EVALUATION OF THE PROFITABLITY OF TECHINICAL ANALYSIS FOR ASIAN CURRENCIES IN THE FOREX SPOT MARKET FOR SHORT-TERM TRADING

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Abstract: *Technical analysis has garnered an unprecedented amount of interest among short-term traders in the Forex spot market over the past couple of decades. The main purpose of this study is to examine the profitability of technical analysis as applied to three active Asian currencies in the Forex spot market for short-term trading. This study also tests the relationship between various related parameters of currency trading such as Maximum Drawdown, Time in Position, Dealt Lots, Trading Charges and profitability. It covers ten currency pairs, including ten foreign exchange rates of three active Asian currencies in the Forex spot market (the Japanese Yen, Singaporean dollar, and Hong Kong dollar), five time frames involving Intra-day timeframes, and ten technical indicators (5 leading and 5 lagging). The study covers a period of three months running from April 10, 2012 through July 10, 2012. The results indicate that technical analysis is profitable for Asian currencies as attested by the fact that all the currency pairs, time frames and indicators have yielded trading profits in the Forex spot market.*

Key words: *Forex spot market, Technical analysis, Short-term trading***.**

1. Introduction

Financial markets have always been appealing to investors all around the world to exploit the opportunity for making investments. Amongst the most rewarding financial markets, the foreign exchange market has had an unprecedented growth over the past two decades. According to a 2010 Bank for International Settlement (BIS) report, it has become the largest and most liquid market in the world with $4 trillion daily turnover. In October 2011, it was estimated that the turnover averaged around $4.7 trillion a day (Bech, 2012). The Foreign exchange market is referred to either as the FX, currency market or Forex. This article will refer to it as the 'Forex.'

The Forex market is a decentralized or over the counter (OTC) market. It is operated around the globe without the limitations of a central physical exchange. Any currency can be electronically traded through the Internet, five days a week, 24 hours a day (Norris et al., 2009). In short, it is a round-the-clock market. It has high leverage and involves low transaction costs. Forex market participants are involved in it for different purposes; two important and primary purposes being speculation and currency conversion (Chen, 2009; and Frieden, 2008). Participants include central banks, commercial banks, financial institutions, hedge funds, corporations, and individual traders.

The most influential participants in the Forex market involve the major commercial and investment banks, and hedge funds, whilst the least significant ones are individual retail traders (King et al., 2011; Chen, 2009).

Forex trading commenced in the floating era in the early 1970s in the wake of the collapse of the Bretton Woods Agreements and Smithsonian Agreement (Madura, 2008). Although it was infeasible for retail market to access the Forex market even after the Smithsonian collapsed, this era is regarded as the time at which the modern-day Forex trading as it exists today was born. Historically, entry to the Forex market was restricted to banks, hedge funds, large commodity trading advisors (CTAs) and institutional investors as a result of regulations, capital requirements and technology. However, growing competition and the advent of the Internet made it possible for other market participants, especially retail traders to obtain access to this market (Lien, 2004; and King et al., 2011).

Analysis of the Forex market is performed by two methods: (i) fundamental analysis and (ii) technical analysis. Both approaches are considered as effective tools in forecasting the price movement (Sweeney, 2005; Murphy, 2000).

(i) Fundamental Analysis refers to the method by which market trends and price

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movements are forecasted based on the analysis of some economic indicators. These indicators involve a large spectrum of activities on the macroeconomic situation (e.g., government policies, bank policies, natural disasters, social stability, and economic trends).

(ii) Technical Analysis is defined as the forecasting method of price movements based on the inductive analysis of the past price behavior, in any asset markets (Menkhoff & Taylor, 2007). Technical analysis of the Forex market is performed by a qualitative method (e.g., the recognition of certain patterns in the data from visual inspection of a time-series plot) or quantitative techniques (e.g., based on an analysis of moving averages), or a combination of both (Menkhoff & Taylor, 2007; Murphy, 2000).

The widespread use of technical analysis in the Forex market puzzled many economists who were skeptical of it (e.g. Allen & Taylor, 1992; Cheung & Chinn, 2001) since technical analysis disregards economic fundamentals and relies heavily on information on past exchange rate movements. However, several empirical studies were conducted on the success of technical trading rules, which indicated that, either charting works, or markets are informationally inefficient in a variety of markets (e.g. Brock et al., 1993; Cadsby & Ratner, 1992).

Executing a trade using technical analysis presents challenges. They involve market timing, money management and emotional control. Market timing refers to the importance of the right time to enter/exit a trade. Money management is the process to limit the risk and preserve the capital. Emotional control reflects the ability to prevent getting stuck in psychological traps, such as fear of loss, greed, and hope, which can lead to the misjudgments and substantial losses (Chen, 2009; Murphy, 2000).

This article attempts to deal with the aforementioned challenges, in such a way as to help traders achieve the goals of maximizing the profits through systematic trading steps by using algorithmic or automated trading system. Specifically, it aims to study the profitability of technical analysis for three active Asian currency pairs in the Forex spot market for short-term trading. In addition, it aims to explore the relationship between various related parameters of currency trading, namely, maximum drawdown, time in position, dealt lots, trading charges, and net profit. A third objective is to examine the differences in various related parameters of currency trading when trading with different currency pairs, different time frames, and different technical indicators and to identify those suitable for currency trading.

After reviewing the relevant literature, introducing the conceptual framework developed from previous empirical studies, and articulating the methodology adopted in this research, this article focuses on the results. It then makes recommendations to various stakeholders (traders, academics, and practitioners).

2. Literature Review

Theoretical models for technical analysis include the Noisy Rational Expectations models (Grossman & Stiglitz, 1976; Smidt, 1965b; Treynor & Ferguson, 1985; Brown & Jennings, 1989; and Blume et al., 1994), the Behavioral (Feedback) models (De Long et al., 1990, 1991; Shleifer & Summers, 1990; and Shiller, 2003), the Herding models (Froot et al., 1992), the Agent-based models (Schmidt, 1999, 2000, 2002; Beja & Goldman, 1980; and Froot et al., 1992), and the Chaos Theory (Clyde & Osler, 1997). What all these models have in common is that they have proven that technical analysis is an effective tool in any asset market.

- *Literature on the Importance of Technical Analysis*

Several surveys have been conducted in this context and underlined the importance and widespread use of technical analysis in the Forex market. The work of Allen and Taylor (1990, 1992), is considered to be the first systematic study. They reported that technical analysis is applied as an important tool in 90% of the decision making of Forex traders in London. They further showed that reliance on technical analysis among market participants was skewed toward shorter forecast horizons.

Later research by Menkhoff and Taylor (2007) established an assortment of stylized facts about the importance and widespread use of technical analysis in the Forex market. They concluded that technical analysis was widely used in the foreign exchange market, emphasizing that applying it may be profitable.

- *Literature on the Profitability of Technical*

Analysis

Park and Irwin (2004, 2007) conducted an exhaustive and comprehensive review of empirical literature on the profitability of technical analysis in asset markets. They classified previous empirical studies into two classes, "early", and "modern" studies, depending on the characteristics of the testing procedures. Early Studies (1960-1987) conducted in Forex market include Dooley and Shafer's (1983), and Sweeney's (1986).

Modern studies can be divided into various sub-groups: (i) Model- Based Boot Strap studies (Levich & Thomas, 1993; LeBaron, 1999; Neely, 2002; and Saacke, 2002); (ii) Genetic Programming (Neely et al., 1997); (iii) Bootstrap Reality Check (Qi & Wu, 2002); (iv) Chart Pattern (Chang & Osler, 1999); (v) Nonlinear Model (Sosvilla-Rivero et al., 2002; Yao & Tan, 2000) and (vi) Automated Trading or Algorithmic Trading System Studies. The latter will be considered next.

- *Automated Trading or Algorithmic Trading System Studies*

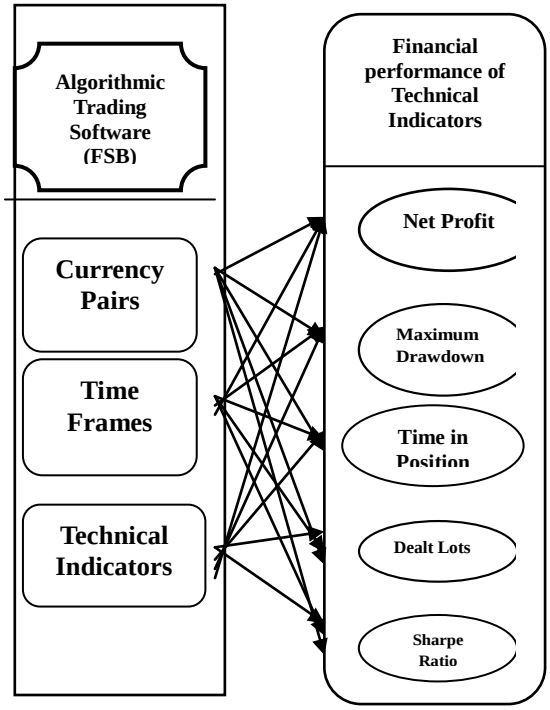
The interest in algorithmic trading has increased in recent years, beginning in the U.S. equity market more than 15 years ago (Chaboud et al., 2009). In 2006, Dempster and Leemans introduced adaptive reinforcement learning algorithm (ARL) as the basis for a fully automated Forex trading system application. They applied this system for one-minute frequency for the EUR/Dollar, over the period from 2000 to 2002. They reported a gross return of 26 percent per annum.

Austin et al. (2004) developed an adaptive system for the Forex trading. The system combines a number of technical indicators to give an optimal trading rule for a particular currency pair. They examined 15-min frequency for Yen–Dollar, Sterling–Dollar, and Swiss Franc–Dollar and determined that with some machine learning techniques, profitability extended to costs of 8 bp overall in some currencies.

Krishnan and Menon (2009) explored the impact of currency pairs, time frames and technical indicators on trading profit in the Forex spot market during 2006-2008. They applied the Forex Strategy Builder (FSB) based on algorithmic trading to create and back-testing the profitability of 10 technical trading rules for four major currency pairs. The result shows that all currency pairs, time frames, and technical indicators have yielded profit. This research applies Dempster and Leemans' (2006) Automated Trading or Algorithmic Trading System and, consistent with Krishnan and Menon's (2009) study, uses the Forex Strategy Builder.

3. Conceptual and Research Framework

Figure 1: Conceptual Framework of the Study



Source: created by the author for this study

As shown in Figure 1 below, the conceptual framework in this study consists of independent variables fed to the automated trading system to be analyzed. They include currency pairs, time frames and technical indicators. The dependent variable consists of the outputs generated by the software.

We will discuss the independent variables first.

- *Currency Pairs:* This research, which aims to analyze three active Asian currencies (the Japanese yen, Singaporean dollar, Hong Kong dollar) in the Forex spot market, encompasses different types of currency pairs, such as major, cross-rate, and exotic pairs. The currency pairs covered by this study include 10 Forex exchange rates:

- *1 Major Pair*: the USD/JPY (U.S. dollar against Japanese yen);

- *6 Cross-rates*: the EUR/JPY (euro against Japanese yen); the CAD/JPY (Canadian dollar against Japanese yen); the GBP/JPY (British pound against Japanese yen); the CHF/JPY

(Swiss franc against Japanese yen); the AUD/JPY (Australian dollar against Japanese yen); and the NZD/JPY (New Zealand dollar against U.S. dollar).
- *3 Exotic Pairs*: the USD/SGD (U.S dollar against Singaporean dollar); the SGD/JPY (Singaporean dollar against Japanese); and the USD/HKD (U.S. dollar against Hong Kong dollar). Several studies have been conducted to explore the importance role of the currency pairs regarding the profitability of technical analysis. Most of them have examined the major currency pairs (e.g. Krishnan & Menon, 2009; Austin et al., 2004; Schulmeister, 2007). All these studies have concluded that using technical analysis for developed market currencies was profitable. Some studies tested the profitability of technical trading rules on cross-rate markets (Lee & Mathur, 1996b; Neely & Weller, 1999; Cheung & Wong, 1997; Lee et al., 2001).
- *Time Frames:* This work aims to analyze the data in short-term horizon. Intra-day time frames involve 5-minutes, 15-minutes, 30-minutes, 1-hour, and 4-hours. Several studies have implied that technical analysis is an effective tool to predict the price movements for short-term trading (e.g. Bask, 2007; Balaji, 2007).
- *Technical Trading Rules:* A set of technical indicator applied in this work are in line with indicators used in Krishnan and Menno's (2009) study. They consist of ten technical indicators: 5 leading, Relative Strength Index (RSI), Stochastic Oscillator, Commodity Channel Index(CCI), Williams %R, and Momentum; and 5 lagging, Bollinger Bands, Parabolic SAR, Moving Average Convergence Divergence (MACD), Average Directional Index (ADX), and Accumulation/ Distribution (A/D). Profitability of a wide range of technical trading tools has been extensively discussed in the Forex market (Schulmeister, 2007; Qi & Wu, 2006; and Chong & Shik, 2007).

The dependent five variables, which, as aforementioned, consist of the outputs generated by the software, include net profit, maximum drawdown, dealt lots, time in position, and Sharpe ratio. A number of studies, including some considered in the preceding section (e.g. Krishnan and Menon, 2009), have added a sixth variable, trading charges. This research, however, does not include it in the framework since it is not part of any of the hypotheses. Each dependent variable will now be discussed.
- Net profit refers to excess returns of technical analysis on investment account. – Maximum drawdown to the magnitude of a decline in account value, either in percentage or dollar terms, as measured from peak to trough during the trading period. It is indicative of risk.
- Dealt lots point to the number of lots (specific amounts of base currency) applied for a particular currency pair in the market for the specified period. It reflects the strength of the currency.
- Time in position indicates the liquidity position of the trader in the market. It refers to a percent rate of bars that a trader is on market to the total number of bars during the trading period.
- Sharpe ratio is a measure of the risk-adjusted return of an investment.

Although excluded from the hypotheses, trading charges should also be briefly discussed since, as their name indicates, they are costs. They include the spread and swap/rollover. Spread can be defined as the difference between a broker's buying and selling price in pips. Spread is the only cost paid once by a trader to a broker. Swap/rollover numbers represent the interest rate differential between the two currencies in pips. They are calculated when a position is transferred into the following business day.

The way the variables interact can be summarized as follows: the three main independent variables are fed to an automated trading software, called Forex Strategy Builder, which then generates all the dependent variables we have discussed.

As discussed above, the Forex Strategy Builder (FSB) Software Automated trading software which this study uses was utilized by Krishnan and Menon (2009) in their research. The construction of systems that autonomously trade in securities or currencies has been an active area of research among practitioners and academics over the past decade (Austin et al., 2004; Dempster & Jones, 2001, 2002; Dempster et al., 2001; Dempster & Romahi, 2002; and Dempster & Leemans, 2006).

4. Research Methodology

The study design is descriptive and analytical in nature since its aim is to undertake an in-depth analysis on various

parameters related to currency trading in the Forex spot market. Convenient sampling was used to describe or interpret the characteristics of the target population in this study. The sample size regarding the period covered by the study, currency pairs, technical indicators, and time frames have been chosen in accordance with the availability of data, the very definition of convenience sampling. The sample size in this study is 500 (10 currency pairs multiplied by 5 time frames multiplied by 10 Technical indicators). As to the duration of the study, it runs over three months, April 10, 2012 through July 10, 2012.

The entire Forex historical data of the ten currency pairs are secondary data extracted from Meta Trader 4 (MT4) and imported to the FSB software. The technical indicators and time frames were selected and fed into the FSB. The Forex Strategy Builder is used to analyze and test historical data by providing a set up of the strategy in place, with all the defined parameters as framed by the researcher. They include:

- *Account Setting*: Account currency: USD; Initial account value: 10000; Leverage: 1/100.
- Market Setting: Spread: 4 pips for majors, 6 pips for cross-rates, and 8 pips for exotic pairs. The swap numbers for short and long positions: 1.00 and -1.00 for the major currency pair. Swap numbers for short and long positions: 2.00 and -2.00 for the other currency pairs (9 of them).
- *Money Management*: Stop Loss: 100 pips, Take Profit: 200 pips, Lot Size: 100,000 unit of base currency.
- *Opening Point of the Position*: Bar Opening, Logic - Enter the market at the beginning of the bar and Base price – Open.
- *Opening Logic Condition*: Opening logic conditions are used in this work vary, depending on the indicator logic.
- *Closing Point of the Position*: Day Closing, Logic - Exit the market at the end of the day and Base price – Close
- *Generating Trading Strategy*: Once the trader has defined aforementioned parameters, a strategy is generated by clicking submit button. This study aims to choose the specific setting for technical indicators or specific algorithm in order to generate a strategy.
- *Statistical Treatments of Data*: the financial statistics information of each strategy is generated and presented by the FSB software once the Forex historical data has been analyzed. All the data is then set in tables framed by the researcher in preparation for statistical significance analysis which uses the Statistical Package for the Social Sciences (SPSS). The tools used for statistical analysis involve descriptive statistics, correlation, and one-way ANOVA

5. Results and Discussion

- *Overview of Profitability*

The profitability of currency pairs will be considered first. That of time frames and technical indicators will then be analyzed.

Table 1: Profitability of Currency Pairs

Currency Pair	N	Mean Net Profit ($)	Standard Deviation
AUD/JPY	50	4,919.34	1,880.667
CAD/JPY	50	5,288.62	2,094.088
CHF/JPY	50	6,458.36	3,377.449
EUR/JPY	50	5,674.38	1,975.430
GBP/JPY	50	5,028.58	2,352.250
NZD/JPY	50	6,119.14	2,713.241
SGD/JPY	50	4,777.42	1,611.587
USD/HKD	50	545.07	277.637
USD/JPY	50	6,580.15	1,618.453
USD/SGD	50	3,581.68	1,613.618
Overall	500	4,897.27	2,674.135

As Table 1 shows, all ten currency pairs chosen for this study have yielded profits using technical trading indicators. This is in keeping with many other studies conducted in this field (e.g. Krishnan & Menon, 2009; Lee & Mathur, 1996b; Cheung & Wong, 1997; and Lee et al., 2001).

As Table 1 also makes it clear, profitability differs greatly among different currency pairs. This can be accounted by the different types of currency pairs chosen for this study. In case of the USD/HKD (exotic pair), there is an inconsistent behavior with all types of currency pairs, even within its own group. Among the ten currency pairs, the profitability is high in respect of trading with the USD/JPY and low in respect of trading with the USD/HKD as compared to the other eight currency pairs. It can thus be concluded that using technical analysis for developed market currencies is more profitable than it is for

emerged market currencies. This is consistent with the findings of Austin et al. (2004) and Schulmeister (2007).

Table 1 also points to a notable difference in the measures of dispersion. The lowest value of standard deviation by considering the mean value belongs to the USD/JPY, among the 10 pairs, underscoring the strength of the USD/JPY in the market. Although the lowest value of standard deviation in the table pertains to trading with the USD/HKD, due to the great difference in mean, it cannot be considered as the lowest value.

Table 2: Profitability of Time Frames

Time Frame	N	Mean Net Profit ($)	Standard Deviation
5- minutes	100	5,136.57	2,672.711
15-minutes	100	5,385.49	3,254.923
30-minutes	100	4,970.57	2,679.641
1-hour	100	4,981.38	2,648.986
4-hours	100	4,012.36	1,733.852
Overall	500	4,897.27	2,674.135

Consistent with earlier studies (e.g. Bask, 2007; and Balaji, 2007), Table 2 indicates that trading with different time frames can yield profit. It should be noted that trading with shorter time frames, including 5-minutes and 15- minutes, yields better results. The measure of dispersion is reverse. Standard deviation is lowest in the longest time frame (4-hours).

Table 3: Profitability of Different Types of Indicators

Type of Indicator	N	Mean Net Profit ($)	Standard Deviation
Leading Indicator	250	4,791.40	2,669.511
Lagging Indicator	250	5,003.15	2,679.909
Overall	500	4,897.27	2,674.135

As shown in Table 3, types of indicators, leading or lagging do not have much effect on the trading profit. This is in keeping with studies by Schulmeister (2007), and Qi and Wu (2006). Lagging indicators have yielded better results as compared to leading indicators, a finding supported by Okunev and White's (2003) study.

Table 4: Profitability of Technical Indicators

Technical Indicator	N	Mean Net Profit ($)	Standard Deviation
RSI	50	6,180.52	4,134.988
Stochastic	50	4,704.39	2,109.862
CCI	50	4,420.74	2,146.335
William %R	50	4,348.77	1,990.187
Momentum	50	4,302.57	1,880.224
Bollinger Band	50	4,042.12	1,799.697
Parabolic SAR	50	4,941.13	2,405.251
MACD	50	5,818.25	3,703.584
ADX	50	5,365.83	2,549.253
A/D	50	4,848.43	2,339.555
Overall	500	4,897.27	2,674.135

As underlined in Table 4, all the technical indicators, carefully chosen for this study, have yielded profits. The profitability is especially high in the case of the use of RSI for trading and to a slighter extent that of MACD and ADX. In contrast, the profitability is low in the case of the use of Bollinger Band for trading. Therefore, it can be concluded that generally, all the technical indicators, if used scientifically with combinations of proper strategies, will most likely generate significant profits in the Forex spot market. Dempster and Jones (2001) and Krishnan and Menon (2009) had made similar determinations. There is a notable difference in the measure of dispersion. The lowest value is related to trading with Bollinger Band, while the highest value related to trading with RSI.

Table 5: Analysis of the Relationship between Dependent Variables and Different Currency Pairs

Currency Pair	Descriptive Statistics	Maximum Drawdown($)	Dealt Lots	Time in Position(%)	Sharpe Ratio	Net Profit($)
AUD/JPY	Mean	994.06	375.96	28.72	.24	4,919.34
	SD	555.480	313.237	19.924	.099	1,880.667
CAD/JPY	Mean	1,013.54	419.60	36.36	.24	5,288.62
	SD	538.047	339.680	21.938	.115	2,094.088
CHF/JPY	Mean	1,201.72	468.82	37.22	.25	6,458.36
	SD	767.640	382.672	21.358	.109	3,377.449
EUR/JPY	Mean	1,054.28	416.66	28.80	.24	5,674.38
	SD	607.477	343.763	19.899	.106	1,975.430
GBP/JPY	Mean	1,138.56	458.40	28.20	.22	5,028.58
	SD	655.768	489.942	21.767	.095	2,352.250
NZD/JPY	Mean	1,179.08	451.50	37.76	.22	6,119.14
	SD	581.867	264.559	20.235	.086	2,713.241
SGD/JPY	Mean	898.54	274.62	41.54	.27	4,777.42
	SD	412.359	153.819	18.173	.084	1,611.587
USD/HKD	Mean	82.53	209.70	78.10	.32	545.07
	SD	33.906	92.554	16.702	.112	277.637
USD/JPY	Mean	1,108.93	334.18	56.92	.25	6,580.15
	SD	409.489	133.010	18.413	.072	1,618.453
USD/SGD	Mean	792.21	352.56	34.92	.23	3,581.68
	SD	545.491	383.881	19.710	.085	1,613.618
Overall	Mean	946.35	376.20	40.85	.25	4,897.27
	SD	623.165	321.353	24.617	.100	2,674.135

- *Overview of Risk-Return Aspects*

Table 5 summarizes the analysis of the related parameters of currency trading with different types of currency pairs. One observation that can be made right away is that the maximum drawdown is less for the AUD/JPY as compared to other currency pairs, except for the exotic pairs. Therefore, the risk involved in the AUD/JPY is lower, with less volatility in the risk factor. The lowest value of standard deviation occurs with trading with the USD/JPY. Of the seven developed market currencies considered in this study, the CHF/JPY carries the highest risk factor.

Dealt lots for the CHF/JPY are the highest, with the GBP/JPY and the NZD/JPY the second highest. This indicates that these three currency pairs are traded the most in the market, which also happens to reflect their strength.

Table 5 also shows that the AUD/JPY, EUR/JPY, and GBP/JPY have the lowest similar percentage of time in position, indicating that these currency pairs provide high liquidity to the traders in the market. The lowest value of standard deviation is also follows the same pattern of order.

The Sharpe ratio is the highest (0.25) for both the USD/JPY and CHF/JPY. This result shows that trading with these pairs generates higher risk-adjusted returns when compared to the other eight currency pairs. The USD/JPY has the lowest value of dispersion.

Table 6: Analysis of Relationship between Dependent Variables and Different Time Frame

Time Frame	Descriptive Statistics	Maximum Drawdown($)	Dealt Lots	Time in Position (%)	Sharpe Ratio	Net Profit
5-minutes	Mean	1,270.45	564.58	43.07	.18	5,136.57
	SD	763.151	460.409	27.633	.086	2,672.711
15-minutes	Mean	1,071.63	453.93	39.07	.22	5,385.49
	SD	684.409	358.424	26.780	.085	3,254.923
30-minutes	Mean	930.95	345.53	34.97	.25	4,970.57
	SD	571.035	210.688	23.179	.085	2,679.641
1-hour	Mean	808.74	312.89	36.62	.28	4,981.38
	SD	492.133	224.532	20.956	.095	2,648.986
4-hours	Mean	649.96	204.07	50.54	.31	4,012.36
	SD	328.960	91.579	21.009	.098	1,733.852
Overall	Mean	946.35	376.20	40.85	.25	4,897.27
	SD	623.165	321.353	24.617	.100	2,674.135

Table 6, a summary of the analysis of related parameters of currency trading with different time frames, shows that both the maximum drawdown and dealt lots decrease as the duration of trading time frame increases. This is in keeping with Krishnan and Menon's (2009) study, in which they argued that trading with shorter time frames is more risky and popular when compared to longer time frames.

The lowest percentage of time in position is found at 30-minutes, followed by the 1-hour time frame. What this shows is that the liquidity increases with longer time frames when compared to the shorter ones. Sharp ratios increase as the time frames go up, suggesting that better risk-adjusted performances are associated with longer time frames.

Table 7: Analysis of Relationship between Dependent Variables and Different Technical Indicators

Technical Indicat or	Descriptive Statistics	Maximum Drawdown($)	Dealt Lots	Time in Position (%)	Sharpe Ratio	Net Profit
RSI	Mean	1,111.74	465.88	42.52	.24	6,180.52
	SD	756.436	436.028	25.075	.094	4,134.988
Stochastic	Mean	782.41	315.28	38.36	.27	4,704.39
	SD	474.157	201.212	24.054	.091	2,109.862
CCI	Mean	759.07	278.32	34.32	.28	4,420.74
	SD	421.379	178.287	22.339	.096	2,146.335
William %R	Mean	784.82	291.96	35.98	.26	4,348.77
	SD	475.795	199.833	25.633	.098	1,990.187
Momentum	Mean	835.07	285.16	36.96	.27	4,302.57
	SD	475.885	158.565	22.362	.095	1,880.224
Bollinger Band	Mean	710.80	259.86	39.64	.27	4,042.12
	SD	363.361	154.071	32.513	.091	1,799.697
Parabolic SAR	Mean	1,153.52	511.20	49.46	.19	4,941.13
	SD	680.679	421.735	19.639	.082	2,405.251
MACD	Mean	999.44	348.74	32.38	.29	5,818.25
	SD	690.699	238.053	21.917	.091	3,703.584
ADX	Mean	1,112.30	512.24	49.64	.23	5,365.83
	SD	747.281	492.623	22.753	.112	2,549.253
A/D	Mean	1,214.28	493.36	49.28	.20	4,848.43
	SD	749.240	345.967	21.753	.103	2,339.555
Overall	Mean	946.35	376.20	40.85	.25	4,897.27
	SD	623.165	321.353	24.617	.100	2,674.135

In Table 7, which summarizes the analysis of related parameters of currency trading with different technical indicators, the maximum drawdown is the lowest for Bollinger Band, with CCI the second lowest and Stochastic and William %R the third and fourth lowest. Clearly, trading with these four indicators is less risky as compared to other indicators. The measure of dispersion is in the same order.

The lowest Dealt lots are also related to Bollinger Band, followed by CCI and Momentum, showing that these three indicators regarding the selected initial settings in the FSB software include less number of trades in the market as compared to other indicators. Dealt lots are the highest for ADX and Parabolic SAR and A/D next, albeit slightly less. These indicators are more frequently used by traders as compared with the other indicators analyzed in this study.

The lowest time in position pertains to MACD, followed by CCI, and William %R. These indicators provide high liquidity to the traders. MACD has the highest Sharp ratio, followed by CCI, which shows that trading with these indicators generates better risk-adjusted returns.

- *Overview of Correlation Analysis*

The Pearson two-tailed correlation technique was used to analyze the relationship between maximum drawdown, dealt lots, time in position, trading charges and net profit. The results are shown in Table 8.

Table 8: Analysis of Correlation between Net Profit and other Dependant Variables

Independent Variable		**Pearson Correlation**			
		Maximum Drawdown VS Net Profit	**Dealt Lot VS Net Profit**	**Time in Position VS Net Profit**	**Trading Charges VS Net Profit**
Currency Pair	AUD/JPY	.562**	.713**	.580**	.714**
	CAD/JPY	.448**	.583**	.393**	.583**
	CHF/JPY	.575**	.515**	.260	.526**
	EUR/JPY	.579**	.597**	.459**	.597**
	GBP/JPY	.680**	.727**	.471**	.742**
	NZD/JPY	.467**	.710**	.348*	.724**
	SGD/JPY	.496**	.647**	.467**	.646**
	USD/HKD	.514**	.751**	.211	.812**
	USD/JPY	.392**	.693**	.454**	.706**
	USD/SGD	.603**	.637**	.568**	.633**
Type of Indicator	Leading Indicator	.688**	.645**	.029	.684**
	Lagging Indicator	.664**	.531**	.001	.587**
Time Frame	5-minutes	.650**	.521**	-.019	.572**
	15-minutes	.694**	.608**	.005	.647**
	30-minutes	.708**	.691**	.000	.742**
	1-hour	.713**	.690**	.199*	.743**
	4-hour	.600**	.563**	.173	.729**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 8 points to a significant relationship between maximum drawdown and net profit at a significance level of 0.01, for all of the currency pairs, time frames and types of indicators. The variables are positively correlated, which indicates that the profit will increase when maximum drawdown goes up. These results are inconsistent with the findings of Krishnan and Menon (2009) who found these variables to be negatively correlated.

There is also a significant relationship between dealt lots and net profit at a significance level of 0.01, for all of the currency pairs, time frames and types of indicators. The variables are positively correlated, which indicates that profit will increase as the dealt lots increase. This result is in keeping with the findings of Hiemstra and Jones (1994), and Krishnan and Menon (2009).

Moreover, there is a significant

relationship between time in position and net profit at a significance level of 0.01, for all currency pairs, except the CHF/JPY and USD/HKD. The variables are positively correlated, which implies that when the time in position increases, the profit increases. The results are supported by the findings of Confas (2007).

There is, however, no significant relationship between time in position and net profit, in the case of leading indicators. It can also be observed that there is no significant relationship between time in position and net profit in the case of time frames, except for 1-hour time duration.

There is a significant relationship between time in position and net profit at a significance level of 0.05, for 1-hour time frame.

Trading charges include charged spreads and charged rollovers. There is a significant relationship between trading charges and net profit at a significance level of 0.01, for all currency pairs, time frames and types of technical indicators, implying that the impact of trading charges on profitability is significant.

- *Testing of Hypotheses*

Fifteen out of sixteen of null hypotheses were rejected. Only the null hypothesis 4 (H40) was accepted (for more details, see Table 9 in Appendix One).

6. Conclusions and Recommendations

Based on the descriptive statistics, it can be concluded that technical analysis is profitable for the three active Asian currency pairs traded in this market as attested by the fact that all ten currency pairs, five time frames and ten indicators have yielded trading profits in the Forex Spot market over the period considered in this study. Trading Japanese yen crosses such as the AUD/JPY, CAD/JPY, CHF/JPY, EUR/JPY, GBP/JPY, and NZD/JPY are very profitable, second only to the USD/JPY.

Among exotic pairs the SGD/JPY and the USD/SGD are respectively the most profitable when compared to the USD/HKD.

The profitability is the highest in respect of trading USD/JPY and the lowest with regard to trading USD/HKD. Among developed currency pairs, the AUD/JPY is the least risky and among exotic pairs, the USD/HKD is the least risky. The CHF/JPY, the GBP/JPY, and the NZD/JPY are respectively the most traded pairs in the market, which speaks volume about the strength of these currency pairs.

Three currency pairs, the AUD/JPY, EUR/JPY, and GBP/JPY respectively provide the highest liquidity to traders in the market. Trading with the USD/JPY and CHF/JPY generates risk-adjusted returns. Trading with shorter time frames, 5-minutes, 15-minutes, and 30-minutes, is more profitable, yet riskier. Currency trading with shorter time frames is more popular than in the case of longer time frames in the Forex market, even though it carries higher risks. Liquidity increases with longer time frames as compared to shorter ones.

The better risk-adjusted performance is found in longer time frames. As to the use of indicators, RSI, MACD and ADX are the three most profitable. Trading with Bollinger Band and by CCI and Stochastic is less risky compared to other indicators. ADX and, to a lesser extent, Parabolic SAR and A/D were most used for trades when compared with other indicators. MACD, CCI, and William %R provide high liquidity to the traders. Trading with MACD and CCI indicators generates better risk-adjusted returns.

Finally, based on the findings of the hypotheses testing, there are variations in profitability when trading with different currency pairs, time frames and technical indicators. There is also a significant difference in related parameters of currency trading when trading with different currency pairs, time frames, and technical indicators.

- *Recommendations to Hedge Fund Managers and Institutional Investors*

Among Forex market participants, hedge funds and institutional investors are the second most influential parties after banks. As Pojarliev (2005) observed, some currency managers feared investing in emerging market currencies. The results of this study show that conventional technical trading tools could be successfully applied for emerging market currencies as well. So the reticence noted among hedge fund managers may not be rooted in a lack of adequate tools. This is an assumption that could be well worth investigating. While understandably intuition alone cannot be a substitute for a rigorous analysis, it can nonetheless be an indicator of a direction to go into. The information provided in this study could thus be useful for their

investment decision making and for them to realize that there are opportunities in the Asian currency market.

- *Recommendations to Individual Traders*

This research could be beneficial to individual traders who either have traded currency or want to start trading in this market.

The information provided in this study is also valuable for those traders who trade manually as it can help them maximize their profit by learning how to use algorithmic trading. This form of trading could, among other, help them effectively overcome some of the difficulties inherent to manual trading. One such difficulty which automated trading can easily overcome is market timing, something which algorithm can resolve as it decides the timing trade entry and exit opportunities based on certain pre-defined parameters and constraints. The two other main difficulties encountered by manual traders are emotional control and money management, both of which can solved by automated trading which is based on a predefined logic. There is also advanced risk management options on algorithmic trading software, that can be easily selected based on trader's preference.

- *Recommendations to Academics and Practitioners*

This work can be applied as a reference for academic studies and researchers who are interested in studying in this field. The methodology used in this work can be used for other financial markets.

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Appendix One

Table 9: The Summary of Hypotheses Testing

Hypotheses	Statistical Treatment
$H1_0$: There is no significant difference in Net Profit when trading with different currency pairs. **$H1_a$:** There is a significant difference in Net Profit when trading with different currency pairs.	One-way ANOVA
$H2_0$: There is no significant difference in Net Profit when trading with different time frames. **$H2_a$:** There is a significant difference in Net Profit when trading with different time frames.	One-way ANOVA
$H3_0$: There is no significant difference in Net Profit when trading with different technical indicators. **$H3_a$:** There is a significant difference in Net Profit when trading with different technical indicators.	One-way ANOVA
$H4_0$: There is no significant difference in Net Profit when trading with either a leading or a lagging indicator. **$H4_a$:** There is a significant difference in Net Profit when trading with either a leading or a lagging indicator.	One-way ANOVA
$H5_0$: There is no significant difference in Maximum Drawdown when trading with different currency pairs. **$H5_a$:** There is a significant difference in Maximum Drawdown when trading with different currency pairs.	One-way ANOVA
$H6_0$: There is no significant difference in Maximum Drawdown when trading with different time frames. **$H6_a$:** There is a significant difference in Maximum Drawdown when trading with different frames.	One-way ANOVA
$H7_0$: There is no significant difference in Maximum Drawdown when trading with different technical indicators. **$H7_a$:** There is a significant difference in Maximum Drawdown when trading with different technical indicators.	One-way ANOVA
$H8_0$: There is no significant difference in Time in Position when trading with different currency pairs. **$H8_a$:** There is a significant difference in Time in Position when trading with different currency pairs.	One-way ANOVA
$H9_0$: There is no significant difference in Time in Position when trading with different time frames. **$H9_a$:** There is a significant difference in Time in Position when trading with different time frames.	One-way ANOVA
$H10_0$: There is no significant difference in Time in Position when trading with different technical indicators. **$H10_a$:** There is a significant difference in Time in Position when trading with different technical indicators.	One-way ANOVA
$H11_0$: There is no significant difference in Sharpe Ratio when trading with different currency pairs. **$H11_a$:** There is a significant difference in Sharpe Ratio when trading with different currency pairs.	One-way ANOVA
$H12_0$: There is no significant difference in Sharpe Ratio when trading with different time frames. **$H12_a$:** There is a significant difference in Sharpe Ratio when trading with different time frames.	One-way ANOVA

$H13_0$: There is no significant difference in Sharpe Ratio when trading with different technical indicators. **$H13_0$:** There is a significant difference in Sharpe Ratio when trading with different technical indicators.	One-way ANOVA
$H14_0$: There is no significant difference in Dealt Lots when trading with different currency pairs. **$H14_a$:** There is a significant difference in Dealt Lots when trading with different currency pairs.	One-way ANOVA
$H15_0$: There is no significant difference in Dealt Lots when trading with different time frames. **$H15_a$:** There is a significant difference in Dealt Lots when trading with different time frames.	One-way ANOVA
$H16_0$: There is no significant difference in Dealt Lots when trading with different technical indicators. **$H16_a$:** There is a significant difference in Dealt Lots when trading with different technical indicators.	One-way ANOVA