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**IFTA Journal Editor**
Larry V. Lovrencic, F Fin, Dip TA(ATAA)
First Pacific Securities
P.O. Box 731
Rozelle NSW 2039 Australia
Tel: + 61 2 95555287
Email: lvl@firstpacific.net

**IFTA Chairperson**
Bill Sharp
Valern Investment Management, Inc.
140 Trafalgar Road
Oakville, Ontario L6J 3G5 Canada
Tel: (1) 905 338 7540, Fax: (1) 905 845 2121
Email: bsharp@valern.com

**IFTA Business Office**
Ilse A. Mozga, Business Manager
157 Adelaide Street West, Suite 314
Toronto, Ontario M5H 4E7 Canada
Tel: (1) 416 739 7437
Email: iftaadmin@look.ca
Website: www.ifta.org

2005 Edition
To be a professional requires extensive training, the mastery of particular knowledge and the commitment to continually update that knowledge. Professionals commonly belong to an association, agree to abide by a code of ethics and are certified by an organisation or a government.

The International Federation of Technical Analysts (IFTA) assists practitioners of technical analysis in fulfilling the requirements to be regarded as professionals. This journal contributes, in its own small way, as a medium for continuing education in technical analysis by ‘showcasing’ a selection of research papers that were submitted for Level III of IFTA’s Diploma in International Technical Analysis (DITA) educational program. The research papers were required to:

a) be original,
b) deal with at least two different international markets,
c) develop a reasoned and logical argument and lead to a sound conclusion supported by the tests, studies and analysis contained in the paper,
d) be of practical application, and
e) add to the body of knowledge in the discipline of international technical analysis.

As you are aware, IFTA has restructured its certification programs. With a body of knowledge underwritten by professional technicians and a syllabus developed by recognized experts, IFTA’s certification programs set the global standard for Technical Analysis Accreditation.

The Certified Financial Technician Program consists of two examinations and is primarily designed for self-study, but a number of IFTA Member Societies offer preparation courses. Candidates who successfully complete both stages of the program receive the Certified Financial Technician (CFTe) certification and are eligible to advance to the Master of Financial Technical Analysis Program.

The Master of Financial Technical Analysis Program is designed for the advanced practitioner who seeks to apply analytical and practical insight and understanding to a major original research work. Successful candidates are awarded the Master of Financial Technical Analysis (MFTA) certification, and will, as with the previous DITA III, have their papers submitted to the IFTA Journal Committee for possible publication.

The 2005 IFTA Journal features three research papers that have been selected for publication, as articles. Jean-Marc Guillot’s article examines a methodology he developed by applying a technical analysis toolkit to trade foreign exchange markets. Jean uses the tools to analyse and forecast the next moves and levels in the short to medium term time frame. Donald Dony’s article illustrates that the breakout direction of most Symmetrical Triangles may be predicted in advance through the application of cycle and channel analysis and Akihiro Niimi’s article examines the Trend Extraction Timing Model (TTM), which is designed to capture the trend and adopt a contrarian approach.

I also wish to bring to your attention an article by Professor Henry (Hank) Pruden, Professor of Business at Golden Gate University, San Francisco, USA. Professor Pruden’s article, which, by the way, was not submitted as a research paper, examines the significant contribution that three persons of French heritage or education, Gustave Le Bon, Rene Thom and Benoit B. Mandelbrot, have made to academic disciplines that are of interest to technical analysts.

I thank the authors for their contribution. I’m sure that readers of this journal will find all of the articles to be interesting and insightful.

There have been some changes to the team that puts together this Journal. Earlier this year, Ms Barbara Gomperts retired as desktop publisher. Her contribution over many, many years is very much appreciated, not only by me as the IFTA Journal Editor but also by the IFTA Journal Committee, the IFTA Board of Directors and all IFTA colleagues. Claire Schwarz, of Siris Consulting, has taken up the role of desktop publisher. I had previously worked with Claire on the ATAA Journal for many years and knew her to be efficient, precise and diligent.

There were also changes to the IFTA Journal Committee, which assesses the suitability of the submitted research papers for publication. Dr Gregor Bauer, Regina Meani and Roberto Vargas have joined John Schofield and myself on the Committee. Each colleague spent many hours assessing and/or editing the papers and I am grateful to them for their contribution. I must point out that Regina Meani had the unenviable task of proofreading the Journal prior to publication and I congratulate her on a job well done.

Once again, we have produced a truly international journal. It is the result of a collaboration of IFTA colleagues from Europe, South East Asia, North America and Australia.

Hopefully this Journal and the articles in it will stimulate further thought and discussion, fulfil its role of contributing to the continuing education of IFTA colleagues and thus strengthen the professional standards to which we aspire.

Larry V Lovrencic, F Fin, DipTA (ATAA)
Editor
Introduction
From French soil during the last 120 years there has sprung forth at least three persons who made contributions of significance in the social sciences and/or mathematics, which are of interest to technical market analysts. Each one of those persons helped to foster a unique model that can place technical market analysis upon a more solid, scientific and secure foundation. These three persons of French heritage or education are Gustave Le Bon, Rene Thom and Benoit B. Mandelbrot.

The purpose of this article is to set forth an exposition of a model for market analysis that emanates from Le Bon, from Thom and from Mandelbrot. To the extent possible, each model will be presented in graphic and analytical form. The correspondence between each model and special topics or studies of technical analysis shall be revealed. Also, to the extent possible, research findings and/or chart illustrations demonstrating the application of each model to market analysis will be given.

Behavioral Finance: A Background
An important approach has been developing within the past decade between the academic and theoretical world of finance and the practice and practitioners of technical market analysis. This approach was heavily fueled by new thinking and methods from the behavioral sciences of psychology and sociology, which have been ascending in the world of finance, while the old orthodox school of the efficient market has descended into an eclipse.

The new thinking and methods that have arrived from the behavioral sciences to enter the world of finance have become known as behavioral finance. Prominent among these new insights into the behavior of markets were the works of Daniel Kahneman on the Cognitive biases which distort our decisions and actions and make the investor much less rational than the iconic man model of the efficient market. Kahneman was recognized for his new thinking and research with the Nobel Prize in Economics in 2002. Clearly the winds were shifting favorably in the direction of the “fear and greed” model upon which market technicians had anchored their thinking and methods.

The focus upon individual psychology, mind and behavior by Kahneman has been expanded upon and forwarded by other noteworthy academicians. The most notable have been Professor Andrew Lo and the Laboratory for Financial Research at the Sloan School of Management, Massachusetts Institute of Technology. And in the field of technically based trading, the ideas and practical applications of Mark Douglas, and Dr. Van Tharp have been a significant enlightenment for traders.

Another behavioral finance approach to understanding market behavior has been the studies of mass or crowd behavior. Most students of the technical approach to analyzing the market are familiar with the century and a half old treatise by McKay, On the Extraordinary Delusions and Madness of Crowds. In that seminal volume McKay revealed how the Tulip Bulb mania in Holland, the Missippi Scheme in France and the South Sea Bubble in Great Britain all reflected the irrational epidemics that spread through populations of investors and speculators.

In the case of McKay and Extraordinary...Delusions...we observe an author, whose home was in the British Isles, generate thoughts, which instructed analysts and investors around the globe for over a century.

Three French Models

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LeBon and Crowd Behavior

Mass Psychology

As a stock market operator, you must keep your own counsel. It is vital that you not become swept up by the emotions of the crowd.

There is a tremendous underlying tendency toward convergence and conformity on Wall Street. Current appraisals of the market, estimations of the future, favorite industrial groups and their major stocks all reflect moves toward consensus. This is a mindless conformity in as much as the crowd usually exaggerates a trend and in the end underperforms the market averages.

Mindlessness is one of the hallmarks of crowd think. Singularly a group of investors may be rational businessmen, lawyers, doctors, and Indian Chiefs. Thrown together as members of a group seeking profit on Wall Street, there will arise an unconscious “groupthink”; they share rising and sinking feelings with the tape; they are attracted to the same stocks at the same time and are apt to sell them in unison.

“The gathering has thus become what, in the absence of a better expression, I will call an organized crowd, or, if the term is considered preferable, a psychological crowd. It forms a single being, and is subjected to the law of the mental unity of crowds.” (LeBon, The Crowd)

The substitution of the unconscious action of crowds for the conscious activity of individuals is one of the principal characteristics of the present age.”

“We see, then, that the disappearance of the conscious personality, the predominance of the unconscious personality, the turning by means of suggestions and contagion of feelings and ideas in an identical direction, the tendency immediately to transform the suggested ideas into acts; these we see, are the principal characteristics of the individual forming part of a crowd. He is no longer himself, but has become an automaton who has ceased to be guided by his will.” (Le Bon, The Crowd)

Curves, S-Shaped and Bell-Shaped

The herd instinct is reflected by the S-shaped curve of the life cycle model (Figure 1), while the bell-shaped model shows how groups of market participants may be positioned and interrelated, ranging from the smart money to those who enter the market last (Figure 2). Together, the two form a cycle model that can be used to organize indicators to gauge technical market conditions and to predict crowd behavior. In fact, economic theorist Theodore Modis argues that life cycle models can forecast the rise and fall of almost anything. (Modis)

The adoption-diffusion life cycle model, which is widely used in social science and in marketing research, can also be modified to fit the stock market. Using the Life-Cycle Model, Figure 3 shows how the four major parameters of technical analysis - price, volume, time, and sentiment - are interrelated. Further, the model can be used to specify and interrelate indicators to measure those parameters. It also reveals how these parameters can combine to form continuation or reversal patterns.

![Figure 1: Adoption of an Innovation](image1)

![Figure 2: Adopter Categorization](image2)
Four Elements

The four major parameters are a distinct aspect of the technical condition of the US stock market. Since the data for each parameter is independent from that of the others, the indicators representing them can be combined. This feature of price, time, volume, and sentiment is very important; it gives a more complete conclusion regarding the market’s present position and probable future trend.

By framing the indicators into the model shown in Figure 3, the trader can better judge when the odds are optimal to buy an upside breakout. The combined picture of price-volume-sentiment-time appears different in the lower-left quadrant (accumulation) of the model than in the upper right (distribution). One would want to buy every high-volume upside breakout in the former case, but not when the latter circumstances appear to prevail. Further timing clues are given by the classic bottom-reversal patterns in the lower left and the classic top-reversal patterns in the upper right.

Joe Granville’s “tree of indicators” concept comes into play during the building and testing of complex models. (Granville) In this notion, rather than simply relying upon price trend and sentiment, the analyst can add together indicators such as price pattern, Elliott wave count, point-and-figure proportion, on-balance and total volume, and put-call ratio to fully exploit the technical information available. Using the Life-Cycle Model, analysts can make sense of how these various parameters are tied together.

Depending upon the trader-analyst’s time horizon and confidence in certain indicators, an arsenal of specific technical indicators can be judiciously selected. If, for example, an analyst is an intermediate-term options or futures trader, then he or she might wish to examine the price parameter using stochastics or relative strength index (RSI) to study momentum, an hourly Dow Jones chart to count Elliott waves, and a point-and-figure chart of the DJIA to measure the potential extent of moves. These price indicators are seen positioned along the S-shaped curve.

By framing the indicators into the model, the trader can better judge when the odds are optimal to buy an upside breakout.

With respect to volume, the analyst might include total daily New York Stock Exchange (NYSE) volume, a measure of overall upside vs. downside volume, and perhaps also a further refinement of an on-balance volume study of the 30 stocks in the DJIA. Volume is appropriately viewed under price on the bell-shaped curve.

Sentiment can be seen as measuring both the opinion and the behavior of various market participants. Sentiment indicators of opinion are captured by the feedback loop and indicators of sentiment behavior fit into the bell-shaped adoption curve. Here, the analyst might choose to evaluate market opinion by using the Investor’s Intelligence ratio of bulls to bears. In addition, he might evaluate prevailing sentiment using the headlines and leading stories from newspapers and magazines. He can then appraise speculative behavior by calculating OEX put/call open interest and volume ratios. Finally, the intermediate-term investor might utilize the fourth major parameter, time, by analyzing a 10- to 13-week trough-to-trough cycle, the duration spent in a given trend, and significance of seasonal influences or special days in the month.

Behavioral Finance: Cusp Catastrophe Model

“Catastrophe theory is a new mathematical method for describing the evolution of forms in nature. It was created by Rene Thom who wrote a revolutionary book, Structural Stability and Morphogenesis in 1972, expanding the philosophy behind the ideas. It is particularly applicable where gradually changing forces produce sudden effects. We often call such effects catastrophes, because the lack of intuition about the underlying continuity of the forces makes the very discontinuity...
of the effects so unexpected. The remarkable thing about the results is that, although the proofs are sophisticated, the elementary catastrophes themselves are both surprising and relatively easy to understand, and can be profitably used by scientists who are not expert mathematicians (Zeeman, 1977).

**Cusp Model in Operation**

Now let us imagine Figure 5 in operation. The flow of the market index takes place over a smooth surface composed of equilibrium points. Changes in the control variables, fear and greed, have unique responses on the behavior surface. The dynamic process of the model causes the index to seek out local points of stable, albeit temporary, equilibrium.

Starting at a bear market low, where the market index is on the lower attractor sheet, the level of greed (demand) is suppressed by the level of fear (supply). Mounting greed (e.g., expectation of higher prices) gradually overcomes fear until the edge of the sheet is reached, at which point the market breaks out of an upside reversal pattern via a catastrophe jump to the top sheet as the mood of the market becomes decidedly bullish. The index then flows along a rising channel on the top sheet until the bullish potential is exhausted. At that point, both greed and fear are high. Finally, as fear overcomes greed the market index is pushed to a threshold on the top sheet, then the price index plunges to the bottom sheet via a bearish catastrophe jump.

Catastrophe Theory analyzes equilibrium and its breakdown. As such, it is ideally suited for understanding the stock market where price movements result from the balances and imbalances between buying power and selling pressure, which in turn are animated by the forces of greed and fear. Applications of Catastrophe Theory can be qualitative in nature. Catastrophe Theory does not pretend to render pinpoint or unalterable predictions far in advance. The theory does not negate the art of interpretation.

In Catastrophe Theory the prior history of behavior states of the market is required to predict the future. This undercuts the assumptions of the “random walk” or efficient market hypothesis. Catastrophe Theory underscores the relevance of the historical, chart approach to analyzing the market.

The Cusp model encompasses duality and opposition. There is room for a greed axis and a fear axis. It brings the opposition between bullish versus bearish sentiments into clear relief.

Figure 6 depicts the overall results of a laboratory on irrational exuberance conducted at CalTech University experiment. It shows the absolute maximum value of the company with oil at its maximum potential market value. Stock prices beyond the maximum value line were not rational because everyone in the game knew that the value above this line was beyond any underlying asset value. At set intervals, the dividends were paid. These dividend payment intervals are shown in Figure 6 by the dashed vertical lines. All participants in the experiment knew this information before the game was played.

The prices established by the buyers and sellers in the experiment did not drop as would have been expected from the logic of rational economic analysis of the situation even though all players were rational and had the same information. The traders in the Cal Tech experiment persistently traded at prices that were greater than the fundamental value indicated the company was worth. As the experiment progressed, the traders in the experiment ignored the maximum value line. The students in the experiment paid for the stock in the experiment well beyond what even the most optimistic investor should have paid. Apparently, chasing dividend distribution dates, they continued to trade based upon the greater fool theory.

Eventually, as the oil well neared depletion, the market began to show signs of nervousness. This nervousness by players in the experiment was very evident on the videotape since Professor Plott had tied price bids to purchase the stock to lower sounds on the musical scale. The high notes reflected sell offers while the low notes were bid orders. As the market neared extreme upside valuations, there arose heightened nervousness evidenced by a striking increase in the intensity of the lower notes. Both sellers and buyers were shifting their

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**Figure 5: A Cusp Catastrophe Model of a Stock Exchange**

**Figure 6: The Overall Results of the Experiment**

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expectations downwards apace with lowering tones and the sound volume level increased rapidly. Such a change in the sound of the market, the sentiment, has been often noted by traders on the floor of the exchange as a harbinger of a reversal of price trend. As the experiment progressed the buy offers that were well below the existing price began to increase, although the price level itself stabilized into a horizontal trend channel. Ultimately there occurred a sudden, sharp drop — the catastrophic jump — in the transaction price in the experiment. The market changed suddenly and swiftly; sentiment flipped from bullish to bearish as the price plunged to its underlying economic asset value.

It should be mentioned that this experiment was conducted without exogenous factors. There were no news or media reports, no external noise, and no one was allowed to voluntarily enter or leave the game. These restrictions may have contributed to the stability of the price data along a horizontal trend channel rather than prompting price to oscillate upward and downward as time progressed.

**Descending Price Peaks: Dissipative Gradient**

Our expectation of a pattern of “descending price peaks” within the trend channel but before the price break was a key reason why we had disagreed with Professor Plott’s assertion that the break in price was unpredictable and unbeatable. As he opined, there was simply no way to get out on the way down. However, technical analysis with aid of the Cusp Model’s, “dissipative gradient” of descending price peaks led us to expect a window of opportunity that would alert a few astute traders to exit before the crash. The evidence from the Cal Tech Experiment on Irrational Exuberance confirmed that expectation: the downward plunge in price at the end of the Cal Tech experiment was predictable (Figure 7).

**Figure 7: Descending Prices Peaks**

Descending price peaks were long ago recognized by such technical analysts as Richard D. Wyckoff as a reliable pattern prognosticating of behavior for lower prices to come. The repeated attempts to rally which failed to reach previous price levels (i.e., lower price peaks) showed that demand was reaching exhaustion. Greed/bullish sentiment was no longer supporting the elevated price; hence a price drop was about to occur.

The pattern of descending price peaks that occurred in the experiment was reminiscent of the right-hand side of the classic price-reversal patterns analysis employed by technical analysts Edwards and MaGee. For example, within the classic head-and-shoulders top formation, the technical-analyst-trader is counseled to enter a short position on the third rally or pullback to the neckline of price support. Prior rallies to higher prices would have been to the right shoulder and to the head of that formation. In sum, the Cusp Catastrophe Model reveals the “triple descending peaks” pattern as a powerful technical tool. In our judgment, technicians tend to overlook and underappreciate the pattern of descending peaks as a tip off of weakness and harbinger of panic.

**Mandelbrot and Fractal Analysis**

The book by Benoît B. Mandelbrot and Richard L. Hudson, *The (Mis)Behavior of Markets* is a brilliant tour de force by the award winning mathematician and father of fractal geometry. His varied and long-standing interests in the behavior of financial market are brought together into this important book that should be required reading for every serious student of finance.

Mandelbrot goes directly to the nature of the non-linear, dynamic behavior that rules the true mathematical makeup of markets. While doing so he destroys the Efficient Market Hypothesis and its allies of orthodox finance.

Mandelbrot concludes, “Modern’ financial theory is founded upon a few, shaky myths that lead us to underestimate the real risk of financial markets... Orthodox financial theory is riddled with false assumptions and wrong results.”

Among other things, Mandelbrot observes that markets are ruled by “power curves,” and not normal curves, and that there exists long-term dependence not independence. Financial markets are turbulent - like the wind or the flood and thus fractal analysis applies. The behavior of markets, what the real data show in numerous markets over many different time frames, says Mandelbrot, is that “Market ‘Timing’ Matters Greatly. Big Gains and Losses Concentrate into Small Packages of Time.” However, Mandelbrot is critical of most of what passes for the technical analysis approach to market timing, which he feels is too often done superficially and with erroneous interpretations of charts.

**A Clearer Description of Reality Thanks to Fractals**

The events that take place on the market during a single day: highs and lows, periods of unrest, bubbles and crashes also occur over months, years and decades...

Fractal figures reflect the widespread phenomena that can be observed through a variety of temporal and spatial scales. Benoît Mandelbrot discovered that cotton markets were fractals in 1962-63. He immediately realized that price distributions were not being adjusted in accordance with a bell-curve but in response to a power law. Furthermore, these market variations can be brutal, frequently clustering in groups.
Hence, he developed a new model that made it possible to extract the key parameters of existing prices, going beyond simple averages or variances. His model made the generation of random curves possible “miming - imitating” market behavior and predicting future fluctuations. Economists will oftentimes only remember the lessons of this work in particular, (see “Les leçons de Mandelbrot” p.82) while leaving behind the tool that will remain the cause of joy for physicists, engineers and biologists in a multitude of fields.

In 1997, Mandelbrot came back to his first love and refined his approach in an article that remains amongst one of the hundred most telecharged articles from the public database for social science. The fractal becomes a multi-fractal and he introduces the new concept of time as a fractal, in other words “irregular time.” A broker’s sense of time differs from that of a clock. It can appear to be stretched out: when few actions seem to be exchanged or contracted; when orders to buy and sell are multiplied. The proper reproduction of the evolution for the dollar/deutschemark parity would be the new model’s first success story. Followed by the Motorola or Lockheed actions. Since then the concept has been explored by other researchers. In 2000-2001, Frenchmen Emmanuel Bacri, Jean Delour and Jean-François Muzy (BDM) presented a slightly different model that was even closer to reality. Certain private companies have already purchased their ideas...

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1. The founding principle
   Small diagrams/drawings are sufficient for generating complexity. Shattered line (1) works as a generator. In the following stage, this pattern is repeated in each segment (2). (So on and so forth.)
   a. This curve represents the fractal
   b. This diagram represents variations during different stages
   Different results/effects can be obtained by playing/experimenting with these kinds of ideas.

2. Du hasard sauvage “Random Hits, Crashes, Events”
   This diagram represents 3 different generators (generators?) selected at random: each stage reflects unpredictable market variations.

3. Examples of extreme events
   If generator (1) or (2) is broken (by sudden ruptures), evolutionary curves (a), or variations (b) are associated with laws of power; this also reflects a dramatic jump, analogous to the cotton exchange as observed by Mandelbrot.

4. Memory
   According to the “height” of the ruptured/shattered line of generator (1) or (2), different results/effects are obtained. In this case, variations have consistent traits. A series of positive values will be maintained and then followed by negative values. As opposed to the second diagram where fluctuations can be considered as “wild.”
Summary and Conclusion

From French soil during the last 120 years there has sprung forth at least three persons who made contributions of significance in the social sciences and/or mathematics, which are of interest to technical market analysts. Each one of those persons helped to foster a unique model that can place technical market analysis upon a more solid, scientific and secure foundation. These three persons of French heritage or education are Gustave Le Bon, Rene Thom and Benoit B. Mandelbrot.

“The Crowd”, the celebrated book by Gustave Le Bon, underpins the behavioral model, the “Life Cycle Modeling Crowd behavior”. The adoption-diffusion life cycle model, which is widely used in social science and in marketing research, can also be modified to fit the stock market. The Life Cycle Model shows how the four major parameters of technical analysis - price, volume, time, and sentiment - are interrelated. Further, the model can be used to specify and interrelate indicators to measure those parameters. It also reveals how these parameters can combine to form continuation or reversal patterns.

A technical analyst can apply the logic of the Life Cycle Model to construct a mechanical trading system. In addition, the Life Cycle Modeling adoption-diffusion characteristics help to explain the accumulation, markup distribution and markdown phases of a market cycle. Therefore, technical analyses are urged to continue to extend their applications of The Wyckoff Method and other pattern recognition approaches with the aid of The Life Cycle Model from behavioral finance.

Rene Thom’s CUSP Model from Catastrophe Theory can assist the technical analysis and technical-trader to deal with and to capitalize upon extreme speculative moves or bubbles. Increasingly, markets appear to be ending with more spike reversals. Hence, the cusp model of Thom can assist the technician and the trader to supplement and complement the more tranquil studies engendered with the Le Bon inspired Life Cycle Model.

Mandelbrot’s fractal analysis offers further refinement to the behavioral / mathematical models of Le Bon and Thom described above. The scaling principle of fractal analysis provides a sound vision for the Elliott Wave Principle. Thus an analyst could presumably use fractals to “Zoom in” to smaller and smaller time frames of data in an effort to fine-tune a technical turning point. Moreover, there may exist other richer applications of Mandelbrot’s fractal geometry.

From among the three Frenchmen, Le Bon and Thom and Mandelbrot, the insights of Mandelbrot have probably been the least exploited by students and practitioners of technical analysis. Thus, perhaps, further study and research and implementation of the fractal analysis of Benoit B Mandelbrot deserves the priority attention of creative and enterprising technical market analysts.

Bibliography


Using Indicators from the Derivatives Markets to Forecast FX Moves

Jean-Marc Guillot ■ JeanMarc.Guillot@lodh.com

As a trader, I have developed a TA toolkit that I use on a daily basis to trade the Forex market. It is not a mechanical system, but more a methodology one can successfully apply to the currency market.

Working on FX options and also on FX forwards and futures, I employ a mix of several analysis tools. While some of them are well recognized, such as Bollinger Bands, MACD, RSI and Slow Stochastic, I have developed my own way to use and interpret them.

The two other tools are more closely linked to the derivatives market. The first one is the price curve of the OTC FX options risk reversal data. The risk reversal shows the option delta (i.e., theoretical risk level) and compares the call or the put in terms of implied volatility, determining which is the more expensive. The second one is the price curve of the non-commercial positioning on the International Monetary Market (Chicago Mercantile Exchange). This data monitors how traders are exposed on the FX standardised market.

Both derivatives indicators may reach extreme levels and, depending on the reading of the first set of tools, can be used in a contrarian approach or as a measurement tool for the strength of the trend. As the FX market is strongly influenced by OTC FX options flows, strikes and barriers and as well by professional traders positions on the IMM, these two specific indicators are very powerful tools to monitor the global FX market psychology and then to forecast the next FX moves.

In my interpretation of the first set of indicators I look at a 20-period moving average and two envelopes of 1 and 2 standard deviations for Bollinger Bands. The MACD is calculated with the "normal" 26, 12 and 9 levels. The RSI is a 14 period indicator. The Slow Stochastic is very close to the spot's move with %K 5, 3 and %D 5, 3, 3.

The MACD is used as a main trend indicator. When it is trading above the zero line the main trend is up, whereas a MACD below zero suggests a bearish main trend. An erratic move of this indicator close to the zero line reflects a trading range. The crossovers with the signal line are interpreted as more short term moves, correction patterns. As for example, when the signal line crosses the MACD line on the upside around -0.01, this is seen as an upside corrective move on the spot in a global bear trend.

When the MACD indicates a trending market, the RSI is used to monitor the strength of the move. When this indicator enters one of the extreme areas, below 30 or above 70, this is a sign of strength for the move in motion. This is not read as an oversold/overbought condition any longer. Then, when a crossover on the MACD suggests a correction, a divergence on the RSI would confirm that scenario. When the MACD is scotched to zero, the RSI helps to play the congestion pattern. The 30 and 70 levels are used to buy and sell the spot in the range.

The Slow Stochastic is used as a complementary indicator. It reinforces the diagnosis when it confirms the view deducted from the RSI’s analysis. Here extreme levels are seen below 20 and above 80. The probability of being right is increased when both the RSI and the Slow Stochastic show the same strength or the same divergence or the same overbought/oversold conditions in a range.

Bollinger Bands are very helpful in defining entry and exit levels for trading positions.

In a trading range environment (MACD close to zero), bands are seen as supports and resistances. If the RSI and Slow Stochastic show extreme levels on the approach of the 1-standard deviation band, this could be a good buy or sell level of the spot. A stop-loss could then be placed a few pips (FX basis points) above / below that band (very short term) or above / below the level of the 2-standard deviations band. If extreme conditions on RSI and Slow Stochastic only appear on the approach of the 2-standard deviations band, one could create a new position here. The stop-loss should then be put around 0.50% above / below that band.

In a trending environment, daily closes out of the bands are seen as valid entry signals. Here again the first signal comes on the break of the 1-standard deviation band. The stop-loss should then be placed below the 20-period moving average and above this line for short positions.

People looking to play longer-term trends could wait for a daily close out of the larger bands. A stop-loss should be placed in line with the previous logic.

The following table is a summary of the main conjunctions of indicators.

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<tr>
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<th>Spot level</th>
<th>Decision</th>
<th>Stop-loss</th>
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www.ifta.org
Risk reversals represent the difference in terms of implied volatility for a call and a put with the same delta, i.e. the same theoretical risk. They provide an accurate measure of supply and demand dynamics in the options market. When risk reversals favour puts, option market makers are skewing prices to reflect rising downside risk. When they favour calls, those market makers are concerned about the upside momentum.

In a way, risk reversals are showing us what the market is thinking through the market makers perception of the main risk. Depending on the market conditions and sentiment, risk reversals can have a real predictive power or be merely coincident indicators of flow.

The International Monetary Market is a part of the Chicago Mercantile Exchange. The commitments report (http://www.cftc.gov/cftc/cftccotreports.htm) from this exchange clearly shows long and short open positions and the global positioning on currency futures contracts with a split between the speculative and non-speculative community. A look at the positions history plotted as a chart shows how extreme the positions are at a specific date. This data can be used, as the risk reversals previously explained, to monitor the market participants’ perception of the main trend and the next moves on the FX market. This indicator perfectly reflects the market psychology and could then be used as a technical analysis tool.

Contrarian investing is a strategy that relies on behaving in opposition to the prevailing wisdom. It is based on the principle that the majority is most pessimistic at market bottoms and most optimistic at market peaks.

As expressed in the last two points, FX options risk reversals and IMM positioning data reflect market’s thinking about the next currency move.

When the data is plotted on a chart, one can identify the extreme levels and use them as contrarian indicators. When some levels are reached, the probability that the trend is close to an end is pretty high. A risk reversal extremely in favour of EUR puts would then be interpreted as a EUR buy signal. When IMM positioning shows that everybody is short the EUR, one should be more sensitive to any upside move and the risk of a short squeeze would be high...

I will use the data in complement and/or comparison to my first set of tools. The key element remains the MACD level as it will indicate the trend in motion or confirm a trading range scenario.

In a trending market, when MACD and its signal line do not show any correction risk, IMM positions and risk reversal should confirm the trend. In a EUR uptrend, IMM should show growing long EUR positions whereas risk reversals should favour EUR calls along the curve. If both indicators enter extreme areas on their respective chart, this will be interpreted as a factor of strength for the trend in motion, same as the RSI above 70 and Slow Stochastic above 80. This could be one more reason to play the trend, but there is no valid contrarian argument at the time.

In a trending market, when MACD and its signal line suggest a correction, the contrarian view will be in force on IMM and risk reversal analysis. If one or two of them are indicating extreme levels, this will increase the probability of a correction soon. Usually, such a situation will be in line with a divergence on the RSI and/or the Slow Stochastic. These two more classical indicators could both indicate overbought/oversold conditions and confirm the fact that the trend in motion should at least make a pause soon.

One more interesting indicator from the derivatives market is the global gamma positioning. The gamma represents the sensitiveness of an option position in terms of delta to the spot moves. When the market is strongly short gamma above a certain spot level, this increases the risk of acceleration from that level in the case of a break. Option traders will then have to adjust their risk by buying or selling heavily the spot from that level. This factor affects equally the speed and the strength of the move.

The following examples are based upon daily market data for the morning session Monday 13-October-03.
The MACD and its signal line are both indicating a trending market. The trend is bullish for the EUR as confirmed by the spot trapped for several days between the upper 1 and 2 standard deviations Bollinger bands. The signal line is getting closer to the MACD suggesting the trend is already losing some momentum. A look at the RSI and the Slow Stochastic shows that some bearish divergences. Moreover, since the beginning of October, when the spot was making new highs, both indicators already looked heavy.

IMM positioning is at an extreme level, close to the level seen in May 03 before the downside correction occurred on the EUR/USD. The 25 delta 3-month risk reversals are strongly in favour of EUR calls, also close to the extreme level they reached in May before the EUR/USD corrected down.

Taking this into account, the following trading recommendations could be made:

- **Sell EUR buy USD at 1.1825** (take-profit)
  - or at 1.1515 (stop-loss)
  - **Target**: 1.1180/1.1200
  - (Current level of the 2std deviation lower band 1.1190, 61.8% Fibonacci retracement in the move 1.0760/1.0860 is at 1.1180)
- **Stop-loss**: 1.1955
  - (Above the top of the year at 1.1932)

The MACD and its signal line are both indicating a trending market. Clearly below the zero level, they reflect a bearish trend for the USD. The fact that both lines are close to -2 and do not show any potential crossover is an indication that the trend in motion is strong. In September 03, the acceleration of the trend was confirmed by a first daily close of the spot below the lower 2-standard-deviations Bollinger Band. Currently, the momentum still looks strong, as the spot remains trapped between the two lower Bollinger Bands.

Both the RSI and the Slow Stochastic are trading in the well-known “oversold” territory (below 30 and 20). This is one more argument in favour of a strong downside momentum for the greenback, especially as no bullish divergence appears at this stage.

Both the IMM positioning and the FX options 25-delta 3-month risk reversals are showing very extreme readings. They have reached records for the three-year history. The IMM shows clear long JPY positions and the risk-reversals are more than 3% in favour of JPY calls. The contrarian approach is not valid this time (except for a very short term correction) and the levels of these indicators are seen as more proof of the strength of the medium term USD downtrend! Even the implied volatility back up around 11% supports that scenario.

A buy for the USD at 108.50 is not suggested for medium term purposes as the downside trend looks strong and is not over yet. The only two factors in favour of a stronger USD at the time were the extreme reading conditions of all indicators and a new potential intervention of the Bank of Japan on behalf of the Ministry of Finance. Both would only have a short-term impact and help the pair to reach the 110.00 area again. Therefore one would suggest:

- **Sell USD buy JPY at 110.20**
  - (take profit, low of the previous congestion range)
- **Target**: 104.50 / 105.00
  - (bottom of a previous long term historical trading range and also level of huge FX options barriers)
- **Stop-loss**: 113.05
  - (above the latest congestion phase, the recent gap and the 20-day moving average).
The MACD and its signal line are both indicating a trending market. They are not showing any crossover in favour of a correction yet. Below the zero line, they support a bearish view on the USD and a bullish view on the CAD. The only argument that moderates this view is that the MACD is higher than it was during the previous USD bottom in May whereas the spot made a fresh low. The RSI is below 30 but has been hesitating around the 30 line for about one month. The Slow Stochastic is showing the first USD bullish divergence.

IMM positioning is long CAD, but at a lesser extent than in May 03 at the previous bottom. It is not extreme enough to be used as a contrarian tool, but does not reflect a strong momentum either. Risk reversals are in favour of CAD calls, close to levels seen in May 03. The increasing implied volatility is supporting the bearish scenario.

For a trading recommendation: The trend is bearish USD but with a lack of momentum, compared to the previous analysis on the USD/JPY. The 1.3100 level (61.8% Fibonacci retracement in the long term move 1.1189/1.6188) could be an acceleration level or a medium term support...

- Sell USD buy CAD at 1.3325 (take profit, level of the lower 1-standard deviation Bollinger band)
- Target: 1.2350 / 1.2400 (76.4% Fibonacci retracement in the long term 1.1189 / 1.6188 move)
- Stop-loss: 1.3505 (above the 20-day moving average).

As the FX is an Over-The-Counter market, there is no proper way to monitor the real volume traded on each pair. The IMM commitment of traders is one way to approach the volume impact on the spot level. In keeping with volume data, IMM positioning gives a good indication of the market’s sentiment, fears and hopes and also exaggerations.

The FX option market is a specialized part of the global FX market. Moves on the options could be a consequence of the latest developments on the spot or a catalyst for the next move to come. Risk reversals, and also levels of strikes and barriers, are very relevant to the market’s state of mind. They reflect how comfortable traders and market makers feel with their respective positions and the market’s trend.

These indicators, and also the global gamma factor, are powerful tools to analyse the FX market and forecast the next moves and levels and are more efficient over the short to medium term. This is a specific and personalised way to trade the FX market that can be profitable when followed with consistency and humility.

### Appendix

#### i. Bibliography:

- **Technical Analysis**

- **FX options & Derivatives**

#### ii. Software and data:

- Reuters graphics Professional, Version 3.7
- RBC Capital Markets data on IMM positioning
- IMM weekly charts, 4CAST Analysis.
Applying Cycle and Channel Analysis to Forecast the Breakout Direction of Symmetrical Triangles

Donald W. Dony ■ dwdony@shaw.ca

Traditional Technical Analysis stipulates that the breakout direction of a Symmetrical Triangle is generally unpredictable. Some clues as to such breakout direction may sometimes be extracted from the prevailing trend or from the volume near the apex of the triangle but, for the most part, the direction cannot be predetermined until the breakout occurs. In Technical Analysis of Stock Trends, Edwards and Magee state that "prices may move out of a Symmetrical Triangle either up or down. There is seldom, if ever, as we have said above, any clue as to the direction until the move has actually started, i.e., until prices have broken out of their triangular ‘area of doubt’ in decisive fashion." (1)

This article will hopefully illustrate that the breakout direction of most Symmetrical Triangles may be predicted in advance through the application of cycle and channel analysis. A trend, through the application of cycle analysis, is half of a cycle. "An up trend is simply the rising half of a sine wave and a down trend the falling half" (2). When Symmetrical Triangles appear as consolidations, it is during that half cycle, either up or down. When they appear as reversals, it is at a cycle peak or trough.

My work with Technical Analysis started in the mid 1980’s and my interest in analyzing market cycles began in 1990. Since that time I have repeatedly observed that when Symmetrical Triangles develop, the breakout direction is in concert with the main or dominant cycle and not random. Moreover, while the accepted development of a Symmetrical Triangle - the upper boundary lines sloping downward and the lower boundary line sloping upward - have four points as the generally accepted minimum requirement, my experience in researching this formation leads me to a more conservative view, and the Symmetrical Triangles used throughout this article will mostly be six or more point patterns (Fig 1).

The main cycle and channel principals employed herein are based on the five cycle principals that J. M. Hurst illustrated in his 1970 book, “The Profit Magic of Stock Transaction Timing”. It is not the intent of this article to cover the five principals at all, but to point out that the foundation of the analysis is based upon them (3):

1) The Summation Principal - Price motion consists of the cyclical summation of all the active cycles within the specified cyclical period: the main cycle may have sub-cycles
2) The Commonality Principal - There are common features with all cycles.
   a) Cycle formations exist in the price movement of all securities.
   b) The durations of the cycles are similar in each security.
   c) The peaks and troughs of cycle fluctuations are time synchronized.
   d) The magnitudes of the cycles with similar durations are similar in all securities.
3) The Variation Principle - Each cycle varies from the ideal cycle because the magnitude of the cycle varies over time: as the magnitude increases, the duration increases. As the magnitude decreases, so does the duration.
4) The Nominality Principal - Because of the variation of cycles, the use of nominal cycle duration is used to quantify the cycle model. These nominal durations are part of the commonality of cycles within all securities.
5) The Proportionality Principal - The duration of a cycle is related to its magnitude: as the duration of a cycle increases, so does the magnitude. The opposite also occurs.

Symmetrical Triangles occur as reversals or continuation patterns within a trend. Before locating such a pattern within a cycle and using the data to predict the breakout direction, the graphic boundaries and the isolation of the dominant cycle must be established. This is a two step process. First, cycle boundaries are constructed by drawing two lines that are at a constant vertical distance apart. The lines should contain as much of the price data, or movement, as possible. All of the channels in the examples below have been calculated to contain 97.5% of the price data and utilize centred moving averages as templates, as defined using Channels, Cycles & Simulations (CCS) software. “Channel boundaries represent the limits of excursion of all cycles (and random movement) that have wavelengths shorter than the channel itself.”(4) This method establishes the boundaries of the price movement and helps to highlight the dominant cycles (Fig. 2).
The second step is to isolate the main cycle. This is accomplished by using the difference between two averages. The first average is the average wavelength of the cycles, and it’s established by calculating the distance between several dominant lows that mark the bottom channel line; in Fig. 2 this is about 30 weeks and, therefore, a 209 daily (30 week) MA average is the first average, which is then centred. The second average is a weighted half of the first average MA and is also centred. The difference between these two averages is plotted and illustrated as per Fig. 3. CCS software refers to these average minus average (AMA) as Millard Cycles.

The channel used throughout the samples in this article, by means of test results and observations, is a 101 day centred moving average. This period was the longest time frame found to contain the majority of price data points on all samples. By using the longest period MA, the channel can be viewed as two relatively smooth lines with price data touching or closely touching the channel boundaries. This is important when identifying the cycle periods. Cycle periods are best illustrated when the rising price data intersects the top channel line and falling price data intersects the bottom channel line (Fig. 2). The period for the channel therefore needs to be long enough to provide a smooth line yet short enough to allow the price data to intersect it. To extract the dominant cycle in each sample, the average minus average (AMA), or Millard Cycles, were individually calculated. By using the average time period between where the price data reached the 101 day lower channel line, an average cycle period can be established, providing us also with its weighted half. Subtracting one from the other gives us the AMA (Fig. 3). It is interesting to note that many of the individual dominant cycle periods in the samples are similar or multiples of the same number; this is part of J. M. Hurst’s commonality and summation principal.

The following charts are different examples that will serve to illustrate the approach in using cycle and channel analysis to determine the breakout direction of Symmetrical Triangles. All examples contain two charts: the upper chart is the daily bar price data within a 101 day centred moving average channel, and the lower chart contains the AMA that has been found to reflect that security’s individual dominant cycle period. This sine wave isolates a particular cycle within the price data. Using a combination of cycles, as defined by the average minus average, and the direction of the 101 day channel, the breakout direction of the Symmetrical Triangles may be determined with greater accuracy than when using only traditional Technical Analysis methods.

The first example is of the FTSE 30 Index (Fig. 4). The time frame here is about nine months. The daily chart shows the presence of a 10 week cycle, with a price low at the end of May 1999 and another low in early to mid August 1999. A 71 day or point AMA was calculated and a stable and predictable 10 week cycle emerged (Fig. 5).

In Fig. 4 we can see two Symmetrical Triangles, with the first triangle - in mid to late August - developing at the peak of the 10 week cycle (Fig. 5). As the price data reached the upper channel line in late August 1999, the probability of a price reversal increased. With both the downward sloping channel line (Fig. 4), and the peaking AMA in September 1999 (Fig. 5), cycle and channel evidence indicated that the price data would reverse direction from the existing upward trend. The second triangle, late October 1999 (Fig. 4) showed the price data had reached and penetrated the lower channel line. The 101 day channel line was bottoming in late October and therefore should start to move up in the coming weeks. This pointed to a possible price reversal. The 71 day AMA (Fig. 5) was also moving up, indicating that a new 10 week cycle had started. With the combination of a bottoming and up curving channel line, and a new 10 week cycle starting, cycle and channel
analysis suggested that the price would not continue downward, but reverse direction. This is indeed what happened at breakout #2.

The following example, Pace Micro, was calculated to have an 85 day cycle (Fig.7), by using the average time between the lows in January, April, July and October 2001. When the Symmetrical Triangle formed in April/May 2001, Pace Micro was in a downward trend with a stable 85 day cycle reoccurring, and the 101 day channel (Fig.6) highlighting this very consistent cycle. When breakout #3 occurred in June 2001, the AMA was already about 4 weeks past its peak and dropping fast (Fig. 7). With this information, and the channel remaining in a downward trend, there was little doubt left as to the direction of the breakout.

The chart for Land Securities below is an excellent example of a Symmetrical Triangle - in this case two of them - being analyzed as a reversal pattern versus a continuation pattern. The trend had been moving down for over 5 months when the first triangle appeared in January 2002 (Fig. 8). Traditional Technical Analysis would suggest that the greatest probability of the breakout direction was for the continuation of the current 5 month trend. This was not to be the case. Two price lows were chosen to establish the AMA time period: the low in mid September and the one in late December 2001 were about 12 weeks apart, thus an 85 day AMA. In January, the first triangle reversed the stock’s direction (breakout #4). The 85 day AMA had bottomed about 3 weeks earlier and was now trending up, while the 101 day channel was also showing signs of reversing. At the time of the second triangle breakout (breakout #5), the 85 day AMA was about 2.5 weeks past its top and had clearly rolled over, while the 101 day channel had also turned down. Both cycle and channel indicators left little doubt as to the directions for the two Symmetrical Triangles’ breakouts, in this example.

All of the previous examples of cycle and channel analysis were performed on different markets using past data. In order to better illustrate this methodology, a further example is offered below: Aeterna Labs. This stock is initially analysed as its Symmetrical Triangle is forming - data up to July 4th 2003 - and then shown with subsequent data - as of August 15th 2003 - on a “before and after” scenario.

Fig. 10 shows the 101 day channel for Aeterna Labs. rising and offering no evidence of a price peak. The trend, as of late March 2003, is up. Fig. 11 shows its 189 day, or 27 week, AMA. The double bottoms occurring in late September 2002 and early April 2003 would indicate the dominant cycle. As the dominant cycle is 6 months, the cycle developed from the low in late September 2001 until the September 2002 low, equal to two wavelengths of the dominant cycle’s duration. This helps verify the dominant cycle’s duration. The Symmetrical Triangle developing through June falls approximately 90 days or halfway through the dominant cycle. Above average volume in May-June 2003, occurring after the stock more then doubled from its April 2003 low, adds evidence of possible distribution and not accumulation.

Conclusion

I found with the topping and rolling over of the 189 day AMA in late June 03 (Fig.11); and prices already projecting through the lower channel line; the above average volume (distribution) and the triangle forming at the mid-point of the 189 day AMA; the evidence indicates that the breakout direction of the triangle will be down and that the upward trend will change. The gap at $6.00 - $6.75 should be the support and the price target.
There are, however, drawbacks to this methodology! In the above examples, the average minus average (AMA), which graphically defines the dominant cycle within a security, was relatively easy to extract. This is not always the case. As cycles are cumulative, the security’s movement is ultimately the composite of many cycles with different periods and magnitudes (5). Often, the different cycles are out of phase. This transforms the normally symmetrical and repeating AMA of the dominant cycle into a more randomly shaped and non-symmetrical line. The prediction accuracy of AMA analysis is greatly dependant on symmetrical rhythmic waves. If the waves are not uniform and stable, the analysis can be questionable at best. Below are two examples:

Fig. 14 for Ashtead Grp. shows a 13 week Symmetrical Triangle formed between late August and mid December 2001. The 101 day channel flattens slightly during that time period, but not to the degree that would suggest a change in trend. Establishing the dominant cycle through visual observation proved challenging as there was not a singularly strong cycle during the selected time frame. A weak 55 day or about 7.8 week cycle was observed several times. Price lows were in early August, late September, late November 2000, late January and late March 2001. The 55 day AMA produced a moderately predictable sine wave, yet one with greatly fluctuating magnitude. The predictability of this sine wave (Fig. 15) as a trading tool was greatly diminished.

Figures 12 and 13 use subsequent data as of August 15, 2003. As can be seen, the Symmetrical Triangle that formed in June did breakout to the downside. Fig. 12 shows that the 101 day channel has now rolled over, but there was no indication from this channel in Fig. 10 above, that Aeterna Labs. would reverse its trend direction. After monitoring the stock over the observation time period (July 4 - August 15), the channel began to peak and showed visible signs of reversing in late July.

In Fig. 16 below, Reuters was exhibiting a slightly rising trend within a longer term sideways trading pattern before its triangle formation. At the time of the triangle breakout (Breakout #8), late in August 2002, the 101 day channel was moving up with an indication of flattening. However, while there are several major lows in the chart, they are not uniformly spaced, thus making it difficult to pinpoint a well defined dominant cycle. As a result, a 101 day AMA was used to extract the dominant cycle within Reuters (Fig.17). AMAs are most beneficial as a
Cycle and channel analysis should probably not be considered as a complete trading system, but as an important addition to the analyst's list of technical tools. A better understanding of direction and market timing of a security can be achieved through the ability of visually examining the direction of the channel and the dominant cycle provided by AMA analysis. Caution should always be applied when using the AMA as a timing tool. Even when the dominant cycle appears well defined, there maybe shorter duration cycles that might be in conflict with the dominant cycle. This can cause the security to behave differently, in the short term, than the dominant AMA would have predicted. Therefore, examining the next shorter cycle, usually half the duration of the dominant cycle, through its AMA in conjunction with the dominant cycle's AMA is strongly recommended before establishing a trading position.

The analyst should also be aware, when utilizing cycle and channel analysis to predict future price movements, that the channels and AMA's are calculations using centred moving averages, or the difference between centred moving averages. As with all centred MA's, there is a lag time behind price data, and while software programs such as CCS extends the MA lines and thus eliminates the lag when viewed on the chart, the duration and magnitude, and thus the shape of the cycle waves of the AMA's, may need alteration due to new data provided. Predicting the completion or low of a cycle in the future is not an exact science, but its accuracy can be enhanced when traditional Technical Analysis (support/resistance levels, trend lines, volume analysis, etc.) tools are included.

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Software and data.

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Timing Analysis Using the Trend Extraction Timing Model (TTM)

Akihiro Niimi
office@ntaa.gr.jp

Introduction

Moving Averages and the MACD have been commonly used as technical timing tools to capture the trend of price movements. However, since trends using these tools are calculated based on past average prices, three problems have become obvious:

1) It causes a time delay to capture price movements,
2) It is not always effective to expect future price movements by using these parameters optimized to maximize historical performance in the simulation (i.e. the impressive simulations results of timing tools in presentation materials sometimes deceive us by using “optimized” parameters which maximize historical performance during the specified period), and
3) The decision process by trend-following tools makes mistakes repeatedly while the trend is flattened and the price moves up and down in a narrow range.

TTM (Trend Extraction Timing Model) is a proprietary trend-following model which optimizes the lagging tendency in trends, the arbitrary character in parameter setting, the decision rules to combine a trend-following strategy and a contrarian strategy against existing technical timing tools. TTM was developed based on the concept of human thinking or with the view to employ DECOMP (time series analysis package) developed at The Institute of Statistical Mathematics. TTM defines trend and reversal ratios to the price movements using these parameters optimized to maximize statistical performance during the specified period, and the extracted components of DECOMP as of 4 July 2003.

Theoretical Background: DECOMP

DECOMP identifies trend components with little time delay, depending on statistical mathematics instead of identifying trends relying on a past average by moving average.

It decomposes non-stationary time series data into several components, as shown below.

\[ Y(t) = T(t) + AR(t) + S(t) + \varepsilon(t) \]

- \( Y(t) \): time series data
- \( T(t) \): trend component
- \( AR(t) \): autoregressive component
- \( S(t) \): seasonal component
- \( \varepsilon(t) \): noise component
- \( t \): time

The probability-differencing equation for trend and autoregressive components is as follows.

\[ \Delta T(t) = (1-B)^k T(t) - \nu(t) \]

\[ \nu(t) \sim N(0, \tau_\nu^2) \]

- \( k \): order of differencing
- \( B \): backshift operator

\[ AR(t) = \sum a(i) AR(t-i) \]

\[ \nu_{ar}(t) \sim N(0, \tau_{ar}^2) \]

- \( l \): order of autoregressive process
- \( a(i) \): coefficient of autoregressive component

An appropriate stochastic differencing model was assumed for each component and integrated in the form of state space representation. The estimation of the order of each component was obtained through estimating the state vector by the Kalman filter and fixed interval smoother algorithm. It is therefore possible to isolate trends with much less time delay than traditional moving averages.

The sensitivity of the trend can be indirectly defined by selecting the order of the autoregressive process in the state space model without any arbitrary decision like parameter control as a moving average. In other words, if we choose the large order of autoregressive process, the autoregressive component tends to capture more sensitive price movements and the trend component might be less sensitive. Fig. 1 indicates the weekly currency index (USD/JPY) and three components extracted by DECOMP as of 4 July 2003.
Trend-following Strategy by TTM: Introduction of the trend ratio

TTM defines the trend ratio to develop a trend-following strategy by comparing a short-term trend and a long-term trend. Instead of the short and the longterm, two trends with different sensitivities (different order of autoregressive process) are taken as follows.

$$\text{Trend ratio} = \frac{\text{Short-term trend}}{\text{Long-term trend}} = \frac{\text{Trend with high sensitivity to time series data}}{\text{Trend with low sensitivity to time series data}}$$

(For comparison’s sake against the currency index, the starting accumulated performance based on the historical positions. The grey area corresponds to the long position (the trend ratio is above 1.0), while the white area corresponds to the short one, with the bold line showing the accumulated performance of the contrarian strategy. If we choose the contrarian strategy based on the reversal ratio for a year since October 2001, the performance substantially improved.)

Contrarian Strategy by TTM: Introduction of reversal ratio

As reviewed from the results of this performance (prepared on the assumptions that all costs and market impact are 0% and leverage is 100% for long and short positions), the strategy based on the trend ratio indicates a more favorable performance if the index has cyclical movements with stable trends (from June 2001 to November 2002). Since October 2002, performance was substantially decreased because of the mean-reverted price movements with the flattened trend. If a contrarian strategy, as stated later, is combined with this trend-following strategy, the performance and drawdown will be improved.
narrow range (mean-reverting) since October 2002.

As already described, we can take the trend ratio to capture the trend reversal at peaks or bottoms. If the price is falling down in a steady trend, a short position can be taken by the trend ratio. Then the bottom is passed over (as shown in the gray area in the right side of Fig. 6), however, the autoregressive component abruptly rebounds (i.e. the momentum of the autoregressive component is changed to be positive) although the trend is still downward. We take the reversal ratio for the contrarian strategy regardless of this short position by the trend ratio and change the short position to the long position after the bottom. (The yellow area in Fig. 6 indicates the final position by the judgment to follow the momentum of the autoregressive component) Following these logical considerations, although we basically rely on the trend-following strategy based on the trend ratio, it is possible to represent significant changes in the position before the peak and after the bottom, if we change the position by the reversal ratio and the momentum of the autoregressive component.

Excessively early decision rules to reverse existing positions by the contrarian strategy may sometimes result in a poor performance if the price keeps on rising abruptly and the autoregressive component continues to increase (i.e. the price is rising even though we changed into a short position from a long one) or if the price starts falling again and a second bottom is going to be formed (i.e. the price is falling though we changed into a long position from a short one). These wrong decisions to take reversal positions were revised and backed to the trend-following positions systematically, because TTM is recalculated in a form conforming to the current time series whenever the data is renewed. Hence, losses in the wrong reversal positions might be limited and TTM protects us from taking the wrong positions continuously.

Decision rule at mean reverting (up and down with flattened trend) (V2)

If the price movements fluctuate up and down with a flattened trend, the autoregressive component is also fluctuating in positive and negative directions at each point. In this case, the contrarian strategy is more effective to capture the price movement rather than the trend-following strategy and we should give our intention to the reversal ratio rather than the trend ratio. The most important decision is on what basis we should give our intention to the reversal ratio or the trend ratio. The most important decision is on what basis we should give our intention to the reversal ratio rather than the trend ratio.

If the price is going upward in a steady trend, the trend ratio suggests a long position, but if the price increased abruptly at the peak of the upward trend, the trend cannot follow this abrupt price movement and it is represented in the rise of the autoregressive component (the gray area in the left side of Fig. 6).

To capture this trend reversal before the peak, we consider the momentum of the autoregressive component. If it continues to be positive, we take the reversal ratio for the contrarian strategy, regardless of a long position by the trend ratio and change the position at an earlier point for entering a short position.

declined because the currency index maintained a steady trend with low volatility. Contrarily, the performance improved after the currency index was flattened and moved up and down in a narrow range (mean-reverting) since October 2002.

Decision Process by TTM: Combination with trend-following and contrarian strategies

Decision rule at trend reversal (V1)

As already described, we can take the trend ratio to capture the trend of price movements and the reversal ratio to capture the mean reverting of price movements with the flattened trend. The principal strategy of TTM is the trend-following strategy and we use the trend ratio to capture the trend and consider the relationship between the trend and the reversal ratio to capture the trend reversal at peaks or bottoms.

If the price is going upward in a steady trend, the trend ratio suggests a long position, but if the price increased abruptly at the peak of the upward trend, the trend cannot follow this abrupt price movement and it is represented in the rise of the autoregressive component (the gray area in the left side of Fig. 6).

To capture this trend reversal before the peak, we consider the momentum of the autoregressive component. If it continues to be positive, we take the reversal ratio for the contrarian strategy, regardless of a long position by the trend ratio and change the position at an earlier point for entering a short position.
To eliminate the possibility of arbitrary parameters in the decision, we try to review whether or not the rule adopted in V1 above is applicable to this case. Following these position rules, the performance from B to C produces negative returns if the trend ratio is above 1.0. But it is possible to secure positive returns from A to B and from C to D because the position is taken based on the reversal ratio. (The yellow portion in Fig. 7 indicates the final position.)

It is quite difficult to identify the flattened trend and take the contrarian strategy to the mean reverting price movements. However, in the case of TTM, applying the V1 rule seeks to capture the positive performance by a long position through the use of the reversal ratio in a rising mode of the price movements at mean reverting, but abandons the positive performance by a short position in a falling mode of the price movements at mean reverting.

Effectiveness of TTM and Verification of Performance

Fig. 8 indicates the simulation results of TTM based on the above-mentioned decision rules to the weekly currency index (USD/JPY) and the stock index (MSCI US Equity Index) during the period of two and half years from 29 December 2000 to 4 July 2003. In Fig. 8 and 9, the long and short positions are represented by the gray area and white area, respectively, with the accumulated performance results shown with the bold line.

To compare the performance, the starting points of the accumulated performance index and original index are aligned. Neither market impactor nor transaction cost is included in these simulations and the 100% long position or 100% short one (i.e. leverage is 100%) had been taken at respective weekend closing prices based on the decision rules by TTM.

I have to mention that the position and performance in Fig. 8 and 9 were calculated for each week based on trend ratios, reversal ratios, and the momentum of autoregressive components. These simulations do not involve any “insample” methods, which use the “best-performed” parameters during the period, as if they were found at the inception date.

The accumulated performance of TTM to the currency index (USD/JPY) and the MSCI US Index were 35% and 50% since inception and 13.5% and 17.4% per annual basis. Their sharp ratios were 1.35 and 0.83, being rather low ratios in the MSCI US Index, which has high volatility. The turnover rates were 2560 % p.a. for the currency index (USD/JPY) and 2160 % p.a. for the MSCI US Index, which means the positions change about twice a month. Both winning ratios were about 63% and the results were much more impressive than other trend-following models.

As described above, the combination of the trend-following strategy and the contrarian strategy in TTM has allowed us to secure a relatively favorable performance even when the currency index (USD/JPY) and the MSCI US Index formed a steady trend or flattened during the two and half years. Since it is based mainly on the trend strategy, however, it could not cope correctly with such events as seen in 11 September 2001 and produced a substantial amount of negative return from the MSCI US Index. It has taken about one year to recover from this drawdown.
Conclusion

Dr. Magane Matsuoka and myself created the original idea of TTM in 1990. I have improved TTM and refined a convincing decision process and rules for more than ten years to achieve consistent returns with different market environments. In conclusion, I have to mention there are three specific edges to achieve good performance: First is the quality of the proprietary scientific tool to produce trend and reversal ratios; Second is the quality of two ratios to combine trend-following and contrarian strategies; and third is the convincible decision rule to switch these strategies without using any arbitrary parameters.

The arbitrary parameters of technical tools and simulations optimized to maximize a historical performance sometimes cause disappointment of a future performance and deny the reliability of the tools and the models. But the scientific background and convincible decision rules, differing from these parameters, construct an impressive timing strategy to combine the trend-following and contrarian strategies. Hence, I recognize this as the most eminent feature of TTM.

TTM is basically designed to capture the trend and adopt the contrarian approach to use several ratios and components that are calculated based on closing prices. This approach differs from other trading strategies that utilize other timing tools, frequencies and time series. (e.g. combination of volume, open, high, low and close prices) To make the best use of this feature, we can apply TTM for any time series (e.g. sector index, yield spread or any composite index) and decide on the timing simply to capture the specified indices based on these strategies. However, it cannot be fitted to all price movements with high volatility and also in the case of the price jumping. The concept of TTM embodies the human thought process and if it is difficult to take the timing visually from a specified price movement, we could also expect poor performance by using TTM.

In the next stage of my research, I will attempt to improve TTM as follows:

1. Define a procedure to identify the trend reversal after a peak and before a bottom and combine the existing decision rules to take a neutral position around the trend reversal
2. Adopt overlay rules to cope with the price jumping by reviewing the movements of the autoregressive and noise components.
3. Refine TTM and the decision process by adopting the innovative trend extraction models.
4. Develop systematic trading strategies based on TTM to capture the price movements in different time frequencies (e.g. daily, weekly, and monthly) and construct final decision rules and exposures to cope with actual daily trading.

I am eager to continue the advanced research on the above-mentioned four points to refine the reliability of TTM and improving the accuracy of its decision process and performance.

References


Errata

During the printing process for the 2004 IFTA Journal, a set of tables on pages 28 to 30 were incorrectly substituted in Mr Shiro Yamada’s article titled Derivation of Buying and Selling Signals Based on the Analyses of Trend Changes and Future Price Ranges.

We sincerely apologise to Mr Yamada for this mishap.

The correct Tables 1, 2 and 3 follow.

Table 1

Trading system under identification of trend changes (Nikkei 225)

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of trading</th>
<th>Success</th>
<th>Failure</th>
<th>Success ratio</th>
<th>Profit (Max. profit)</th>
<th>Loss (Max. loss)</th>
<th>Total of profit and loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>42.9%</td>
<td>1,839 (981.)</td>
<td>–1,815 (-789)</td>
<td>24</td>
</tr>
<tr>
<td>1990</td>
<td>14</td>
<td>6</td>
<td>8</td>
<td>42.9%</td>
<td>19,706 (7,342)</td>
<td>–5,946 (-1,756)</td>
<td>13,760</td>
</tr>
<tr>
<td>1991</td>
<td>11</td>
<td>4</td>
<td>7</td>
<td>36.4%</td>
<td>7,512 (2,849)</td>
<td>–4,625 (-1,112)</td>
<td>2,887</td>
</tr>
<tr>
<td>1992</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>45.5%</td>
<td>6,094 (2,473)</td>
<td>–5,241 (-1,318)</td>
<td>853</td>
</tr>
<tr>
<td>1993</td>
<td>10</td>
<td>3</td>
<td>7</td>
<td>30.0%</td>
<td>5,157 (2,553)</td>
<td>–2,834 (-1,013)</td>
<td>2,323</td>
</tr>
<tr>
<td>1994</td>
<td>22</td>
<td>6</td>
<td>16</td>
<td>27.3%</td>
<td>3,114 (1,617)</td>
<td>–5,180 (-855)</td>
<td>–2,066</td>
</tr>
<tr>
<td>1995</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>33.3%</td>
<td>4,267 (2,813)</td>
<td>–3,201 (-909)</td>
<td>1,065</td>
</tr>
<tr>
<td>1996</td>
<td>17</td>
<td>5</td>
<td>12</td>
<td>29.4%</td>
<td>4,021 (2,204)</td>
<td>–4,746 (-823)</td>
<td>–726</td>
</tr>
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<td>1997</td>
<td>10</td>
<td>3</td>
<td>7</td>
<td>30.0%</td>
<td>7,268 (3,052)</td>
<td>–2,504 (-601)</td>
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</tr>
<tr>
<td>1998</td>
<td>10</td>
<td>4</td>
<td>6</td>
<td>40.0%</td>
<td>3,395 (1,903)</td>
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<td>1999</td>
<td>19</td>
<td>7</td>
<td>12</td>
<td>36.8%</td>
<td>2,610 (1,515)</td>
<td>–4,222 (-685)</td>
<td>–1,612</td>
</tr>
<tr>
<td>2000</td>
<td>13</td>
<td>4</td>
<td>9</td>
<td>30.8%</td>
<td>4,222 (1,993)</td>
<td>–4,931 (-978)</td>
<td>–709</td>
</tr>
<tr>
<td>2001</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>60.0%</td>
<td>3,787 (1,554)</td>
<td>–1,333 (-704)</td>
<td>2,455</td>
</tr>
<tr>
<td>2002</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>33.3%</td>
<td>1,051 (992)</td>
<td>–1,563 (-670)</td>
<td>–512</td>
</tr>
<tr>
<td>Total</td>
<td>172</td>
<td>62</td>
<td>110</td>
<td>36.0%</td>
<td>74,042 (7,342)</td>
<td>–50,177 (-1,756)</td>
<td>23,865</td>
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</table>

Trading system under identification of trend changes and analysis of future price ranges (Nikkei 225)

Short term: 5-day MA, Long term: 25-day MA, Estimation period: 5 days

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of trading</th>
<th>Success</th>
<th>Failure</th>
<th>Success ratio</th>
<th>Profit (Max. profit)</th>
<th>Loss (Max. loss)</th>
<th>Total of profit and loss</th>
</tr>
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<tbody>
<tr>
<td>1989</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>37.5%</td>
<td>3,729 (2,450)</td>
<td>–2,137 (-789)</td>
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<td>13</td>
<td>6</td>
<td>7</td>
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<td>19,210 (8,063)</td>
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<td>1991</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>45.5%</td>
<td>7,901 (2,849)</td>
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<td>12</td>
<td>5</td>
<td>7</td>
<td>41.7%</td>
<td>6,274 (2,473)</td>
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<td>2,172</td>
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<td>1993</td>
<td>10</td>
<td>3</td>
<td>7</td>
<td>30.0%</td>
<td>4,671 (2,553)</td>
<td>–3,181 (-870)</td>
<td>1,491</td>
</tr>
<tr>
<td>1994</td>
<td>21</td>
<td>7</td>
<td>14</td>
<td>33.3%</td>
<td>3,623 (1,656)</td>
<td>–4,506 (-855)</td>
<td>–883</td>
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<tr>
<td>1995</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>50.0%</td>
<td>4,588 (2,651)</td>
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<td>17</td>
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<td>29.4%</td>
<td>4,415 (2,204)</td>
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<td>6</td>
<td>40.0%</td>
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<td>3,248 (1,903)</td>
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<td>12</td>
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<td>8</td>
<td>38.5%</td>
<td>4,001 (1,835)</td>
<td>–4,143 (-870)</td>
<td>–142</td>
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<tr>
<td>2001</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>50.0%</td>
<td>3,200 (1,554)</td>
<td>–1,469 (-704)</td>
<td>1,731</td>
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<tr>
<td>2002</td>
<td>6</td>
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<td>4</td>
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<td>1,558 (1,484)</td>
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<td>Total</td>
<td>172</td>
<td>67</td>
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<td>39.0%</td>
<td>75,772 (8,063)</td>
<td>–44,697 (-1,756)</td>
<td>31,075</td>
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### Table 2

**Trading system under identification of trend changes (Nikkei 225)**

#### Short term: 25-day MA, Long term: 75-day MA

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of trading</th>
<th>Success</th>
<th>Failure</th>
<th>Success ratio</th>
<th>Profit</th>
<th>(Max. profit)</th>
<th>Loss</th>
<th>(Max. loss)</th>
<th>Total of profit and loss</th>
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<td>0.0%</td>
<td>0</td>
<td>(0)</td>
<td>–1,105</td>
<td>(–1,105)</td>
<td>–1,105</td>
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<td>1990</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>3,796</td>
<td>(2,853)</td>
<td>–5,257</td>
<td>(–5,257)</td>
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<td>3</td>
<td>50.0%</td>
<td>5,911</td>
<td>(4,579)</td>
<td>–5,643</td>
<td>(–2,681)</td>
<td>268</td>
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<tr>
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<td>3</td>
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<td>2</td>
<td>33.3%</td>
<td>3,532</td>
<td>(3,532)</td>
<td>–4,249</td>
<td>(–2,806)</td>
<td>–717</td>
</tr>
<tr>
<td>1993</td>
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<td>5</td>
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<td>(1,719)</td>
<td>–4,423</td>
<td>(–1,225)</td>
<td>–2,627</td>
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<td>2</td>
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<td>1</td>
<td>50.0%</td>
<td>450</td>
<td>(450)</td>
<td>–167</td>
<td>(–167)</td>
<td>282</td>
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<tr>
<td>1995</td>
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<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>6,646</td>
<td>(4,387)</td>
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<td>(–174)</td>
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<td>(2,436)</td>
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<td>(–450)</td>
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<td>1</td>
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<td>263</td>
<td>(263)</td>
<td>–751</td>
<td>(–751)</td>
<td>–488</td>
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<tr>
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<td>4</td>
<td>20.0%</td>
<td>2,148</td>
<td>(2,148)</td>
<td>–8,131</td>
<td>(–1,938)</td>
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<td>6</td>
<td>1</td>
<td>5</td>
<td>16.7%</td>
<td>2,050</td>
<td>(2,050)</td>
<td>–5,192</td>
<td>(–1,748)</td>
<td>–3,142</td>
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<tr>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>100.0%</td>
<td>126</td>
<td>(126)</td>
<td>0</td>
<td>(0)</td>
<td>126</td>
</tr>
<tr>
<td>2001</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>7,028</td>
<td>(4,838)</td>
<td>–575</td>
<td>(–575)</td>
<td>6,453</td>
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<tr>
<td>2002</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0.0%</td>
<td>0</td>
<td>(0)</td>
<td>–3,252</td>
<td>(–1,323)</td>
<td>–3,252</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>19</strong></td>
<td><strong>31</strong></td>
<td><strong>38.0%</strong></td>
<td><strong>36,441</strong></td>
<td><strong>(4,838)</strong></td>
<td><strong>–36,676</strong></td>
<td><strong>(–5,257)</strong></td>
<td><strong>–235</strong></td>
</tr>
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**Trading system under identification of trend changes and analysis of future price ranges (Nikkei 225)**

#### Short term: 25-day MA, Long term: 75-day MA, Estimation period: 5 days

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of trading</th>
<th>Success</th>
<th>Failure</th>
<th>Success ratio</th>
<th>Profit</th>
<th>(Max. profit)</th>
<th>Loss</th>
<th>(Max. loss)</th>
<th>Total of profit and loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0.0%</td>
<td>0</td>
<td>(0)</td>
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<td>(–212)</td>
<td>–405</td>
</tr>
<tr>
<td>1990</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>8,831</td>
<td>(4,817)</td>
<td>–565</td>
<td>(–565)</td>
<td>8,267</td>
</tr>
<tr>
<td>1991</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>60.0%</td>
<td>2,664</td>
<td>(1,939)</td>
<td>–672</td>
<td>(–438)</td>
<td>1,792</td>
</tr>
<tr>
<td>1992</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0.0%</td>
<td>0</td>
<td>(0)</td>
<td>–3,880</td>
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<tr>
<td>1993</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td>28.6%</td>
<td>1,951</td>
<td>(1,874)</td>
<td>–3,226</td>
<td>(–869)</td>
<td>–1,275</td>
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<tr>
<td>1994</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>2,263</td>
<td>(1,642)</td>
<td>–1,223</td>
<td>(–1,223)</td>
<td>1,040</td>
</tr>
<tr>
<td>1995</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>50.0%</td>
<td>1,639</td>
<td>(1,639)</td>
<td>–174</td>
<td>(–174)</td>
<td>1,465</td>
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<td>3</td>
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<td>1,560</td>
<td>(1,301)</td>
<td>–893</td>
<td>(–522)</td>
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<td>1</td>
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<td>(–79)</td>
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<td>(0)</td>
<td>2,677</td>
<td>(–1,009)</td>
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<td>6</td>
<td>2</td>
<td>4</td>
<td>33.3%</td>
<td>972</td>
<td>(749)</td>
<td>–3,366</td>
<td>(–1,448)</td>
<td>–2,394</td>
</tr>
<tr>
<td>2000</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>100.0%</td>
<td>1,302</td>
<td>(1,302)</td>
<td>0</td>
<td>(0)</td>
<td>1302</td>
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<tr>
<td>2001</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>66.7%</td>
<td>318</td>
<td>(201)</td>
<td>–447</td>
<td>(–447)</td>
<td>–130</td>
</tr>
<tr>
<td>2002</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>100.0%</td>
<td>177</td>
<td>(127)</td>
<td>0</td>
<td>(0)</td>
<td>177</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>21</strong></td>
<td><strong>29</strong></td>
<td><strong>42.0%</strong></td>
<td><strong>26,166</strong></td>
<td><strong>(4,817)</strong></td>
<td><strong>–17,807</strong></td>
<td><strong>(–1,500)</strong></td>
<td><strong>8,359</strong></td>
</tr>
</tbody>
</table>
Table 3

Trading system under identification of trend changes (DJI)

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of trading</th>
<th>Success</th>
<th>Failure</th>
<th>Success ratio</th>
<th>Profit</th>
<th>(Max. Profit)</th>
<th>Loss</th>
<th>(Max. Loss)</th>
<th>Total of profit and loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>12</td>
<td>3</td>
<td>9</td>
<td>25.0%</td>
<td>375</td>
<td>(175)</td>
<td>-562</td>
<td>(-116)</td>
<td>-187</td>
</tr>
<tr>
<td>1990</td>
<td>13</td>
<td>4</td>
<td>9</td>
<td>30.8%</td>
<td>604</td>
<td>(403)</td>
<td>-507</td>
<td>(-84)</td>
<td>97</td>
</tr>
<tr>
<td>1991</td>
<td>22</td>
<td>3</td>
<td>19</td>
<td>13.6%</td>
<td>271</td>
<td>(243)</td>
<td>-1,059</td>
<td>(-122)</td>
<td>-788</td>
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<tr>
<td>1992</td>
<td>18</td>
<td>3</td>
<td>15</td>
<td>16.7%</td>
<td>347</td>
<td>(296)</td>
<td>-990</td>
<td>(-125)</td>
<td>-643</td>
</tr>
<tr>
<td>1993</td>
<td>14</td>
<td>4</td>
<td>10</td>
<td>28.6%</td>
<td>167</td>
<td>(107)</td>
<td>-393</td>
<td>(-85)</td>
<td>-226</td>
</tr>
<tr>
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<td>12</td>
<td>6</td>
<td>6</td>
<td>50.0%</td>
<td>522</td>
<td>(298)</td>
<td>-440</td>
<td>(-104)</td>
<td>82</td>
</tr>
<tr>
<td>1995</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>44.4%</td>
<td>1,134</td>
<td>(732)</td>
<td>-357</td>
<td>(-102)</td>
<td>777</td>
</tr>
<tr>
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<td>15</td>
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<td>11</td>
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<td>946</td>
<td>(554)</td>
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<td>(-218)</td>
<td>-455</td>
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<tr>
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<td>4</td>
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<td>1,676</td>
<td>(1,093)</td>
<td>-170</td>
<td>(-104)</td>
<td>1,506</td>
</tr>
<tr>
<td>1998</td>
<td>15</td>
<td>4</td>
<td>11</td>
<td>26.7%</td>
<td>3,192</td>
<td>(1,095)</td>
<td>-2,169</td>
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<td>1,022</td>
</tr>
<tr>
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<td>14</td>
<td>3</td>
<td>11</td>
<td>21.4%</td>
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<td>(1,184)</td>
<td>-1,857</td>
<td>(-410)</td>
<td>-132</td>
</tr>
<tr>
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<td>18</td>
<td>4</td>
<td>14</td>
<td>22.2%</td>
<td>1,513</td>
<td>(944)</td>
<td>-4,582</td>
<td>(558)</td>
<td>-3,070</td>
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<tr>
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<td>5</td>
<td>11</td>
<td>31.3%</td>
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<td>(979)</td>
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<td>807</td>
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<td>5</td>
<td>2</td>
<td>3</td>
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<td>570</td>
<td>(429)</td>
<td>-605</td>
<td>(-373)</td>
<td>-35</td>
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<tr>
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<td>192</td>
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<td>138</td>
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<td>16,015</td>
<td>(1,184)</td>
<td>-17,260</td>
<td>(-558)</td>
<td>-1,245</td>
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Trading system under identification of trend changes and analysis of future price ranges (DJI)

Short term: 5-day, MA, Long term: 25-day MA

<table>
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<tr>
<th>Year</th>
<th>No. of trading</th>
<th>Success</th>
<th>Failure</th>
<th>Success ratio</th>
<th>Profit</th>
<th>(Max. Profit)</th>
<th>Loss</th>
<th>(Max. Loss)</th>
<th>Total of profit and loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>12</td>
<td>3</td>
<td>9</td>
<td>25.0%</td>
<td>407</td>
<td>(175)</td>
<td>-593</td>
<td>(-187)</td>
<td>-186</td>
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<tr>
<td>1990</td>
<td>13</td>
<td>5</td>
<td>8</td>
<td>38.5%</td>
<td>693</td>
<td>(403)</td>
<td>-415</td>
<td>(-66)</td>
<td>278</td>
</tr>
<tr>
<td>1991</td>
<td>22</td>
<td>4</td>
<td>18</td>
<td>18.2%</td>
<td>392</td>
<td>(293)</td>
<td>-832</td>
<td>(-124)</td>
<td>-440</td>
</tr>
<tr>
<td>1992</td>
<td>19</td>
<td>4</td>
<td>15</td>
<td>21.1%</td>
<td>366</td>
<td>(296)</td>
<td>-967</td>
<td>(-125)</td>
<td>-602</td>
</tr>
<tr>
<td>1993</td>
<td>14</td>
<td>4</td>
<td>10</td>
<td>26.6%</td>
<td>213</td>
<td>(72)</td>
<td>-348</td>
<td>(-85)</td>
<td>-134</td>
</tr>
<tr>
<td>1994</td>
<td>11</td>
<td>4</td>
<td>7</td>
<td>36.4%</td>
<td>236</td>
<td>(97)</td>
<td>-373</td>
<td>(-92)</td>
<td>-136</td>
</tr>
<tr>
<td>1995</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>44.4%</td>
<td>834</td>
<td>(403)</td>
<td>-345</td>
<td>(-102)</td>
<td>490</td>
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<td>15</td>
<td>4</td>
<td>11</td>
<td>26.7%</td>
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<td>(-218)</td>
<td>-779</td>
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<td>7</td>
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<td>-161</td>
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<td>1,139</td>
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<td>-1,144</td>
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<td>-4,433</td>
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<td>11</td>
<td>31.3%</td>
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<td>(1,054)</td>
<td>-2,277</td>
<td>(-333)</td>
<td>920</td>
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<td>(-182)</td>
<td>1,433</td>
</tr>
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<td>134</td>
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<td>14,773</td>
<td>(1,208)</td>
<td>-16,588</td>
<td>(-554)</td>
<td>-1,814</td>
</tr>
</tbody>
</table>
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IFTA BUSINESS, ADMINISTRATION & BANKING SERVICES
Ilse A. Mozga
International Federation of Technical Analysts
157 Adelaide St. W., Suite 314
Toronto, Ontario, M5H 4E7 Canada
Tel. 1 416.856.9774 iftaadmin@look.ca