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Technical Analysis: An Asian Perspective

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TECHNICAL ANALYSIS: AN ASIAN PERSPECTIVE



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Technical Analysis: An Asian Perspective

Abstract

Technical analysis, namely the moving average rule and the channel rule, is applied to the currency of an Asian managed floating exchange rate regime (USDSGD) to see if opportunities for profitable trading exist. Instead of using only daily or monthly data, higher frequency time frames of 10, 15, 30 and 60 minutes are analyzed. Profitable strategies (if any) will be broken down and analyzed within smaller time frames to see if the profits are specifically in sample.

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Chapter 1: Introduction

It has been conjectured by several academics that significant profits can be made in the currency markets using simple technical analysis rules like moving average crossovers and filter rules. Numerous technical analysis studies have been done on the major currencies but seldom in Asian currencies. This may be due to the fact that most Asian currencies imposes certain capital controls and needs for offshore liquidity are met by mostly non deliverable forwards, whose liquidity might be suspect. Only a handful of studies (Martin, 2001; Pukthuanthong-Le, Levich and Thomas, 2007; de Zwart et al., 2009; Lee et al., 2001) have attempted to look at technical analysis in emerging markets.

The reason why we're looking at technical analysis in the foreign exchange market (as opposed to the stock or commodities markets) is that unlike equity models, there is actually less confidence in currency valuation models (Frankel and Rose, 1995; Taylor 1995b; John Y. Campbell, Andrew W. Lo and A. Craig MacKinlay 1996). In equity models you could possibly value a company by discounting its future cash flows, but how then, do u exactly value a country (or in the case of the Euro, several countries)? Also, while a company could go bankrupt and shares of an individual stock could plummet to zero, the occurrence is less conceivable for a single currency. In addition, trading horizons are often shorter for foreign exchange traders (Allen and Taylor, 1990; Taylor and Allen, 1992) with most of them only participating in intraday trading and it has been shown by Menkhoff and Taylor (1997) and Oberlechner (2001) that

the shorter the trading horizon, the more likely it is that traders will use technical analysis to guide their decisions. This is complemented by the findings by Sarno and Taylor (2002) and Cheung, Chinn, and Garcia Pascual (2005) that fundamental exchange rate models fail at shorter term horizons. These suggest that use of technical analysis would be more popular in the currency markets as compared to other markets.

Several explanations have been given for this apparent inefficiency of excess profits, including spurious effects (data snooping, data mining or publication bias), behavioral biases, inadequate risk measuring techniques, and intriguingly, central bank intervention. It was argued the central banks have objectives that might not be profit maximizing in nature, like smoothing excess volatility, and this allows market participants to profit at its expense, as proposed by Dooley and Shafer (1983, p. 65), Levich (1985), and Sweeney (1986). In fact, the link between central bank intervention and supernormal profits has been tested in some papers, with most of the earlier papers reporting a significant positive correlation (Szakmary and Mathur, 1997; LeBaron, 1999). The principle behind abnormal profits and central bank intervention can be summed up in the following statement by Saacke (2002, p. 467)

“After an exogenous shock to fundamentals, the exchange rate would, without central bank interventions, jump to a new equilibrium level (e.g. Dornbusch overshooting). Wishing to reduce volatility, central banks try to prevent the exchange rate from jumping by leaning against the wind. Thereby they delay the adjustment of the exchange rate. If adjustment is delayed, exchange rates will display a trend during the

phase of adjustment. This trend may then be picked up and exploited by trend-following forecasters.”

Therefore, this study aims to provide more insight on the usefulness of technical analysis in an emerging market currency with frequent central bank intervention. For this purpose, we decide to apply technical analysis on Sing Dollar data, which fulfils all the criteria listed above.

The contribution of this study to the literature is fourfold. Firstly, the study is one of the few studies to apply technical analysis in an Asian context. As written by Kim and Nofsinger (2008), there is some evidence – anecdotal, theoretical, and empirical – that Asians suffer from cognitive biases on a different level than people of other cultures. They also mentioned that anecdotally, individual investors in Asia are often seen as mere gamblers. Technical analysis on an Asian currency therefore could yield interesting insights

Secondly, most of the technical analysis studies done had focused on the majors and cross rates, which are mostly freely floating currency regimes. Only Martin (2001), de Zwart et al. (2009) and Pukthuanthong-Le, Levich and Thomas (2007) have looked at managed floating regimes but none, strangely, at the Sing Dollar. Central banks intervene in managed floating regimes more frequently than freely floating regimes and therefore technical analysis is supposed to be more effective, according to the theory that intervention results in excess profits from technical analysis.

Thirdly, most of the studies done thus far have focused on technical analysis using daily data. However, since trading horizons of currency traders are usually shorter, with many of them taking only intraday positions; it is a wonder that not more studies have been done on shorter time intervals. This study shall focus on time intervals of 10, 25, 30 and 60 minutes, as well as daily data. To my knowledge, this is also the first study that analyzes multiple time frames for a single currency.

Lastly, this study can be seen as a true out of sample test for studies like Szakmary and Mathur (1997), Saacke (2002) and Taylor (1994), considering that this study is done on different time frames, in a different market and in a different time period.

Chapter 2: Asian currencies

Asian countries have adopted a variety of exchange rate regime to suit their domestic and economic needs, with pegged systems (Hong Kong) and free floats (Japan).

However most Asian countries uses managed floating exchange rate regimes in its various forms, with liquidity provided offshore by non deliverable forwards for countries with restrictions on foreign capital movements. Theoretically, technical analysis rules should perform better in managed float systems should central bank intervention induce profitability. Table 1 lists the exchange rate policies of East Asia according to 4 general categories – pegged, crawling peg, managed float and free float.

Table 1. Exchange Rate Policies of East Asia

Economy Exchange Rate Policy

Cambodia	Managed Float
China	Crawling Peg
Hong Kong	Pegged
Indonesia	Managed Float
Japan	Free Float
Laos	Managed Float
Malaysia	Managed Float
Philippines	Free Float
Singapore	Managed Float
South Korea	Free Float
Taiwan	Managed Float
Thailand	Managed Float
Vietnam	Crawling Peg

Source: International Monetary Fund, De Facto Classification of Exchange Rate Regimes and Monetary Policy Framework, [<http://www.imf.org/external/np/mfd/er/2006/eng/0706.htm>].

In addition, most Asian countries impose certain capital controls and needs for offshore trading is fulfilled by non deliverable forwards. A non deliverable forward works in a similar way to normal deliverable forwards, only that no physical

settlement of the currency takes place at maturity. Instead, counterparties settle the difference between the contracted price and fixing price with US dollars. Non deliverable forwards could be similar, but might not necessarily be equivalent to onshore spot rates net of interest rate differentials as prices are affected by supply and demand, liquidity, counterparty risk and speculative views on the fixing rates (Laura Lipscomb (2005)). Non deliverable forwards are over the counter products and hence there are no central clearing markets and therefore the availability of price data is severely limited. With the exception of Singapore, Hong Kong and Thailand, non deliverable forwards are adopted for offshore currency trading in Asian countries excluding Japan. Of these, Hong Kong is using a linked exchange rate system, under which the Hong Kong Monetary Authority intervenes to keep the exchange rate between 7.75 and 7.85 Hong Kong dollars and Thailand only lifted its capital control measures in 2008. Therefore, the focus of our attention shall be on the Sing dollar.

The management of the Sing dollar band can be summarized below.

‘The MAS operates a managed float regime for the Singapore dollar. The trade-weighted exchange rate is allowed to fluctuate within an undisclosed policy band, rather than kept to a fixed value. The band provides flexibility for the system to accommodate short term fluctuations in the foreign exchange markets as well as some buffering the estimation of the country’s equilibrium exchange rate, which cannot be known precisely. MAS intervention operations generally ‘lean against the wind’. If the exchange rate moves outside the band, MAS will usually step in, either buying or selling foreign exchange sp as to steer the exchange rate back within the band’ –MAS

Chapter 3: Technical Analysis – a brief overview

Technical analysis is actually a confounding term. Although decisions are based on seemingly technical and numerical indicators like price and oscillating indicators etc, the underlying belief is that it is mass market psychology driving price action and traders are basing decisions on this belief. Observing technical indicators is only the means to an end. In other words, technical analysis is not technical.

Technical analysis has a long history and dates back to Europe in the 17th century. In essence, it comprises of 3 tenets. Firstly, a technical analyst believes that market actions discount everything else and that all information is already incorporated into current prices. Secondly, prices move in trends, implying predictability of future prices. Lastly, history tends to repeat itself. This aspect is the most important, as it implies that excess profits could be made in the future by adopting a profitable strategy that worked in the past. It also implies that investors are not rational and that the efficient market hypothesis is not valid, even in its weak form, as prices should already reflect all past publicly available information.

There are various forms of technical analysis. The majority of technical analyses are detailed in textbooks like Murphy (1986, 1999) and Pring (1991). Technical analyst primarily uses two tools in making decisions – charting and technical indicators. Charting includes the drawing of trend lines, the formation of retracement levels etc and often requires no small amount of subjective judgment. A more detailed discussion on the subject can be found in the book by Bulkowski (2000). The focus of

this study will be on technical indicators, which on the other hand are based on concrete mathematical parameters that throw subjective judgment out of the window.

Basically, there are two types of technical indicators – momentum indicators and contrarian indicators. Momentum rules identifies trends and include indicators like moving averages crossovers (Cootner, 1962; Van Horne and Parker, 1967, 1968; James, 1968; Dale and Workman, 1980) and filter rules (Poole, 1967; Dooley and Shafer, 1976, 1984); Logue and Sweeney, 1977) while contrarian indicators identifies reversals and comprises of indicators like the relative strength index (J. W. Wilder, 1978; Henderson 2002) and stochastics. Of these, this study is going to concentrate on 2 trend following rules – moving average crossovers and channel rules.

Although technical analysis has its critics, its popularity in the financial markets cannot be disputed and it is still widely followed in the market. In the surveys by Allen and Taylor (1990) and Taylor and Allen (1992) they discovered that almost all currency traders based in London incorporate technical analysis into their decision making process. They also found out that technical and fundamental analysis is not mutually exclusive and the shorter the time frame, the more traders tend to rely on technical analysis. In fact, surveys show that 30% to 40% of foreign exchange traders around the world believe that technical analysis is the major factor determining exchange rates in the short run up to 6 months (e.g. Menkhoff, 1997; Gehrig and Menkhoff, 2003). Their survey is supported by the findings of Cheung and Chin (2001) and Cheung, Chin and Marsh (2004)

Chapter 4: Literature Review

Technical analysis might sound enticing on paper but how does it actually perform in reality? In a pioneering paper, Fama and Blume (1966) found no evidence of significant profits using a class of technical trading rules in the stock market. Their finds were backed up by Van Horne and Parker (1967, 1968) and Jensen and Benington (1970). However, more recent work by Brock, Lakonishok and LeBaron (1992) and Sullivan, Timmermann and White (1999) have refuted the idea. Other studies that found positive profits using technical analysis include studies by Menkhoff and Schlumberger (1995), Lee and Mathur (1996a, 1996b), Maillet and Michel (2000), Lee et al. (2001) and Martin (2001). In the paper by Park and Irvin (2007) they conclude that a majority of modern studies showed that technical trading strategies generated positive economic profits.

Most of the papers on technical analysis have focused on daily data while only a handful has taken an intraday approach. These papers include Curcio et al (1997), Neely and Weller (2003), Sager and Taylor (2004), Melvin, Sager and Taylor (2006) and Kozhan and Salmon (2010). The former two studies found no evidence of positive excess returns after transaction costs are considered. Using tick by tick data, Kozhan and Salmon found that excess profits exists for a trading rule in 2003 but these profits disappeared by 2008.

In addition, almost all studies on technical analysis in the foreign exchange market have focused on the majors with very few studies done on emerging markets/Asian

currencies. Anne D. Martin (2009) found statistically significant profits using the moving average rule on currencies of developing countries. However the rule does not outperform a risk free strategy after taking into account the Sharpe ratio. Gerben de Zwart et al. (2009) took a holistic approach by combining both fundamental and technical information to generate trading signals for 21 emerging currency markets and found economically and statistically significant positive risk-adjusted returns. Pukthuanthong-Le, Levich and Thomas (2007) found that while excess profits using trend following rules have disappeared over time, opportunities still exists in the exotic currencies.

One of the more significant paper relating central bank intervention to that of excess profits using technical analysis is that by LeBaron (1999). Using simple moving averages rules on 2 currencies (Deutsche Mark and Yen against the Dollar, he found significant profits of more than 5% annually. He then excluded days in his data where official interventions by the central bank took place and found out that the profits were reduced significantly. This study was complimented by that of Saacke (2002) who supplemented the earlier study by including interventions by the Deutsche Bundesbank and by adding more technical analysis rules. The results are consistent with the findings by Szakmary and Mathur (1997), where they also found a day of the week effect, where trading profits are generally higher on Fridays and Mondays, consistent with conjectures in previous studies where news concerning intervention tends to be revealed over weekends. Silber (1994) took a slightly different approach in that he linked markets where technical analysis proved profitable to markets where central bank intervention exists.

However, the above findings have been challenged by Neely (1998), who came up with a pertinent point – most of the observed profits occur concurrently with the period where intervention took place. This implies that there could be a positive correlation between intervention and positive profits but not necessarily causation, especially if interventions tend to occur during days when markets are trending or when volatility is excessive. In a follow up study, Neely (2002) found that intervention reacts to the same strong short-run trends from which the trading rules have recently profited using high frequency data.

In another study, Sapp (2004) found that market volatility is higher before interventions which in itself can be a plausible explanation for interventions. It also implies that the positive returns earned by technical analyst during this period are in fact an adequate compensation for risk bearing.

Finally, there has been some evidence that trading rule profits has been declining over time. LeBaron (2002) discovered that returns from MA trading rules declined during the 1990s. Olson (2004) found out that post 1970 returns declined to zero by the 1990s, using MA rule portfolios tested in successive five-year periods. Similarly, Schulmeister (2008) found that even profits from the best of 1024 technical trading rules has been declining since the 1980s and Pukthuanthong-Le, Levich and Thomas (2007) find that currencies for emerging markets tend to have more profit opportunities than developed nations. Finally, in a conclusive study, Neely, Weller and Ulrich (2009) conducted out of sample test on a variety of previously studied rules and concluded that simple technical trading rules were profitable up to the 1990s but

as knowledge of the usefulness of these rules became more and more widespread, profitability disappeared. The decline in the profitability of trading rule returns has been partly attributed to the rise in algorithmic trading. Kozhan and Salmon (2010) found that returns to a genetic algorithm that proved profitable in 2003 disappeared by 2008 and attributed the declining profitability to a rise in algorithmic trading over the same period. Their findings are backed up by Chaboud et al.(2009) who reported that algorithmic traders accounted for 60% of total trading volume in 2008 (whereas in 2003 they were almost nonexistent) in two currency markets.

Chapter 5: Data and Methodologies

In the section, the technicalities of the moving average rule and the support and resistance rules shall be explored. In the extensive literature on technical analysis, the moving average rule is especially prominent. (Neftci, 1991; Lee and Mathur, 1996a, 1996b; Neely, 1997; Szakmary and Mathur, 1997; Neely, 1998). The basis of the idea is that an upward trend is identifiable and a long position is taken when the short term moving average exceeds the long term moving average and similarly, a downward trend is identified and a short position is taken when the short term moving average goes lower than the long term moving average. Mathematically, the rule is expressed as

Where P_{0t} is the opening price of that period t while I = length of short term periods and J = length of long term periods. Since there is no one rigid rule as to what is usually used, we employ a combination of moving average rules to prevent our results from being dependent on one specific parameter setting (see Okunev and White, 2003). To this end, we test all scenarios where $I = 1, 2, 3, 4, 5, 6, 7, 8, 9$ and $J = 10, 15, 20, 25, 30, 50, 100$, a total of 63 combinations. Also, since we do not know what the optimal intraday time frame is, we use time intervals of 10, 15, 30 and 60 minutes, as well as daily returns. Whenever a signal is produced, a position is initiated using the price at

P_{ct}

the end of the period, . An example is provided below. For illustrative purposes, let $I=2$ and $J=10$.

Period	Opening Price	Closing Price	Short term average (2)	Long term average (10)	Position
7:00:00	73	74			
8:00:00	74	75	73.5		
9:00:00	76	79	75		
10:00:00	77	75	76.5		
11:00:00	74	75	75.5		
12:00:00	75	76	74.5		
13:00:00	78	80	76.5		
14:00:00	81	84	79.5		
15:00:00	82	85	81.5		
16:00:00	85	83	83.5	77.5	1
17:00:00	82	81	83.5	78.4	1
18:00:00	77	76	79.5	78.7	1
19:00:00	75	74	76	78.6	-1
20:00:00	73	71	74.5	78.3	-1

Therefore, in the example above, a long position at the price of 83 is taken on 1600 hours when the short term moving average exceeds the long term moving average. The long position is closed out at a price of 74 on 1900 hours when the short term moving average goes below the long term moving average. A corresponding short position at 74 is established at the same time.

Total percentage profit for a period can be calculated as

and

Where T equals to the transaction cost for a 1 way trade, that is, the transaction cost either squaring out the original position plus the transaction cost of entering a new position but not both. T is represented by the bid-ask spread with the spread estimated at 0.05% for a round trip (e.g. Levich and Thomas, 1993; Bessembinder, 1994; Lee and Mathur, 1996; Neely, 1997). However, spreads have improved over time due to

greater liquidity and technological advances. Therefore, 0.05% for a round trip in USDSGD can be considered conservative. The first term is equivalent to the profit/loss made on the position while the second term is the transaction costs incurred both ways. For comparison purposes, we shall include results based on profits without transaction costs.

Support and resistance, or channel rules are also widely popular (Irwin and Uhrig (1984), Taylor(1994)). Much like the moving average rule, the rule alternates between a short or long position and is never neutral. Channel rules stipulates that when prices move to a new high or low, it is likely that prices will continue in that direction. For example, a long position at P_{ot} is established when the opening price in the current period P_{ot} exceeds the maximum price $P_{high,N}$ over the preceding N periods. The long position is closed out and reversed when the current opening

P_{ot}

price is lower than the low price $P_{low,N}$ over the preceding N periods.

A short position is therefore taken at P_{ot} . The cycle goes on until the end of the examination period. Mathematically, the rule is expressed as

$P_{high,tN}$

....)

Flow:IN

,...)

otherwise

The third term of the rule states that the position is held till a position of the opposite sign is signaled, which is consistent with the original work done by Donchian (1960). As with the moving average rule, the choice of N is varied to prevent out results from being dependent on any one specific parameter setting. Therefore, we chose values of 5, 10, 15, 20.....100 with differences of 5. An example is provided below. For illustrative purposes, let N=5.

Period	Opening Price	High Price	Low Price	High over previous 5 periods	Low over previous 5 periods	Position	Entry Price
7:00:00	74	75	74				
8:00:00	76	76	75				
9:00:00	74	76	73				
10:00:00	77	77	75				
11:00:00	74	74	72				
12:00:00	73	75	72	77	72	-	
13:00:00	78	78	74	77	72	1	78
14:00:00	80	81	80	78	72	1	-

15:00:00	80	82	80	81	72	1	-
16:00:00	84	85	83	82	72	1	-
17:00:00	81	82	81	85	72	1	-
18:00:00	77	77	76	85	74	1	-
19:00:00	75	75	74	85	76	-1	75
20:00:00	73	73	71	85	74	-1	-

In the example above, a position is taken on 1300 hours when the current opening price P_{ot} exceeds the maximum price during the preceding 5 periods, i.e. 77. The entry price is also 77. The position is squared out at a price of 75 when the opening price fell to 75 on 1800 hours when 75 became lower than the low price (76) of the preceding 5 periods. A corresponding short position is also established at 75.

Total percentage profit for a period can be calculated as

and

Where similarly, T equals to the transaction cost for a 1 way trade and the first term equals the profit/loss made on the position while the second term is the transaction costs incurred both ways. For comparison purposes, we shall include results based on profits without transaction costs.

Numerous studies on the distribution of short term assets returns have shown that prices are rarely normally distributed, with their distribution normally (no pun intended) being skewed and leptokurtic. Therefore, other than a t-test, the non-parametric sign rank test is employed to test the statistical significance of the returns.

An out of sample test is warranted if one considers the varied parameter settings and the possible scenarios above. It is highly probable that at least one will produce significant profits by chance or luck alone. However, instead of implementing a strict out of sample test, what this study does it break up profitable rules (if any) that work in certain periods into smaller sub periods. This could give us further clues into why certain rules work in certain periods. For example, learning (Lo, 2004) could extinguish earlier gains or the moving average rules works in every year except the height of the financial crisis due to increased volatility. Insights like there could be gleaned from breaking up the data into smaller periods.

Spot rates for USDSGD were obtained from Bloomberg. Only traded rates are captured. For intraday data, 10, 15, 30 and 60 minutes data were utilized from January 8 2008 to January 8 2011. For daily data, we utilize the data from January 1 2000 to 3 January 2011.

Chapter 6: Results

A look at the results show that the profits are mostly either negative or non significant. The results are characterized by non zero skewness and high kurtosis levels, effectively meaning that the distributions are non normal, which renders the sign-rank test better than the t-test.

Table 2 to 6 in Appendix 1 report the in sample test of the moving average rule profitability within time frames of 10 minutes, 15 minutes, 30 minutes 60 minutes plus daily data, with the results broken down into a yearly analysis. The cells highlighted in pink either means that the profits are positive or that the results are significant at the

95% confidence interval. Some of the MA specifications produce astoundingly positive and significant results but in almost all instances profitability disappears after transactions costs are included. For example the moving average specification of 1,10 (I=1, J=10) produce a significant return of 29.80% yearly but the profits disappeared when transaction costs are included. However, there are several exceptions within the daily time frames where there are certain rules where positive and significant returns remain after transaction costs are included. However, the best of these rules only produce a return of 2.72% annually, which is hardly anything to shout about. In addition, the results do not hold after breaking down the profitable period into smaller samples.

Moving on to the channel rule, it can be seen from table 7 to 11 in Appendix 2 that profitability is practically nonexistent. The few specifications with positive profits are not in any sense significantly different from zero, with or without transactions costs. As there are no profitable rules, a dissection of the observed period into smaller sub samples is not needed.

In a further analysis of the results from our moving average results, we separate the profits from long and short positions and the average number of periods a long/short position is held to see if any significant differences exist. The results are then compared to the MAS policy during the period to see if it coincides with the direction the central bank is taking during the relevant period.

Table 12 to 15 in Appendix 3 illustrates the profit of long and short positions of the shorter time frames and the relevant T stats and sign ranked test results. Also included

is the average/total number of time periods each position is held, as well as the number of such positions. The cells highlighted in green means a positive profit was observed while the cells highlighted in yellow means that the results are significant at the 95% confidence interval. Of more interest are the results from the daily time frames in table 16, and this is where we will concentrate our attention.

From table 17 in Appendix 4, it can be seen that MAS has adopted a policy of gradual and modest appreciation till mid 2001. It can be seen that although the profits of longs is more than the profits of shorts most of the time in that period, especially in 2011, there is no consistent significance across the results. Also interesting is the fact that long positions are held, on average, longer than short positions, suggesting that MAS policy of a stronger SGD did not translate into short term strength for the currency (since we measure the prices in USD/SGD and not the SGD NEER itself) and that the central bank was consistently 'fighting' against the market.

Thereafter, a policy of zero appreciation was adopted till April 2004. Such a policy is likely to result in no bias between short and long positions but it can be seen in table 16 that the profits of shorts are slightly more than that of longs, though again the results are not significant across the board. In this period, the numbers of days short positions are held are far longer than the days a long position is held, suggesting consistent SGD strength (USD/SGD weakness) in the short term vs the long term.

Although the policy of the central bank is for a neutral movement of the SGD NEER, this evidence suggest that MAS have to consistently fight against strong term strength in the SGD NEER.

After the earlier part of 2004, MAS decided to re-adopt a policy of gradual and modest appreciation to combat inflation till October 2007, after which a slightly higher slope was introduced till Oct 2008, when a zero percent appreciation stance was needed to fight the full effects of the global financial crisis. In such a scenario one would expect the profits and number of days of shorts is held to be significantly higher than that of longs, especially in the latter part. From table 16 it can be seen that apart from 2005 (where the profits of shorts and longs are often sparse and random) and 2008 (where both short and long positions seemed to be consistently profitable) the direction of profitable positions during 2004, 2006 and 2008 clearly leaned towards shorts, although again no consistent significance was seen. In this particular instance, it seemed like that market was obliging towards the central bank wishes of a stronger SGD (and weaker USD/SGD). In addition, in the same periods (2004, 2006 and 2007) the length of time a short position is held is consistently longer than that a long position is held

The onset of the financial crisis meant that the central bank leaned away from a policy of SGD appreciation in end 2008 and towards a neutral policy until April 2010, where a policy of modest and gradual appreciation was introduced for 6 months before the central bank increased slightly the slope of the SGD NEER again. However, once again there was no evidence of the outperformance of long positions over short positions and vice versa in either 2008 or 2009. However, the results from 2010 clearly showed that once again, the profits of short positions is higher than that of long positions, suggesting the SGD strength and USD/SGD weakness has once again

kicked in. In addition, the length of time a short position is held is higher than that of long positions again.

All in all, evidence of consistent outperformance of one position over the other during different policy periods is mixed at best. Although there are some years where short positions outperformed longs, the results are mostly not significant in terms of either the sign rank test or the T statistic. Also, outperformance of shorts vs longs in a climate of SGD NEER appreciation, or in a period of zero appreciation for the matter, is not consistent across either strategies or all periods.

Chapter 7: Discussion and Conclusion

The results of this study show that trend following strategies like the moving average rule and the channel rule produce unremarkable results at best, and even positive profits disappear out of the original sample. These results are consistent with studies done by Lee and Mathur (1996a) Lebaron (2002) and Olson (2004) that it is no longer possible to make excess profits using trend following rules in currency markets. There could be three reasons for this. Firstly, it could be that the efficient market hypothesis

holds and that it is simply impossible to achieve positive excess returns using indicators based on past prices. The second reason could be that profits existed in the past but was eroded due to the growth in the hedge fund industry and the rise of algorithmic trading. Finally, it could be just a trick of time, that is, trend following rules worked well in the past because coincidentally markets could be trending up to the 1990s (when they could still make money) but stopped trending in from the late 1990s.

What next then? Instead of looking at simple mechanical rules like filter rules and moving averages, more studies could be done on more complex indicators like the moving average convergence divergence (MACD) rule or the rate of change (ROC) rule. Also, since markets no longer seem to be trending, it could be worthwhile to look at contrarian strategies instead, like the relative strength index (RSI) and stochastics to identify overbought and oversold levels. Indeed, this could be an interesting topic, if one takes into account Neely's (1998, 2002) findings that trading profits using trend following strategies materialized before intervention occurred. This could imply that while he could be right that central bank intervention do not result in profitability of trend following rules, it could possibly result in the profitability of contrarian strategies, especially if you have the central bank to 'back' you up.

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Appendix 1

TABLE 2		Without Transaction cost																													
Strategy																															
Year		1 10	2 10	3 10	4 10	5 10	6 10	7 10	8 10	9 10	1 15	2 15	3 15	4 15	5 15	6 15	7 15	8 15	9 15	1 20	2 20	3 20	4 20	5 20	6 20	7 20	8 20	9 20	1 25	2 25	
2008																															
Profit(%)		0.00022	0.00028	0.00030	0.00017	0.00015	0.00002	-0.00002	0.00004	0.00015	0.00009	0.00014	-0.00004	-0.00025	-0.00019	-0.00029	-0.00020	-0.00012	-0.00009	-0.00006	0.00004	0.00006	-0.00008	-0.00010	-0.00016	-0.00019	-0.00009	-0.00015	0.00001	0.00011	
T Stats		0.30103	0.18993	0.16878	0.43546	0.49112	0.94231	0.93683	0.84956	0.49881	0.68000	0.50671	0.85330	0.25391	0.37086	0.18348	0.34176	0.57643	0.68485	0.79466	0.83880	0.77763	0.71855	0.65303	0.46134	0.36659	0.67352	0.47100	0.94615	0.61455	
Signed Ranked		0.30315	0.62680	0.88051	0.71316	0.60720	0.29186	0.25643	0.48925	0.72353	0.20977	0.40555	0.08786	0.02383	0.04065	0.03411	0.09718	0.12024	0.08969	0.02999	0.12596	0.24293	0.07432	0.09341	0.12668	0.08707	0.18169	0.07948	0.14270	0.29598	
2009																															
Profit(%)		-0.00016	-0.00019	-0.00018	-0.00024	-0.00024	-0.00031	-0.00016	0.00001	0.00001	-0.00011	-0.00002	-0.00007	-0.00003	0.00000	-0.00002	-0.00003	-0.00005	-0.00004	-0.00001	0.00003	-0.00004	0.00002	0.00005	-0.00002	-0.00005	-0.00015	-0.00009	-0.00009	-0.00010	
T Stats		0.37691	0.28594	0.31759	0.18767	0.18771	0.09166	0.36753	0.96293	0.96955	0.56337	0.89285	0.71984	0.88412	0.98711	0.90094	0.86437	0.80240	0.81186	0.95963	0.85536	0.81398	0.92954	0.78246	0.89655	0.79743	0.41454	0.61363	0.63639	0.57211	
Signed Ranked		0.00132	0.00147	0.00382	0.00508	0.01199	0.00304	0.06907	0.30937	0.48713	0.01091	0.06390	0.02995	0.13833	0.41993	0.45246	0.39450	0.31703	0.25726	0.07746	0.10302	0.06494	0.28520	0.37340	0.30179	0.22476	0.12669	0.13361	0.03538	0.02701	
2010																															
Profit(%)		0.00022	0.00009	0.00012	-0.00003	-0.00013	-0.00018	-0.00023	-0.00019	-0.00011	0.00016	0.00002	-0.00009	-0.00017	-0.00014	-0.00011	-0.00018	-0.00014	-0.00014	0.00003	0.00000	-0.00003	-0.00011	-0.00016	-0.00026	-0.00024	-0.00019	-0.00019	-0.00007	0.00005	
T Stats		0.19127	0.59889	0.46194	0.84844	0.45636	0.27977	0.17572	0.25572	0.53154	0.34943	0.92263	0.59936	0.32147	0.41736	0.50029	0.30231	0.39634	0.41901	0.86841	0.98782	0.88232	0.52238	0.34176	0.12754	0.14986	0.25389	0.27136	0.67541	0.77831	
Signed Ranked		0.13829	0.06129	0.23981	0.03080	0.00628	0.00441	0.00140	0.00674	0.04552	0.15332	0.04966	0.01669	0.00377	0.00538	0.01139	0.10314	0.10578	0.01852	0.03643	0.05531	0.04057	0.04286	0.00861	0.01290	0.00343	0.00529	0.02508	0.01080	0.01723	0.20432
ALL																															
Profit(%)		0.00008	0.00005	0.00007	-0.00005	-0.00008	-0.00017	-0.00015	-0.00006	0.00000	0.00003	0.00004	-0.00007	-0.00015	-0.00011	-0.00014	-0.00015	-0.00011	-0.00010	-0.00002	0.00002	-0.00001	-0.00007	-0.00007	-0.00015	-0.00017	-0.00016	-0.00015	-0.00006	0.00001	
T Stats (Pr > t)		0.44691	0.67181	0.52861	0.61885	0.44376	0.11260	0.16731	0.55857	0.96599	0.76330	0.72413	0.51697	0.16804	0.29836	0.18936	0.17998	0.29427	0.38283	0.88110	0.85193	0.89724	0.55016	0.49170	0.15522	0.10856	0.13754	0.15635	0.58147	0.95555	
ned Ranked (Pr =)		0.00074	0.00128	0.01519	0.00180	0.00104	0.00006	0.00037	0.00881	0.06799	0.00171	0.00638	0.00029	0.00012	0.00109	0.00189	0.00208	0.00393	0.00434	0.00064	0.00236	0.00281	0.00126	0.00286	0.00121	0.00063	0.00197	0.00061	0.00039	0.00612	

Transaction cost																														
Strategy																														
Year		1 10	2 10	3 10	4 10	5 10	6 10	7 10	8 10	9 10	1 15	2 15	3 15	4 15	5 15	6 15	7 15	8 15	9 15	1 20	2 20	3 20	4 20	5 20	6 20	7 20	8 20	9 20	1 25	2 25
2008																														
Profit(%)		-0.00915	-0.00673	-0.00591	-0.00565	-0.00563	-0.00586	-0.00629	-0.00718	-0.00953	-0.00739	-0.00537	-0.00472	-0.00456	-0.00431	-0.00424	-0.00404	-0.00401	-0.00404	-0.00650	-0.00472	-0.00395	-0.00369	-0.00342	-0.00332	-0.00324	-0.00310	-0.00311	-0.00574	-0.00411
T Stats		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2009																														
Profit(%)		-0.00924	-0.00726	-0.00641	-0.00614	-0.00604	-0.00622	-0.00647	-0.00720	-0.00960	-0.00729	-0.00544	-0.00471	-0.00426	-0.00393	-0.00383	-0.00382	-0.00390	-0.00402	-0.00619	-0.00451	-0.00393	-0.00342	-0.00314	-0.00307	-0.00302	-0.00306	-0.00295	-0.00548	-0.00413
T Stats		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2010																														
Profit(%)		-0.00870	-0.00675	-0.00591	-0.00580	-0.00579	-0.00599	-0.00643	-0.00725	-0.00952	-0.00702	-0.00553	-0.00473	-0.00436	-0.00416	-0.00405	-0.00405	-0.00400	-0.00407	-0.00621	-0.00466	-0.00394	-0.00360	-0.00347	-0.00339	-0.00329	-0.00312	-0.00309	-0.00565	-0.00407
T Stats		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ALL																														
Profit(%)		-0.00904	-0.00693	-0.00609	-0.00588	-0.00583	-0.00604	-0.00642	-0.00723	-0.00957	-0.00726	-0.00546	-0.00473	-0.00440	-0.00414	-0.00404	-0.00398	-0.00398	-0.00405	-0.00631	-0.00464	-0.00396	-0.00357	-0.00335	-0.00327	-0.00319	-0.00311	-0.00306	-0.00564	-0.00412
T Stats		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

TABLE 5																															
60 mins Without Transaction cost																															
Year	Strategy	1 10	2 10	3 10	4 10	5 10	6 10	7 10	8 10	9 10	1 15	2 15	3 15	4 15	5 15	6 15	7 15	8 15	9 15	1 20	2 20	3 20	4 20	5 20	6 20	7 20	8 20	9 20	1 25	2 25	
2008																															
Profit(%)		-0.00202	0.00040	-0.00003	0.00011	-0.00016	0.00013	0.00050	0.00020	0.00063	-0.00257	-0.00063	0.00007	-0.00043	-0.00088	-0.00068	0.00001	-0.00093	-0.00096	-0.00111	0.00045	0.00004	-0.00033	-0.00072	-0.00097	-0.00019	0.00057	0.00099	-0.00046	0.00051	
T Stats		0.10562	0.75116	0.97996	0.93200	0.90007	0.91384	0.68893	0.87100	0.61553	0.03929	0.61614	0.95578	0.73173	0.48267	0.58347	0.99194	0.45408	0.44314	0.37513	0.72006	0.97613	0.78906	0.56634	0.43618	0.88106	0.64997	0.42686	0.71404	0.68566	
Signed Ranked		0.01676	0.69781	0.67664	0.80000	0.71452	0.65186	0.53722	0.92797	0.81805	0.01913	0.24150	0.53983	0.42868	0.22109	0.45702	0.86367	0.27455	0.28118	0.28353	0.99867	0.64204	0.48437	0.36120	0.51561	0.95363	0.59219	0.44957	0.53587	0.90875	
2009																															
Profit(%)		-0.00229	-0.00155	-0.00147	-0.00143	-0.00095	-0.00030	-0.00063	-0.00064	-0.00067	-0.00209	-0.00203	-0.00229	-0.00202	-0.00185	-0.00134	-0.00104	-0.00126	-0.00171	-0.00186	-0.00143	-0.00033	-0.00076	-0.00123	-0.00142	-0.00127	-0.00154	-0.00173	-0.00103	-0.00011	
T Stats		0.02807	0.13788	0.15983	0.17035	0.36460	0.77419	0.54453	0.53748	0.51917	0.04552	0.05170	0.02817	0.05321	0.07564	0.19886	0.31718	0.22639	0.10081	0.07534	0.16992	0.75519	0.46758	0.23970	0.17270	0.22448	0.13971	0.09774	0.32481	0.91599	
Signed Ranked		0.01272	0.04402	0.07641	0.13224	0.32247	0.62621	0.34564	0.32076	0.49579	0.06161	0.05743	0.02381	0.06879	0.12309	0.26113	0.50433	0.30199	0.19508	0.14569	0.27628	0.90947	0.64647	0.46916	0.34734	0.38437	0.18556	0.14355	0.32051	0.92055	
2010																															
Profit(%)		-0.00091	-0.00066	-0.00007	0.00015	0.00099	0.00019	-0.00011	-0.00089	-0.00022	0.00043	-0.00050	0.00085	0.00037	0.00034	-0.00041	-0.00063	-0.00083	-0.00082	0.00078	-0.00029	0.00015	0.00058	0.00032	0.00019	0.00027	-0.00027	0.00011	0.00051	0.00046	
T Stats		0.36194	0.50862	0.94620	0.88368	0.31988	0.84954	0.91080	0.37379	0.82513	0.66968	0.61785	0.39659	0.70797	0.73088	0.68481	0.52613	0.40682	0.41349	0.43228	0.76816	0.87873	0.56048	0.75087	0.84733	0.78410	0.78873	0.91273	0.61167	0.64344	
Signed Ranked		0.06200	0.16015	0.60175	0.51928	0.91537	0.66703	0.41737	0.19277	0.72321	0.92149	0.31544	0.95729	0.71194	0.53327	0.23209	0.14565	0.20415	0.15853	0.72903	0.13746	0.32004	0.67899	0.45199	0.40867	0.34378	0.18777	0.38489	0.39423	0.42920	
ALL																															
Profit(%)		-0.00176	-0.00069	-0.00060	-0.00045	-0.00008	-0.00005	-0.00014	-0.00048	-0.00012	-0.00143	-0.00108	-0.00049	-0.00072	-0.00079	-0.00078	-0.00057	-0.00100	-0.00114	-0.00076	-0.00047	-0.00009	-0.00022	-0.00054	-0.00073	-0.00038	-0.00042	-0.00023	-0.00034	0.00025	
T Stats		0.00533	0.27345	0.34319	0.47633	0.89962	0.93742	0.82114	0.44220	0.85386	0.02325	0.08790	0.43540	0.25134	0.20943	0.21544	0.36746	0.11246	0.07050	0.22720	0.45733	0.88696	0.73142	0.38771	0.25042	0.54451	0.50284	0.71577	0.58702	0.69540	
Signed Ranked		0.00008	0.02077	0.09489	0.14583	0.42706	0.37460	0.46666	0.16163	0.64926	0.01033	0.01703	0.08526	0.07801	0.05141	0.09033	0.18625	0.04986	0.03081	0.08096	0.12881	0.34052	0.32493	0.17106	0.16506	0.28546	0.22424	0.35608	0.15365	0.63592	
60 mins With Transaction cost																															
Year	Strategy	1 10	2 10	3 10	4 10	5 10	6 10	7 10	8 10	9 10	1 15	2 15	3 15	4 15	5 15	6 15	7 15	8 15	9 15	1 20	2 20	3 20	4 20	5 20	6 20	7 20	8 20	9 20	1 25	2 25	
2008																															
Profit(%)		-0.01189	-0.00663	-0.00623	-0.00581	-0.00584	-0.00562	-0.00555	-0.00671	-0.00864	-0.01030	-0.00611	-0.00466	-0.00471	-0.00501	-0.00460	-0.00380	-0.00469	-0.00474	-0.00746	-0.00402	-0.00386	-0.00392	-0.00400	-0.00413	-0.00318	-0.00242	-0.00185	-0.00262	-0.00366	
T Stats		0.00000	0.00000	0.00000	0.00001	0.00001	0.00001	0.00002	0.00000	0.00000	0.00000	0.00000	0.00032	0.00025	0.00010	0.00032	0.00281	0.00024	0.00019	0.00000	0.00201	0.00268	0.00221	0.00169	0.00119	0.01234	0.05568	0.14342	0.00000	0.00472	
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00001	0.00014	0.00000	0.00000	0.00000	0.00055	0.00014	0.00009	0.00006	0.00025	0.00350	0.01397	0.03328	0.00005	0.00123
2009																															
Profit(%)		-0.01149	-0.00852	-0.00768	-0.00714	-0.00659	-0.00601	-0.00685	-0.00745	-0.00989	-0.00922	-0.00740	-0.00694	-0.00626	-0.00587	-0.00514	-0.00471	-0.00487	-0.00540	-0.00797	-0.00583	-0.00398	-0.00397	-0.00436	-0.00438	-0.00416	-0.00434	-0.00448	-0.00646	-0.00394	
T Stats		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00024	0.00023	0.00005	0.00004	0.00010	0.00005	0.00003	0.00000	0.00031
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000	0.00001	0.00082	0.00053	0.00019	0.00010	0.00018	0.00003	0.00002	0.00001	0.00139	
2010																															
Profit(%)		-0.00989	-0.00754	-0.00601	-0.00540	-0.00451	-0.00547	-0.00600	-0.00773	-0.00908	-0.00638	-0.00552	-0.00338	-0.00360	-0.00344	-0.00415	-0.00427	-0.00451	-0.00458	-0.00500	-0.00468	-0.00366	-0.00279	-0.00280	-0.00283	-0.00257	-0.00311	-0.00270	-0.00467	-0.00330	
T Stats		0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00051	0.00087	0.00006	0.00003	0.00001	0.00001	0.00000	0.00000	0.00001	0.00042	0.00675	0.00635	0.00571	0.01180	0.00228	0.00784	0.00002	0.00160	
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00001	0.00012	0.00009	0.00014	0.00020	0.00002	0.00006	0.00003	0.00060	
ALL																															
Profit(%)		-0.01110	-0.00766	-0.00671	-0.00617	-0.00569	-0.00576	-0.00619	-0.00735	-0.00926	-0.00865	-0.00635	-0.00502	-0.00488	-0.00476	-0.00460	-0.00427	-0.00468	-0.00488	-0.00684	-0.00488	-0.00387	-0.00360	-0.00372	-0.00376	-0.00328	-0.00329	-0.00302	-0.00580	-0.00366	
T Stats		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Signed Ranked		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

3_25	4_25	5_25	6_25	7_25	8_25	9_25	1_30	2_30	3_30	4_30	5_30	6_30	7_30	8_30	9_30	1_50	2_50	3_50	4_50	5_50	6_50	7_50	8_50	9_50	1_100	2_100	3_100	4_100	5_100	6_100	7_100	8_100	9_100		
-0.00281	-0.00343	-0.00302	-0.00284	-0.00160	-0.00099	-0.00056	-0.00638	-0.00389	-0.00260	-0.00273	-0.00270	-0.00282	-0.00196	-0.00076	-0.00103	-0.00457	-0.00263	-0.00180	-0.00122	-0.00072	-0.00028	0.00002	0.00003	0.00029	-0.00174	-0.00121	-0.00034	-0.00014	0.00018	0.00010	-0.00016	-0.00023	0.00003		
0.02825	0.00733	0.01766	0.02536	0.20646	0.43046	0.65778	0.00000	0.00261	0.04244	0.03249	0.03413	0.02667	0.12234	0.54573	0.41439	0.00053	0.04159	0.16030	0.33875	0.57118	0.82226	0.98469	0.98039	0.81953	0.18465	0.34685	0.79192	0.91250	0.89009	0.93619	0.90080	0.85451	0.98232		
0.00676	0.00195	0.00335	0.00564	0.08347	0.25101	0.48733	0.00003	0.00037	0.00677	0.00628	0.00641	0.00722	0.02827	0.23827	0.14155	0.01121	0.03569	0.11597	0.16365	0.35963	0.58722	0.86732	0.84332	0.97660	0.70503	0.63987	0.96225	0.99026	0.79640	0.86611	0.95514	0.95572	0.87123		
-0.00366	-0.00414	-0.00348	-0.00320	-0.00262	-0.00292	-0.00302	-0.00569	-0.00404	-0.00362	-0.00305	-0.00283	-0.00254	-0.00290	-0.00320	-0.00290	-0.00387	-0.00338	-0.00336	-0.00298	-0.00269	-0.00277	-0.00282	-0.00254	-0.00238	-0.00199	-0.00145	-0.00136	-0.00150	-0.00158	-0.00147	-0.00124	-0.00118	-0.00118		
0.00072	0.00012	0.00111	0.00267	0.01332	0.00596	0.00444	0.00000	0.00021	0.00078	0.00438	0.00781	0.01664	0.00642	0.00256	0.00618	0.00046	0.00178	0.00169	0.00513	0.01115	0.00894	0.00758	0.01631	0.02418	0.06566	0.17433	0.20027	0.15641	0.13319	0.16310	0.23760	0.26242	0.25957		
0.00212	0.00015	0.00101	0.00232	0.00694	0.00369	0.00211	0.00017	0.00035	0.00044	0.00165	0.00323	0.00848	0.00344	0.00214	0.00234	0.01326	0.00959	0.00475	0.01134	0.02413	0.01707	0.01645	0.02137	0.02199	0.30032	0.29848	0.24347	0.14264	0.11992	0.15180	0.17383	0.19723	0.17742		
-0.00223	-0.00160	-0.00159	-0.00251	-0.00232	-0.00212	-0.00223	-0.00379	-0.00249	-0.00177	-0.00136	-0.00150	-0.00185	-0.00174	-0.00206	-0.00193	-0.00278	-0.00115	-0.00059	-0.00060	-0.00027	0.00018	-0.00034	-0.00021	0.00009	-0.00081	-0.00028	-0.00006	-0.00018	-0.00021	-0.00058	-0.00070	-0.00074	-0.00108		
0.03051	0.11757	0.11961	0.01432	0.02268	0.03685	0.02783	0.00040	0.01653	0.08461	0.18305	0.14108	0.06869	0.08667	0.04282	0.05709	0.00834	0.26379	0.56258	0.55792	0.79255	0.86076	0.73308	0.83857	0.92694	0.43072	0.78240	0.95611	0.85615	0.83453	0.56436	0.48808	0.46002	0.28200		
0.00224	0.01114	0.01208	0.00173	0.00124	0.00205	0.00258	0.00032	0.00190	0.01347	0.02964	0.01521	0.00653	0.01164	0.00559	0.00543	0.01433	0.09885	0.14290	0.13133	0.20782	0.33795	0.15798	0.25314	0.33210	0.23005	0.25082	0.30662	0.27236	0.31725	0.15327	0.16967	0.14235	0.07009		
-0.00294	-0.00306	-0.00270	-0.00285	-0.00219	-0.00203	-0.00195	-0.00529	-0.00349	-0.00268	-0.00237	-0.00233	-0.00238	-0.00218	-0.00200	-0.00197	-0.00371	-0.00237	-0.00190	-0.00160	-0.00121	-0.00096	-0.00104	-0.00090	-0.00067	-0.00152	-0.00097	-0.00059	-0.00063	-0.00057	-0.00066	-0.00071	-0.00073	-0.00076		
0.00001	0.00000	0.00003	0.00001	0.00064	0.00155	0.00230	0.00000	0.00000	0.00004	0.00023	0.00030	0.00021	0.00069	0.00177	0.00214	0.00000	0.00027	0.00328	0.01293	0.05842	0.13390	0.10299	0.16060	0.29619	0.02065	0.13278	0.36155	0.32706	0.37620	0.29855	0.26579	0.25398	0.23310		
0.00000	0.00000	0.00000	0.00000	0.00001	0.00003	0.00008	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00006	0.00003	0.00002	0.00026	0.00081	0.00182	0.01179	0.02612	0.02405	0.03910	0.06583	0.13376	0.13271	0.20905	0.14273	0.18518	0.12655	0.12697	0.10925	0.08824

Appendix 2

TABLE 7																				
10 min																				
Without Transaction cost																				
Year \ Strategy	5.00000	10.00000	15.00000	20.00000	25.00000	30.00000	35.00000	40.00000	45.00000	50.00000	55.00000	60.00000	65.00000	70.00000	75.00000	80.00000	85.00000	90.00000	95.00000	100.00000
ALL																				
Profit(%)	-0.00031	-0.00024	-0.00029	-0.00024	-0.00027	-0.00029	-0.00026	-0.00027	-0.00022	-0.00020	-0.00023	-0.00023	-0.00019	-0.00015	-0.00014	-0.00015	-0.00015	-0.00013	-0.00011	-0.00009
T Stats (Pr > t)	0.00495	0.03076	0.00966	0.03179	0.01301	0.00867	0.01746	0.01638	0.05016	0.06899	0.04036	0.04022	0.07893	0.17855	0.19276	0.17895	0.16648	0.23811	0.33252	0.40448
Red Ranked (Pr >= t)	0.00000	0.00001	0.00001	0.00023	0.00021	0.00050	0.00390	0.00308	0.00507	0.00835	0.00685	0.00691	0.02378	0.08017	0.10230	0.13049	0.11138	0.21034	0.39794	0.47508
10 min																				
With Transaction cost																				
Year \ Strategy	5.00000	10.00000	15.00000	20.00000	25.00000	30.00000	35.00000	40.00000	45.00000	50.00000	55.00000	60.00000	65.00000	70.00000	75.00000	80.00000	85.00000	90.00000	95.00000	100.00000
ALL																				
Profit(%)	-0.00304	-0.00185	-0.00148	-0.00120	-0.00108	-0.00099	-0.00087	-0.00081	-0.00070	-0.00064	-0.00064	-0.00061	-0.00055	-0.00047	-0.00045	-0.00043	-0.00015	-0.00013	-0.00011	-0.00009
T Stats (Pr > t)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00003	0.00008	0.00012	0.16648	0.23811	0.33252	0.40448
Red Ranked (Pr >= t)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00008	0.00010	0.00024	0.00065	0.00063	0.00084	0.00467	0.02279	0.03335	0.04597	0.11138	0.21034	0.39794	0.47508
TABLE 8																				
15 min																				
Without Transaction cost																				
Year \ Strategy	5.00000	10.00000	15.00000	20.00000	25.00000	30.00000	35.00000	40.00000	45.00000	50.00000	55.00000	60.00000	65.00000	70.00000	75.00000	80.00000	85.00000	90.00000	95.00000	100.00000
ALL																				
Profit(%)	-0.00036	-0.00030	-0.00047	-0.00040	-0.00021	-0.00015	-0.00012	-0.00016	-0.00019	-0.00020	-0.00024	-0.00019	-0.00018	-0.00018	-0.00017	-0.00012	-0.00012	-0.00011	-0.00009	-0.00013
T Stats (Pr > t)	0.02838	0.06530	0.00457	0.01656	0.19349	0.37576	0.47507	0.34725	0.24070	0.21851	0.14875	0.23958	0.27970	0.27479	0.30135	0.46306	0.47128	0.52193	0.59415	0.42113
Red Ranked (Pr >= t)	0.00000	0.00008	0.00003	0.00120	0.03952	0.02418	0.05037	0.10332	0.09598	0.07668	0.06399	0.13205	0.16203	0.14138	0.17497	0.28645	0.40151	0.55295	0.57580	0.39178
15 min																				
With Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00380	-0.00227	-0.00193	-0.00153	-0.00113	-0.00093	-0.00080	-0.00076	-0.00073	-0.00069	-0.00069	-0.00060	-0.00056	-0.00053	-0.00050	-0.00043	-0.00041	-0.00039	-0.00035	-0.00039
T Stats (Pr > t)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00002	0.00005	0.00005	0.00038	0.00099	0.00160	0.00293	0.00988	0.01369	0.02142	0.03493	0.01915
Red Ranked (Pr >= t)	0.00000	0.00000	0.00000	0.00000	0.00069	0.00062	0.00290	0.01249	0.01453	0.01365	0.01347	0.04077	0.05776	0.05539	0.07762	0.14902	0.23513	0.35883	0.39265	0.24288
TABLE 9																				
30 min																				
Without Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00081	-0.00058	-0.00065	-0.00081	-0.00049	-0.00050	-0.00035	-0.00043	-0.00041	-0.00024	-0.00026	-0.00042	-0.00028	-0.00005	-0.00003	-0.00007	-0.00004	-0.00003	-0.00009	-0.00011
T Stats (Pr > t)	0.01274	0.07786	0.04577	0.01298	0.13633	0.12868	0.28835	0.19265	0.20949	0.47277	0.43185	0.19601	0.39656	0.87740	0.93234	0.83488	0.90707	0.92375	0.79291	0.73541
Red Ranked (Pr >= t)	0.00000	0.00027	0.00090	0.00008	0.00461	0.02861	0.16885	0.13013	0.26181	0.59493	0.57357	0.27599	0.64620	0.97301	0.90479	0.73316	0.94071	0.83985	0.77260	0.71130

30 min																				
With Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00514	-0.00300	-0.00233	-0.00215	-0.00154	-0.00139	-0.00112	-0.00112	-0.00103	-0.00078	-0.00076	-0.00091	-0.00072	-0.00045	-0.00040	-0.00043	-0.00037	-0.00034	-0.00039	-0.00039
T Stats (Pr > t)	0.00000	0.00000	0.00000	0.00000	0.00001	0.00004	0.00085	0.00084	0.00208	0.02020	0.02310	0.00631	0.03137	0.17685	0.22577	0.19853	0.26830	0.29902	0.24463	0.23387
ned Ranked (Pr >= t)	0.00000	0.00000	0.00000	0.00000	0.00010	0.00204	0.03188	0.03210	0.09878	0.32062	0.32381	0.12642	0.40022	0.76086	0.64668	0.50779	0.71966	0.63977	0.58900	0.53371
TABLE 10																				
60 min																				
Without Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00113	-0.00107	-0.00044	-0.00017	-0.00006	-0.00006	-0.00024	0.00000	0.00004	0.00013	0.00013	0.00026	0.00035	0.00037	0.00041	0.00068	0.00049	0.00046	0.00037	0.00020
T Stats (Pr > t)	0.07773	0.09388	0.48919	0.79076	0.92757	0.92905	0.70851	0.99385	0.94865	0.83817	0.83948	0.68603	0.58716	0.56951	0.52207	0.28763	0.44914	0.47040	0.56732	0.75686
ned Ranked (Pr >= t)	0.00174	0.00370	0.10773	0.24786	0.64657	0.51852	0.65161	0.56186	0.63244	0.53809	0.54370	0.87589	0.94417	0.98050	0.97869	0.72348	0.84901	0.71911	0.73997	0.77142
TABLE 11																				
60 min																				
With Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00606	-0.00371	-0.00227	-0.00157	-0.00115	-0.00100	-0.00106	-0.00070	-0.00058	-0.00043	-0.00039	-0.00021	-0.00008	-0.00004	0.00003	0.00035	0.00017	0.00016	0.00008	-0.00008
T Stats (Pr > t)	0.00000	0.00000	0.00063	0.01742	0.07984	0.12679	0.10658	0.28459	0.37192	0.51064	0.55225	0.74818	0.90607	0.94599	0.95820	0.59318	0.79894	0.80028	0.90430	0.90144
ned Ranked (Pr >= t)	0.00000	0.00000	0.00472	0.03732	0.25622	0.22318	0.36701	0.31709	0.39678	0.33450	0.35543	0.65851	0.85736	0.79712	0.80147	0.89015	0.98505	0.85142	0.85406	0.87883
TABLE 11																				
day																				
Without Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00292	0.00621	-0.00103	0.00196	-0.00091	-0.00091	-0.00091	-0.00091	-0.00091	-0.00091	-0.00091	-0.00091	-0.00091	-0.00477	-0.00477	-0.00477	-0.00477	-0.00477	-0.00477	-0.00477
T Stats (Pr > t)	0.63319	0.30947	0.86605	0.75479	0.88485	0.88485	0.88485	0.88485	0.88485	0.88485	0.88485	0.88485	0.88485	0.44742	0.44742	0.44742	0.44742	0.44742	0.44742	0.44742
ned Ranked (Pr >= t)	0.57242	0.22549	0.92900	0.27538	0.43665	0.43665	0.43665	0.43665	0.43665	0.43665	0.43665	0.43665	0.43665	0.72549	0.72549	0.72549	0.72549	0.72549	0.72549	0.72549
TABLE 11																				
day																				
With Transaction cost																				
Year \ Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALL																				
Profit(%)	-0.00319	0.00599	-0.00115	0.00187	-0.00100	-0.00100	-0.00100	-0.00100	-0.00100	-0.00100	-0.00100	-0.00100	-0.00100	-0.00486	-0.00486	-0.00486	-0.00486	-0.00486	-0.00486	-0.00486
T Stats (Pr > t)	0.60196	0.32720	0.85028	0.76559	0.87380	0.87380	0.87380	0.87380	0.87380	0.87380	0.87380	0.87380	0.87380	0.43923	0.43923	0.43923	0.43923	0.43923	0.43923	0.43923
ned Ranked (Pr >= t)	0.55830	0.23363	0.94112	0.27836	0.44028	0.44028	0.44028	0.44028	0.44028	0.44028	0.44028	0.44028	0.44028	0.71953	0.71953	0.71953	0.71953	0.71953	0.71953	0.71953

TABLE 13

15 mins																														
ALL																														
Profit of Long	-0.000102398	-0.000289504	-0.000386515	-0.000391357	-0.000253514	-0.000227788	-0.000143521	-0.000242893	-0.000240378	-0.000305416	-6.56776e-05	-0.000246144	-0.000306017	-0.000262737	-0.000298907	-0.000395037	-0.000442446	-0.000395816	-0.000240146	-2.35595e-05	-0.000218705	-0.000184833	-0.000166407	-0.000256146	-0.000287325	-0.000193979	-0.000162384	-0.000239431	-0.000275471	-0.000300308
T*Stats	0.654638702	0.204660724	0.089767153	0.146104262	0.264236999	0.318817959	0.530757259	0.286925823	0.293272531	0.186294512	0.177892599	0.283133004	0.181343655	0.249471111	0.191499146	0.126773674	0.056053549	0.087951477	0.298804086	0.911793908	0.340823027	0.420289746	0.471540876	0.20420683	0.217003043	0.638494115	0.488004096	0.300769971	0.212080548	0.152803189
Signed Ranked	0.001498202	2.27693e-05	-0.000295959	0.000590938	0.001106309	0.003748653	-0.005859367	0.003753244	0.022588397	0.000136376	0.001516811	0.000437389	0.000164854	0.000170789	0.000516217	0.000886316	0.000404645	0.000968936	4.98089e-05	-0.000897079	0.000164885	0.000305216	0.006208411	0.003550254	0.005872009	0.030044103	0.000757409	0.000113345	0.000538383	
Profit of Short	-4.97297e-05	-5.78006e-05	-0.000241426	-0.000283403	4.01541e-06	-1.93995e-05	-8.95873e-05	1.34416e-06	-7.82288e-05	0.00047764	-0.000143688	-0.000129254	-8.45288e-05	-0.000312038	-0.000388916	-4.3598e-05	-0.000109476	-0.000278142	0.00040013	-0.000136639	-7.78208e-05	-4.83905e-05	-3.61267e-05	9.93124e-06	0.000135791	1.2808e-05	6.78765e-05	-6.81535e-05	-5.91325e-05	0.00019674
T*Stats	0.62645403	0.799385239	0.289670952	0.21328316	0.98989005	0.91959148	0.60280429	0.995288159	0.738090324	0.510793818	0.525212387	0.568160383	0.709412952	0.170925333	0.086564821	0.84759154	0.625444689	0.2142008	0.52936188	0.547515016	0.712011613	0.830795962	0.872300308	0.964576436	0.542999478	0.954232001	0.995597552	0.761467575	0.793373088	0.626015758
Signed Ranked	0.051997005	0.093512595	0.029551563	0.023691919	0.288784873	0.237512182	0.511324576	0.978270248	0.937719735	0.230384884	0.02962413	0.043292298	0.245534242	0.078531918	0.067811031	0.592190018	0.503836325	0.14897028	0.492749327	0.145140913	0.113728603	0.254708617	0.344838503	0.434746675	0.821397379	0.622555329	0.821397379	0.622555329	0.791741006	0.791741006
No. of long	6782	5237	4631	4412	4294	4397	4726	5396	7128	5438	4106	3483	3169	2996	2914	2872	2900	2948	4694	3474	2932	2614	2437	2219	2237	2195	2168	4189	3078	2555
No. of short	6783	5237	4631	4412	4294	4398	4725	5395	7128	5438	4106	3483	3169	2995	2913	2871	2899	2947	4694	3474	2932	2614	2437	2218	2236	2194	2167	4189	3079	2555
total no of days (long)	37228	37091	36944	36985	37125	36947	36964	36990	36791	36889	36807	36803	36801	36793	36799	36789	36698	36768	36700	36759	36710	36664	36605	36593	36599	36593	36644	36538	36601	36601
total no of days (short)	37515	37652	37799	37758	37618	37796	37779	37652	37854	37996	37938	37943	37972	37950	38004	38045	37944	37975	38043	37984	38033	38079	38138	38079	38150	38168	38098	38184	38141	38141
average no of days (long)	5.48842695	7.082489975	7.977542664	8.382819583	8.645784816	8.402774619	7.821413457	6.855077835	5.203563421	7.635560132	8.964198734	10.56703991	11.61249609	12.3674232	12.62626689	12.79213069	12.65482776	12.48077004	7.835607679	10.58376511	12.51703252	14.06235654	15.06360279	15.816206304	16.36343317	16.67107062	16.87038745	8.746752476	11.8733355	14.32534462
average no of days (short)	5.530738611	7.188612373	8.162167988	8.538027985	8.765968181	8.599306321	6.97775718	5.282761716	6.961015079	9.289162202	10.89234154	11.97317766	12.64507513	13.07280636	13.27319958	13.2349036	12.67546658	8.10160608	10.93120322	12.9753023	14.5398699	15.60648338	16.42752378	17.0563050	17.38833181	17.61329028	9.094772021	12.40142904	14.92784834	
2008																														
Profit of Long	0.000402129	0.00021515	-0.000180877	-0.000193004	9.72169e-05	6.35563e-05	0.000290591	0.000166323	-0.000213882	0.00049271	0.000227	1.62618e-05	0.000223083	0.000232344	0.000202929	0.000117961	-0.000254531	-0.000213864	-0.000140525	0.000330773	-0.000139967	7.41983e-05	0.000219862	-0.000273233	-3.14857e-05	8.81014e-05	-5.57397e-05	-0.000231351	-0.000103639	-0.000188121
T*Stats	0.370237748	0.631977298	0.688535258	0.666891072	0.826907788	0.887168322	0.51885291	0.707939803	0.741939838	0.613925591	0.971099915	0.623789653	0.59451249	0.655588368	0.794838037	0.576997202	0.560854985	0.756101621	0.459035669	0.750502509	0.868724771	0.628511357	0.530207376	0.945385386	0.984748028	0.938088036	0.606790606	0.816478958	0.658956789	
Signed Ranked	0.68423922	0.789309774	0.26294971	0.28112677	0.5602087	0.519744031	0.761598965	0.547735232	0.29562628	0.78516498	0.627803574	0.520318706	0.71564482	0.971956015	0.911007366	0.862292129	0.44686321	0.38531343	0.134524579	0.431871427	0.601615023	0.418440084	0.923672974	0.490311301	0.743270788	0.682717089	0.634194597	0.158803119	0.388128953	0.33914962
Profit of Short	-0.000449847	-0.000182398	-0.000558872	-0.000570993	-1.93448e-05	-0.000146464	-0.0004891315	-0.00048717	0.00047495	0.00011873	3.46266e-05	-0.000397399	-0.000505328	-0.000086827	-0.000124842	-0.000342311	-0.000163574	-0.000221884	0.000375551	3.80291e-05	-8.20377e-05	-0.000433847	4.9604e-05	0.000289927	0.000155958	9.25103e-06	-0.105342e-05	-3.93433e-05	7.72131e-05	
T*Stats	0.32907632	0.688083578	0.149006608	0.264295162	0.963770448	0.750872253	0.278277696	0.307661287	0.747531699	0.805545022	0.599635346	0.832363259	0.26707126	0.078032256	0.01338617	0.44899409	0.719656001	0.67147668	0.40086447	0.933668828	0.856684173	0.340279707	0.494531428	0.911626467	0.514498822	0.719015886	0.983394199	0.981588867	0.931452984	0.864915007
Signed Ranked	0.016807523	0.118863676	0.053483507	0.080254395	0.435294465	0.193135955	0.051306494	0.205205141	0.539814206	0.21491695	0.209450202	0.078670748	0.061154776	0.029435336	0.00212528	0.129032127	0.456990201	0.333114181	0.81083346	0.47584457	0.280342634	0.059406164	0.101656997	0.387436986	0.959782936	0.491922554	0.322016447	0.234386018	0.452716774	0.538010543
No. of long	1224	1683	1507	1416	1367	1396	1511	1745	2296	1779	1343	1133	1031	975	940	924	999	954	1543	1125	995	799	746	725	715	707	1366	999	821	
No. of short	2214	1693	1507	1416	1366	1395	1510	1742	2296	1779	1343	1133	1030	974	939	923	998	953	1543	1125	995	799	746	725	715	707	1366	999	821	
total no of days (long)	11945	11838	11782	11853	11878	11862	11848	11887	11878	11791	11731	11789	11783	11818	11775	11755	11812	11789	11790	11768	11769	11684	11672	11688	11612	11820	11820	11820	11820	11820
total no of days (short)	11959	12066	12122	12122	12026	12042	12056	12017	12026	12106	12168	12110	12146	12081	12124	12168	12188	12144	12082	12105	12104	12102	12125	12185	12120	12222	12001	12077	12069	
average no of days (long)	5.395212285	7.03868903	7.818181818	8.370762712	8.689100219	8.497134671	7.841164792	6.818950832	5.173349448	6.629050569	8.734921817	10.405191915	11.39961203	12.12102564	12.56295174	12.69480519	12.47177849	12.32180294	7.65521711	10.47911111	12.29405631	13.79181287	14.86254729	15.7613941	16.1504483	16.34125874	16.50919378	8.702781845	11.83282382	14.39707674
average no of days (short)	5.401325682	7.168944063	8.04379562	8.51099322	8.80386735	8.632258065	6.98410596	6.898392652	5.237804878	6.804946599	9.060312733	10.68843778	11.79323301	12.40349076	12.61180809	13.18418202	12.99360341	12.74297171	7.830200907	10.76	12.61480771	14.15438596	15.26860295	16.25355121	16.80886655	17.07692308	17.28712871	8.785505124	12.08908099	14.7035641
2009																														
Profit of Long	-0.000209457	-0.000506026	-0.000240005	-8.31189e-05	-0.000188317	-0.000130223	-5.01084e-05	-0.000360488	-0.000210752	-0.000482027	-9.98988e-05	4.91804e-05	-0.000283564	-0.000243428	-0.000487441	-0.000487073	-0.000501769	-0.000460954	-0.000107288	-3.98204e-05	-0.000168779	-0.000154547	1.0234e-05	-2.30634e-05	-0.000377335	-0.00026764	-0.000199512	4.5512e-05	-0.00047225	-0.000198803
T*Stats	0.574881178	0.170586947	0.580963148	0.821388033	0.769072268	0.725446125	0.892736798	0.33004722	0.563210684	0.199258643	0.78841202	0.894256917	0.440958526	0.508802333	0.18912666	0.189803598	0.176293997	0.20109769	0.774271282	0.914243016	0.727671749	0.675759478	0.978002428	0.950606468	0.311609122	0.73164145	0.952880289	0.904060922	0.353681818	0.596388756
Signed Ranked	0.01574208	0.02231222	0.101628302	0.160393149	0.11058282	0.165490498	0.224230683	0.050945812	0.29953693	0.00774075	0.03404652	0.132871141	0.054645609	0.09441474	0.01405636	0.01877205	0.00832359	0.01233196	0.02286917	0.04503974	0.11579313	0.142070616	0.208800029	0.140844802	0.04835615	0.088800329	0.157755358	0.057010979	0.01749895	0.108099935
Profit of Short	2.29985e-05	-0.000314955	-0.000380881	-0.000477043	-0.000366224	-0.000284225	-0.000106654	0.00043265	-0.000340869	-0.000412794	4.06328e-05	-0.000100802	-0.000106886	-6.04072e-05	-0.000295556	-0.000510208	-0.000261232	-0.000331059	-8.82469e-05	4.3588e-05	-0.00011388	-0.000201057	-8.78721e							

0.000581421	-0.00055556	-0.00079015	-0.000220725	4.23994-e-05	0.000146016	-0.000715272	-0.000659325	2.76516E-05	-0.00042592	-0.000446739	-0.000481851	-0.000103988	-4.66014E-05	-0.00056159	-0.00027491	-5.24659E-05	-0.000127022	0.000112922	0.000582819	-0.000234238	0.000351498	0.000380885	0.000520769	-0.000336729	0.000351198	0.000572917	0.000198804	-0.000300562	-0.000299078	-0.000317363	-0.000327291	-0.00016587	
0.529987636	0.547097612	0.386899569	0.81053147	0.964859999	0.874950695	0.444626712	0.482512338	0.976544471	0.621427784	0.632187088	0.605714294	0.904702941	0.959803587	0.865731007	0.774543388	0.94853308	0.895152688	0.906488131	0.596517245	0.801707997	0.713891509	0.744683757	0.765865247	0.736561356	0.726474505	0.565039666	0.842342337	0.764871422	-0.765189853	-0.705182338	0.744420015	0.907544214	
0.361767075	0.266100299	0.208026436	0.562484441	0.773700701	0.848774013	0.133030564	0.15232817	0.698873157	0.454228029	0.357940854	0.364449580	0.522614685	0.57441795	0.595026261	0.407565293	0.85855032	0.555411234	0.79102858	0.790618358	0.873666018	0.956686206	0.905750833	0.946262626	0.828511787	0.962802029	0.716658383	0.896656682	0.660526009	0.65795516	0.709482354	0.612789043	0.776203588	
0.000276349	0.000574465	0.000936839	0.00077568	0.000734168	0.000546254	6.52437E-05	0.000704844	0.000630996	0.000997599	0.000711115	0.00029701	0.00025298	8.6201E-05	-9.9304E-05	0.00040888	0.000592147	0.000522879	0.000635705	0.000973881	0.000576249	0.000741341	0.000919324	0.000962338	0.000826577	0.000825105	0.000918086	0.001158021	0.0008939	0.000724481	0.000567839	0.00039147		
0.748480077	0.505629534	0.723183878	0.370558134	0.394168973	0.525385184	0.939207223	0.407833036	0.47368997	0.242064002	0.406249994	0.728643025	0.852976418	0.769992314	0.920688403	0.629550642	0.62670999	0.480787804	0.520053266	0.446767629	0.245294652	0.482218806	0.378482527	0.238707819	0.2378175	0.310583144	0.312114519	0.259195177	0.152717631	0.268980561	0.371594576	0.683712575	0.703018867	
0.98451425	0.786128662	0.97063887	0.606793029	0.617863199	0.605018155	0.700193787	0.968057109	0.889163878	0.699137287	0.788547578	0.97036265	0.932074256	0.961914221	0.802801127	0.884431343	0.881766251	0.72196262	0.801737991	0.650037356	0.932218062	0.596309974	0.401814031	0.384818319	0.354730883	0.406495752	0.574812359	0.591359767	0.286248109	0.489721102	0.576238087	0.626786072	0.991675865	
559	515	494	467	448	433	935	667	566	504	468	420	414	398	391	669	481	408	363	336	299	284	270	254	411	297	245	230	203	194	183	169	165	
550	515	494	467	448	433	935	667	566	505	468	434	415	397	391	668	480	405	362	335	299	284	270	253	411	297	243	230	203	194	183	169	165	
8876	8881	8881	8905	8897	8905	8782	8804	8784	8773	8782	8806	8800	8825	8827	8534	8547	8525	8517	8523	8519	8517	8508	8503	8195	8195	8105	8192	8175	8165	8166	8164	8155	8159
9889	9886	9886	9989	9958	9897	9978	9989	9958	9962	9923	9935	10218	10195	10217	10225	10219	10225	10234	10234	10234	10234	10497	10507	10507	10507	10507	10507	10507	10507	10531	10526	10531	10533
16.14181818	17.24466019	17.97773279	19.07780779	19.81514477	20.56581986	9.30251389	13.1940003	15.51943463	17.40674603	18.76495726	20.33718245	21.25603865	22.2853554	22.5754457	12.75635277	17.7692707	20.9753695	23.46280992	25.36607143	28.47517591	29.9843662	31.51111111	33.4783795	19.890767	27.55882256	33.71199416	35.54347826	40.21182266	42.09278351	44.51202186	48.25443781	49.44848485	
17.98	19.1961165	20.01214575	21.10920771	21.98218263	22.7598152	10.67379679	14.90718566	17.5978836	19.78019802	21.2793117	22.94009217	24.00843928	25.0302671	25.40920716	15.28143713	21.2398333	25.22716049	28.24585638	30.50447761	34.21070234	36.00352113	37.9037037	40.47035573	25.54014599	35.37704398	43.20987654	45.7280896	51.86699507	54.2731364	57.53005464	62.34911243	63.83636364	
0.000675461	0.000234627	0.000283159	0.00102831	0.00235368	0.00299502	-8.6093E-05	-1.61856E-05	0.001647793	0.000186039	-6.60379E-05	-0.000320968	0.001198336	0.002187325	0.00287376	0.000849391	0.000240975	0.000765184	0.000162804	0.001847438	0.001068921	0.000265655	0.000202954	0.000216478	0.000313542	0.000150748	0.0001978364	0.001554687	0.001233111	0.000209465	0.000914612	0.000879602	0.00023906	
0.69652252	0.851492317	0.86939954	0.559241764	0.179591356	0.08562648	0.96040357	0.995862654	0.34870476	0.915028862	0.969821233	0.854117974	0.4851127	0.201475427	0.094667428	0.626522294	0.89231619	0.665751524	0.58488328	0.28855029	0.21492975	0.344992928	0.242901758	0.205474425	0.435782626	0.388315877	0.261401569	0.376558127	0.492978548	0.542869115	0.616931998	0.627956058	0.53684865	
0.716369166	0.808221606	0.972672579	0.569213679	0.093264931	0.058745831	0.83696083	0.94390884	0.76901474	0.685117638	0.887219115	0.712404463	0.137443423	0.721730909	0.67572461	0.632123293	0.542203107	0.184102089	0.228095975	0.286867358	0.197426257	0.142649673	0.22711224	0.26116322	0.11136639	0.178939493	0.203887461	0.266473328	0.292199116	0.311098155	0.260127322			
-0.001203648	-0.000549125	-0.000767970	0.000882993	0.000607307	0.000593129	-0.001731456	-7.49537E-05	-0.000418918	0.002783E-06	5.78295E-05	-0.000309562	-0.000834684	0.000803008	-0.000461782	-0.000278214	0.000152302	0.000293991	0.000599385	0.000606305	0.000966561	0.00147233	0.000102459	0.001123807	-0.00011322	-0.000488884	0.010394E-05	0.000866275	0.001183305	0.001044134	0.00071228	0.000499118	0.00075188	
0.502012853	0.7597441	0.834999811	0.585391802	0.724650108	0.740673845	0.341531277	0.96594467	0.81471725	0.98665806	0.966219791	0.862399493	0.832170493	0.69912067	0.78076175	0.25180774	0.9312219	0.866128919	0.78662121	0.723861781	0.58262615	0.480770111	0.569936936	0.49910762	0.950611189	0.789393788	0.96458987	0.73904767	0.504780584	0.556732561	0.705633363	0.777601113	0.670857267	
0.494895734	0.488821639	0.64199825	0.629804249	0.872963957	0.650451308	0.251578409	0.366641951	0.529578686	0.573702224	0.688029497	0.797222024	0.728183574	0.63076654	0.325819837	0.626709841	0.985349886	0.994026251	0.991768591	0.967134242	0.645026257	0.5752221178	0.998403097	0.889605654	0.688011768	0.757436954	0.919881798	0.998403097	0.889605654	0.688011768	0.757436954	0.919881798	0.998403097	
191	176	169	157	157	143	330	232	193	170	163	151	142	136	135	236	170	144	123	118	102	93	90	85	140	101	80	72	61	57	56	54	51	
199	175	168	156	148	142	329	232	193	170	161	151	142	136	134	235	169	138	122	117	101	92	90	85	140	102	81	73	62	58	57	55	52	
2999	2997	3003	3022	3023	3024	2969	2985	2980	2978	2961	2990	2984	3001	3003	2999	2934	2936	2938	2928	2938	2935	2942	2938	2931	2932	2927	2919	2916	2916	2916	2925	2925	
3038	3040	3034	3015	3014	3003	3063	3042	3052	3054	3054	3042	3048	3021	3029	3083	3078	3076	3074	3084	3074	3077	3071	3074	3071	3074	3071	3074	3071	3074	3071	3074	3071	3074
15.70157068	17.02849009	17.76927079	19.24804706	21.15333333	21.21678322	9.96696967	12.86673971	15.44041451	17.51764706	18.28834356	19.8013245	21.10408451	22.13976588	22.24444444	12.41101695	17.25682325	20.9714627	23.8899187	24.89830508	26.75088233	31.59139785	32.61111111	34.61176471	20.98571429	29.01980198	36.65	40.6277728	47.85243948	51.15789474	54.47142857	56.3043104	57.35294118	
15.98947397	17.12740289	18.05925261	19.26929308	20.81478792	21.14788792	10.14870359	13.13626069	15.8134715	17.7179141	20.14679536	21.46478394	22.71329529	22.60447787	13.11974984	18.21301715	22.1295647	25.71314167	26.27504027	30.54659823	34.14130448	34.18888888	36.11764706	21.6	29.71568627	37.4074071	43.57534249	49.08846516	52.51724138	53.48895649	55.38181818	58.40384615		
-0.002701829	-0.001914282	-0.001476665	-0.000698947	-0.001437663	-0.001406116	-0.001132323	-0.000102114	-0.001645832	-0.001599155	-0.001182473	-0.000289939	-0.000122369	-0.001712344	-0.0002124978	-0.000103585	-0.000162322	-0.000448757	-0.000988959	-0.000867841	-0.000577774	-0.0005029	-0.001208513	-0.001474168	-0.000264736	-0.000227999	-0.000197304	-0.000200951	-0.000109365	-0.0003937	-0.000518943	-0.000829401	-0.000417037	
0.02873118	0.200529234	0.321591048	0.635126895	0.332317379	0.339677788	0.465280554	0.503959596	0.286275487	0.305571439	0.429496627	0.795389965	0.490826596	0.24731501	0.481038191	0.504628654	0.490789894	0.337798602	0.515772804	0.566737597	0.27702626	0.738621799	0.479778818	0.32941661	0.866830421	0.88952896	0.899603377	0.645708931	0.477742712	0.591000216	0.738672316	0.592401919	0.78886463	
0.148938413	0.192479632	0.481125523	0.841566652	0.331694495	0.287988716	0.531999612	0.566497514	0.389710783	0.362848571	0.368199385	0.829690728	0.564038092	0.31492369	0.400852884	0.651381195	0.660395944	0.413221667	0.647309881	0.63054268	0.29973789	0.880984374	0.425480116	0.321963058	0.976576183	0.973483498	0.92288959	0.801146274	0.431998629	0.570832325	0.698927618	0.501537263	0.698053143	
0.000140007	0.000349324	0.000294362	0.000347622	0.000363698	-0.00012651																												

2003	Profit of Long	0.02509988	-0.00891272	-0.003319002	-0.043432665	-0.014936447	-0.008626499	-0.011615008	-0.02049205	-0.012571373	0.015010193	-0.007818449	-0.000200381	0.006935614	-0.010155314	-0.002528281	0.010407224	0.011890701	-0.005374564	0.026896142	-0.000234867	-0.001980322	0.003023742	0.007062325	0.009494796	-0.010210619	-0.007589695	0.009620051	0.006388461	-0.007465611	-0.010737168
	T Stats	0.292220278	0.716603377	0.896382926	0.095752813	0.568082633	0.730394037	0.662592055	0.460119087	0.624067746	0.548277275	0.756091919	0.993866524	0.815177465	0.681841482	0.919496532	0.691276457	0.647801724	0.843941614	0.288821721	0.992654947	0.937632033	0.905996361	0.788720379	0.851186878	0.696594588	0.772547077	0.701970739	0.804481077	0.771354793	0.674024203
	Signed Ranked	0.387272652	0.488538569	0.612259561	0.02569317	0.315669712	0.501416863	0.661677875	0.471681199	0.595740913	0.615834177	0.594527945	0.779666994	0.991993844	0.447732326	0.759432849	0.788752525	0.776084666	0.907772953	0.389171745	0.836207346	0.828027991	0.998974506	0.943644181	0.979237677	0.609680842	0.721968949	0.798640193	0.921506988	0.612177072	0.526777389
	Profit of Short	0.027744013	0.011368801	0.002829411	0.019478389	0.002955931	0.0018164228	0.017115569	0.002199999	-0.00232721	0.015477286	0.022292188	0.010149919	0.009757877	0.015432557	0.009975544	-0.01259275	0.004043466	0.015890802	0.011369831	0.03879189	0.017657513	0.026342906	0.019998056	0.012083514	0.008753373	0.015019687	0.017496915	0.003884111	0.01493705	
	T Stats	0.26206232	0.646129743	0.90429251	0.405516621	0.900165681	0.453777979	0.405913731	0.922110991	0.226740208	0.526077748	0.354861164	0.665905653	0.681189653	0.513875938	0.967471168	0.990813071	0.945815286	0.524718327	0.508921778	0.570433319	0.872770333	0.460431073	0.257646743	0.390988708	0.606652351	0.714200397	0.527131451	0.461295888	0.870565758	0.533522021
	Signed Ranked	0.317097373	0.772192825	0.977599258	0.470392084	0.922536934	0.441378153	0.399949671	0.626299834	0.333273565	0.602801051	0.449130839	0.771273592	0.718507859	0.454775619	0.939916713	0.808807054	0.544739628	0.338570587	0.391076861	0.561441389	0.838209592	0.537313456	0.224020072	0.409785676	0.598211105	0.701886101	0.443482928	0.386986638	0.86426997	0.434276885
	No. of long	23	15	14	14	16	18	15	19	27	17	15	12	13	11	11	11	9	10	14	10	9	9	7	7	7	7	6	15	10	9
	No. of short	23	15	14	14	16	18	15	19	27	17	15	12	13	11	11	11	9	10	14	10	9	9	7	7	7	7	6	15	10	9
	total no of days (long)	121	122	122	121	117	122	119	111	125	123	122	119	123	129	127	122	126	128	119	118	121	121	121	120	121	120	117	119	118	120
	total no of days (short)	140	139	139	140	144	139	142	150	136	138	139	142	138	142	134	139	135	133	140	140	140	140	140	140	141	140	144	144	143	141
	average no of days (long)	5.26896565	8.13333333	8.714285714	8.642857143	7.3125	6.777777778	7.933333333	5.842105263	4.6296263	7.25294118	8.133333333	9.166666667	9.461538462	11.72272727	11.54545454	11.090090909	14	12.8	8.5	11.8	13.44444444	13.44444444	17.28571429	17.14285714	17.14285714	19.5	7.8	11.8	14.3	13.33333333
	average no of days (short)	6.08956522	9.26666667	9.92874129	10	9	7.722222222	9.46666667	8.33333333	5.03703037	8.11767059	9.26666667	11.83333333	10.61538462	12	12.18181818	12.63636364	15	13.3	10.14285714	14.3	15.55555556	15.55555556	20	20.14285714	20	14.285714	24	9.6	14.3	15.66666667
2004	Profit of Long	-0.042786912	0.005957025	0.003423998	-0.02890627	-0.036671956	-0.024091179	-0.033517087	-0.021411935	-0.041131119	-0.019983624	-0.02637932	-0.031957188	-0.012004178	-0.003277968	-0.003203788	0.013351705	-0.000574675	-0.013460407	-0.006317412	-0.048701498	-0.024771038	-0.025629101	0.003555266	-0.00774633	-0.003599099	-0.011348436	0.005991597	-0.02894523	-0.03623692	-0.00389688
	T Stats	0.22422042	0.857611301	0.624427865	0.408012679	0.246954119	0.47431887	0.322633777	0.534886659	0.675993035	0.584039404	0.449840949	0.327377903	0.724041902	0.926903199	0.5289401	0.720128411	0.987789923	0.717385313	0.869841162	0.178832862	0.504657372	0.482241896	0.924403457	0.843321493	0.918808585	0.750612055	0.865462527	0.439882973	0.334027298	0.460325129
	Signed Ranked	0.414242399	0.637416236	0.662592931	0.546451473	0.335324126	0.519497985	0.238366544	0.457478947	0.553620495	0.923119038	0.677395374	0.399703462	0.782696959	0.863609489	0.901504765	0.760325323	0.856186552	0.420168593	0.424520085	0.985642144	0.838871504	0.966532162	0.790820166	0.607898774	0.391078877	0.271780303	0.374880112			
	Profit of Short	0.014286255	0.007388802	0.007427161	0.015869022	0.019143844	0.031504858	0.014672435	0.015090267	0.005998354	0.005910589	0.007469799	0.019123214	0.013477056	0.00045174	0.009312622	0.005613768	-0.009590178	0.009396919	0.015453715	0.011532323	0.003956043	0.012133669	0.012930278	0.023623216	0.009708989	0.013729268				
	T Stats	0.464016391	0.723024737	0.72322126	0.446852683	0.369813991	0.123888804	0.462001128	0.451583988	0.767812378	0.760265886	0.708246203	0.562766326	0.512450829	0.982080166	0.6307162	0.772870638	0.511686020	0.451954913	0.959471349	0.638930463	0.417393356	0.287745783	0.422726141	0.555531021	0.843070174	0.542948725	0.520388180	0.219409837	0.629766367	0.477045204
	Signed Ranked	0.359793031	0.541517085	0.430433746	0.20374506	0.198825724	0.126245081	0.58634225	0.501503779	0.525736691	0.649979812	0.552247668	0.341019888	0.508388445	0.801575514	0.469856269	0.462345649	0.323900062	0.36568919	0.847057204	0.441302517	0.252033994	0.167000452	0.292812263	0.506009796	0.767711961	0.449793412	0.525302772	0.118575182	0.45995538	0.32025004
	No. of long	19	17	13	12	13	12	15	17	14	12	10	10	8	7	6	6	13	10	8	7	6	6	14	6	6	6	14	9	9	
	No. of short	19	17	13	12	13	12	15	17	14	12	10	10	8	7	6	6	13	10	8	7	6	6	14	6	6	6	14	9	9	
	total no of days (long)	93	92	91	94	89	89	97	99	97	88	90	86	86	87	83	85	85	85	84	87	90	84	85	88	85	88	87	88	88	
	total no of days (short)	158	159	160	157	162	162	154	158	154	165	161	165	166	164	164	168	166	166	167	164	161	167	163	166	163	166	163	164	163	163
	average no of days (long)	4.894796842	5.411764706	7	7.833333333	6.846153846	7.416666667	8.083333333	6.2	5.705882353	6.285714286	7.5	8.6	8.6	10.875	10.875	11.85714286	14.16666667	14.16666667	6.538461538	8.4	10.875	11.25	12	14.16666667	14.16666667	14.16666667	6.214285714	9.77777778	9.77777778	9.77777778
	average no of days (short)	8.315799474	9.35294176	12.30789231	13.08333333	12.46153846	13.1	13.83333333	10.53333333	9.08823529	11.64285714	13.41666667	16.5	16.5	20.5	20.5	24	27.66666667	27.66666667	12.78923077	16.7	20.5	20.125	23.85714286	27.66666667	27.66666667	27.66666667	27.66666667	11.74428571	18.11111111	18.11111111
2005	Profit of Long	0.025612102	0.013252931	0.017002308	0.023823557	-0.006209232	-0.004196887	-0.015297621	0.009340735	0.011482499	0.029914023	0.015122228	0.013465514	0.004477395	0.003551159	0.002648656	0.013292598	0.015408937	0.002038265	0.014596373	0.011240248	0.000381218	0.015216173	0.014754894	0.010150456	0.011053999	0.004304612	0.000781213	-0.009789388	-0.016369774	-0.021692205
	T Stats	0.274296149	0.558623145	0.458757862	0.29113457	0.776318307	0.849634011	0.483036937	0.627362467	0.591322377	0.154996404	0.476765174	0.529249616	0.832885378	0.862202829	0.880752701	0.529497828	0.467126893	0.346717953	0.472880188	0.578789202	0.584886688	0.458559489	0.473823986	0.320710725	0.593134986	0.861305126	0.574957403	0.683280035	0.496403415	0.364432666
	Signed Ranked	0.262320886	0.623137192	0.439361675	0.321677402	0.694909052	0.995590508	0.479293212	0.841788854	0.760666669	0.195744241	0.569555252	0.461337396	0.827603022	0.877495331	0.934067794	0.662399106	0.483609396	0.357416712	0.474228038	0.610144202	0.942201618	0.924001618	0.964500075	0.795616353	0.579888872	0.944271085	0.698277746	0.488036628		
	Profit of Short	0.005521736	0.002921499	0.004799378	-0.000350649	0.016599157	0.005737871	0.028153028	0.013478355	0.005712917	0.023935452	0.015347611	0.006056037	0.039455556	0.022759763	0.002828541	-0.007234321	-0.01119902	-0.008652821	0.029971153	0.014818023	-0.019801629	-0.01461994	-0.048819545	-0.030945952	0.006095271	-0.002014454	0.003393556	-0.013228212	-0.009514743	
	T Stats	0.829513852	0.384027526	0.8518818	0.989447492	0.545854176	0.832130411	0.308376079	0.629162112	0.841888381	0.422591219	0.59212581	0.831075815	0.21831288	0.268289056	0.435795004	0.921126097	0.803320565	0.692506738	0.775306246	0.490369394	0.622036034	0.503947258	0.627077105	0.10887585	0.303630986	0.794611931	0.932016476	0.890456969	0.589627271	0.694505193
	Signed Ranked	0.785563975	0.504588882	0.856079902	0.703627514	0.838019506	0.809489491	0.64885582	0.930892169	0.927265384	0.486463486	0.811520001	0.792650514	0.338482054	0.475955974	0.696962099	0.815136265	0.407940086	0.282659168	0.806666267	0.891353324	0.886763753	0.879479656	0.944187151	0.250962951	0.703671341	0.904194399	0.9639302	0.623676237	0.821732438	0.822922361
	No. of long	18	17	14	15	13	15	16	20	16	9	9	8	7	9	8	8														

Appendix 4

TABLE 17				
Summary of recent MAS policy decisions				
	Date	Mid-point change (centre)	Appreciation bias (slope)	Bandwidth (band)
1	27-Jul-00	No Change	Shift to gradual and modest appreciation	No Change
2	22-Feb-01	No Change	No change - Gradual and modest appreciation	No Change
3	12-Jul-01	No Change	Shift to zero percent appreciation	No Change
4	10-Oct-01	No Change	No change - Zero percent appreciation	Widened
5	2-Jan-02	No Change	No change - Zero percent appreciation	Restored/Narrowed
6	11-Jul-02	No Change	No change - Zero percent appreciation	No Change
7	2-Jan-03	No Change	No change - Zero percent appreciation	No Change
8	10-Jul-03	Re-centred (lower) at prevailing level	No change - Zero percent appreciation	No Change
9	10-Oct-03	No Change	No change - Zero percent appreciation	No Change
12	12-Apr-04	No Change	Shift to gradual and modest appreciation	No Change
13	11-Oct-04	No Change	No change - Gradual and modest appreciation	No Change
14	12-Apr-05	No Change	No change - Gradual and modest appreciation	No Change
15	11-Oct-05	No Change	No change - Gradual and modest appreciation	No Change
16	11-Apr-06	No Change	No change - Gradual and modest appreciation	No Change
17	10-Oct-06	No Change	No change - Gradual and modest appreciation	No Change
18	10-Apr-07	No Change	No change - Gradual and modest appreciation	No Change
19	10-Oct-07	No Change	Increased slightly the slope of the SGD NEER policy band	No Change
20	10-Apr-08	Re-centred (higher) at prevailing level	No change - Gradual and modest appreciation, with slightly higher slope	No Change
21	10-Oct-08	No Change	Shift to zero percent appreciation	No Change
22	14-Apr-09	Re-centred (lower) at prevailing level	No change - Zero percent appreciation	No Change
23	12-Oct-09	No Change	No change - Zero percent appreciation	No Change
24	14-Apr-10	Re-centred (higher) at prevailing level	Shift to gradual and modest appreciation	No Change
25	14-Oct-10	No Change	Increased slightly the slope of the SGD NEER policy band	Widened slightly

