VOLATILITY BEHAVIOR PATTERNS AND INFORMATION TRANSMISSION MECHANISM: EVIDENCE FROM MALAYSIAN FUTURES MARKETS

by

NORYATI BINTI AHMAD

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CORAK SIFAT KEMERUAPAN DAN MEKANISMA ALIRAN MAKLUMAT: BUKTI DARI PASARAN NIAGAAN KE DEPAN DI MALAYSIA

ABSTRAK

Kajian ini menggunakan model bivariat ARMA(p,q)-EGARCH(p,q) untuk menyiasat samada maklumat di antara pasaran niagaan ke depan dan pasaran tunai di Malaysia dialirkan melalui momen pertama atau momen kedua atau kedua-duanya. Tempoh kajian adalah antara 2 Januari, 1990 hingga 31 Disember 2003. Kajian ini juga menyiasat kesan hubungan antara pasaran niagaan ke depan dengan pasaran tunai dengan pasaran-pasaran luar negeri. Khususnya, ia mengkaji samada maklumat dari pasaran niagaan ke depan S&P 500, HSIF dan NSIF menpengaruhi hubungan pasaran tersebut di peringkat harga atau kemeruapan atau kedua-duanya. Kajian ini juga mengkaji sifat kemeruapan pasaran niagaan ke depan di Malaysia untuk memahami proses aliran kemeruapan dengan lebih baik . Akhir sekali untuk mengenalpasti samada proses aliran maklumat (dalam dan luar negeri) dipengaruhi oleh perubahan struktur, tempoh kajian dibahagi kepada sub tempoh sebelum, selepas dan selepas krisis.

Hasil kajian mendapati bahawa tahap keberterusan kemeruapan pasaran niagaan ke depan FKLI dan FCPO adalah tinggi dan mempunyai min kemeruapan berbalik. Seterusnya, terdapat hubungan tidak simetri bagi kedua-dua pasaran niagaan ke depan tersebut, di mana berita baik memberikan kesan yang lebih ke atas kemeruapan berbanding berita buruk. Aliran maklumat wujud di antara pasaran niagaan ke depan dan pasaran tunai di Malaysia pada peringkat pulangan dan kemeruapan, di mana pasaran niagaan ke depan lebih dominan. Tiada sifat tidak simerti apabila interaksi di antara pasaran niagaan ke depan dan pasaran tunai diambilkira. Aliran kemeruapan adalah simetri di peringkat kemeruapan. Terma pembetulan ralat (error correction term) mempunyai kuasa prediktif yang signifikan ke atas min dan kemeruapan bersyarat. Penemuan menunjukkan bahawa perhubungan pasaran niagaan ke depan dan pasaran tunai di pengaruhi oleh

maklumat dari pasaran-pasaran niagaan ke depan luar negeri. Bagi pasaran niagaan ke depan indeks saham di Malaysia, S&P 500 merupakan pengeluar maklumat di peringkat pulangan, manakala HSIF berpengaruh di peringkat kemeruapan. Pasaran niagaan ke depan NSIF tidak ada kesan terhadap kemeruapan FKLI and pasaran tunainya. Limpahan kemeruapan adalah bersifat tidak simetri tetapi tanda tidak simetri berbeza mengikut aliran limpahan. Terdapat tanda positif bagi aliran kemeruapan dari pasaran niagaan ke depan luar negeri ke pasaran niagaan ke depan FKLI dan pasaran tunainya, dan sebaliknya tanda negatif apabila kejutan kemeruapan berasal dari pasaran niagaan ke depan tempatan. Sementara itu, bagi pasaran niagaan ke depan komoditi, sekali lagi pasaran niagaan ke depan US memainkan peranan dominan di peringkat pulangan. Namun begitu, hubungan tersebut adalah negatif. Terdapat aliran maklumat salingan di peringkat kemeruapan dan kejutan negatif memberi kesan yang lebih besar ke atas kemeruapan pulangan. Corak kemeruapan dan mekanisma aliran (di peringkat harga dan kemeruapan) dalam dan luar negeri di pengaruhi oleh perubahan struktur, terutamanya bagi pasaran niagaan ke depan indeks saham. Selepas tempoh krisis, pasaran niagaan ke depan dan pasaran tunainya adalah lebih sepadu. Kejutan daripada pasaran niagaan ke depan dan pasaran tunainya memberikan kesan kemeruapan yang bertentangan ke atas pasaran-pasaran niagaan ke depan luar negeri. Tiada aliran kemeruapan di antara pasaran niagaan ke depan FCPO dan FSOY semasa krisis kewangan tetapi kembali selepas krisis tersebut. Secara keseluruhan, penemuan kajian ini dapat digunakan sebagai asas kepada pelabur dan pengurus portfolio (tempatan dan asing) untuk membentuk strategi perniagaan dan lindung nilai yang efektif. Bagi pengubal dasar, kajian ini dapat membantu mereka merumuskan polisi dan melaksanakan kawalan untuk mempertingkatkan integriti dan mengwujudkan kestabilian pasaran.

ABSTRACT

This study employs bivariate ARMA(p,q)-EGARCH(p,q) model specifications model to investigate whether information between Malaysian futures and cash markets is transmitted through first moments or second moments or both. Using daily data, the study covers the period from January 2, 1990 until December 31, 2003. The study also investigates the effects of the Malaysian futures - cash market relationship in the light of international market interdependencies. More specifically, it looks at whether information from foreign futures markets of S&P 500, HSIF and NSIF influence the futures-cash relationship and whether the effects come through price level or volatility or both. In addition, the study also looks at the volatility patterns of Malaysian futures markets in order to facilitate a better understanding of the volatility transmission process. Lastly, to determine whether this transmission of information process (be it within and across markets) is affected by structural changes, the sample period was sub -divided into pre-crisis, during-crisis and post-crisis periods.

Results indicate that the volatility behavior patterns of FKLI and FCPO futures markets are highly persistent but mean-reverting. Volatility of these futures markets also reacted asymmetrically to its past innovations, where positive news caused higher volatility than negative news. Transmission of information between Malaysian futures and cash markets occurs at both returns and volatility level, where futures markets tend to dominate the cash market at both levels. Volatility transmission is not asymmetric when the interactions between the futures and cash markets are included. The error correction terms have significant predictive power on both the conditional mean and volatility of these futures markets. Findings show that domestic futures-cash relationship is being influenced by the information transmitted from foreign futures markets. As for the Malaysian stock index futures, S&P 500 futures is the information producer at return level, while HSIF futures is at volatility level. NSIF futures have no influence on the volatility of FKLI and its related cash markets.

Volatility spillovers are asymmetric in nature but the sign of asymmetric differs based on the direction of spillovers. Positive sign is observed when volatility transmission is from foreign futures market to the Malaysian FKLI and KLCI markets and vice-versa if shocks originate from Malaysian markets to foreign futures markets. As for the commodity futures market, once again US market plays a dominant role at return level but the influence is negatively related. Reciprocal transmission of information is documented in terms of volatility and negative shocks lead to greater volatility.

Volatility patterns of Malaysian futures markets and the transmission mechanism (at price and volatility level) within and across markets especially for stock index futures are affected by structural changes. Stock index futures markets are more integrated at regional level after the crisis period and intensify during the crisis period. Shocks from Malaysian futures and cash markets cause adverse volatility effects on foreign futures markets. Volatility transmission between FCPO and FSOY markets disappear during the financial crisis and reappear after the crisis. In sum, findings of this study can form the basis for investors and portfolio managers (local and foreign) to develop effective trading and hedging strategies and for regulators to formulate policy and implement control measures to enhance the integrity and stability of the markets.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

As a result of increased globalization as and the explosion in information and communications technology, today's financial markets are found to be more interrelated and integrated. These developments have enhanced the transfer of information flows from one market to another. In response to these developments, growing empirical studies began to establish this information transmission mechanism. The early research, however, focused on the prices or returns spillover effects between futures and its underlying cash markets (Herbst, McCormack & West, 1987; Kawaller, Koch & Koch, 1987; Khoury & Yourougon, 1991; Ollermann & Faris, 1987; Stoll & Whaley, 1990 among others) and across markets (Bekaert & Harvey, 1995; Liu, Pan & Shieh, 1998; Liu & Pan, 1997; Theodossius & Lee, 1995). The findings on the linkages between the futures and its underlying cash market indicate that most of the time futures prices influence cash prices. In terms of pricing information transmission across markets, empirical evidence finds significant cross markets interactions and that dominant market likes the USA plays an influential role on other markets.

In a plethora of later studies, particularly after the stock market crash of 1987 and the Asian financial crisis 1997, the emphasis shifted to how information is transmitted at volatility level (e.g., Hamao, Masulis & Ng, 1999; Koutmos, 1995; Lin, Engle & Ito, 1994; Ng, 2000; Miyakoshi, 2003). Those periods of market turbulence have brought to light the significance of the transmission of volatility information not only within markets but also across markets. Volatility is an integral part of many financial decisions. Defined as dispersion around the mean returns, volatility means risk and represents a threat to the integrity and efficiency of the market affected. Chan, Chan and Karolyi (1991) and Ross (1989) demonstrate the importance of information-volatility relationship and state that

volatility is related to the amount of information released. Hence volatility is an important source of information apart from asset prices themselves. In addition, previous studies conducted by Koutmos and Tucker (1996), Koutmos and Booth (1995), Engle, Ito and Lin (1990), and Iihara, Kato and Tokunaga (1996) indicate that volatility is also time-varying. They argued that when information flows continuously into the market it will cause changes in the riskinesss of the financial markets which imply that volatility is not constant but time-varying.

Despite the growing number of studies on the transmission of information at returns and volatility level, most of these studies are on equity markets of developed countries like US, UK, Canada and Japan. Relatively very little research has examined this information transmission mechanism on futures markets and particularly on developing markets like Malaysia. Understanding how the futures markets and its related cash markets are related within a country and across countries has important implications on risk management process in order to devise hedging strategies, pricing of contingent claims, and policy making decision. Thus this study attempts to determine the nature of transmission of information between Malaysian futures markets and their respective underlying cash markets as well as how the relationship between futures and cash markets will be affected by information transmitted across foreign futures markets. In addition, the present study also seeks to investigate whether the transmission process is affected before, during and after periods of economic turmoil.

1.2 Problem Statement

How is information transmission process between Malaysian futures markets and their respective underlying cash markets related? Are they related through mean returns or through volatility or both? Engle and Susmel (1993) pointed out that two markets can either be correlated through their first moments but unrelated through their second moments or uncorrelated through their first moments but related through their second

moments. Studying the interaction of these two markets only through one transmission mechanism and ignoring the other may provide inconclusive evidence regarding their relationship if they are also related through their first moments or second moments or both. Besides, this valuable information may enhance their abilities to construct more efficient trading and hedging strategies and asset allocation decisions.

The relevance of information flow increases in pace with the growing financial and commercial integration of the world markets. At the same time, improvement in electronic coordination, free flow of capital and push for increased market deregulation across national markets further accelerate this flow of information. If foreign futures markets do have an influence on Malaysian futures-cash market relationship, is this information transmission mechanism through price level, or volatility, or both? As mentioned earlier in the chapter, numerous studies have investigated the return and volatility spillover effects across markets (among them are Booth, Lee & Tse, 1996; Engle, Ito & Lin, 1990; Eun & Shim, 1989; Hamao et al.,1990; King & Wadhwani, 1990; Koutmos & Booth,1995) are mostly on major developed markets. In contrast to these well known financial markets, the Malaysian futures markets are typically much smaller, less liquid and more volatile. Furthermore, since Malaysian futures market has a unique investor structure that is dominated mostly by domestic retail and individual investors rather than domestic institutional and foreign institutional investors, the results on the returns and volatility information transmission mechanism between foreign futures markets and the futures-cash relationship could be different from those in the developed markets.

Engle and Patton (2001), Koutmos and Tucker (1996) and Rockinger and Urga (2001) all report evidence that positive and negative shocks may lead to volatility being asymmetric. Evidence on most of this literature suggests that adverse news causes higher volatility than good news. In Malaysia, there is still a lack of research to capture

the asymmetric impact of innovations that may exist in the volatility transmission mechanism. The study attempts to fill this gap by examining whether volatility spillover between Malaysian futures markets and its associated markets as well as across foreign futures markets is asymmetric in nature.

Choudry (1996), Hamao et al., (1990), Kanas (1998), Koutmos and Booth (1996), and Wang and Firth (2004) discover that the impact of economic turmoil does affect the transmission of mean returns and volatility information within and across markets. To what extent is information transmission mechanism between Malaysian futures-cash markets and the other foreign futures markets affected by the July 1997 financial crisis? If structural changes do exist, then there is a need for investors to reassess and reformulate their investment, hedging and portfolio strategy.

In order to have a better understanding of this information transmission process, the study also looks at volatility behaviour patterns of the Malaysian futures markets. Volatility behaviour is known to show certain stylized characteristics. An understanding of the volatility behaviour of the futures prices is essential in modeling volatility. Failure to incorporate the volatility pattern that existed in prices could lead to model misspecification. Alexander (2001), Engle and Patton (2001), and Knight and Satchell (1999) argued that a good volatility model should be able to incorporate certain features of volatility process. These stylized characteristics about volatility are important to be able to have a reliable forecast of future volatilities. The common stylized characteristics of asset price volatility are pronounced persistence, mean-reversion and asymmetry. Even though these stylized characteristics are said to be part of the volatility process, empirical studies in US revealed that these characteristics vary from one asset price to another. Whether Malaysian futures markets exhibit such patterns remained to be answered as no study had been done to examine all the three stylized features of

1.6 Justification of the Study

There are several reasons for the interest in the transmission of returns and volatility information within Malaysian futures markets and across foreign futures markets. Firstly, literature on this transmission process has mostly been limited to equity markets and very much centered around developed markets like US, UK, Japan and Canada. The Malaysian futures markets have not been extensively researched in comparison to its related cash markets particularly in the area of volatility. This study will further expand the knowledge in the field of finance particularly in volatility behaviour patterns of our futures markets, returns and volatility spillover effects within futures markets and across futures markets.

Secondly, very few studies that investigate the information transmission process between Malaysian futures markets and their underlying cash markets focus on both the returns and volatility interactions. Prior studies on the Malaysian futures market focus mostly on the lead-lag relationship with the cash market through their first moments. (e.g., Abdullah and Mohammad, 2001; Chooi, 1997; Deraman, 1997; and Tazli, 2001). An attempt to study the relationship not only through their first moments but also through their second moments will provide more conclusive evidence regarding the interaction of the Malaysian futures market with their respective related cash markets.

Thirdly, to the researcher knowledge no study has explicitly examines the information linkages between Malaysian futures-cash markets and other foreign futures markets. While there are studies that focus on returns and volatility transmission process within the same market and other studies investigating the information process across markets, there is a lack of study that consider both of these aspects simultaneously. This study bridges this gap by explicitly modeling the Malaysian futures-cash interactions within an international context. Besides, due to different trade relationship, political influence, geographical proximity and socio-economic factors, transmission of

information through first and second moment interactions may differ across markets. As such findings on this study will provide a better understanding of the linkages between these markets and the nature of risks that investors, in domestic and foreign markets, have to face with. In addition, this study can provide a basis for foreign investors to compare the Malaysian futures markets with their futures markets and hence construct appropriate portfolio strategies to increase return on their portfolio.

Fourthly, very few studies take into account long-run equilibrium relationships between two markets when studying the dynamic interdependence of the futures returns and its associated cash markets, and/or futures returns with other futures markets. Bhar (2001), Choudry (1999), Lee (1994), and Koutmos and Tucker (1996) are among the few that have considered these factors into their studies and found them to have explanatory power not only at returns but also volatility levels. They argued that model misspecification may arise if two markets are related in a long-run but is not included in the model. This study will examine whether there is a long-run relationship between the markets studied and incorporate them in the model where appropriate.

Fifthly, this study employs bivariate exponential GARCH (EGARCH) model that allows for both mean and volatility spillovers between the two markets. According to McKenzie (1999), bivariate model allow for simultaneous estimation of several parameters and hypotheses as well as cross-variable conditional volatility interactions. Furthermore, the EGARCH model is also suitable for capturing the asymmetric impact of shocks on the volatility transmission between markets. Studies by Kanas (1998), Koutmos (1998), Koutmos and Booth (1995) and Nelson (1991) have found evidence of asymmetries in the conditional volatility of the markets studied. So far there is a lack of empirical evidence that suggests Malaysian futures markets volatility responds asymmetrically to past shocks from within market and across markets.

1.7 *Definition of Terms*

Throughout this study, there are several terms that are frequently used. These terms are defined as follows:

Autoregressive process refers to a variable, X_t, that depends on its value in the previous period, X_{t-1} plus an error term (Gujarati, 2003).

Asymmetric effects. Volatility is asymmetric if positive and negative innovations have different impact on the asset price volatility (Engle and Patton, 2001).

Cash market. Cash market (also known as spot market) is a place where buying and selling of financial or commodity asset takes place today for delivery of the assets is also done today. Cash market is sometimes referred to as an underlying market (Chance, 2001).

Cointegration test is a test conducted to detect whether there exists a stable relationship between levels of two economic variables (Gujarati, 2003).

Conditional heteroscedasticity refers to conditional variance which changes throughout the process (Enders, 1995).

Futures market A term used to designate a place where the buying and selling of financial or commodity assets for delivery in the future (Chance, 2001).

Innovations. It is defined as the stochastic error terms, ε_t and is sometimes known as shocks. In the ARCH-type models, innovations refer to the news (residual squared error terms) impact on the conditional variance (Gujarati, 2003).

Leverage effects. The term refers to a condition where a decrease in the price of an asset will result in a higher increase in the volatility returns of that asset. In equity returns, the leverage effects could be due to an increase in debt-equity ratio or risk premium effects (Kanas, 1998).

Moving average process is a weighted average of random disturbances error, ε_t dated back one, two or more period ago (Studenmund, 2000).

Returns spillover. Returns spillover is the impact of one market's innovation on the conditional mean of another market. Price volatility is also called first moment interdependencies (Koutmos and Booth, 1995).

Stationary time series refers to variable that has a constant mean, variance and covariance (Studenmund, 2000).

Structural change. Structural change occurs when the values of the estimated parameters of the model are not the same through the entire period studied. The change could be due to external forces or policy changes (Gujarati, 2003).

Volatility. This term is measured as variance of return in this study and is referred to as dispersion around the mean return (Gujarati, 2003).

Volatility clustering. Volatility is said to arrive in clusters when large (small) price changes is followed by large (small) price changes in the price of an asset, irrespective of the sign (Choudhry, 1996).

Volatility persistence. Volatility is said to be persistent if current returns have a large impact on the forecast variance many periods in the future (Engle and Patton, 2001).

Volatility spillover. This is also known as second moment interdependencies. It is defined as how an innovation from one particular market has an impact on the conditional variance of another market. It is also referred to as volatility transmission (Kuotmos and Booth, 1995).

1.8 Organization of Chapters

This study is divided into six chapters. Chapter 1 introduces the background of the study, objectives and significant of the study. The remaining chapters of this

research are organized in the following manner. Chapter 2 examines the market structure of the Malaysian futures markets and looks at the two futures markets that are being studied in this research. Chapter 3 highlights the literature relevant to volatility behaviour patterns and the information transmission mechanism within and across markets. Chapter 4 describes the model specifications and outlines the methodology used. Chapter 5 presents the empirical results and analyses of the findings. Finally, Chapter 6 discusses the results of the findings, explains their limitations and implications. In addition, this chapter also provides suggestions for future research and concludes.

CHAPTER 2

MALAYSIAN MARKET STRUCTURE

2.1 Background of the Malaysian Futures Markets

Since the establishment of Kuala Lumpur Commodity Exchange (KLCE) in 1980, there has been tremendous restructuring of the regulatory framework and exchanges in the Malaysian derivatives markets. Among the changes made was the consolidation of all the existing exchanges into one exchange on 11 June 2001, converting the open outcry floor trading system of Crude Palm Oil futures market to electronic trading on 29 December 2001, merging of the two clearinghouses into one and the introduction of several new futures product. The changes were deemed necessary due to the impact of globalization, the increasing need for better risk management facilities and also the increasing diversity of financial products. As of 2003, there are seven products offered at the Bursa Malaysia Derivative Berhad (hereinafter MDEX) covering three different markets, that is, equity, financial and commodities. These products are Kuala Lumpur Stock Index futures (FKLI), the 3-, 5- and 10-year Malaysian Government Securities Futures (MGS), 3–Month KLIBOR futures (KLIBOR), KLSE CI Options and Crude Palm Oil futures (FCPO). However the performance of these contracts varies from one contract to another. As can be seen in Table 2.1, except for the KLSE CI futures and the Crude Palm Oil futures contracts, turnover volume for the KLIBOR futures, KLSE CI Options, 3-, 5- and 10-year Malaysian Securities recorded low yearly turnover volume.

Table 2.1
Product Turnover Volume of the Malaysian Futures Markets

Year	FKLI	FCPO	3-Month KLIBOR	KLSE CI Options	5-Year MGS	3-Year MGS	10-Year MGS
1996	77,281	498,118	40,933	-	-	-	-
1997	382,974	484,323	76,384	-	-	-	-
1998	771,244	353,680	24,738	-	-	-	-
1999	436,678	388,967	28,994	-	-	-	-
2000	366,942	308,622	44,812	349	-	-	-
2001	287,528	479,799	54,914	564	-	-	-
2002	233,863	909,073	64,307	1	80,419	-	-
2003	331,216	1,429,959	120,341	0	118,635	781	11

Source: http //www mdex com my (March, 2004)

Initially, the KLIBOR futures contracts performance was very promising when it was introduced in May 1996. Yearly turnover jumped from 40,933 contracts in 1996 to 76,384 contracts in 1997. However, after the financial crisis, the market began to lose its momentum. In 1998 yearly trading volume was only 24,738 contracts as compared to those of KLSE CI futures contracts (771,244) and Crude Palm Oil futures contracts (353,680). Probably the highly regulated interest rate environment also contributed to the dampening of the KLIBOR futures market performance.

As for the KLSE CI Options, the market has been rather slow. Since its introduction in December 2000, the product's highest turnover volume was only 564 contracts in 2001. Bacha (2001) pointed out that the financial crisis, imposition of capital control and lack of awareness and education among local traders regarding the products are the reasons for them being less keen in this market.

On the other hand, the 5-year MGS has shown tremendous potential. Yearly turnover in 2002 was 80,419 contracts and up till August 2003, the turnover volume had reached 106,414 contracts. Nevertheless, this futures contract is still very new in the market.

As mentioned earlier in chapter one, the market structure of the Malaysian futures market is unique since its market demography is dominated mostly by domestic retail investors and local members (see Table 2.2).

Table 2.2
Market Demography of the Malaysian Futures Product

Categories/Year	2001	2002	YTD 2003(Aug)
Foreign Institution:			
FKLI	14%	23%	29%
KLSE CI Options	38%	0%	0%
FCPO	14%	14%	17%
3-MTH KLIBOR	0%	5%	5%
5-Year MGS	NA	0%	0%
Domestic Institution:			
FKLI	4%	6%	6%
KLSE CI Options	0%	0%	0%
FCPO	26%	21%	18%
3-MTH KLIBOR	96%	88%	88%
5-Year MGS	NA	98%	97%
Foreign Retail:			
FKLI	3%	3%	6%
KLSE CI Options	4%	0%	0%
FCPO	4%	5%	4%
3-MTH KLIBOR	0%	0%	0%
5-Year MGS	NA	0%	0%
Domestic Retail:			
FKLI	45%	48%	43%
KLSE CI Options	49%	50%	0%
FCPO	15%	21%	26%
3-Mth KLIBOR	1%	0%	1%
5-Year MGS	NA	2%	2%
Local Member:			
FKLI	31%	19%	15%
KLSE CI Options	2%	50%	0%
FCPO	40%	38%	35%
3-MTH KLIBOR	3%	0%	1%
5-Year MGS	NA	0%	1%
Proprietary:			
FKLI	4%	1%	1%
KLSE CI Options	7%	0%	0%
FCPO	1%	1%	0%
3-MTH KLIBOR	0%	0%	0%
5-Year MGS	NA	0%	0%

Source: http://www.mdex.com.my (February, 2004)

With the exception of the 3-month KLIBOR futures and 5-Year Malaysian Government Securities futures, about 40% of the FKLI futures markets and FCPO futures markets are made up of domestic retail traders and local members. It is known

that domestic retail investors tend to make decisions based on their own firm-specific or insider information rather than relying on more sophisticated analysis and information. As such the role of the Malaysian futures markets in the process of price discovery and spillover effect between its underlying cash markets and other futures markets might be different from those of other financial markets.

In contrast to the other futures markets, both the futures markets of Crude Palm Oil and Kuala Lumpur Stock Index have been very active as well as being in existence for many years relative to the other futures contracts. Besides, relative to the other futures markets, the performance of the two futures markets has been very encouraging and as such the present study will focus on these two markets. A detailed discussion of the market microstructure for each of the two markets and its related underlying asset follows.

2.1.1 Crude Palm Oil futures and its underlying market. The CPO futures market started trading in 1980 and is the first derivative instrument introduced in Malaysian capital market. The Kuala Lumpur Commodity Exchange (KLCE) before merging with Malaysian Monetary Exchange (MME) in November 1998 to become the Commodity and Monetary Exchange (COMMEX) provided the trading place for the CPO futures. Malaysia's CPO futures contracts is the only CPO contract traded in the world.

Before the migration to electronic trading, CPO contracts were traded based on an open-outcry system. CPO futures like other futures contract are very standardized contracts. In CPO futures, 25 metric tones of palm oil constitute a contract. The price quoted for trading is in Ringgit Malaysia (RM) per metric tonne. The tick price is RM1.00 per metric tonne. The contract months available for trading are the spot month, 5 next succeeding months and thereafter alternate months up to 12 months forward. At maturity the contracts are physically settled, that is, at maturity the actual commodity is delivered to the buyer of the contract at the port specified by the seller. The seller has

the option to deliver the actual commodity at Port Klang, Butterworth or Pasir Gudang. Summary of the contract specifications are tabled below.

Table 2.3
Summary of the Crude Palm Oil Futures Contract Specification

Underlying asset	Crude Palm Oil
Contract size	25 MT per contract
Minimum price fluctuation (tick)	RM1.00 per MT
Contract months	Spot month, 5 next succeeding months and thereafter alternate months up to 12 months forward
Last trading day	Noon on 15th of the contract month or preceding day if that day is a non-market day

Source: http//www.commex.com.my, 16 November 2000

Since trading in 1980, the prices have ranged from as low as RM400 per metric tonne to as high as RM2,000 per metric tonne. These changes in prices are affected by factors like world demand, export, weather patterns and prices of other vegetable oils such as soyabean oil, rapeseed oil, sunflower oil and corn oil. CPO futures contract performance has been quite volatile. As stated in Table 2.4, between 1996 and 2001, the lowest average yearly volume was 308,662 lots (2000) and the highest was 498,118 lots (1996). On July 13, 2002, the contracts made history when it recorded the highest ever daily volume and open interest of 7,678 lots and 14,772 lots respectively.

Table 2.4
Performance of Crude Palm Oil Futures contract

Year	Volume	Average Daily Turnover	% Change	No. of Trading Days
1996	498,118	2009	-	248
1997	484,323	1,960	-2%	247
1998	353,680	1,438	-27%	246
1999	388,967	1,568	+9%	248
2000	308,622	1,270	-19%	243
2001	479,799	1,974	+55%	243
2002	909,073	3,666	+86%	248
2003	1,429,959	5,543	+57%	246

Source: www.mdex.com.my. Dated 24 February 2004

The underlying asset for CPO futures is palm oil. Malaysia is the world's largest producer of palm oil. In 2003, Malaysia earned RM20.2 billion in foreign exchange from the export of 12.2 million tonnes of palm oil to 140 countries. About 13.4 million tonnes was produced in that same year. Palm oil prices in 2003 ranged from RM1409 to RM 1911 per metric tonne (see Table 2.5).

Table 2.5
World Major Exporters of Palm Oil: 1994-2004 ('000 Tonnes)

Country	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Malaysia	6,750	6,513	7,212	7,490	7,465	8,911	9,081	10,618	10,886	12,248
Indonesia	2,173	1,856	1,851	2,982	2,260	3,319	4,140	4,940	6,379	6,830
Papua New Guinea	231	220	267	275	213	254	336	328	324	325
Cote d'Ivoire	148	120	99	73	102	101	72	75	65	63
Colombia	20	21	29	61	70	90	97	90	85	105
Singapore	328	399	289	298	241	292	240	224	220	256
Hong Kong	234	275	305	173	103	94	158	192	318	206
Others	0	0	0	0	0	0	0	0	0	0
TOTAL	**10,760**	**10,195**	**10,763**	**12,212**	**11,134**	**13,848**	**15,008**	**17,574**	**19,233**	**21,116**

Source :http://www.mpob.gov.my/ dated 24 February 2004

2.1.2 Kuala Lumpur Stock Index Futures and its underlying market.

The KLSE CI futures contract commenced trading in December 1995. Before the formation of MDEX, KLSE CI was traded at KLOFFE. The KLSE Index futures contract is an agreement between two parties to buy and sell a basket of shares at a future date and price. Unlike the CPO futures, trading was computerized. Delivery is cash settled, since it is not possible for seller of the contract to deliver a basket of shares when the contract matures. This is done by taking an opposite position that one has initially taken. Depending on the price of the underlying index, a trader will either pay or receive cash at delivery. For example, if a trader sells a KLSE CI Index futures at 780 points and the futures settlement price is 750 points at maturity, then the trader of this futures contract will receive RM1,500 [(780 –750) x 1 contract x RM50]. On the other hand, the buyer of the contract must pay RM1, 500 since the settlement price at maturity is lower than the initial price bought.

The minimum price fluctuation on the KLSE CI Index futures is 0.5 index points valued at RM25. The contract months available for trading are spot month, next month and the next two calendars quarterly months. The calendar quarterly months are March, June, September and December. The last trading day for the contract is the last business day of the contract month. Any contract that is not liquidated on the last trading day will be closed out by the clearing house based on the final settlement value of the contract month. Table 2.6 shows a summary of the contract specification for the KLSE index futures.

Table 2.6

Summary of the KLSE CI Index Futures Contract Specification

Underlying asset	Kuala Lumpur Stock Exchange Composite Index (KLSE CI)
Contract Size	KLSE CI x RM50
Minimum price fluctuation	0.5 index point or RM25
Last trading day	The last business day of the contract month
Final Settlement	Cash settlement based on final settlement value

Source: http://www.kloffe.com.my/products/contspec.htm, 16 November 2000

Although the KLSE futures contract is still very new, volume has been growing steadily since its introduction. In December 1995, KLSE CI futures recorded yearly volume of only 672 contracts but jumped to 77,281 lots in the year 1996. Highest monthly volume was 94,850 lots in June 1998, before the onset of the crisis that resulted in the reduction of volume traded (See Table 2.7).

Table 2.7

Performance of the KLSE CI Futures Contract

Year	Volume	Average Daily Turnover	% Change	No. of Trading Days
1996	77,281	312	-	248
1997	382,974	1,544	+395%	248
1998	771,244	3,135	+103%	246
1999	436,678	1,761	-44%	248
2000	366,942	1,504	-15%	244
2001	287,528	1,183	-21%	243
2002	233,863	943	-20%	248
2003	331,216	902	-4%	164

Source. http://mdex.com my. Dated 24 February 2004

The underlying asset of the KLSE CI futures contract is the Kuala Lumpur Composite Index which is used to measure the performance of the Malaysian stock market. KLSE CI is made up of the stocks of 100 companies listed on the Main Board of various sectors of the economy. The index is a market capitalization index. The

performance of the KLSE CI was at its highest point (1314.46) in 1994 before going down to only 262.7 points at the time of the crisis. Figure 1 illustrates the daily prices of KLSE CI during the period from January 1993 until December 2004.

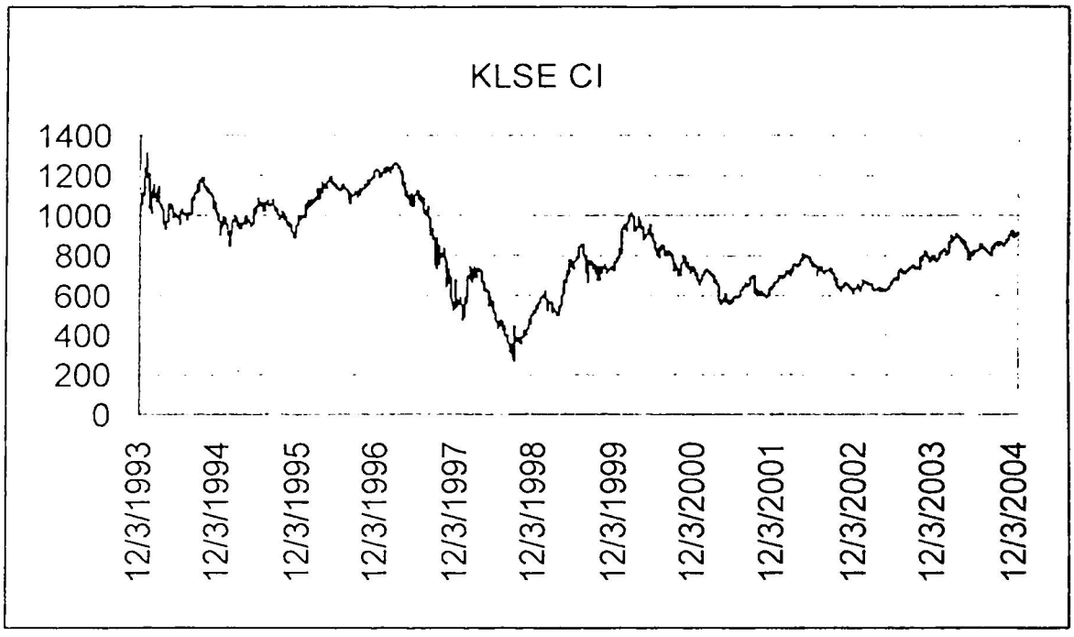

Figure 1. Daily Prices of KLSE CI (Jan 1993 – Dec 2004).

2.2 Summary

Since the onset of the financial crisis in 1997, the Malaysian Derivatives markets have gone through many changes and development. These changes are deemed necessary in order to ensure the futures markets will be functioning effectively and efficiently. Clearly this is an indicator of the increasingly important role and function that futures markets will play in making Malaysia a more dynamic capital market in the future. Its existence offers the market participants more flexibility and efficiency in developing and applying investment strategies.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

This chapter will review the theoretical and empirical literature related to the study. Discussion will be subdivided into the following sections. Section 3.2 will discuss in general the theory of Efficient Market Hypothesis and how the information and cost of carry model are related to this Efficient Market Hypothesis. Section 3.3 will focus on the volatility behavior patterns commonly displayed by the financial asset prices and the empirical evidence regarding such behaviors. Section 3.4 will review the past literatures on the spillover effects on futures and its underlying assets at both price and volatility interaction. Section 3.5 will look at the spillover effects across markets. Section 3.6 summarizes the entire chapter.

3.2 Theoretical Background

3.2.1 Efficient market hypothesis and information. For many years, the Efficient Market Hypothesis (EMH) concept has been the foundation of many financial theories. The main idea behind this concept of efficiency is that no trader can make abnormal profit since information has been incorporated in all asset prices. Specifically, when information enters the market, traders process this information and accordingly take trading position in relation to such information, which is then reflected in the asset prices traded (Kaminsky and Kumar, 1990). Fama (1970) defined efficient markets as those in which asset prices always fully and instantaneously reflect all available information. The EMH operates under certain assumptions, that is, there are no transaction costs, information is costless and is available to all market participants and implications of current information for both current price and distribution of future prices are accepted by all market participants (Fama, 1970).

Generally there are three types of market efficiency: the weak form, the semi-strong form and the strong form. The weak form market efficiency states that current prices reflect information sets that contain only historical prices. The semi-strong form market efficiency prevails if publicly available information is reflected in the current prices. The market is said to be efficient in a strong form if all information (including private information) are incorporated in the current prices. Nonetheless, over the long run, whether the market is efficient in the weak, semi-strong or strong form, it is not possible for market players to make economic profits on the basis of information revealed.

Information is not only revealed through asset prices themselves but also through volatility. The information theories modeled by researchers such as Bookstaber and Pomerantz (1989), French and Roll (1986), Lee and Ohk (1992) and Ross (1989) pointed out that volatility is closely related to information. Fluctuation in asset prices is caused by the changes in the expectation that is brought about by the arrival of information. Volatility is related to market efficiency through information arriving in the market.

Bookstaber and Pomerantz (1989) proposed an information-based model of market volatility. Their model related volatility to information flows. They stated that information leads to changes in expectation, which result in changes in prices, and since volatility is the product of unanticipated price movements, it is thus closely related to information. In their model, information is said to have three features. Firstly, the market does not absorb information immediately and that the degree of persistence in volatility will depend on the impact of the information. The second feature of information is that the type of information flowing into the market influences the volatility of the market. Lastly, the arrival of information is a function of time.

Ross (1989) claims that volatility of a particular asset's prices is related to the rate of flow of information entering the market. As such an increase in the rate of information flow results in return volatility to be higher and likewise higher volatility increases the rate of information flow. In other words, variance of price changes equals the rate of information. A market that is very volatile reflects the greater frequency of information entering the market.

Daigler and Herbst (1996) categorized information flow into three types of information theories. The first theory, which is known as dominant market theory, postulates that information will first enter into a particular market that has an advantage over the other market in terms of liquidity, lower transaction costs and lower bid-ask spread. On the other hand, the pure information theory states that information will flow into all markets at the same time because investors trade in all market when they receive this information. While the independent market theory stipulates that information flows only within that specific market and only investors in that market will react to the information.

Whether sources of information come from prices or volatility or both, theoretically, as new information flows into the market, this information should be absorbed instantaneously in that market. However there is a possibility where a market may react to the information faster than the other causing the other market to be lagging behind this information. This transmission of information may lead to mean returns and volatility spillover between markets. In other words, there is a lead and lag relationship between these markets.

Numerous studies have shown that transmission of information exists not only between markets like futures and its underlying cash market (Bhar, 2001; Koutmos and Tucker, 1996; Min & Najand, 1999; Yu, 2000) but also across markets (Engle, Ito and Lin, 1990; Koutmos, 1999; Miyakoshi, 2003; Najand, Rahman & Yung, 1992).

Engle, Ito and Lin (1990) are among the first researchers to introduce the theory of volatility transmission effects in the form of heat wave hypothesis and the meteor shower hypothesis. The heat wave hypothesis postulates that any shocks emerging from that particular country will only be transmitted within that country, whereas volatility is said to be like a meteor shower when large shocks that originates from a particular country will affect the volatility of another country. According to Engle et al., the existence of volatility spillover between or across markets is an indication of market's inability to fully process its information. They further state that due to this reason, this may be an indication of a violation of market efficiency.

Both Hamao, Masulis and Ng (1990) and Koutmos and Booth (1995) explain that spillover arises due to integration of international market. They defined market integration as prices in different markets showing the same fundamental information. As market becomes more integrated, any shocks emerging from one market will have an impact in another market.

3.2.2 Cost of carry model. Generally, futures prices can be analyzed from the perspective of the efficient market theory and specifically the cost of carry model. The concept of futures market efficiency is no different from that applied in other financial asset markets. Market participants in the futures market receive the same information as those of the cash markets. If futures markets are efficient, the relevant price signal to be used by investors is simply the futures price. For risk-averse decision makers, the volatility of the futures prices plays a central role when such observations are used as forecasts of subsequent cash prices.

According to Cornell and French (1983), the pricing relationship between futures and cash markets can be explained by the cost of carry model. The model specifies that the futures price equals the cash price plus the carry cost less the carry return, that is, in equation form: