of Crude Oil and 10% of S&amp;P 500 Index</td>
<td>0.01021</td>
<td>0.0437</td>
</tr>
<tr>
<td>80% of Crude Oil and 20% of S&amp;P 500 Index</td>
<td>0.01022</td>
<td>0.0390</td>
</tr>
<tr>
<td>70% of Crude Oil and 30% of S&amp;P 500 Index</td>
<td>0.01023</td>
<td>0.0350</td>
</tr>
<tr>
<td>60% of Crude Oil and 40% of S&amp;P 500 Index</td>
<td>0.01024</td>
<td>0.0320</td>
</tr>
<tr>
<td>50% of Crude Oil and 50% of S&amp;P 500 Index</td>
<td>0.01025</td>
<td>0.0305</td>
</tr>
<tr>
<td>40% of Crude Oil and 60% of S&amp;P 500 Index</td>
<td>0.01026</td>
<td>0.0304</td>
</tr>
<tr>
<td>30% of Crude Oil and 70% of S&amp;P 500 Index</td>
<td>0.01027</td>
<td>0.0320</td>
</tr>
<tr>
<td>20% of Crude Oil and 80% of S&amp;P 500 Index</td>
<td>0.01028</td>
<td>0.0349</td>
</tr>
<tr>
<td>10% of Crude Oil and 90% of S&amp;P 500 Index</td>
<td>0.01029</td>
<td>0.0389</td>
</tr>
<tr>
<td>100% of S&amp;P 500 Index</td>
<td>0.0103</td>
<td>0.0439</td>
</tr>
</tbody>
</table>

Table - 4 Sharpe Ratios for Portfolio 1 and for Portfolio 2

<table>
<thead>
<tr>
<th>Sharpe Ratios of Portfolio 1</th>
<th>Sharpe Ratios of Portfolio 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/1987-12/1989</td>
<td>0.16</td>
</tr>
<tr>
<td>02/1987-01/1990</td>
<td>0.06</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>01/2003-12/2005</td>
<td>0.39</td>
</tr>
<tr>
<td>Mean</td>
<td>0.18</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.21</td>
</tr>
<tr>
<td>Wilcoxon Signed - Rank Test</td>
<td>5.1***</td>
</tr>
<tr>
<td>T- test</td>
<td>5.71***</td>
</tr>
</tbody>
</table>

*** Statistically Significant at 1% Level (Two-Tailed Test)
Table - 5 Profile of Sample Firms for Value Effect

<table>
<thead>
<tr>
<th></th>
<th>Oil and Gas Producing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Total Firms</td>
<td>887</td>
</tr>
<tr>
<td>No. of Firms that Have Used Commodity Derivative</td>
<td>201</td>
</tr>
<tr>
<td>No. of Firms that Have Stock Returns Data in the CRSP</td>
<td>344</td>
</tr>
<tr>
<td>No. of Users</td>
<td>20</td>
</tr>
<tr>
<td>No. of Non-users</td>
<td>157</td>
</tr>
<tr>
<td>No. of New-users</td>
<td>120</td>
</tr>
<tr>
<td>No. of New Users that do not Change Derivatives Policy 310 Trading Days before and 60 Days after Event Day and Have Hedge Ratios Data</td>
<td>46</td>
</tr>
<tr>
<td>No. of New Non-users</td>
<td>145</td>
</tr>
<tr>
<td>No. of New Non-users that do not Change Derivatives Policy 310 Trading Days before and 60 Days after Event Day and Have Hedge Ratios Data</td>
<td>31</td>
</tr>
</tbody>
</table>

Table - 6 Profile of Firms that Have Changed Derivatives Policy across Time

<table>
<thead>
<tr>
<th></th>
<th>Number of New-users</th>
<th>Number of New Non-users</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>1997</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>1998</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>1999</td>
<td>24</td>
<td>13</td>
</tr>
<tr>
<td>2000</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>2001</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>2002</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>2003</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>2004</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>2005</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>145</td>
</tr>
</tbody>
</table>
Table - 7 Derivatives Policy Change Announcements by New Users

<table>
<thead>
<tr>
<th></th>
<th>(-30,0)</th>
<th>(0,30)</th>
<th>(-30,30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>46</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.019</td>
<td>-0.002</td>
<td>0.02</td>
</tr>
<tr>
<td>F value</td>
<td>1.87</td>
<td>0.91</td>
<td>1.92</td>
</tr>
<tr>
<td>p value</td>
<td>(0.18)</td>
<td>(0.34)</td>
<td>(0.17)</td>
</tr>
</tbody>
</table>

Explanatory Variables

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.08</td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.08)*</td>
<td>(0.16)</td>
<td>(0.09)*</td>
</tr>
<tr>
<td>Δ Hedge Ratio</td>
<td>0.17</td>
<td>0.12</td>
<td>0.29</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.09)*</td>
<td>(0.17)</td>
<td>(0.09)*</td>
</tr>
</tbody>
</table>

Statistically Significant at 10% Level (One-Tailed Test)

Table - 8 Derivatives Policy Change Announcements by New Non-users

<table>
<thead>
<tr>
<th></th>
<th>(-30,0)</th>
<th>(0,30)</th>
<th>(-30,30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>-0.03</td>
<td>0.24</td>
<td>0.1</td>
</tr>
<tr>
<td>F value</td>
<td>0.15</td>
<td>10.52</td>
<td>4.42</td>
</tr>
<tr>
<td>p value</td>
<td>(0.7)</td>
<td>(0.003)***</td>
<td>(0.04)**</td>
</tr>
</tbody>
</table>

Explanatory Variables

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.009</td>
<td>-0.04</td>
<td>-0.06</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.21)</td>
<td>(0.06)*</td>
<td>(0.09)*</td>
</tr>
<tr>
<td>Δ Hedge Ratio</td>
<td>-0.02</td>
<td>-0.18</td>
<td>-0.2</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.35)</td>
<td>(0.0015)***</td>
<td>(0.02)**</td>
</tr>
</tbody>
</table>

*Statistically Significant at 10% Level (One-Tailed Test)

**Statistically Significant at 5% Level (One-Tailed Test)

*** Statistically Significant at 1% Level (One-Tailed Test)
### Table - 9 Derivatives Policy Effective Changes by New Users

<table>
<thead>
<tr>
<th></th>
<th>(-30,0)</th>
<th>(0,30)</th>
<th>(-30,30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>46</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>F value</td>
<td>0.07</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>p value</td>
<td>(0.80)</td>
<td>(0.80)</td>
<td>(0.74)</td>
</tr>
<tr>
<td><strong>Explanatory Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.03</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>p value</td>
<td>(0.34)</td>
<td>(0.43)</td>
<td>(0.36)</td>
</tr>
<tr>
<td>$\Delta$ Hedge Ratio</td>
<td>0.04</td>
<td>0.03</td>
<td>0.07</td>
</tr>
<tr>
<td>p value</td>
<td>(0.40)</td>
<td>(0.40)</td>
<td>(0.37)</td>
</tr>
</tbody>
</table>

### Table - 10 Derivatives Policy Effective Changes by New Non-users

<table>
<thead>
<tr>
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<th>(-30,0)</th>
<th>(0,30)</th>
<th>(-30,30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
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<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td>F value</td>
<td>0.01</td>
<td>0.15</td>
<td>0.18</td>
</tr>
<tr>
<td>p value</td>
<td>(0.93)</td>
<td>(0.70)</td>
<td>(0.68)</td>
</tr>
<tr>
<td><strong>Explanatory Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.01</td>
<td>-0.06</td>
<td>-0.07</td>
</tr>
<tr>
<td>p value</td>
<td>(0.44)</td>
<td>(0.025)**</td>
<td>(0.12)</td>
</tr>
<tr>
<td>$\Delta$ Hedge Ratio</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.04</td>
</tr>
<tr>
<td>p value</td>
<td>(0.47)</td>
<td>(0.35)</td>
<td>(0.34)</td>
</tr>
</tbody>
</table>

**Statistically Significant at 5% Level (One-Tailed Test)**
<table>
<thead>
<tr>
<th></th>
<th>(-30,0)</th>
<th>(0,30)</th>
<th>(-30,30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.11</td>
<td>0.23</td>
<td>0.16</td>
</tr>
<tr>
<td>F value</td>
<td>2.76</td>
<td>5.44</td>
<td>3.93</td>
</tr>
<tr>
<td>p value</td>
<td>(0.08)^*</td>
<td>(0.01)^***</td>
<td>(0.03)^**</td>
</tr>
</tbody>
</table>

**Explanatory Variables**

<table>
<thead>
<tr>
<th></th>
<th>(-30,0)</th>
<th>(0,30)</th>
<th>(-30,30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.07</td>
<td>-0.06</td>
<td>-0.13</td>
</tr>
<tr>
<td>p value</td>
<td>(0.07)^*</td>
<td>(0.09)^*</td>
<td>(0.04)^**</td>
</tr>
<tr>
<td>Δ Hedge ratio</td>
<td>-0.08</td>
<td>-0.2</td>
<td>-0.27</td>
</tr>
<tr>
<td>p value</td>
<td>(0.11)</td>
<td>(0.0015)^***</td>
<td>(0.005)^***</td>
</tr>
<tr>
<td>Firm size</td>
<td>2.22E-8</td>
<td>7.06E-9</td>
<td>2.78E-8</td>
</tr>
<tr>
<td>p value</td>
<td>(0.015)^**</td>
<td>(0.24)</td>
<td>(0.05)^**</td>
</tr>
</tbody>
</table>

*Statistically Significant at 10% Level (One-Tailed Test)

**Statistically Significant at 5% Level (One-Tailed Test)

*** Statistically Significant at 1% Level (One-Tailed Test)
Table - 12 Profile of Sample Firms for Systematic Risk Exposure Effect

<table>
<thead>
<tr>
<th></th>
<th>Oil and Gas Producing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Total Firms</td>
<td>887</td>
</tr>
<tr>
<td>No. of Firms that have Used Commodity Derivatives</td>
<td>201</td>
</tr>
<tr>
<td>No. of Firms that have Stock Returns Data in CRSP</td>
<td>344</td>
</tr>
<tr>
<td>No. of Users</td>
<td>20</td>
</tr>
<tr>
<td>No. of Non-users</td>
<td>157</td>
</tr>
<tr>
<td>No. of New-users</td>
<td>120</td>
</tr>
<tr>
<td>No. of New users that do not Change Derivatives Policy 250 Trading Days around Effective Day</td>
<td>33</td>
</tr>
<tr>
<td>No. of New Non-users</td>
<td>145</td>
</tr>
<tr>
<td>No. of New Non-users that do not Change Derivatives Policy 250 Trading Days around Effective Day</td>
<td>21</td>
</tr>
</tbody>
</table>
## Table - 13 Beta Change around Derivatives Policy Change

<table>
<thead>
<tr>
<th></th>
<th>New Users</th>
<th>New Non-users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>33</td>
<td>21</td>
</tr>
<tr>
<td><strong>Pre - Effective Day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.5</td>
<td>0.61</td>
</tr>
<tr>
<td>Median</td>
<td>0.64</td>
<td>0.54</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.6</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>Post - Effective Day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.43</td>
<td>0.7</td>
</tr>
<tr>
<td>Median</td>
<td>0.34</td>
<td>0.66</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.47</td>
<td>0.45</td>
</tr>
<tr>
<td>Wilcoxon Signed - Rank Test</td>
<td>0.69</td>
<td>0.61</td>
</tr>
<tr>
<td>p - value</td>
<td>0.49</td>
<td>0.54</td>
</tr>
<tr>
<td>T -Test</td>
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<td>-0.79</td>
</tr>
<tr>
<td>p - value</td>
<td>0.53</td>
<td>0.44</td>
</tr>
</tbody>
</table>
Figure - 1 Light Crude Oil Futures Monthly Prices and Trading Volumes

Source: TradingCharts.com Inc / TFC Commodity Charts
(http://futures.tradingcharts.com/chart/CO/M)
Figure - 2 Light Crude Oil Futures Contract Monthly Trading Volumes

Data Source: TradingCharts.com Inc / TFC Commodity Charts
(http://futures.tradingcharts.com/javachart/CO/M?returl=w3)
Figure - 3 Crude Oil Investment Returns versus Standard & Poor’s 500 Index Returns

Crude Oil Returns versus S&P 500 Index Returns

Rate of Return

Crude Oil Returns
S&P 500 Index

Time

Figure - 4 Correlation between Crude Oil and Standard & Poor's 500 Index

Correlation between Crude Oil and S&P 500 Index

Rolling Time Period
Figure - 5 Diversification Benefit of Crude Oil
Figure - 6 Sharpe Ratios Comparison between Portfolio 1 and Portfolio 2
ENDNOTES


6. I also have examined the risk and return profile of gold. Gold is shown to have zero correlation with equities and has a rate of return almost equal to zero. Therefore, gold may not be a good investment and gold does not provide diversification benefits when included with equities in a portfolio. I also notice that the standard deviation of bi-monthly rates of return on gold is less than the standard deviation of bi-monthly rates of return on stock investments. Gold investment is less risky than stock and crude oil.
REFERENCES


