ARBITRAGE OPPORTUNITIES IN THE KLIBOR FUTURES MARKET IN MALAYSIA

By

SHAKIRAH BINTI SHAHABUDIN

Thesis Submitted to the Graduate School of Management, Universiti Putra Malaysia, in Partial Fulfillment of the Requirement for the Degree of Master of Science

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Chair: **Professor Shamsher Mohamad Ramadili, PhD**

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A futures contract is an agreement to buy or sell an asset at a future date at a price agreed upon today. The Kuala Lumpur Interbank Offered Rate ("KLIBOR") futures or known as FKB3 is the interest rate futures contract available in Malaysia. This study examines the availability of arbitrage opportunities after accounting for transaction costs for interest rate futures contract. Fair value of the KLIBOR futures price is calculated using Implied Forward Rate and is compared to the actual price to determine the arbitrage opportunities from 1996 to 2003. The pricing of the KLIBOR futures contract is said to be efficient when the mispricing between fair value and actual value is small, if not zero. When mispricing is small, the benefit will spill over to the hedgers, whereby they can make a more effective hedging decision. The findings show that mispricing is small for contracts near to maturity and it increases as the contracts move further from maturity. This suggests that arbitrage opportunities are available to be exploited for contracts furthest from maturity. It also suggests that hedging decision can be made effectively if one trades in contracts near to maturity. More concerted efforts should be in place to encourage domestic and foreign retailers as well as foreign institutions to trade in KLIBOR futures contract.

To provide liquidity in the interest rate futures market, Market Makers' Scheme should be reintroduced. The finding also shows that the difference is narrowing between the actual price and the fair price of interest rate futures contracts as a function of time to maturity.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian keperluan untuk ijazah Master Sains

PELUANG MERAIH KEUNTUNGAN DALAM KONTRAK NIAGAAN HADAPAN KADAR TAWARAN ANTARABANGSA BANK KUALA LUMPUR

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Kontrak niagaan hadapan adalah perjanjian di antara pembeli dengan penjual ke atas sesuatu aset pada harga yang ditetapkan untuk urusniaga yang akan berlaku pada masa hadapan yang telah ditetapkan, seperti mana yang terkandung dalam perjanjian. Kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur adalah salah satu daripada kontrak niagaan hadapan yang terdapat di Malaysia. Kajian ini meninjau peluang kepada pelabur untuk meraih keuntungan di dalam kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur tiga bulan, selepas mengambil kira kos urusniaga yang terlibat. Untuk ini, harga yang sepatutnya dinilai untuk kontrak ini ditentukan dengan menggunakan kaedah "Implied Forward Rate" dari tahun 1996 sehingga 2003. Harga ini kemudiannya dibandingkan dengan harga kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur tiga bulan yang berada di pasaran. Perbezaan di antara kedua-dua harga adalah salah harga kontrak. Kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur tiga bulan dikatakan efisyen sekiranya salah harga kontrak adalah kecil. Sekiranya mekanisme harga untuk kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur tiga bulan efisyen, pelabur yang ingin menyekat

kerugian daripada kenaikan atau penurunan kadar faedah juga akan merasa keberkesanannya. Penemuan daripada kajian ini menunjukan bahawa salah harga kontrak adalah kecil bagi kontrak-kontrak yang mempunyai tarikh matang yang singkat. Walaubagaimanapun, bagi kontrak-kontrak yang mempunyai tarikh matang yang panjang, salah harga meningkat tinggi. Ini menunjukan bahawa peluang untuk meraih keuntungan wujud dalam kontrak-kontrak yang mempunyai tarikh matang yang panjang dan aktiviti pembetulan atau dikenali sebagai abitraj diperlukan untuk menyatukan harga pasaran dengan harga yang sepatutnya ke titik keseimbangan. Usaha diperlukan untuk menggalakkan penglibatan pelabur runcit di dalam dan juga di luar negara serta institusi-institusi asing di dalam kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur. Selain itu, untuk memastikan kecairan dalam kontrak niagaan hadapan Kadar Tawaran Antarabangsa Bank Kuala Lumpur tiga bulan ini, “Skim Market-Makers” harus diperkenalkan semula. Penemuan kajian ini juga menunjukkan bahawa salah harga di antara harga pasaran dengan harga yang sepatutnya berkurangan menjelang tarikh matang kontrak.

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I certify that an Examination Committee met on **18 July 2006** to conduct the final examination of **Shakirah Binti Shahabudin** on her **Master of Science** thesis entitled **"Arbitrage Opportunities in the KLIBOR Futures Market in Malaysia"** in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

_____

SHAKIRAH BINTI SHAHABUDIN

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LIST OF ABBREVIATIONS

AON	All-Or-None
BIS	Bank of International Settlement
BLR	Bank Lending Rate
BNM	Bank Negara Malaysia
CME	Chicago Mercantile Exchange
COC	Cost-of-Carry
COMMEX	Commodity and Monetary Exchange of Malaysia
COO	Chief Operating Officer
FKB3	Klibor Futures
FKLI	Futures Kuala Lumpur Index
GDP	Gross Domestic Products
HIBOR	Hong Kong Interbank Offered Rates
HKFE	Hong Kong Futures Exchange
IFR	Implied Forward Rate
ISDA	International Swaps and Derivatives Association
KATS	KLOFFE Automated Trading Systems
KLIBOR	Kuala Lumpur Interbank Offered Rates
KLOFFE	Kuala Lumpur Options and Financial Futures Exchange Berhad
KLSE CI	Kuala Lumpur Stock Exchange Composite Index
LIBOR	London Interbank Offered Rates
MDCH	Malaysian Derivatives Clearing House
MDEX	Malaysian Derivatives Exchange
MME	Malaysian Monetary Exchange
NZFOE	New Zealand Futures and Options Exchange
OTC	Over-the-counter
RP	Repurchase Agreement Rate
UEH	Unbiased Expectation Hypothesis

CHAPTER 1

INTRODUCTION

1.1 Introduction

Individual investors, financial and corporate institutions invest in financial assets, with a hope of earning a positive rate of returns on the investments. However, not all investments will yield a positive rate of returns, as there are factors that hinder an investment from earning a positive rate of return. For instance, unexpected interest rate movements and inflation make the future earnings uncertain. Risk exists when investment is made. Risk can be defined as any source of randomness that may have an adverse impact on a person or corporation's future earning.[1] In finance theory, a security's total risk is made up of two components, which are systematic risk and unsystematic risk. The systematic risk of a security is that part of the total risk that is associated with movements in the underlying market as a whole. It is also known as unavoidable risk, market risk or non-diversifiable risk, since no amount of diversification can reduce it. It is usually measured in terms of beta. Beta is an indicator, which measures an investment's volatility of return, relative to the market return. It measures the relationship between the rises and falls in the overall market and the performance of the individual share or portfolio. Unsystematic risk, which is also known as specific, diversifiable, avoidable risk, on the other hand is specific to particular institution or an industry. One form of unsystematic risk is financial risk.

[1] C.L. Culp, *The Risk Management Process; Business Strategy and Tactics*, John Wiley & Sons, Inc., 2001, Page 14.

The ways and means by which an institution finances their activity constitutes financial risk. The degree of financial risk can be inferred from the capital structure of the institution. The amount of debt or borrowed capital in the financial structure signifies interest payment by the institution to the debt holders or preference shareholders. As a result, the balance of earning for equity shareholders varies depending on the interest and principal payments. Financial risk can be avoided as the management has the discretion to borrow money or otherwise. Financial risk is very much associated with interest rates movements.

An adverse interest rate movement will affect the value of investment portfolio and also the cost of doing business. For instance, if interest rate rises, bond prices will decline resulting in a capital loss. This risk exists because new bonds are likely to be issued with higher yields as interest rates increase, making the old or outstanding bonds less attractive. Hence, the longer the bond's maturity, the greater the impact of a change of interest rate will have on its price. In terms of cost of doing business, when interest rate increases, it will have a direct impact on the lending rates. Financial and corporate institutions usually borrow money to run its daily operations. Increase in interest rate has a domino effect. When lending rate is increased, it will cause a higher cost of borrowing which will eventually increase the cost of production. A higher cost of production will affect the final price of the goods and services produced, of which is passed on to the consumers.

By all means, it is possible for financial and corporate institutions to manage the interest rate fluctuations. One of the ways to manage interest rate risk that has gain popularity in recent years is through hedging via futures contracts. A futures contract

is an agreement to buy or sell an asset at a future date at a price agreed upon today. By definition, hedging is the act of transferring risk to the other party in view of changes in interest rates that will have an adverse impact on the investment in the cash market.

Interest rate futures contracts can be used by borrowers to hedge the cost in the event of rising interest rate while when interest rate falls, lenders can hedge to protect their revenue. For instance, a fund manager expects to receive an amount of money in three months' time. The fund manager anticipates the interest rate to fall by the time the money is invested. To protect the investment against the fall in interest rate, the manager can buy the interest rate futures contracts that will mature at the time the money is invested in cash market. Since the price of interest rate futures contracts is inversely related to the interest rates, the fund manager should buy the futures contracts, as it is cheaper now and sell it later at a higher price. This strategy will generate profits from futures contracts transaction that will offset the decline in cash market investment due to interest rate fall.

Likewise, the contract can also be used to hedge the cost in the event of rising interest rate. Supposed, a corporate or financial institution treasury wants to borrow money in three months' time and anticipate that the interest rate will increase by the time the money is borrowed. To hedge against the interest rate increase, the treasurer can sell the interest rate futures contracts that will mature at the time the money is borrowed in cash market. Since the price of interest rate futures contracts is inversely related to the interest rates, the treasury should sell the futures contracts, as the price is higher now and complete the transaction by buying it later.

While much has been said about interest rate futures as a hedging tool, the ability to hedge interest rate risk effectively lies in the pricing of the interest rate futures itself. The pricing mechanism of the of the interest rate futures contract has to be efficient in such a way that discrepancies of prices between the cash market and futures market is minimal. This is where arbitraging activities are important. By definition, arbitraging is the process of simultaneous buying and selling an instrument in different markets to earn risk-free profits. In this instance, arbitrage transaction is initiated when there are discrepancies of prices between the cash market and the interest rate futures market. When there is misalignment between underlying cash price and interest rate futures price, arbitrageurs will enter the market to ensure that interest rate futures contracts are traded at its fair price. Only when arbitrage trading is active, the objective of efficient contract pricing can be met. This is because an active arbitrage trading will ensure that interest rate futures contracts are fairly priced. Fair price is the price that futures contracts should theoretically be traded. As arbitrageurs constantly believe that the fair price is the true price, they will trade based on trading strategies, thus forcing the market price to be aligned with the fair price. At this point, equilibrium price is reached and the contracts are fairly priced. However, if arbitrage trading is insignificant, interest rate futures price could deviate significantly from its fair price, causing hedgers to avoid using interest rate futures market because of poor hedging results. Chapter 2 discusses the concept of arbitrage in detail.

1.2 Overview of Interest Rate Futures Market in Malaysia

In Malaysia, interest rate futures contract is known as Kuala Lumpur Interbank Offered Rate ("KLIBOR") futures. . This contract began its operation on Malaysian Monetary Exchange ("MME") in 1996. Today, it is under Bursa Malaysia Derivatives Sdn Bhd's purview. Bursa Malaysia Derivatives Sdn Bhd's was formerly known as Malaysian Derivatives Exchange ("MDEX"), the exchange that is responsible for the futures market development.

The Contract represents a Ringgit interbank deposit in Kuala Lumpur Wholesale Money Market with a principle value of Ringgit Malaysia one million (RM 1,000,000) with a three-month tenor. The underlying asset is the three-month Ringgit interbank money market deposit. The three-month Ringgit interbank money market deposit is explained at the end of this section. There are several reasons why three-month tenor is chosen instead of other tenors available in the interbank market. First of all, the underlying cash market, which is the three-month KLIBOR, is the most liquid in the interbank market. Apart from that, the three-month KLIBOR are also being used as a benchmark in pricing of money market instruments such as Bankers Acceptance. Finally, other successful international futures market such as Hong Kong Futures Exchange ("HKFE") and Chicago Mercantile Exchange ("CME") also use three-month tenor interest rate that is HIBOR and LIBOR, respectively.

KLIBOR futures contract work differently from any other futures contract in such a way that the borrowing or lending starts on the day the contract matures. For instance,

when an investor long a KLIBOR futures contract, it means that the investor invests RM 1,000,000 million for a period of 3 months starting from the maturity day of the contract at the futures yield rate. On the other hand, when an investor short a KLIBOR futures contract, it means that the investor borrows RM 1,000,000 million for a period of 3 months starting from the maturity day of the contract at the futures yield rate.

The months that are available for the contract to be traded are the quarterly cycle months of March, June, September and December up to 5 years forward and 2 serial months. The tick size in percent is equivalent to one basis point. One basis point is hundredth of one percent. Thus 0.01% (1 tick) is equivalent to RM25.00 (RM 1,000,000 x 3/12 x 0.01%) per contract. This tick represents the minimum price fluctuation, which is the smallest price increase or decrease in trading a given contract.

KLIBOR futures contract is priced in terms of an index that is 100 minus interest rate. This implies that there is an inverse relationship between futures price and interest rates. Thus, if an investor foresees that interest rate will increase tomorrow, the investor should sell the futures today. This is because a rise in interest rate will lead to a drop in futures price. The reverse strategy should be taken if the investor foresees that the interest rate is to decrease the next day.

The KLIBOR futures contracts expire on the third Wednesday of the contract month. It is cash settled, that is there is no delivery of a cash instrument upon maturity because the Three-Month Ringgit Interbank Deposit is not transferable.

Fair value of the KLIBOR futures price is calculated using Implied Forward Rate ("IFR"). This implies that the futures price does not reflect the current KLIBOR, but instead, the rate that is expected to prevail when the contract matures. IFR technique incorporates the KLIBOR from different tenors in order to determine the KLIBOR futures price.

When the KLIBOR futures first started its trading in mid 1996, it had a promising start. The market recorded turnover of 38,342 contracts for the second half-year of 1996. In terms of average daily turnover, it accounted for 256 contracts. In 1997, the trading volume continued to increase. The average daily turnover was 307 contracts. In July 1997, the monthly turnover reached to 13,893 contracts, the highest monthly turnover since its trading in mid 1996. The turnover increased tremendously due to sharp increase in interest rate following speculative pressures on the ringgit as a result of the financial crisis contagion effects. As a result, the financial institutions hedged their portfolios, which led to an increased turnover of the KLIBOR futures contracts. Furthermore, the volatility in the interbank market has created opportunities for the market players to arbitrage between the cash and futures market. For example, on May 16, 1997 the KLIBOR futures rate stood at 7.50% while the underlying rate was 8.76%. This provides an opportunity to arbitrage due to discrepancy of rate between cash and futures market. However, in December the monthly turnover dropped to 1,196 contracts. The low turnover in the last quarter of 1997 was partly due to the distortion and fragmentation in the KLIBOR futures market and its underlying cash market. For instance, on December 30, 1997 the KLIBOR futures rate was 9.40% while the underlying cash market stood at 9.07%.

This has resulted in increase in basis risk, which is the risk of not being able to fully hedge the price risk, and caused hedging more costly.

Trading volume plummeted further in 1998, in October especially following the implementation of the selective exchange controls in September 1998. Although the trading in Commodity and Monetary Exchange of Malaysia ("COMMEX")[2] was exempted from the 12-Month Rule[3] on the repatriation of capital, foreign interest was reduced. The evidence can be seen for the decrease in the average share of foreign participation of the total turnover. The average share of foreign participation of the total turnover was 23% between August and September 1998 while between October and December 1998, it was only 4.3%. In addition, the banking institutions, which form the largest players in the market, were engaged in managing the non-performing loans and loan recovery rather than participating in the futures market.

In 1999, KLIBOR futures contracts were more actively traded. The average daily turnover was 115 contracts compared to 102 contracts in 1998. One of the factors that lead to higher trading activities was the revival of the Market-Makers' Scheme in August 1999. Market-Makers' Scheme was initiated in 1996 to provide liquidity to the futures market as liquidity is essential in securing the success of the futures contracts. Under this scheme, ten financial institutions were accepted by MME as market-makers in order to achieve and maintain a reasonable level of liquidity of the

[2] COMMEX was formed through the merger of Kuala Lumpur Commodity Exchange ("KLCE") and MME on 7 December 1998 as a multi-product Futures Exchange in the country. In 2001, COMMEX and Kuala Lumpur Options and Financial Futures Exchange Berhad ("KLOFFE") merged to form MDEX.

[3] A "12-month rule" was imposed in September 1998 prohibiting the repatriation of portfolio funds for 12 months following the Asian Financial Crisis. This "12 month rule" was necessary given the prevailing instability of the financial market. There was the possibility that the bad publicity following Malaysia's `unorthodox' measures could result in massive short- term capital outflows. Therefore, a 12- month restriction was considered necessary.

KLIBOR futures contracts. This involved the obligation to trade a minimum amount of 35 lots per day and to quote two-way prices for the first four contract months. In return, market-makers will be compensated in terms of lower commission fees, waiver on the exchange levy and concessions to trade. However, in July 1998, this scheme was terminated as a result of financial crisis. On August 16, 1999, this scheme was re-introduced. The re-introduction of Market-Makers' Scheme led to an increased in the turnover. The bulk of the turnover was contributed by the market-makers, which is 49% – 69 % of total turnover in the last four month of 1999. Also, decline in 3- month KLIBOR from 6.52% in January 1999 to 4% in April 1999 could have contributed to a higher turnover, as the market players demand the contracts for hedging against interest rate movements. Turnover in April was the highest during the year, with average daily turnover of 211 contracts.

From year 2000 to 2003, the annual turnover for KLIBOR futures contracts showed an improvement in terms of higher turnover volume. This was due to the hedging activities by the market players in view of changes in interest rate expectations.

1.2.1 The Underlying Instrument: Three-Month Ringgit Interbank Deposit

Generally, financial institutions will deal directly among themselves in providing short-term lending as well as short-term borrowing without intervention from central bank, Bank Negara Malaysia ("BNM"), in a place called interbank market. The placement of money by an approved interbank institution with another approved institution is known as Ringgit Interbank Deposits. The principal would be repaid with interest quoted in percent per annum on the maturity date of the deposit. This

interbank market, among other things, acts as a reliable and convenient channel for financial institutions to meet their wide deposit base to fund their loans as well as to meet the statutory reserve and minimum liquidity requirements of BNM.

As defined by the BNM, 3-month ringgit interbank deposit is:

i. A placement of money by an approved interbank institution with another interbank institution on terms that the principal would be repaid with interest quoted in percent per annum on the maturity date of the deposit.

ii. The market in ringgit interbank deposits is a wholesale time deposit market with the following features:

    a) Only approved interbank institutions are involved
    b) A money broker may act as intermediary or arranger of the transaction
    c) The transaction amount is large, typically at the standard amount of RM 5 million, and in any case not less than RM 50,000
    d) Tenors which are fixed at the time of dealing range from overnight to 5 years
    e) No deposit of certificate or book is issued, and no collateral would be pledged as security
    f) Documentation is in terms of written RENTAS, the real-time, gross-transfer electronic system confirmation
    g) Oral agreements by the dealing principals done through the telephone are deemed binding and irrevocable

KLIBOR is the interest rate charged (or received) on short-term funds placed in the interbank market. It is an offer rate at which participants in the interbank market are