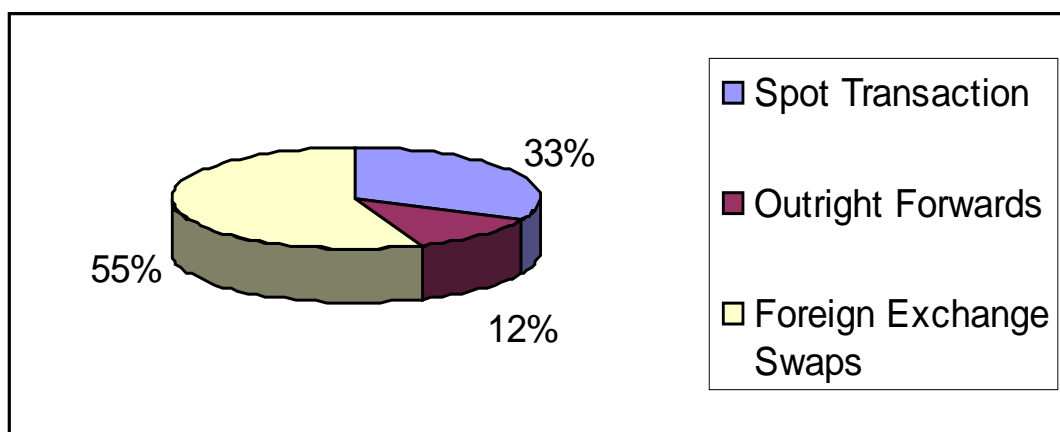


- CHAPTER 1 -
INTRODUCTION

1.0 Overview

Currency or foreign exchange (forex or FX) markets is by far the largest financial market in the world currently, with trading volumes surpassing beyond the US\$4 trillion mark a day (BIS 2007). Figure 1 shows the breakdown of the types of transactions. Although primarily it is dominated by a worldwide network of interbank traders, a new era of Internet based communication technologies has recently allowed individual investors and the business people who directly deal in international trade to gain access to this currency market. It is therefore crucial to observe the currency market behaviour as closely as possible as it will be the determining factor in one's product pricing decisions.

Figure 1: Breakdown of forex transactions



(Source: BIS, December 2007)

The importance of foreign exchange markets has grown with increased global economic activity, trade, and investment, and with technology that makes real time exchange of information and trading possible. As an addition to the understanding and knowledge on the currency movement also helps in making judgments on the domestic economic of a country since deteriorating economic conditions and inflation typically have an adverse affect on foreign exchange rates (Rose 1994).

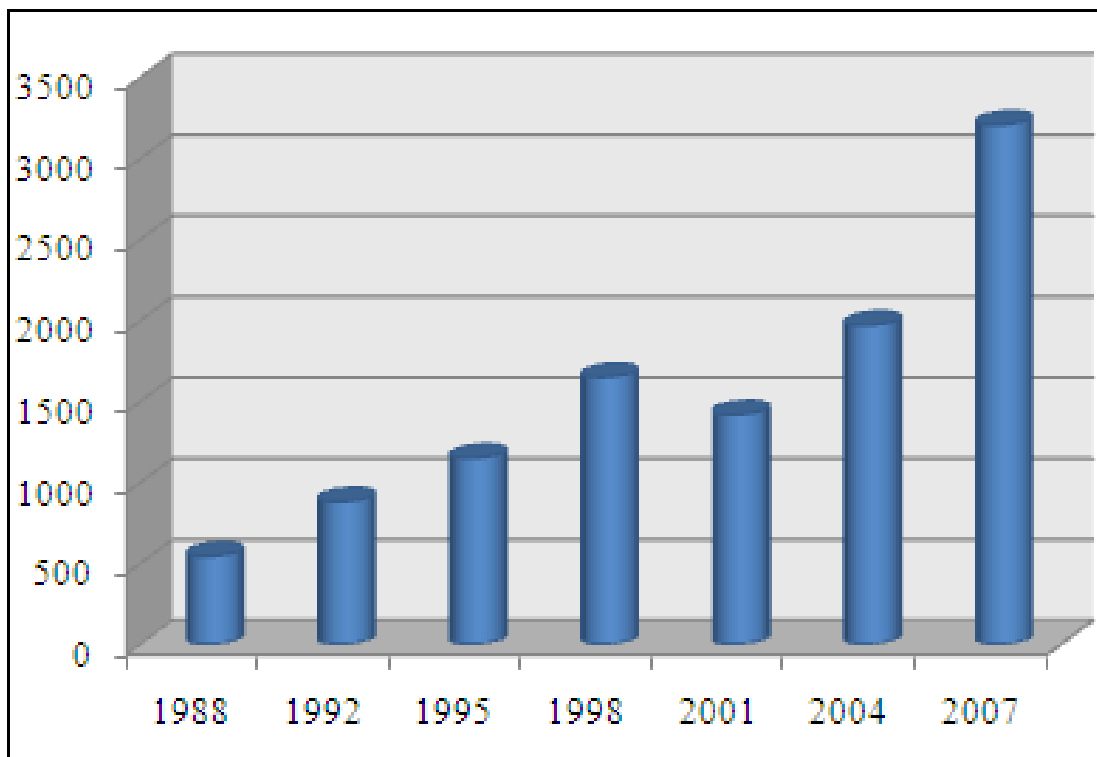
Due to the over-the-counter nature of currency markets, there are rather a number of interconnected marketplaces, where different currencies instruments are traded and this happens continuously throughout the day; as the Asian trading session ends, the European session begins, followed by the North American session and then back to the Asian session, excluding weekends. On the spot market, according to the BIS report (2007), the most heavily traded currency pairs are the EUR/USD (27%), JPY/USD (13%) and GBP/USD (12%), where the US currency was involved in 86.3% of transactions, followed by the euro (37.0%), the yen (17.0%), and sterling (15.0%).

Utilizing the three major pairs (EUR/USD, JPY/USD and GBP/USD) of currency, this study analyze the continuous behavior of the pairs on every Mondays over a period of June till December 2008 applying a high frequency data at every tick of the trade. The MODWT wavelet coupled with Haar filter approach is utilized in this work as its ability to decompose the data into several smaller time scales.

1.1 Foreign Exchange Market

Most forex exchanges are made in bank deposits and involve U.S. dollars. Over a trillion dollars in forex trades take place every day; forex dealers handle most transactions. Businesses, financial institutions, governments, investors, and individuals use the forex markets to adjust their currency holdings. Figure 2 shows the growth in forex market turnover from year 1988 to 2007.

Figure 2: Growth in Forex Market Turnover



(Source: 2007 BIS Triennial Central Bank Survey)

The foreign exchange markets play a critical role in facilitating cross-border trade, investment, and financial transactions. These markets allow firms

making transactions in foreign currencies to convert the currencies in hand into currencies wanted.

A number of factors may influence foreign exchange rates, including the following cited by Rose (1994):

- i. Balance-of-payments position – A country experiencing a trade deficit usually faces downward pressure on its foreign exchange rate.
- ii. Speculation over future currency values – Speculators buy or sell currencies when they see profitable opportunities.
- iii. Domestic economic and political conditions – Deteriorating economic conditions and inflation typically have an adverse affect on foreign exchange rates.
- iv. Central bank intervention – Central banks may buy or sell currencies to influence the value of their currency.

1.2 Problem Statement

Due to the high frequency nature of forex trading where investors most probably reacts to market movement rather than after a detailed analysis. Therefore it is important to for an investor to understand the behavior of currency pair because it helps them to understand the trend and volatility.

Traditionally researchers used econometrics method such as ARMA, which assumes the data set has constant conditional variance. Unfortunately financial data does not have constant conditional variance. In solving this limitation, Engle introduced ARCH model in 1982 permits conditional variance to change over time. The variance is modeled as a linear combination of squared past errors of specified lag. However due to relatively long lag in most cases, it is difficult to meet the stationary and non-negativity stationary conditions. GARCH model was introduced by Bollerslev in 1986 where the conditional variance is modeled as a linear combination of specified lag of squared previous errors and conditional variance of specified lag.

Empirical studies by Krager and Kugler (1993) and Brooks and Hinish (1998) proved that GARCH models are not suitable for non linear data because of the following limitations:

- i. GARCH has three lag structures to pick and this makes it easier to over-fit a model.

- ii. GARCH models operate best under relatively stable market conditions. GARCH is explicitly designed to model time-varying conditional variances, but it often fails to capture highly irregular phenomena. These include wild market fluctuations (for example, crashes and later rebounds) and other unanticipated events that can lead to significant structural change. This scenario often happens in foreign exchange market.
- iii. GARCH models often fail to fully capture the fat tails observed in asset return series. Heteroscedasticity explains some, but not all, fat-tail behavior.

Therefore, in this thesis, the study on the behavior of the three currency pairs mentioned earlier in this study will be based on using wavelet methodology, which has the following key advantages:

- i. Wavelet methodology has the ability to decompose the data into several time scales. There are a great number of traders who trade in various markets over different time scale, from a time period resolution as small as minutes to larger resolutions like years. Due to the different time scale, it is important that the trader is able to see the true dynamic structure of the market invested. Economist and financial analyst have long recognized that there are several time periods in decision making however conventional tools for analysis have limited them to two time

scales, which is short run and long run, because the inability of the tools to decompose data into more than two time scales.

- ii. The wavelet covariance decomposes the covariance between two stochastic processes over different time scales. A wavelet covariance in a particular time scale indicates the contribution to the covariance between two stochastic variables (Lindsay, Percival and Rothrock 1996). Therefore the covariance and correlation over different time scales can be examined

1.3 Objectives of the Study

Using wavelet method, the objectives of this study are:

- i. To study the behavior of three currency pairs (EURO/USD, GBP/USD and YEN/USD). The correlation between volume and spread for each currency pair is analyzed.
- ii. To study the correlation of spread for the following currency pair combination:
 - EURO/USD and GBP/USD
 - GBP/USD and YEN/USD
 - EURO/USD and YEN/USD

(Note: In this thesis, “currency pair combination” refers to this set of combination)

- iii. To study the correlation of volume for all currency pair combination

The scope of the study is limited to the period of June 2008 to December 2008. During this period, data for one hour before and one hour after 1 PM GMT, for every Mondays, is used.

The reason for selecting Monday is because the investors have a reasonably longer time over the weekend to digest the market information to make a more well thought investment decision. The opening of financial market in New York is selected because most of the transaction volume takes place when it is open. Furthermore coupled with the already open London financial market, the transaction would be near optimum in terms of volume.

The period of June to December 2008 is chosen because:

- i. This period it covers the third financial quarter, which is traditionally weak quarter, and fourth financial quarter, which coincides with the holiday seasons.
- ii. Coincide with the subprime crisis period where Lehman Brothers and Bear Stearns collapsed, which is considered as the peak of crisis.

1.4 Significance of the Study

As information technology improves the flow of information, the global markets are becoming highly correlated with each other. In simple terms, if an event happens in any part of the world, the impact can quickly spread globally. Thus minimizes the opportunities for diversifications for investors and opportunity to arbitrage.

The use of wavelet methodology in the study may provide an insight to investors to understand the trend and volatility of three major currency pair in high frequency high volume trading.

The findings of this study may help forex investors to have better understanding on the behavior of the three currency pairs during the period of one hour before and after 1 PM GMT. Thus, the investor can strategize the investment and diversification strategies to take advantage of the behavior.

1.5 Limitation of the Study

The limitations and assumptions considered in this study are:

- i. In this thesis, only three currency pairs (GBP/USD, EURO/USD and YEN/USD) are considered in the analysis.
- ii. It is assumed that the behavior during the period of June 2008 to December 2008, although is a financial crisis period, remains for every time period.
- iii. The data capture already a reflection of all the events that can possibly or have impacted the currency pair selected. Therefore, the results of the study are a reflection of the currency pair behavior towards such events.
- iv. The definition of volatility in this study is defined as the correlation (of spread, volume and both) movement of the individual currency pair or currency pair combination, as defined in earlier section.
- v. As there is no method to prove the significant of the wavelet method, it is assumed that the result of the MODWT analysis is statistically significant.

1.6 Organization of the Thesis

Chapter two documents the literature related to the importance of high frequency data in financial analysis, application of wavelet methods in financial/economic researches and researches done on forex volatility.

Chapter three explains the methodology and theory of the discrete wavelet transformation.

Chapter four documents the results and findings obtained from the wavelet testing using Matlab. Application source code is documented in appendix D.

Chapter five concludes the results and findings, and suggestions on future research.

1.7 Summary

In this chapter, it is highlighted that the traditional analysis method such as GARCH is not suitable for high frequency financial data. Thus in this thesis, wavelet method is used to analyze three currency pairs (EURO/USD, GBP/USD and YEN/USD). The analysis studies the behavior, volatility and the correlation of spread and volume among these three currency pairs. The insight of the result of this study will allow investors to strategize investment and diversification in forex market.