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Technical Analysis for Metals Trading

Presented at Metals Trading and Risk Management course
(Metal Bulletin, 30/6 - 02/7/2008)

Chris Satchwell
02/7/2008

 Doc no. 100.050.03 Last modified: 29/06/2008 15:09


Weekly Aluminium - Public & Bespoke Indicators
(c) Technical Fo
Price
MACD
Probability
xT2N
12-12-2005
01-05-2006
18-09-2006
05-02-2007
25-06-2007
12-11-2007
31-03-2008

TECHNICAL ANALYSIS FOR METALS TRADING

by

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INTRODUCTION

Market decisions can take place over many different timescales. It is usual to look at an individual market decision from multiple time perspectives. A strategic decision to enter or exit might be taken on the basis of weekly information, with tactical timing of the market order decided on the basis of a daily or intra-day timescale.

Intra-day trading is particularly difficult, as it requires rapid access both to data and to appropriate decision analytics, such as the content of Metal Bulletin's "**Market Watch**". With daily or weekly trading, there is usually the luxury of more time to consider a decision in relation to past behaviour in similar circumstances. This allows the use of a wider range of intelligence decision tools, such as those provided by TFL's "**Leapfrog**". Market data has an intrinsic problem of "noise" relative to "signal", which we will look at shortly, but in the author's experience the highest ratio of signal to noise is found in weekly data. Since signals in weekly data are usually the most clear, weekly charts are used in this paper.

Signals are often based on the most recent **sample** of market data, such as closing prices. This sample is referred to as a "**window**" of data, and can be moved progressively through the time series to become a "**moving**" or "**sliding**" window. Later we will look at indicators and **moving** averages that are all based on the most recent sample of data of a defined **size**, sometimes referred to as a "**length**".

Techniques for generating signals work across different time sampling intervals, with the proviso that appropriate window sizes must be found for different timescales. For example, when using moving averages, one window size might be required for weekly trading, but another may produce better results for daily, and yet another if (say) fifteen minute price bars were being used intra-day.

Inferring future price behaviour from price charts is difficult for many reasons – but primarily because price is a "noisy" quantity (ie price varies erratically around a smoother mean value). Technical analysis has developed to address this difficulty with the aid of "**indicators**" and "**oscillators**", which relate to price but are much less noisy. Experienced technical analysts assess the significance of values and gradients of these indicators for their decisions, and use them to great effect. Because of their reduced "noise", indicators and oscillators have far fewer turning points, making it easier to infer their likely future behaviour, and from that, where price is likely to go.

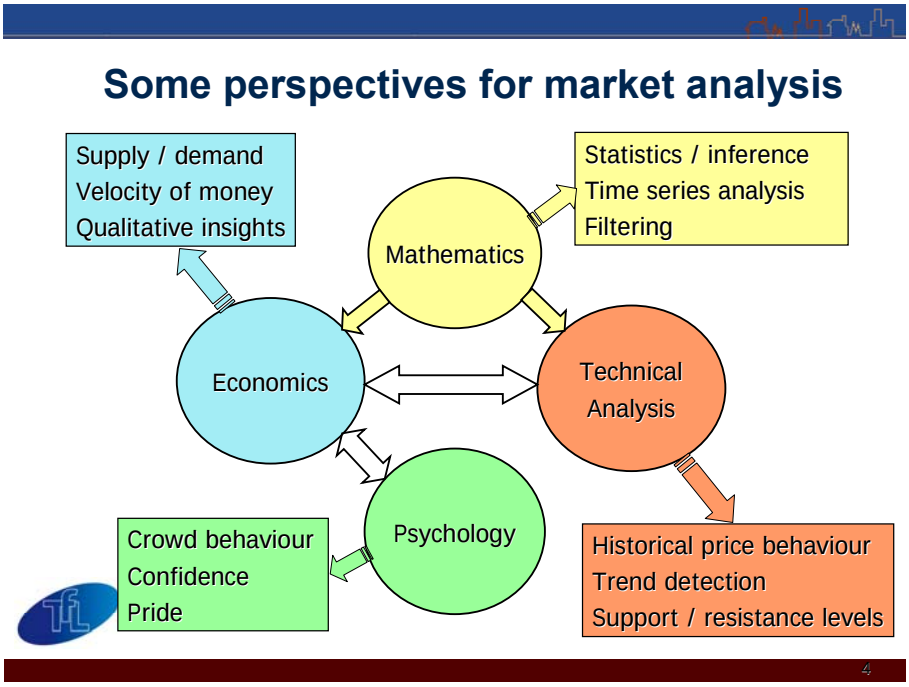
This document will explore the behaviour of price and its likely future direction. Unfortunately, price ultimately depends on the individual decisions of market participants, and so no method of predicting it is likely to be successful all of the time. For this reason a "sure" method of price prediction can never be offered; but what can be offered are predictive techniques that have been found to be helpful for much of the time.

With market decisions, best practice requires examination using multiple analysis techniques and "fusing" their results. Speaking mathematically, for best results from similarly effective models with uncorrelated errors, credibility "investment" should be distributed between them.

In summary: technical analysis can never deliver optimal results when it is used blindly, so other perspectives on the markets need to be examined.

Note that references are listed in the final slide of the presentation.

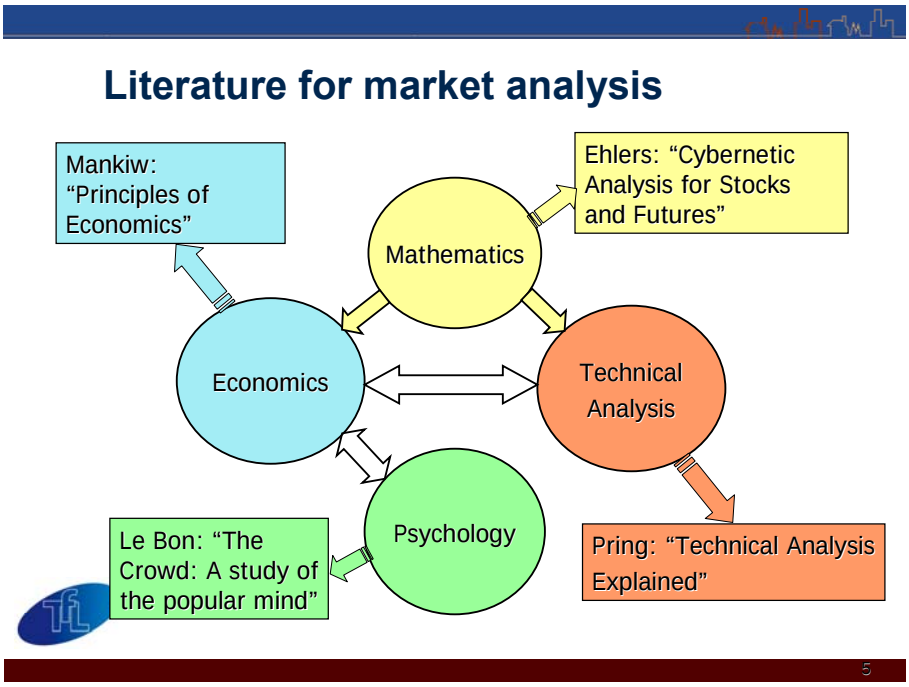
2. QUALITATIVE PERSPECTIVES FOR MARKET ANALYSIS



Principal **qualitative** perspectives are economics and psychology. In commodities, a simple theory of economics known as Cobweb Theory is useful. Literature on the application of psychology to markets is less well developed, but J.K. Galbraith's "A Short History of Financial Euphoria" is worth reading.

Quantitative perspectives come from mathematics and technical analysis – but for reasons of ever-changing market behaviour, these cannot deliver the quality of answer normally expected from mathematics or anything "technical". Mathematics delivers insights into the behaviour of time series as well as concepts of "signal", "noise" and "probability" – all of which tend to be under-used in market decisions at present.

Technical analysis is discussed in greater detail later; but in short, it tends to have been found to work best in practice.

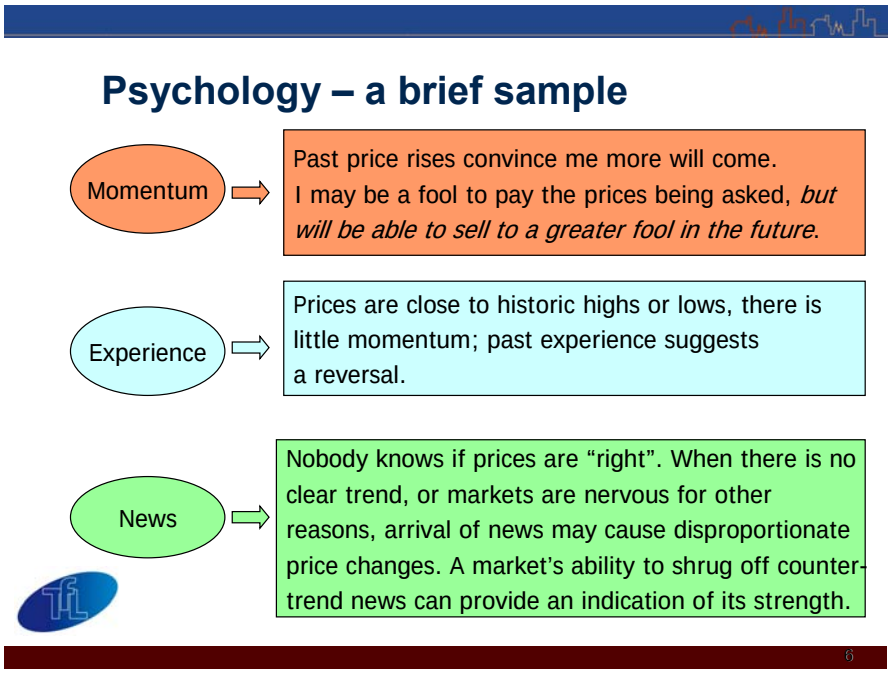


In order to qualify as a technical analyst, one must read certain books, one of which is Martin Pring's "*Technical Analysis Explained*". Pring's web site, www.pring.com, sells a number of useful educational items. Alternatively, the style of writing in John Murphy's "*Technical Analysis of the Futures Markets*" might appeal more to non-native speakers of English.

An acknowledged **mathematical** author on the markets is John Ehlers, whose book is mentioned in the slide above.

Also mentioned in the slide is Gustave Le Bon's book "*The Crowd: A study of the popular mind*" (translated from French). This book was written many years ago and endures through sheer quality. It is useful for understanding crowd behaviour; but was not written directly as a book on markets, so the link between crowd behaviour and market consequences must be derived by the reader.

Although Mankiw is mentioned as an economics text, most standard texts should be as good, so use whichever one you find most helpful.



This psychological market perspective envisages three dominant mental processes.

1. Momentum, which can be dangerous when people convince themselves that past price rises are "proof" they will continue. In extreme cases, such as Dutch tulip mania, or US dot.com bubble, having seen others make money, people are swept up in the euphoria and mortgage their homes to join the boom – often finishing up much poorer, but wiser, than they were before. Their logic is known as the "greater fool" syndrome.

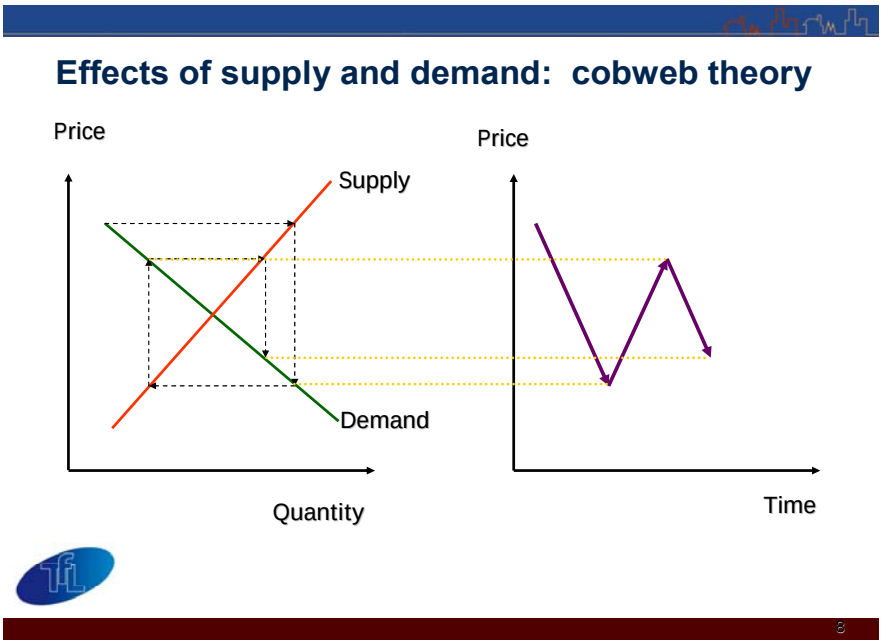
2. Simple experience of past price limits.

3. The impact of news, which is not widely appreciated. When markets are flat, they search for a direction and can become sensitive to any news. If they fear that a top is imminent, they can become highly sensitive to bad news. Conversely, an ability to shrug off bad news in an up-trend offers confirmation of the trend's strength, or, from a market bottom, may even become the start of a new up-trend. In a down-trend, good news may produce a short-term rally in prices, but ultimately the down-trend usually must run its course.

Following on from the slide on psychology, this slide offers some questions for a checklist for your own trading:

Questions for your market awareness 1

1. Is there a strong trend, or is this a non-trending market which is sensitive to news?
2. Are people buying or selling on the "greater fool" basis?
3. Is this market nervous?
4. Is a major top or bottom expected where the market will react to one type of news?
5. Has the market shrugged off price-influencing news?



Every commodity trader should be aware of cobweb theory. It applies to most commodities, but for simplicity will here be explained in terms of horticulture. Starting at the upper left of the demand curve, we assume prices for lettuce are high, which encourages growers to plant more lettuce. The result is oversupply, which can only be consumed by lowering the price – hence prices fall to a point on the demand curve where the supply can be absorbed. Growers are now discouraged, grow something else, the quantity of lettuce available reduces, and so price recovers. The slide shows a stable price oscillation, but if the demand curve is shallow and supply curve steep, a price oscillation can become unstable.

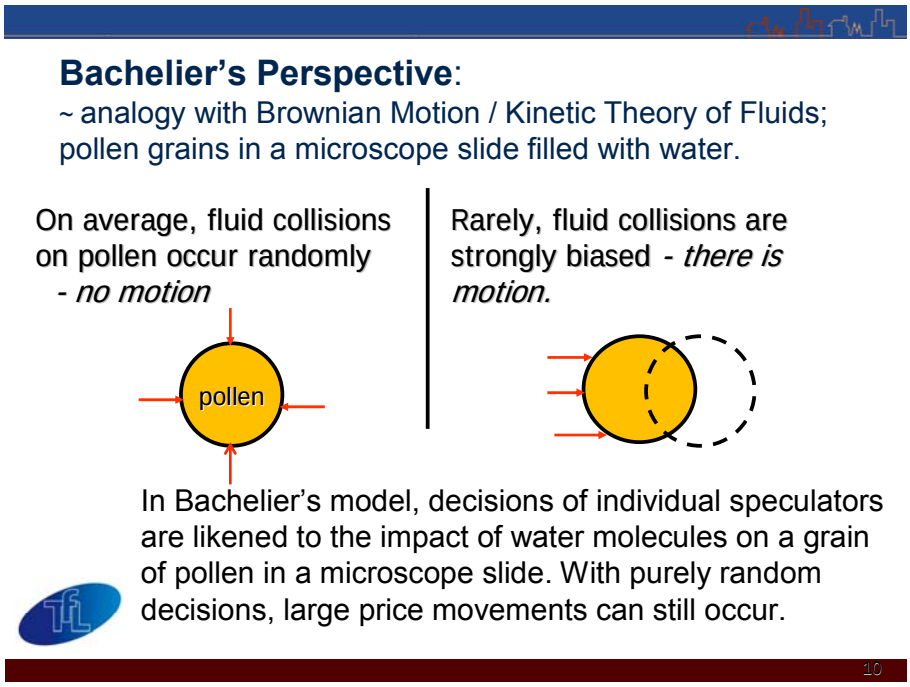
With metals, the lower level of price is likely to be when efficient producers are barely profitable and the inefficient have gone out of business. As prices rise, inefficient producers re-appear. Unfortunately, the top may not be well predicted by cobweb theory, as there may be distortions due to hoarding, buyers wanting to hold the commodity in preference to cash, or purchasing on the basis of "greater fool" logic. If any of these phenomena are present it should be taken as a warning that the days of rising prices may be drawing to a close.

Demand and supply curves are rarely known with accuracy so the market's position on the cobweb chart needs to be inferred indirectly. The slide suggests possible questions for a trader's check list to help with this.

With metals, there are two obvious dangers alluded to in questions on the slide:

1) that "demand" represents stocking warehouses with metals, to earn a profit from holding them, with the intention of releasing them for subsequent profitable "supply", and

2) that new low-cost sources of supply will be discovered.



A Victorian scientist, Brown, tried to study pollen. When he looked at pollen grains in a water-filled microscope slide, he discovered that they moved occasionally for no obvious reason. The mystery was eventually explained as in the slide above.

Bachelier, a student of the French mathematician Poincaré, used the Brownian motion model to explain occasional large stock price movements. In Bachelier's model, investors all (randomly) decide either to buy or to sell at the same time, similar to the occasional bias in fluid collisions on a grain of pollen that cause it to move.

Poincaré was not impressed, but Bachelier's model does apply at times, and explains why markets can sometimes behave irrationally for no apparent reason.

Questions for your market awareness 3

1. Given that large price movements can occur from random causes, is it a mistake to try to rationalise the latest price movement?
2. Are events causing a price change random in their nature?
3. What criteria do I need, to decide whether a price movement is causal rather than random?

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It is easy to believe that everything has a reason, and over-rationalise. It is unwise to forget that some things are **not** rational. The slide's questions are intended to remind you of that, and might be worth including in questions you should be asking yourself as part of your trading.

The perfect trading system?

Someone invents the "perfect" trading system, which becomes widely known → All traders use it to take the same side of a trade → Supply / demand imbalance causes prices to adjust to reduce the effectiveness of the "perfect" system

1. For markets to be effective, buyers and sellers must disagree over price direction
2. No single, widely-known trading system can always be effective
3. Markets must change their behaviours to negate the effectiveness of widely-used trading systems; i.e. they need to behave inconsistently
4. Traders need an armoury of different perspectives to understand market behaviours

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Markets do not like giving large profits away; they will change their characters to prevent it. Note the points on the slide, and remember them in your trading.

The reality: expect markets to change

"So one of the keys to being a successful trader over a period of time is to adapt to change. You must be able to find a new program when one is needed and have the discipline to implement it."

J. Peter Steidlmayer

"Steidlmayer on Markets … A New Approach to Trading" - Wiley 1989

There is no formula for success other than to adapt quickly to changing market conditions

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Peter Steidlmayer was one of the greatest day-traders ever. His words should be heeded.

The uncomfortable truth is that attempts to analyse markets cannot always keep up with their changeable nature. Markets are a little like fashion: their styles may change on a whim, but old styles tend to return unexpectedly.

As an indication of difficulty of trading markets, there are credible reports that more than 90% of new futures trading accounts are wiped out in their first year. One of the aims of this document is to help its readers become part of that elite who survive and prosper.

3. BACKGROUND TO TECHNICAL ANALYSIS

Some subjects, such as mathematics, physical or engineering sciences are easy to teach because they have perfect logic and little (if any) scope for subjective opinion. "Softer" sciences such as psychology or economics have much more scope for subjective opinions. Technical Analysis lies somewhere between these two nodes, but suffers from a lack of academic study or rigour, vocal self-appointed "experts", a lack of widely accepted definitions, and disagreement over what its tools mean or how they should be used.

Technical analysis is founded on observation of what "works". Inevitably different people have had different experience of what "works", and the changeable nature of markets does not help consistent interpretation. There is no real agreement on the scope of technical analysis, nor boundaries between it and related subjects. Unlike economics, there are no Nobel prizes or prestigious university chairs for technical analysis; but its origins go back at least a century and some of its key methods have been independently discovered and recorded on different continents at different times.

The aim here is to test various technical analysis tools to see if they "work" with industrial metals. **The example used will be a weekly chart of tin prices derived from daily close prices**. Unfortunately, no volume information is available, and neither (for possible futures trading) is open interest. Data used probably reflects that which is likely to be available to users of the present techniques, but it should be appreciated that additional techniques become available when additional data is present.

The introductory slide presents the following cautions about technical analysis:

CAUTIONS: *(1) Definitions and principles are fuzzy*

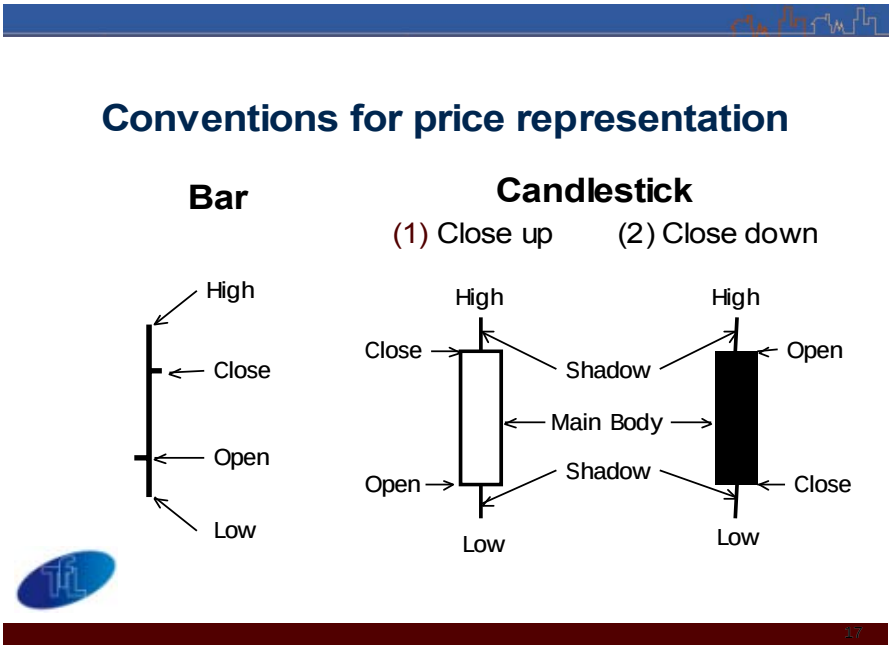
(2) It is guaranteed to be wrong some of the time

(3) It needs to be used with qualitative judgments

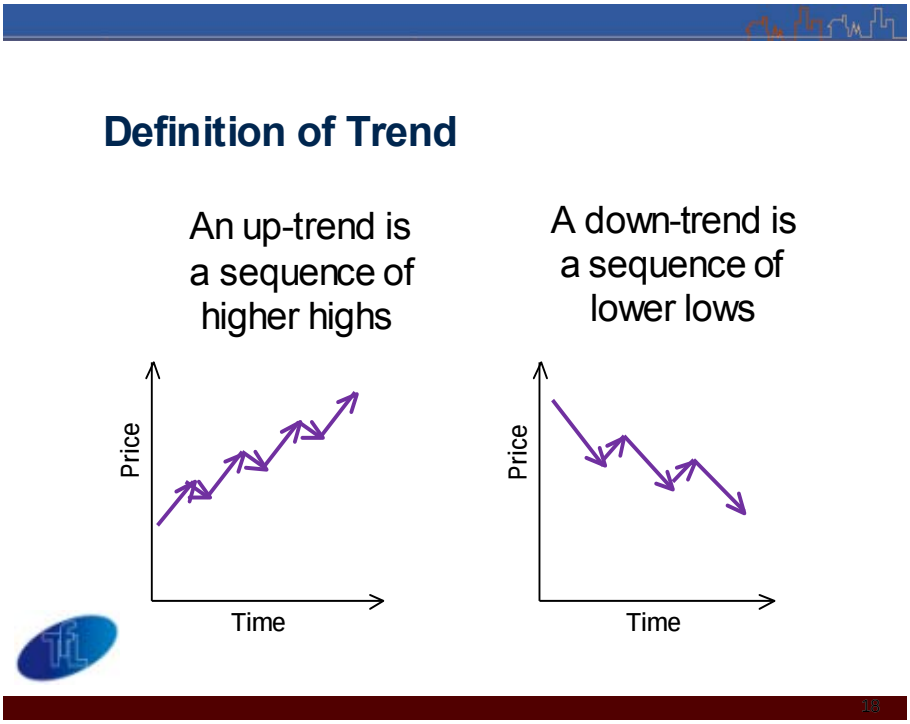
(4) It has a major subjective component

(5) Some consider it more of an art than a science

Two conventions exist for representing price data on a chart:



We will also find a formal definition of a trend useful:



3.1 COMMON TRADING TOOLS

3.1.1 SUPPORT & RESISTANCE

Classical support & resistance

- *In weakly trending markets*, previous turning points (i.e. major highs or lows) create an expectation of a level at which a current price movement will reverse
- *Failure of a major support or resistance* level often signals the start of a new trend

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General principles for finding support or resistance levels

- highest high / lowest low for some recent period
- a level where prices have *repeatedly* reversed in the past
- historical highs or lows
- the more recent the turning point; the larger it is; or the more times it has worked in the past → the more likely it is to be a support or resistance level

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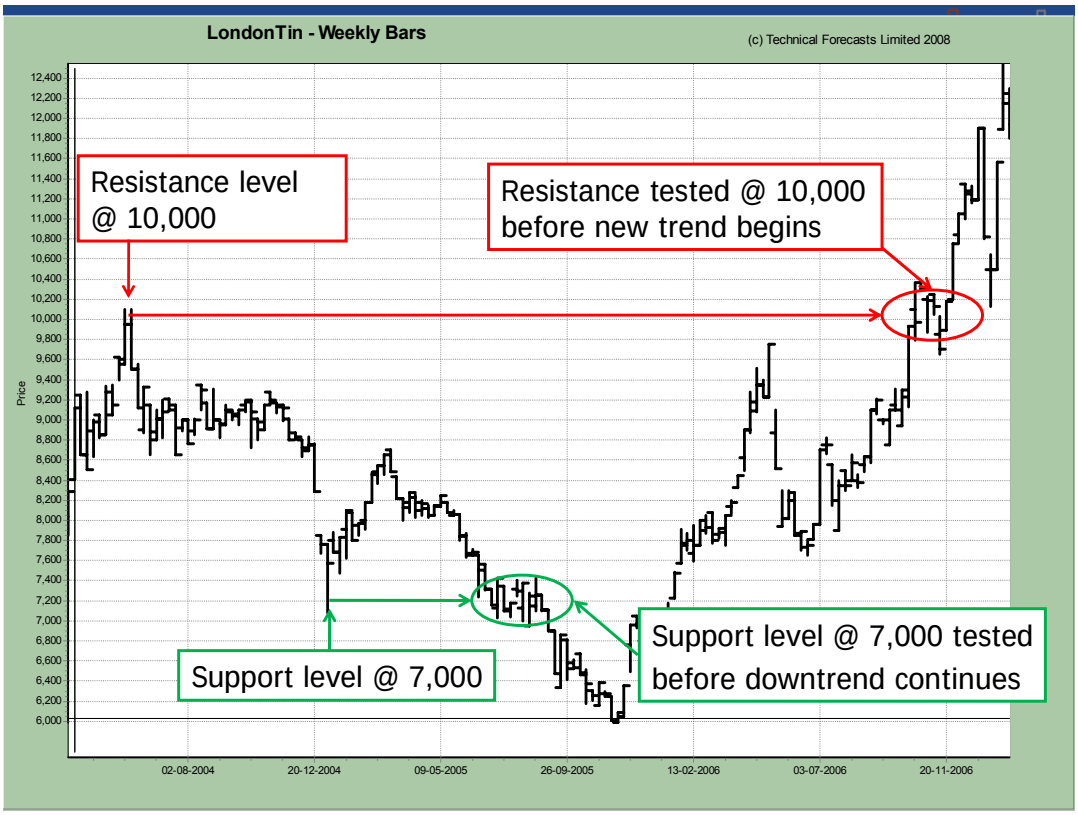
Support and resistance levels are a useful concept for prior assessment of the next likely turning point. Examples are given in the following slide. A great deal is written about them in technical analysis literature, but ultimately, selection of these levels is **subjective** not **objective**. The user has to decide which levels work for their trading objectives in their chosen instruments.



Annotations show typical usage of these levels by technical analysts. Note also in the left of this chart, that prices hover around the 8,000 level for a long time, and (towards the right of the chart) also spend a few weeks there, before powering up to the 10,000 level in a single bar.

This describes the "what"; now let us consider the "when":

Support & resistance – the "when"

1) *When taking a position*, look to see what support or resistance is present, to help assess risk or plan an exit
2) *If prices are close to whole numbers* (7,000 & 10,000 in the previous example) be aware that they may act as support or resistance levels
3) *When prices are at new historic highs*, there may still be support, but resistance becomes unclear
4) *Strongly-trending markets* may just ignore support or resistance levels

Moving averages ~ Φ_N

1. *Conventional:*

- Define a "Window" size "N"
- add up all close prices in window (P_n)
- divide by "N"
- $\Phi_N = (1/N) \sum_{n=1}^{n=N} P_n$

2. *Exponential (EMA):*

- Define "N"
- find $\alpha = 2/(N + 1)$
- at time "t", price P_t

$\Phi_{Nt} = (1- \alpha)\ \Phi_{Nt-1} + \alpha\ P_t$

- start with $\Phi_{N1} = P_1$ & proceed to t = N before using Φ_{Nt}

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Moving averages are widely used in technical analysis. They can be used as resistance or support lines, or to generate trading signals, either when penetrated by price or when a short average crosses a long one. Later, we will look at the MACD method of generating signals, where this idea is highly developed. First, we consider their properties:

Properties of moving averages

- They offer a smoothed interpretation of price
- They lag price because their time average is at their mid point. Time lag is N/2.
- Their gradients help determine price direction
- When too short, they "wiggle" too much, and when too long, "lag" too much
- They can show resistance and support in a trend

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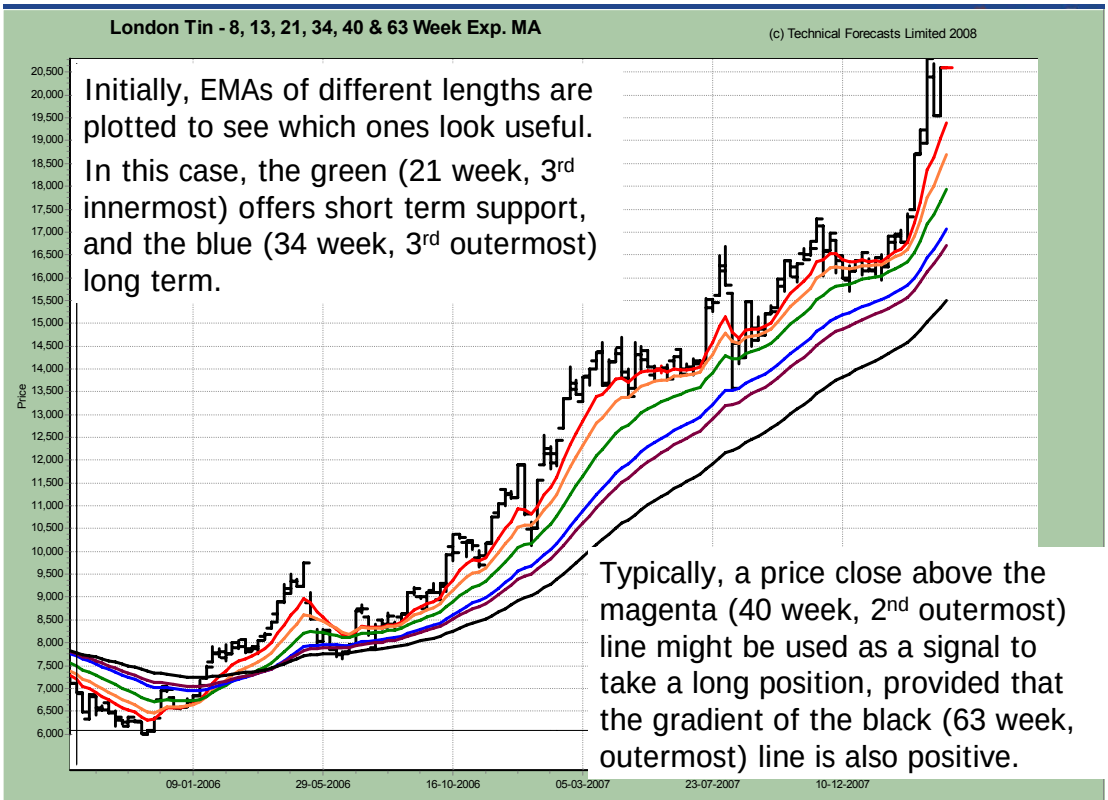
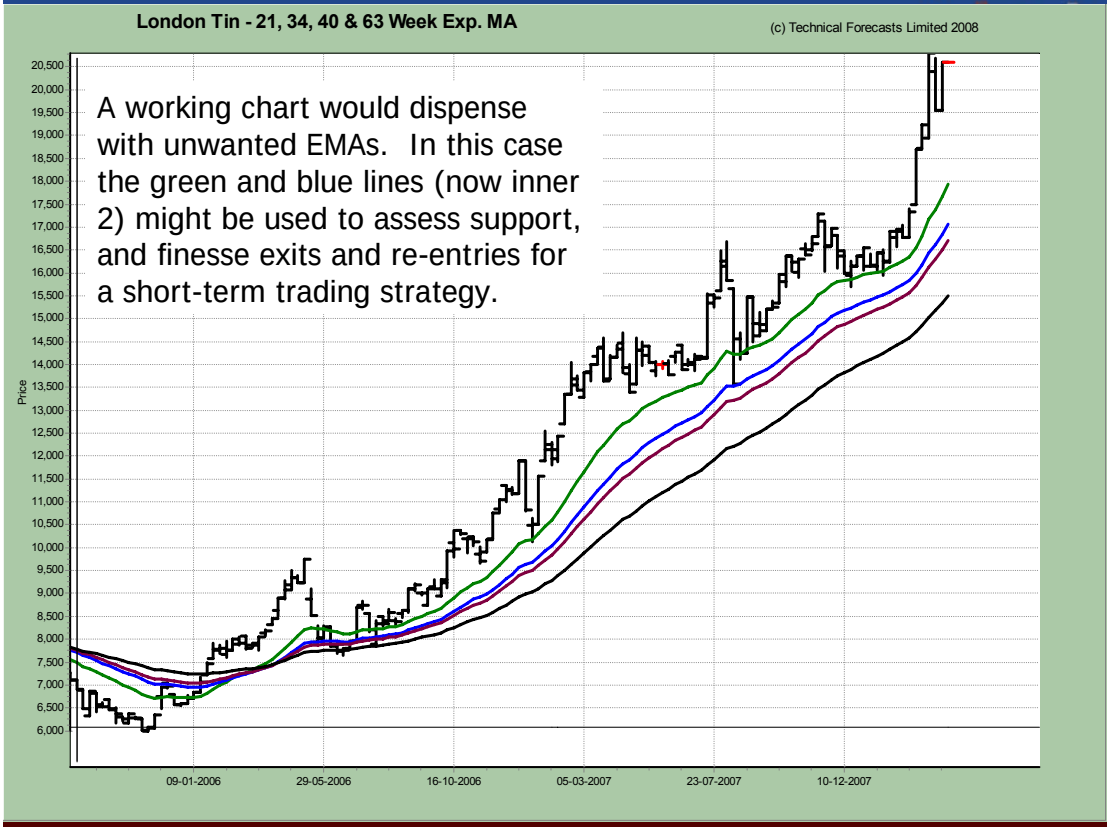
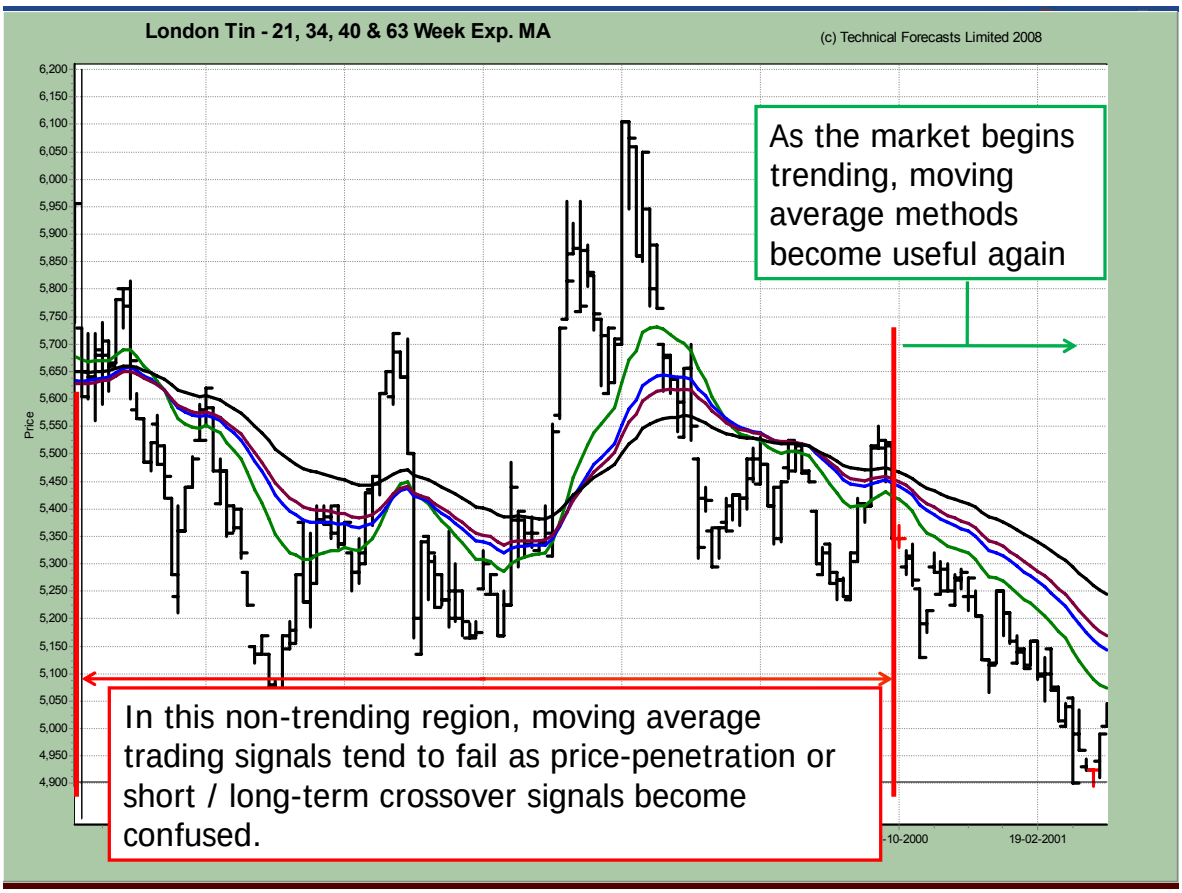

London Tin - 8, 13, 21, 34, 40 & 63 Week Exp. MA
(c) Technical Forecasts Limited 2008
Initially, EMAs of different lengths are plotted to see which ones look useful.
In this case, the green (21 week, 3rd innermost) offers short term support, and the blue (34 week, 3rd outermost) long term.
Typically, a price close above the magenta (40 week, 2nd outermost) line might be used as a signal to take a long position, provided that the gradient of the black (63 week, outermost) line is also positive.
Price
09-01-2006
29-05-2006
16-10-2006
05-03-2007
23-07-2007
10-12-2007


London Tin - 21, 34, 40 & 63 Week Exp. MA
(c) Technical Forecasts Limited 2008
A working chart would dispense with unwanted EMAs. In this case the green and blue lines (now inner 2) might be used to assess support, and finesse exits and re-entries for a short-term trading strategy.
Price
09-01-2006
29-05-2006
16-10-2006
05-03-2007
23-07-2007
10-12-2007

Caution needs to be exercised when using moving averages to generate trading signals. The general rule is to use them in trending markets but avoid using them in other (sideways) markets. In non-trending markets, they tend to produce signals for "whipsaw" trades; e.g. prices move up just enough to produce a moving average "buy" signal, before immediately reversing, and continuing just far enough to generate a "sell" signal, before reversing again. Successions of loss-making trades from moving average signals are common in sideways markets with disastrous consequences for draw-downs and losses. An example is shown below:



MACD (Moving Average Convergence / Divergence)

1. Choose two lengths, one long & one short (e.g. 26, 12) for two EMAs Φ_1 & Φ_2
2. "Raw" MACD is $(\Phi_1 - \Phi_2) / \Phi_1$
3. Define a length (e.g. 9) for an EMA of "Raw" MACD.
   This is "Smoothed" MACD.
4. Typical signals are:
   a. crossing zero
   b. raw crosses smooth

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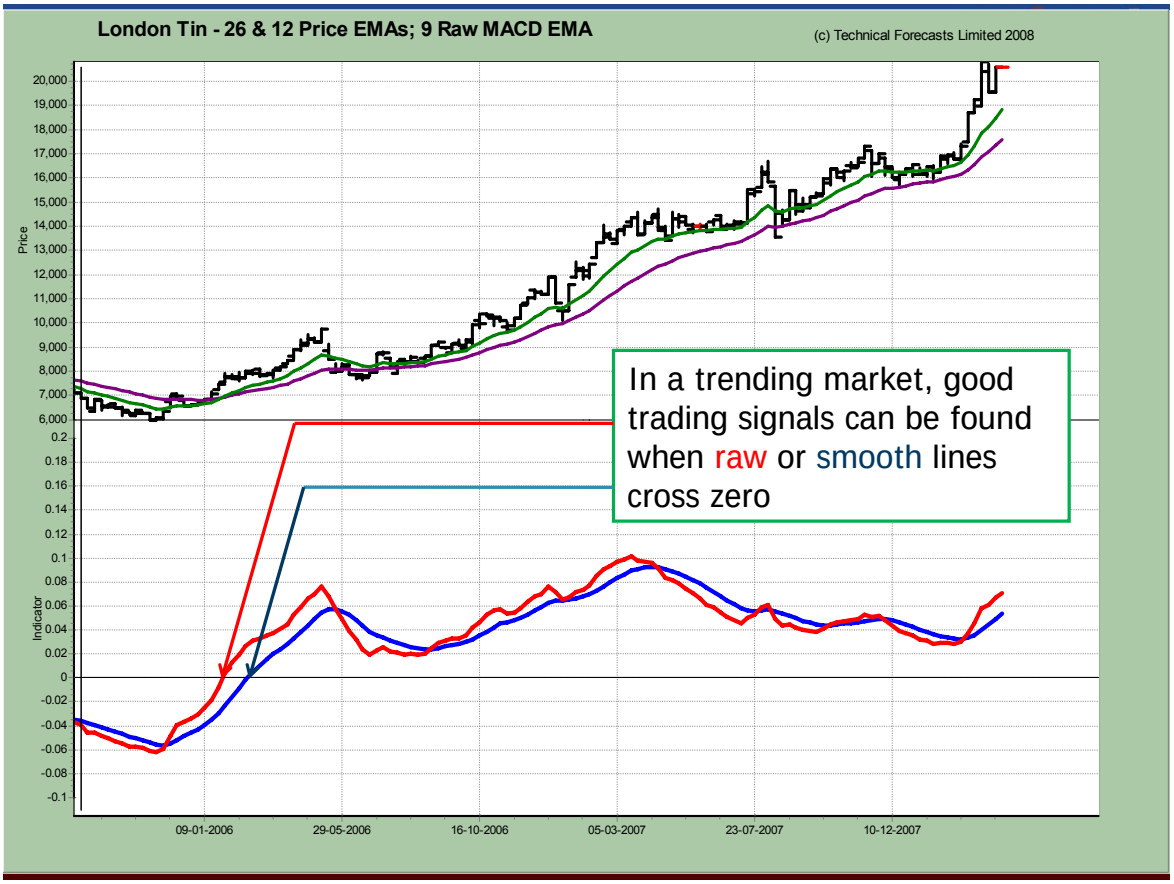

MACD is a widely used trading system in stocks. Recommended parameters for ***daily*** trading are 26, 12 and 9, but are used above on weekly charts for Tin.

MACD signals need to be interpreted differently at different times, depending on the type of market being traded. Transitional markets moving from up to down trend, or sideways into a trend, tend to generate false signals. The following chart shows usage of different types of signal in different markets.

3.1.4 INDICATORS & OSCILLATORS

Indicators and oscillators are quantities derived from "hard" technical data, which are used to aid trading decisions. Raw and smooth MACD lines are examples of indicators.

In general, indicators and oscillators are "lagging" quantities, but lag can be reduced by averaging a measure of difference between closing prices, known as momentum. This can be made non-dimensional, by dividing by price.

Indicators / oscillators

- Oscillators are confined to a fixed numerical range; indicators are not
- Indicators and oscillators have three main functions:
  a) *To assess the strength of any price change with time (momentum)*
  b) *To assess whether a market has recently moved too far too fast (overbought / oversold)*
  c) *To assess the prevailing type of market: trending or non-trending (market classifier)*

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Momentum – assesses price direction

- At times "t-1" & "t", closing prices are P_{t-1} & P_t
- Momentum between t-1 & t is $(P_t - P_{t-1}) / P_t$
- Momentum is a "noisy" quantity, so use an EMA
- To reduce noise further, use regularization (see Ehlers' or Satchwell's books for details)

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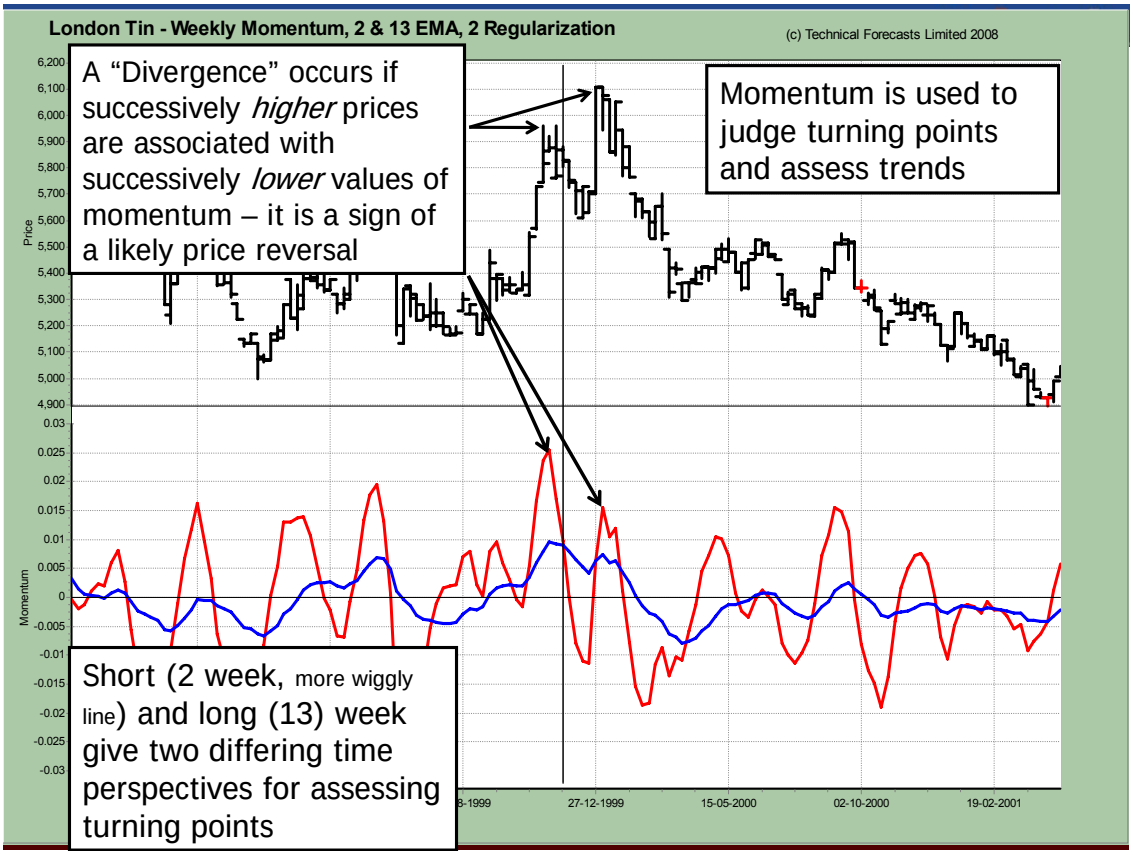
The following slide shows momentum indicators during a difficult trading period for tin. It is usual to use more than one length in order to obtain a multi-period time perspective for trading decisions.



In this case, 2- and 13-week exponentially-averaged and regularized lines are used. Note that in the down trend to the right of the chart, the slower (blue) line is predominantly below zero, although the faster (red) line oscillates above zero in response to short term price peaks.

One way of using momentum is to use a long period line to assess trend (e.g. when it is persistently above or below zero) and a short period line to assess both turning points and good places to enter or exit trades in the direction of the trend.

Another is to look for levels which are habitually associated with price reversals (turning points) and use them to assess whether a turning point is imminent.

There is a problem with smoothing averaged momentum to assess turning points via "gradient" logic. Ehlers reviews a number of "super smoother" methods, the simplest of which is the technique of regularization, details of which can also be found in Satchwell. The technique is popular because it gives users a method of controlling smoothing.

There are clear difficulties in periods where prices are moving sideways. Sometimes sideways price movements occur in a "channel" – which is where a stochastic can be useful, to identify "overbought" and "oversold" situations and produce an appropriate trading signal.

Sometimes, sideways markets occupy a sizable trading channel which is wide enough for profits from price movements to exceed trading costs. In these cases also, a stochastic oscillator can be useful. In narrow channels, price movements are likely to be too small for any trading (apart from selling options) to be worthwhile.

Stochastic – overbought / oversold assessment in non-trending markets

- Expresses close price relative to prices of recent past
- Define a range "N" (usually 5) & find highest high (H) & lowest low (L) in range.
- If current close is "C",
  %K = 100(C – L)/(H – L)
  %D = 3 period moving average of %K
  %D-Slow = 3 period moving average of %D

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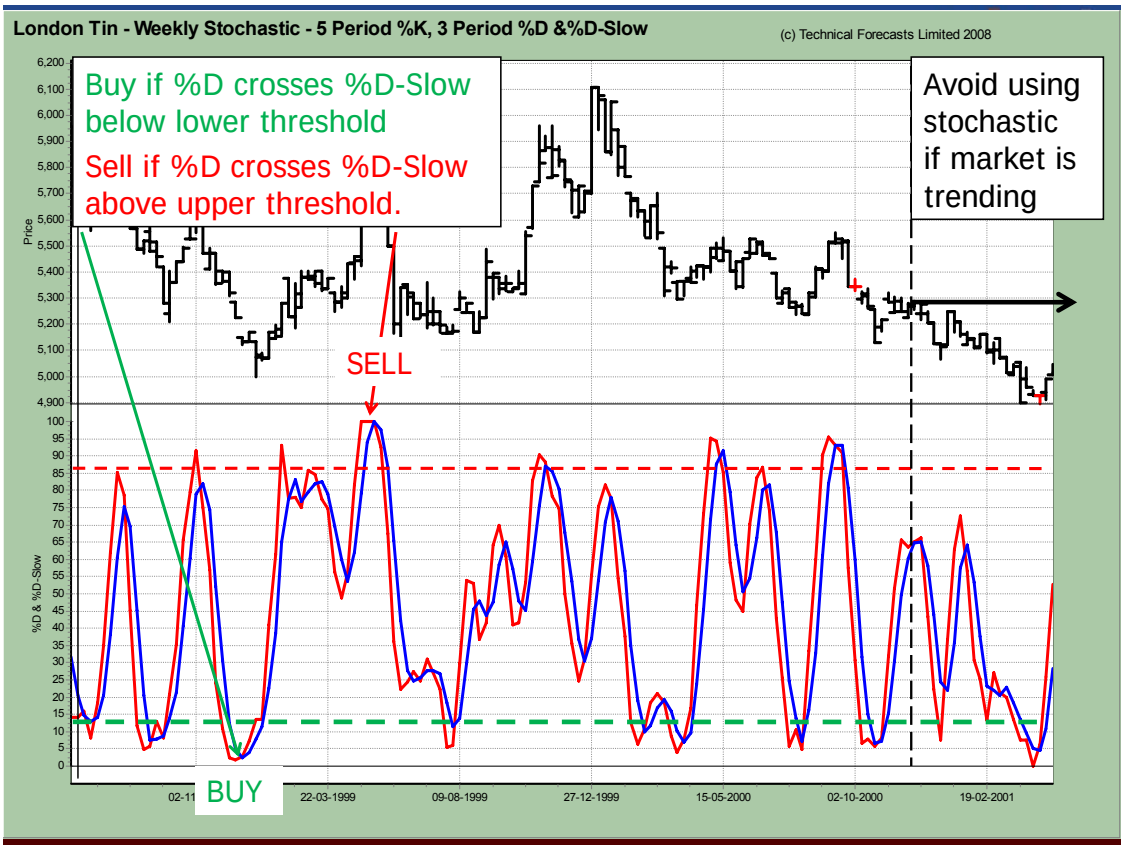
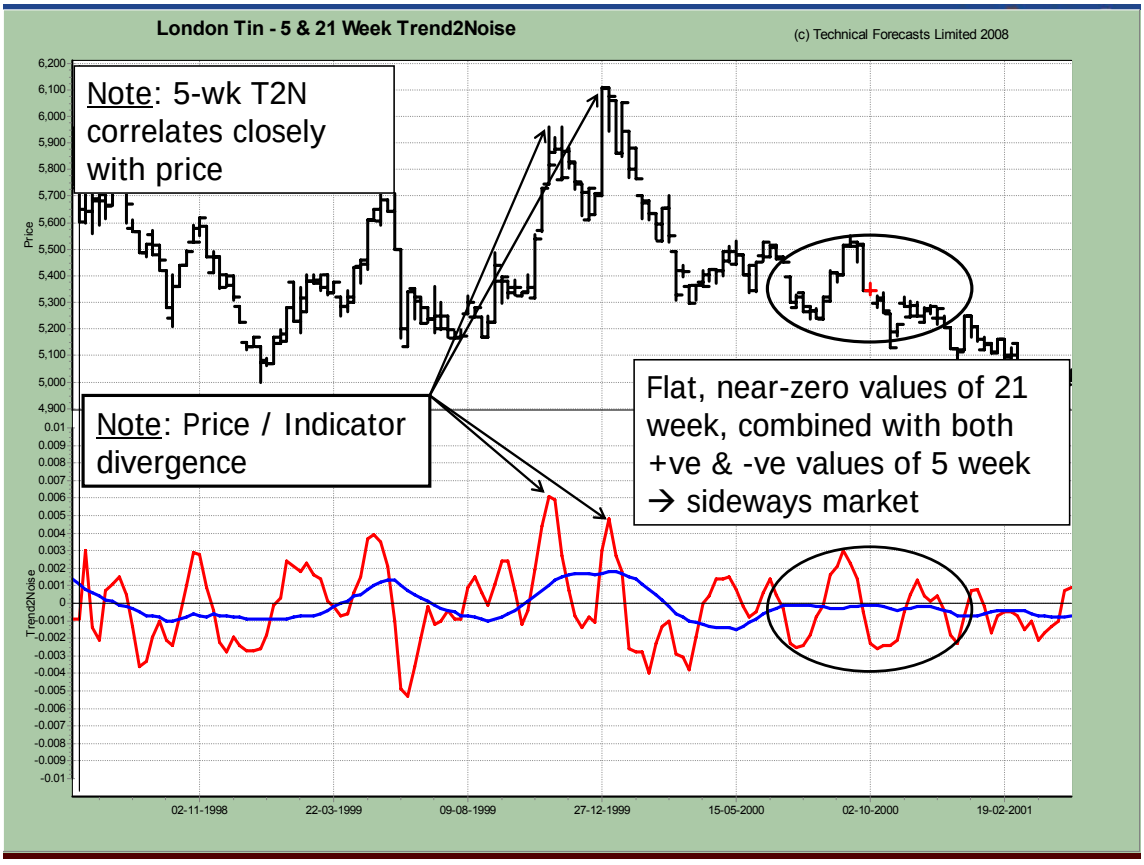


Usage of the stochastic is as shown on the slide. Upper and lower thresholds need to be defined by the technical analysts, and crossover signals beyond those thresholds are then used for trading. If prices move out of a channel, another approach should be used.

Indicators using only closing prices make no use of "range" information; i.e. the difference between a high and a low of a price bar. The next objective is to find a momentum-type indicator to help distinguish between small ranges in a tradable trend, and large ranges in a choppy market with similar raw momentum but which is likely to deliver an unwanted trigger for a stop order. The approach used is a little mathematical, but an outline is given on the following slide:

Trend2Noise – momentum & market classifier

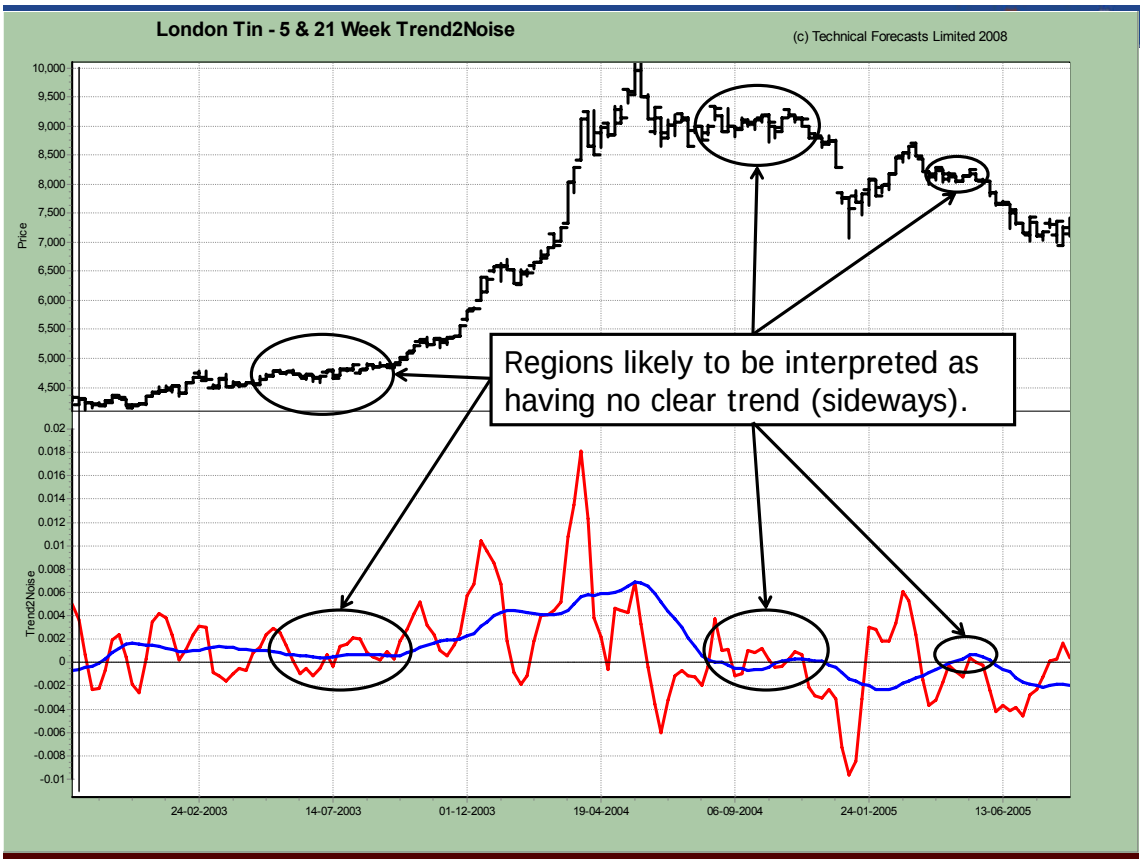
- Fit a "best fit" line through a "window" of closing prices
- For each High / Low price in the price "window" find the largest difference from the best fit line, square and sum
- Find the root mean square (RMS) of the sum
- Trend2Noise is gradient of "best fit" line divided by RMS



With Trend2Noise, an extended, near-zero value of an indicator of appropriate length is indicative of a sideways market. An appropriate length will vary according to the behaviour of the instrument being traded and the objectives of the trader. The longer the length, the better

the sideways signal, but the longer it takes the indicator to settle into or escape from the sideways market interpretation.

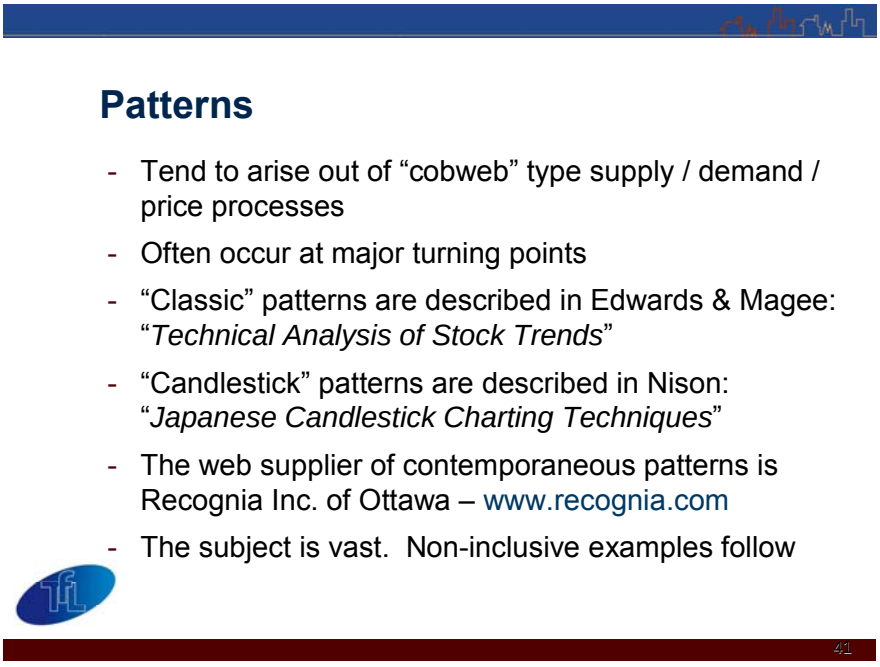
In the graphs shown, the 21-week (blue) line is used to assess "sideways" behaviour and the five-week (red) line used for assessing momentum where price range is included as described. Any extended period of the blue line hovering around zero would negate trading on the basis that the market was behaving in a sideways manner. Otherwise, the blue line could be used to assess trend and the red to enter or exit trades consistent with a trend.



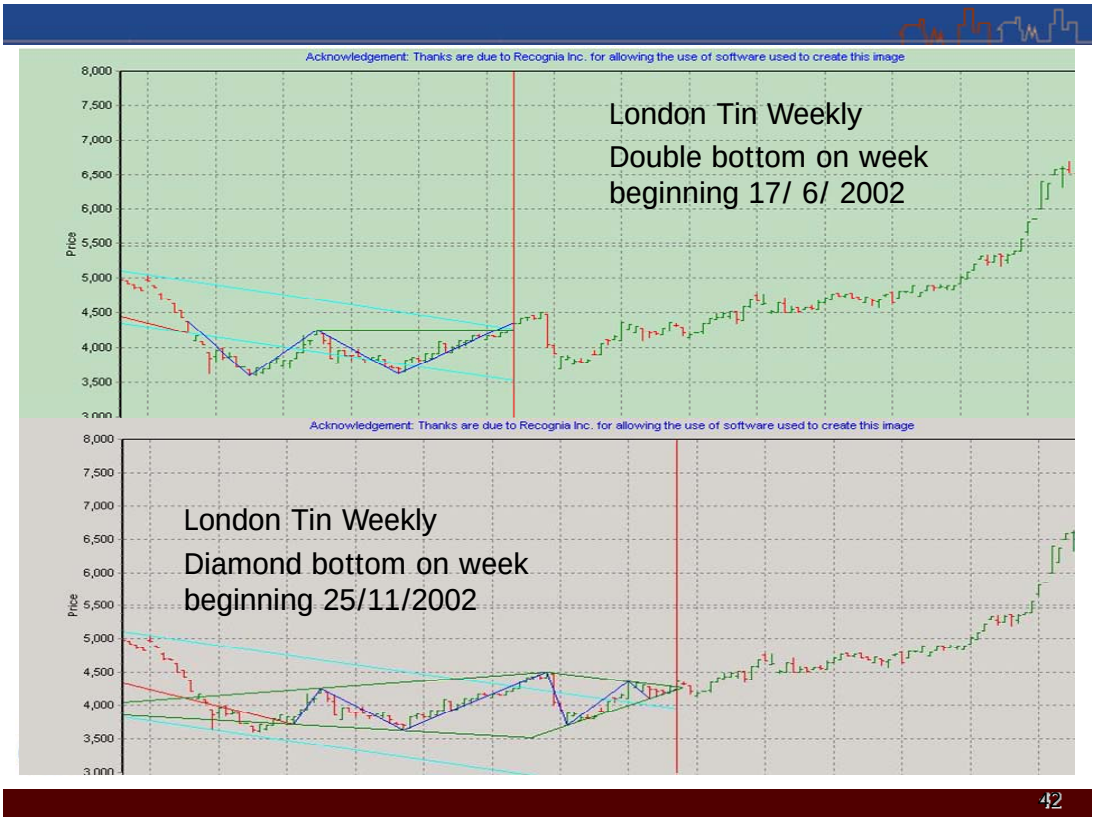
3.2 TRADING PATTERNS

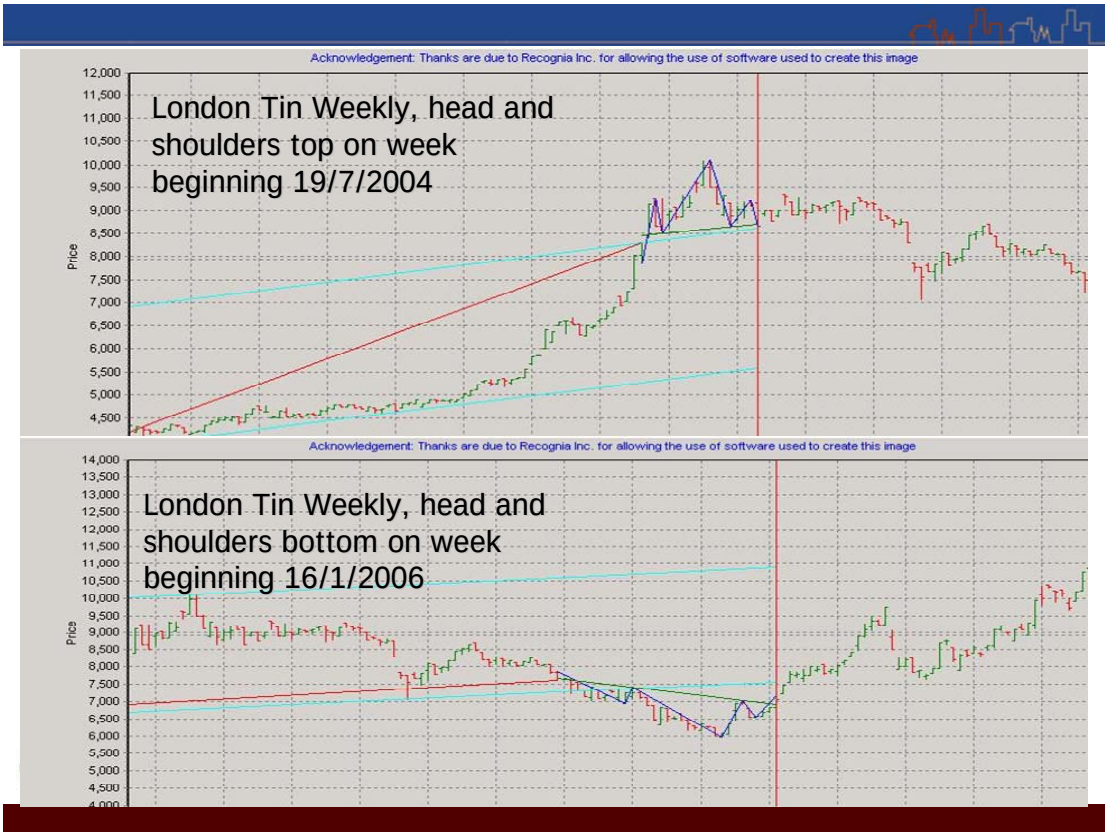
Trading patterns are a microcosm of everything that is right and wrong about technical analysis. In summary:

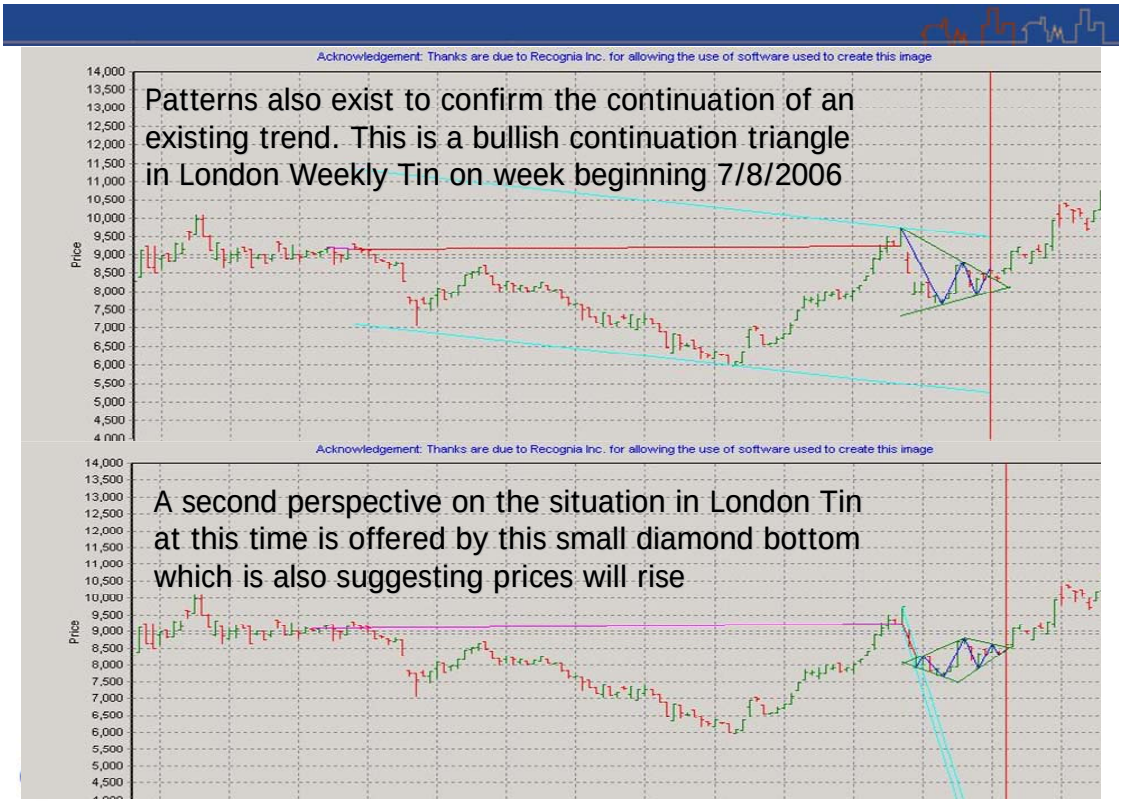
- their history is long but obscure;
- they arose out of observations of market conditions at turning points;
- there are no unambiguous definitions of what they are;
- for individual patterns, subjective definitions of what qualifies as a pattern tend to correlate with its perceived success;
- there are no agreed measures of success;
- patterns have a largely hidden value of indicating what prices are unlikely to do.

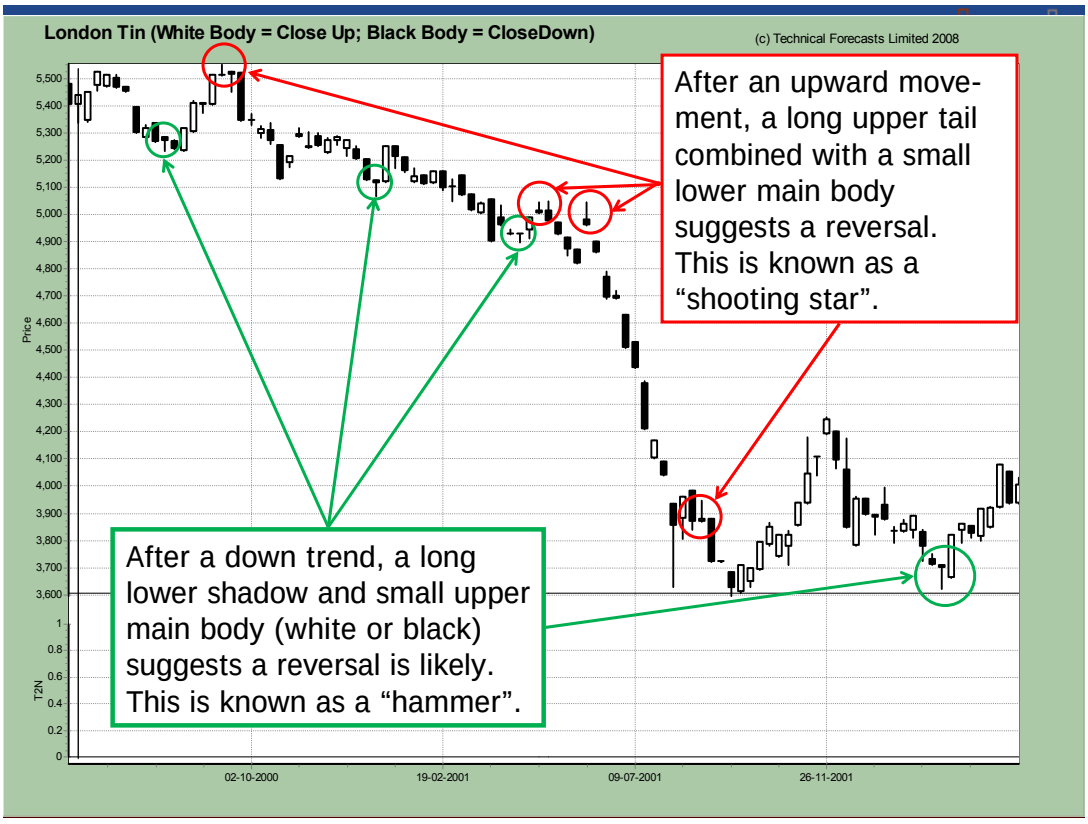


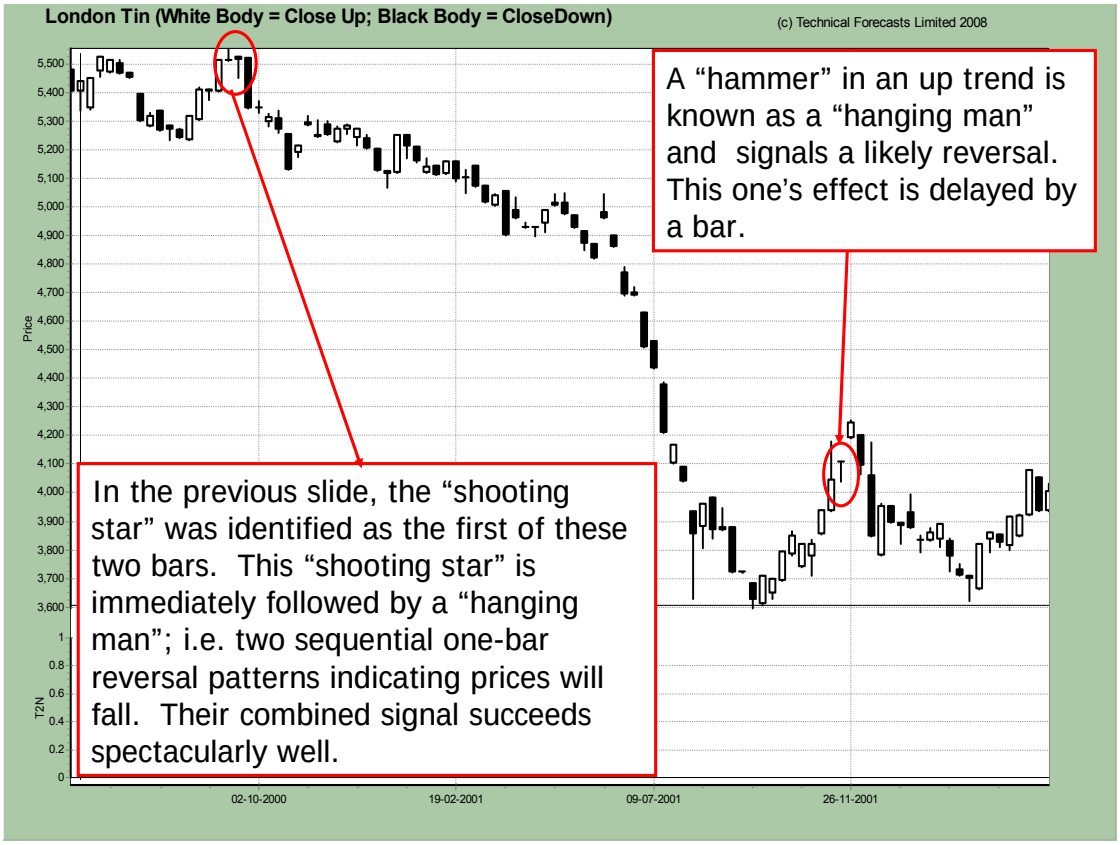
Against this background, I and others at Recognia Inc attempted to establish a consensus for what trading patterns are, develop algorithms and software to recognize them for instruments traded on major exchanges across the globe, and make recognized patterns available to end users via broker web sites. This has now largely been achieved. Unfortunately the subject of trading patterns (also known as formations) is too vast and contentious to cover in detail, so will be described at an introductory level, mostly by example.


Acknowledgement: Thanks are due to Recognia Inc. for allowing the use of software used to create this image
London Tin Weekly
Double bottom on week beginning 17/ 6/ 2002
Price
Acknowledgement: Thanks are due to Recognia Inc. for allowing the use of software used to create this image
London Tin Weekly
Diamond bottom on week beginning 25/11/2002
Price
42


Acknowledgement: Thanks are due to Recognia Inc. for allowing the use of software used to create this image
London Tin Weekly, head and shoulders top on week beginning 19/7/2004
Price
Acknowledgement: Thanks are due to Recognia Inc. for allowing the use of software used to create this image
London Tin Weekly, head and shoulders bottom on week beginning 16/1/2006
Price


Acknowledgement: Thanks are due to Recognia Inc. for allowing the use of software used to create this image
Patterns also exist to confirm the continuation of an existing trend. This is a bullish continuation triangle in London Weekly Tin on week beginning 7/8/2006
Price
Acknowledgement: Thanks are due to Recognia Inc. for allowing the use of software used to create this image
A second perspective on the situation in London Tin at this time is offered by this small diamond bottom which is also suggesting prices will rise
Price


London Tin (White Body = Close Up; Black Body = CloseDown)
(c) Technical Forecasts Limited 2008
After an upward move-ment, a long upper tail combined with a small lower main body suggests a reversal. This is known as a "shooting star".
After a down trend, a long lower shadow and small upper main body (white or black) suggests a reversal is likely. This is known as a "hammer".
Price
T2N
02-10-2000
19-02-2001
09-07-2001
26-11-2001



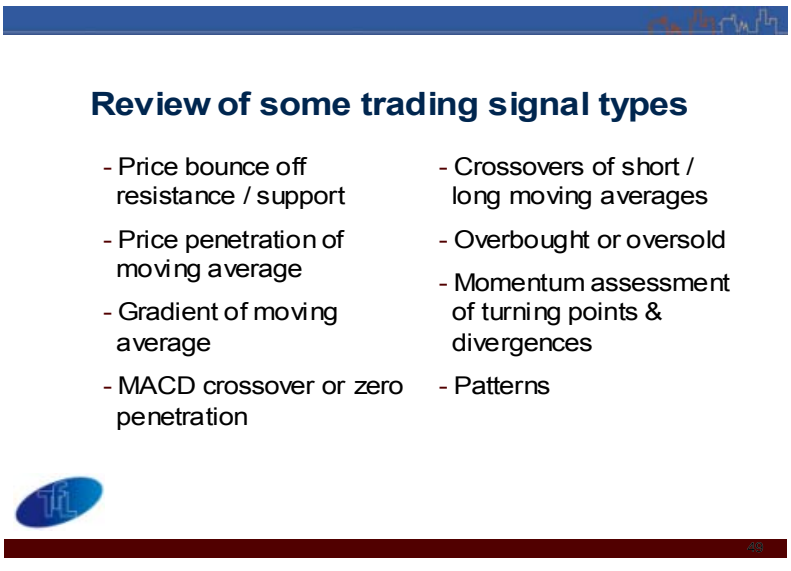
The previous chart poses an interesting question: What is the probability of two sequential top reversal patterns occurring immediately prior to a major downtrend? In terms of a price movement criterion, it may be easy to "prove" that patterns only have a 50% chance of working, but, in practice, this ignores a trader's scope to ensure bad trades are quickly exited to become cheap mistakes, whereas good trades can be allowed to run to return good profits.

A point often overlooked is that the occurrence of a trading pattern is an event whose timing is biased towards major turning points, and not some time-wise random event in the markets.

Before a formation of prices can qualify as a pattern, there usually needs to be a prior trend – but there is little consensus on the question of what constitutes a valid prior trend. It may be better to assess generally whether a market top or bottom (for reversal patterns), or consolidation period during a trend (for continuation patterns), is likely at the point at which a pattern appears. This should help interpretation in situations where a number of "topping" patterns appear before prices finally respond.

Finally, remember it is best **not** to use patterns in isolation, but in conjunction with independent confirmatory information.

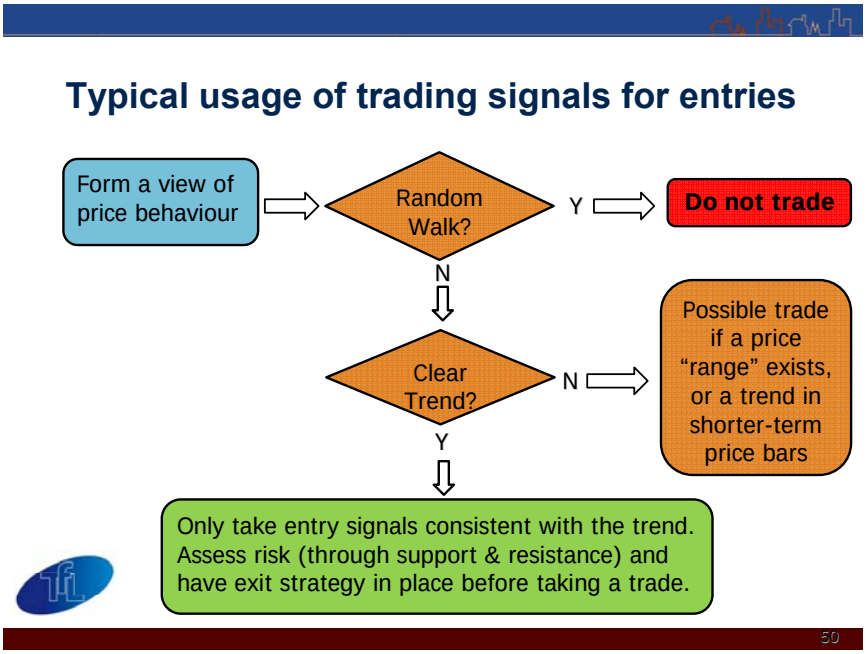
3.3 USING TRADING SIGNALS



We now describe how possible trading signals (reviewed in the slide above) might be used.

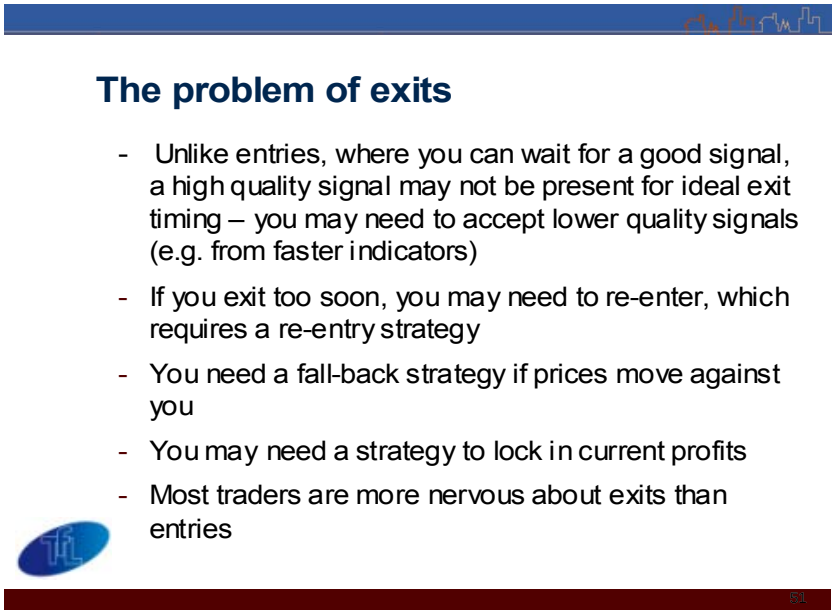
With **entry signals**, unless hedging, the trader has the luxury of being able to do nothing or seek a better opportunity with another instrument. The starting point is often a qualitative appraisal of price behaviour. If prices are behaving randomly or moving in a narrow trend, the decision might be to sell options but not take a long or short position. If there is a trend, or a trading range large enough to yield a profit, a trade might be taken in the direction of the trend (trending market) or at the limit of a trading range (ranging market).

Possible decision logic for **entry** signals is shown in the following slide:

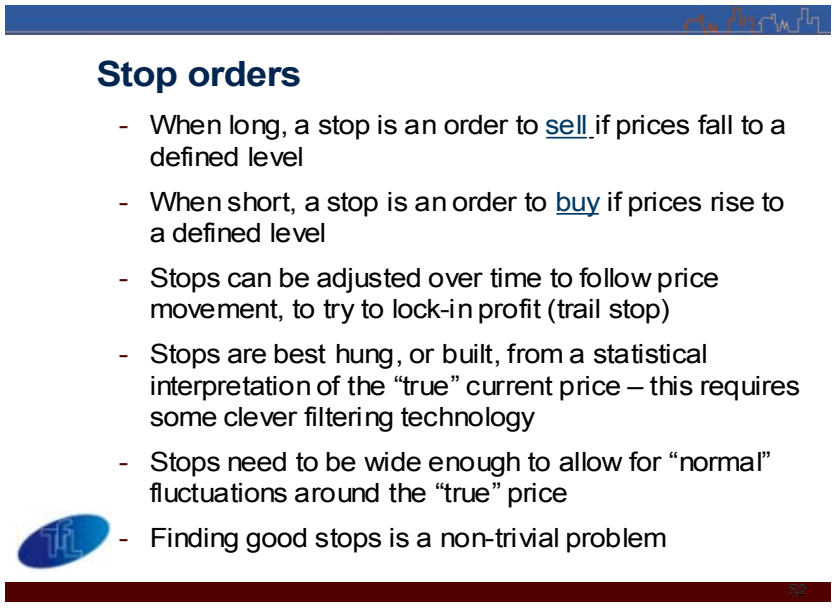


Exits are a very different type of problem to entries. There is a position to be managed, which will lose money if prices move against it. Consequently, the luxury of being able to sit on cash until a good signal arrives, which exists with entries, is no longer present.

The result is that exits often need to be made on the basis of faster, less certain, signals than entries. Unless pockets are deep enough to ride out counter-trend moves, the degree of nervousness for exit signals is generally higher.



In addition to conventional trading signals, the specific problem of exits requires price-conditional orders to protect against adverse moves. These are called **stop orders**.



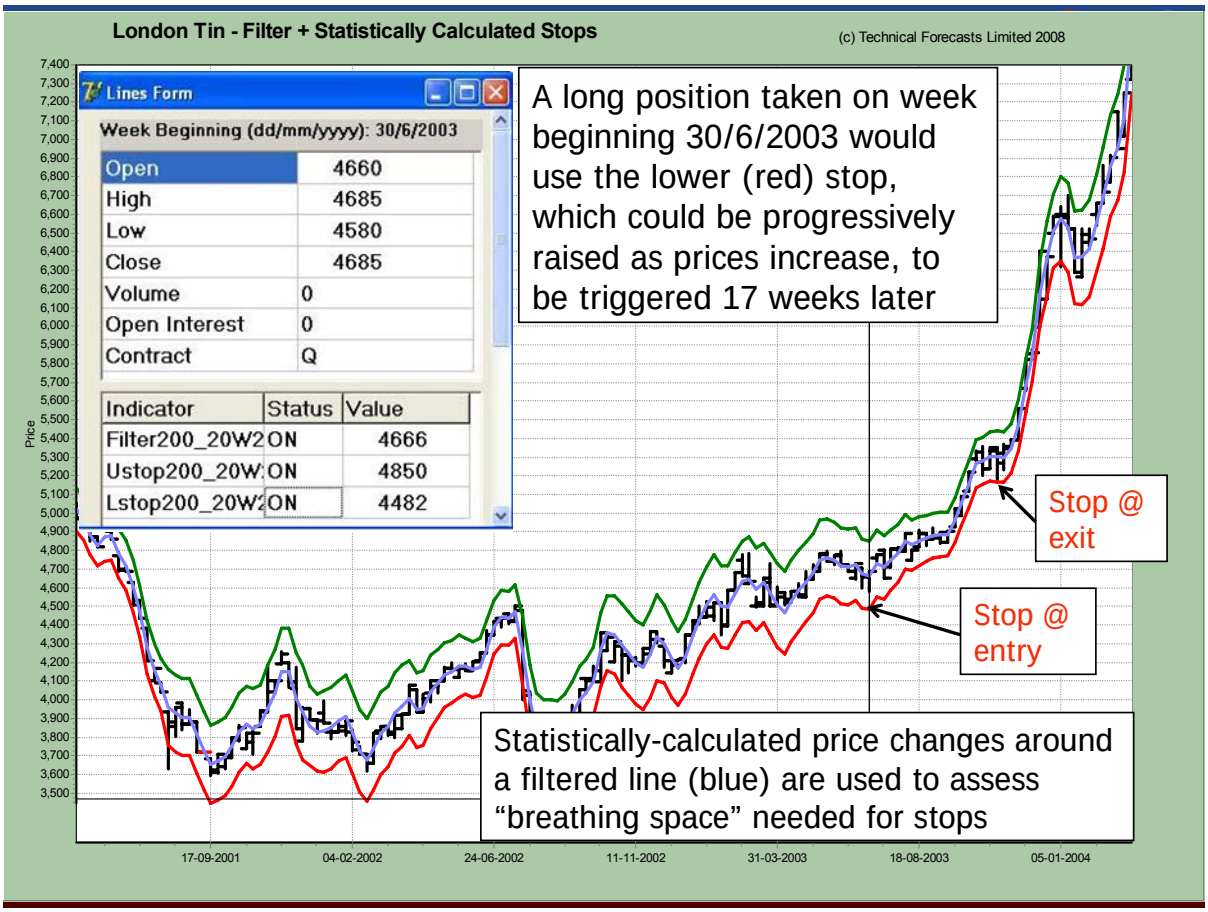
Techniques to find a good filtered line on which to base stops require rational signal/noise decomposition methods. These are usually found in scientific filtering literature, and are well beyond the simple mathematical skill sets on which most technical analysis is based.

Having found such a line, there is then an issue of how much "breathing space" to allow for prices to fluctuate before the stop order should be triggered. The calculus of statistics offers the best basis to do this.

One approach is to use a confidence interval around a filtered line, which users can make wide or narrow. Users could sensibly start with a reasonably wide stop to give a trade a chance to breathe. If prices move in the trade's favour, adjust the stop order to move its trigger price to follow price movement (and attempt to lock in profit), but keep the same breathing space for price fluctuations around the current filtered price level.

Eventually there will be concern about taking a profit, whilst not exiting prematurely if a favourable price move should continue. This is probably when the breathing space (i.e. the confidence interval around the filtered line on which the stop is based) could be reduced.

Stop orders may not be filled close to prices where they are triggered. Sometimes, prices move very fast, and the stop order is filled at a much less advantageous price than that which triggered it. One situation is where a trading session has a gap opening (between the previous close and current open) with the stop price lying somewhere in the gap. The stop order is then filled at or near the open. Past metals' price data shows massive volatility, which is likely to give rise to this kind of problem. Fortunately, more recent price data is less volatile.



Finally, when calculated as described, stops offer an objective measure of trading risk, which is very useful information when a trade is about to be made. This is in addition to any assessment of support or resistance levels.

Stops – final comment

The additional value of statistically-calculated stops over heuristic ones (such as those based on moving averages) is that they offer an objective measure of risk at the time a trade is about to be taken.

Good exits are frequently frustrated for reasons relating to psychology, a failure to monitor all relevant data, and a poor appreciation of the need to be risk averse. This leads to the comments on the following slide:

Exits – final comments

- Never delay an exit because you wish to appear "consistent", or to give the market time to "prove" your entry decision was correct
- If you did not have your current position, and would not enter it now, it is probably time to exit
- Monitor liquidity and its implications for your position
- It is at least as (if not more) important to avoid trouble than to capture good moves – so exits are at least as (if not more) important than entries

4. THE ELLIOTT HYPOTHESIS

Elliott Wave: a technical template for trend behaviour

- Prices for an undervalued instrument move in five waves for the instrument to become maximally overvalued, and thee further waves to correct to a fair value
- In 1998, most commodities were undervalued
- From the Elliott perspective, commodities are now overvalued - the "greater fool" phenomenon makes it difficult to predict tops

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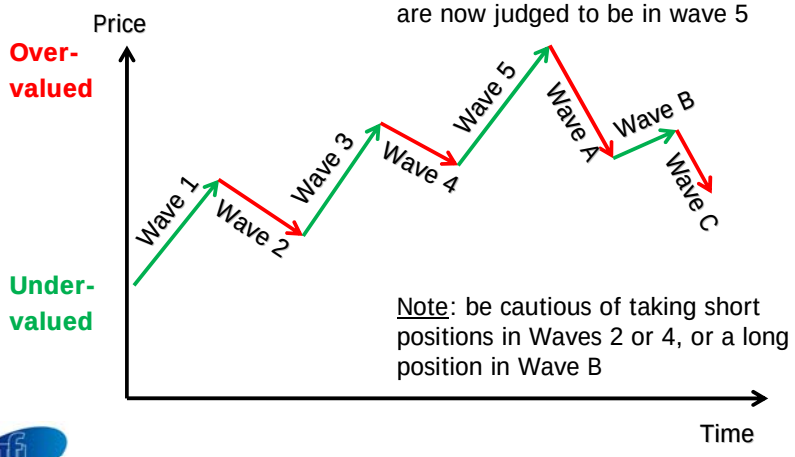
The Elliott Wave offers a perspective on the markets shown by these two slides.

Elliott perspective

A top cannot be predicted, but in Elliott terms, most commodities are now judged to be in wave 5



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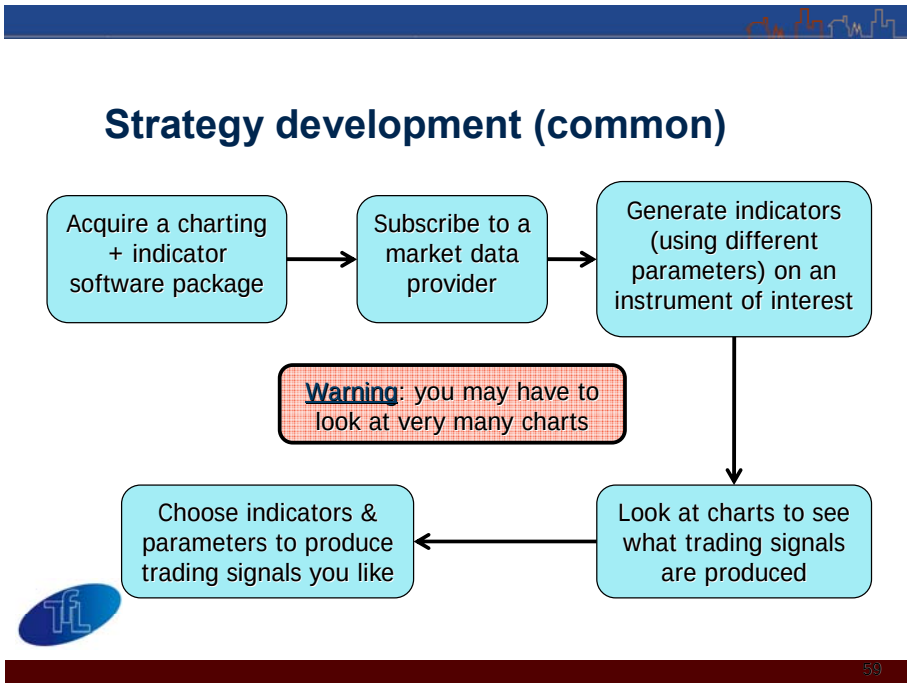
For most commodities, the start of wave one was 1998, and they are now thought to be in wave five. **Note** that marketplaces are full of intrinsic uncertainties – which makes it a mistake to overdevelop, or give too much credence, to any one theory, Elliott or otherwise.

5. PUTTING IT ALL TOGETHER

Some basic questions must be addressed before the material discussed so far can be used effectively. These usually include:

- What are the objectives?
- What are the constraints?
- What business systems are needed?
- What skill sets are available?
- What skill sets are needed?

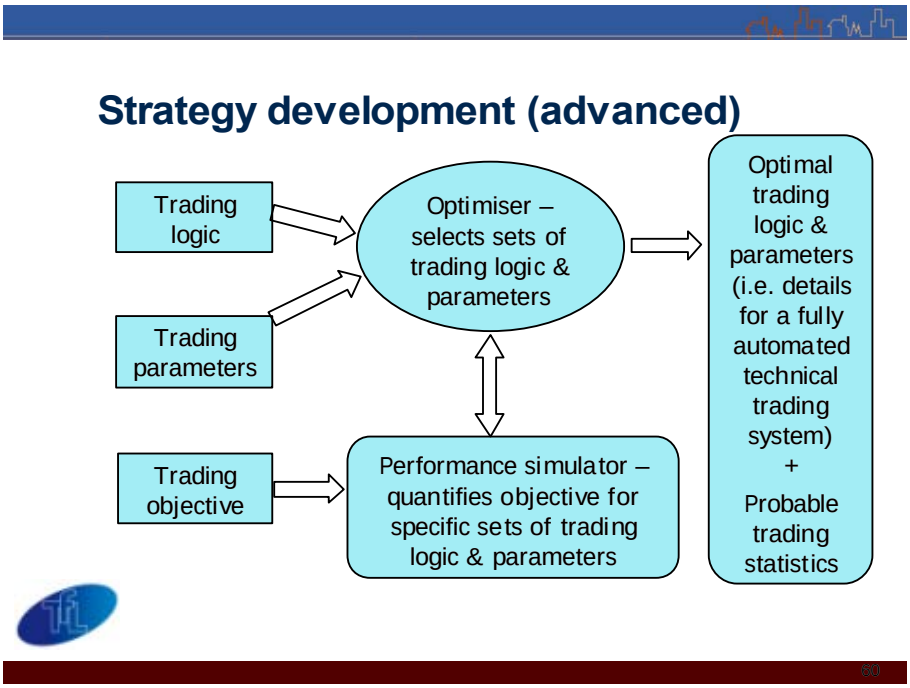
It is usually helpful to begin with a small-scale pilot project as a learning exercise. A common initial route is shown in the following slide:



Money and effort spent on this route is rarely wasted, as this core capability is likely to be needed to check results emerging from more advanced methods of developing a trading capability. This procedure can be lengthy and is not guaranteed to produce optimal results, but practitioners usually obtain a "feel" for markets and ways of attaining their objectives, which is difficult to acquire from more advanced methods.

The problem of systematically searching through trading logic and parameter space can be addressed by using mathematical optimisation techniques. At the simplest level, this might involve an exhaustive search through logic and parameter space, but computing time soon becomes prohibitive.

More advanced techniques, such as simulated annealing or genetic algorithms, tend to produce a better answer in a shorter time, but are not guaranteed to deliver a global optimum.

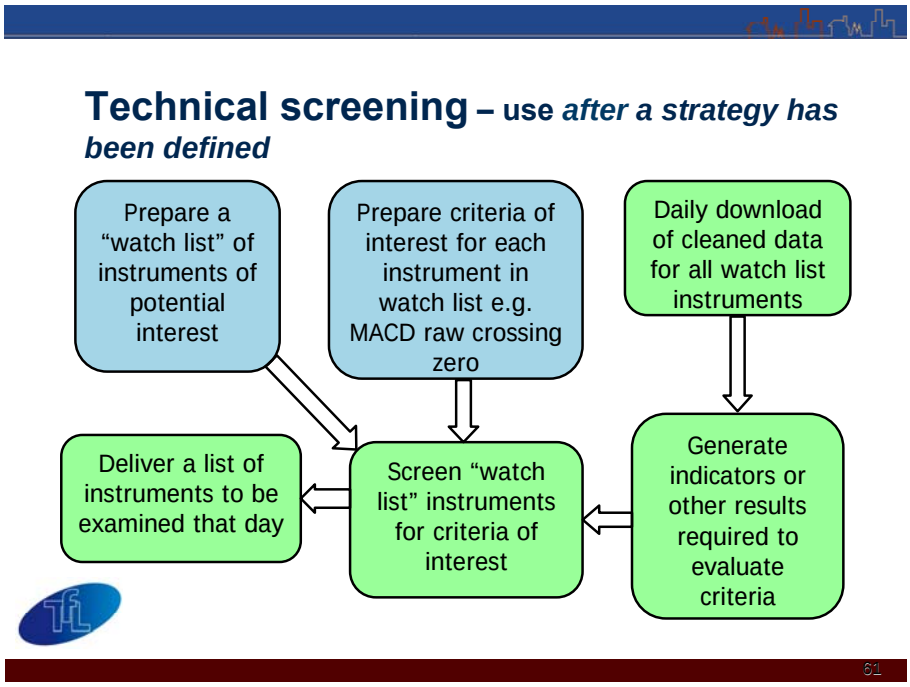


Drawbacks with this approach include:

- Both the objective and the possible solution space have to be pre-defined;
- It is harder to acquire en-route feedback to trigger new trading ideas;
- It takes longer to set up initially;
- When finished, you still need the earlier, more common, capability to examine possible solutions.

Despite these drawbacks, and irrespective of whether a fully-automated trading system is used, there are huge advantages in automating the strategy development process, particularly where large numbers of instruments need to be traded or regular updating is needed to keep pace with changing market conditions.

Often, the objective is to find criteria which will either indicate the potential for a trade or confirm that no potential exists. These criteria emerge from the strategy development process (they may well be its sole objective), and allow large numbers of instruments to be screened for potential trades via the process shown in the following slide:

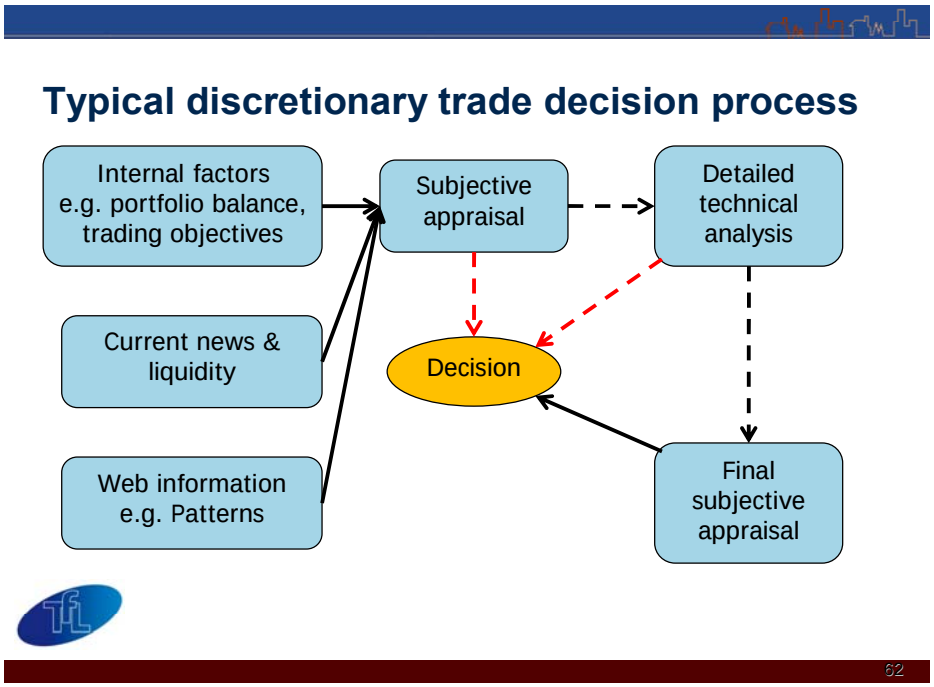


This is precisely what many traders do every day. Blue boxes represent initial strategy development. The upper right green box is the first job of the day – to download data. Each instrument requires certain indicators or oscillators to be produced, which can then be automatically screened for criteria of interest. These should automatically include all instruments where current positions exist. A list of "interesting" instruments is then prepared. The trader examines charts of these for exit or entry decisions.

Arguments over common or advanced trading strategy development can be better appreciated now. With advanced methods, proximity to an optimised technical trading signal, or an optimised technical trading signal itself, can form a criterion of interest. With advanced strategy development methods, it is easier to introduce optimised logic to avoid over-trading, rather than rely on taking every signal, or manual judgements.

Note that a particular problem arises when prices simply do not know where to go, and generate a confusing sequence of potential signals.

A typical decision process is shown in the following slide:



To recap: in addition to all the technical material in the latter half of this presentation, the trader should consider economic, psychological, news and random aspects, as mentioned in the earlier part.

Liquidity seems to have posed particular problems for metals' traders in the past, and they should follow it closely. Symptoms to watch out for are falling open interest (with futures), or widening bid/ask spreads (with prices). From a perspective of trying to keep an equity curve reasonably smooth and positive, traders ideally should seek a portfolio balance of uncorrelated returns. There are both heuristic as well as formal (Modern Portfolio Theory) ways of achieving this.

The above slide is envisaged to be post-screening, implying some initial technical merit has been found in a potential trade. Red dotted lines indicate rejection. Typically, the decision process is:

- Firstly, should one consider a trade at all in this instrument at this time?
- If positive, should one consider a possible trade after a detailed appraisal in the light of more technical analysis tools?
- If still positive, re-appraise everything (including liquidity and an exit strategy) and take a final decision on whether to trade.

Note that the process described involves developing criteria appropriate to individual objectives and circumstances. As with most other things associated with markets, these should be reviewed on a regular basis, to encompass ever-changing threats and opportunities.

This presentation has been introductory in nature. Delegates need to carry out follow-up work, for which I offer some suggestions:

Firstly, go through this document again, and draw up a list of criteria you think are relevant to your trading decisions.

Secondly, consider which trading methods you think are best suited to your needs.

Thirdly, consider the business systems you will need, in order to develop your trading strategies, manage a portfolio and monitor your positions and risk.

Suggested reading for Technical Analysis

- Edwards, R.D. & Magee, J. "Technical Analysis of Stock Trends" 7th edition, CRC Press LLC, 1998, ISBN 0-8144-0373-5
- Ehlers, J. F. "Cybernetic Analysis for Stocks and Futures", Wiley, 2004, ISBN 0-471-46307-8
- Murphy, J. J. "Technical Analysis of the Futures Markets", New York Institute of Finance, 1986, ISBN 0-13-898008-X
- Pring, M. J. "Technical Analysis Explained" 4th edition, McGraw-Hill, 2002, ISBN 007138193-7

Other reading

- Bishop, C.M. "Neural Networks for Pattern Recognition" Oxford University Press, 1995, ISBN 0-19-853849-9
- Galbraith, J. K. "A Short History of Financial Euphoria", Penguin, 1990, ISBN 0-14-023856-5
- Le Bon, G. "The Crowd: A Study of the Popular Mind" Atlanta, Georgia Cherokee Publishing Company, 1982, ISBN 0-87797-168-4
- Mankiw, N. G. "Principles of Economics" 2nd edition, Harcourt College, 2001, ISBN 0-03-025951-7
- Satchwell, C.J. "Pattern Recognition and Trading Decisions", McGraw-Hill, 2005, ISBN 0-07-143480-1

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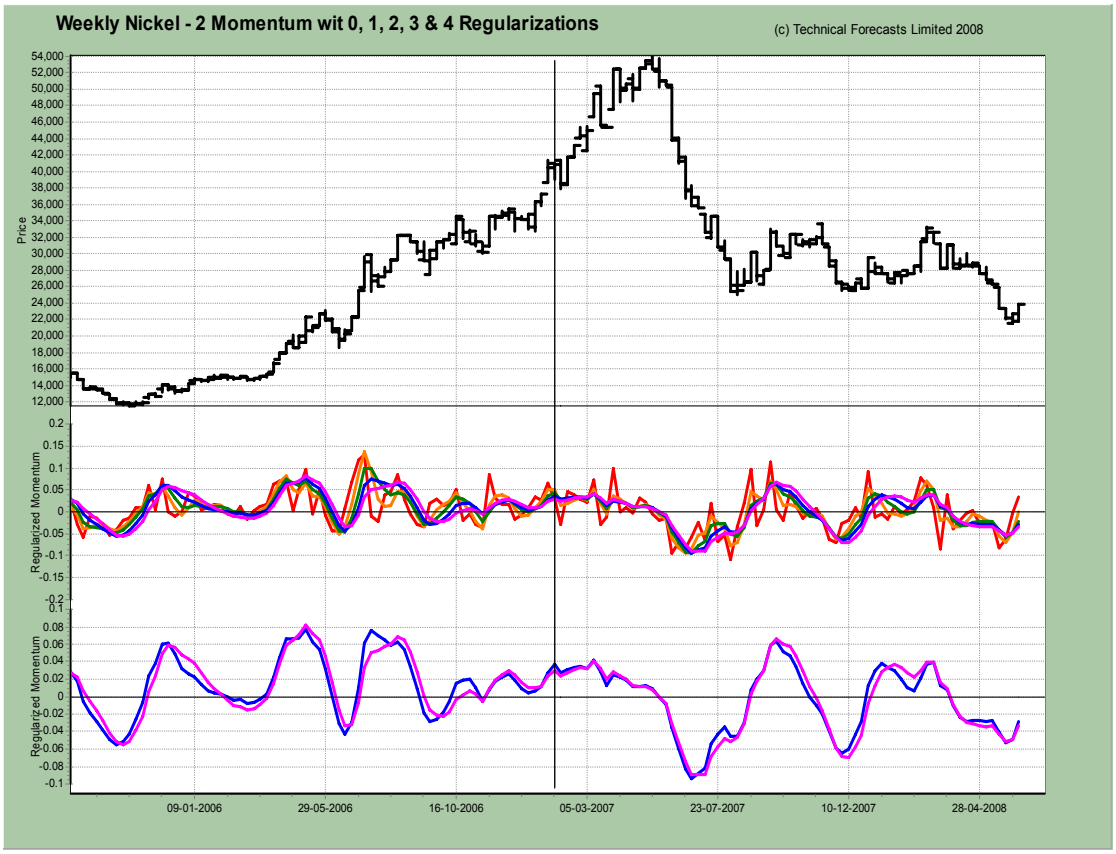
One book omitted from this slide is "Japanese Candlestick Charting Techniques" by Steve Nison: New York Institute of Finance 1991, ISNB 0-13-931650-7. It is well-illustrated and easily readable.

6. ADDITIONAL MATERIAL

Some of the best technical analysis tools are not in the public domain, but are available commercially. A selection of these applied to recent metals data follows.

UNDERSTANDING REGULARIZATION

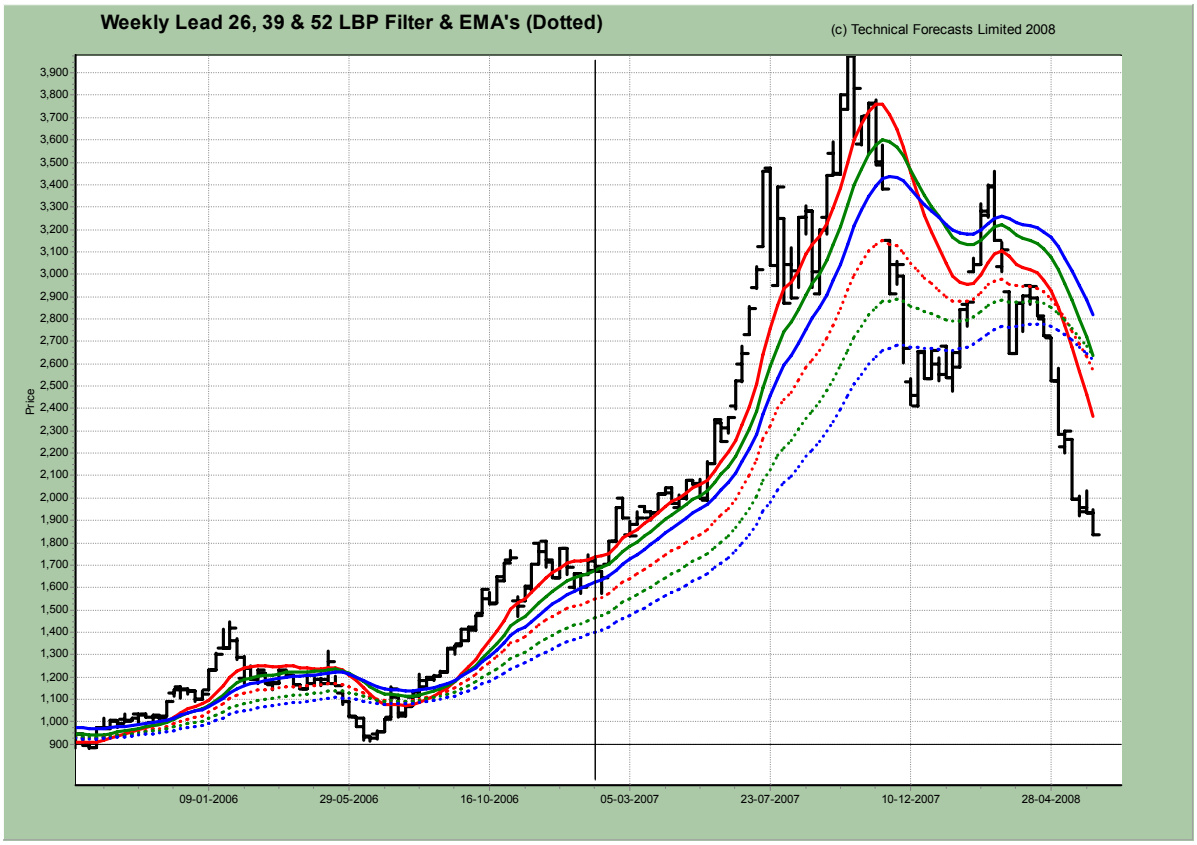


In this weekly nickel chart, the red line on the middle set of axes shows the effect of a 2 EMA of non-dimensional momentum without regularization. As regularization increases, the lines become progressively smoother and more useful for decision purposes.

The lower set of axes shows re-scaled 3 and 4 regularized lines. Being smoother, these are much more usable for trading, and signal price to have almost zero momentum at its peak. At extreme values, their turning points tend to precede those on the price chart and indicate a price turning point is imminent.

The 2 EMA shown is probably shorter than the optimal length for trading nickel with regularized momentum.

UNDERSTANDING LOW BY-PASS FILTERS

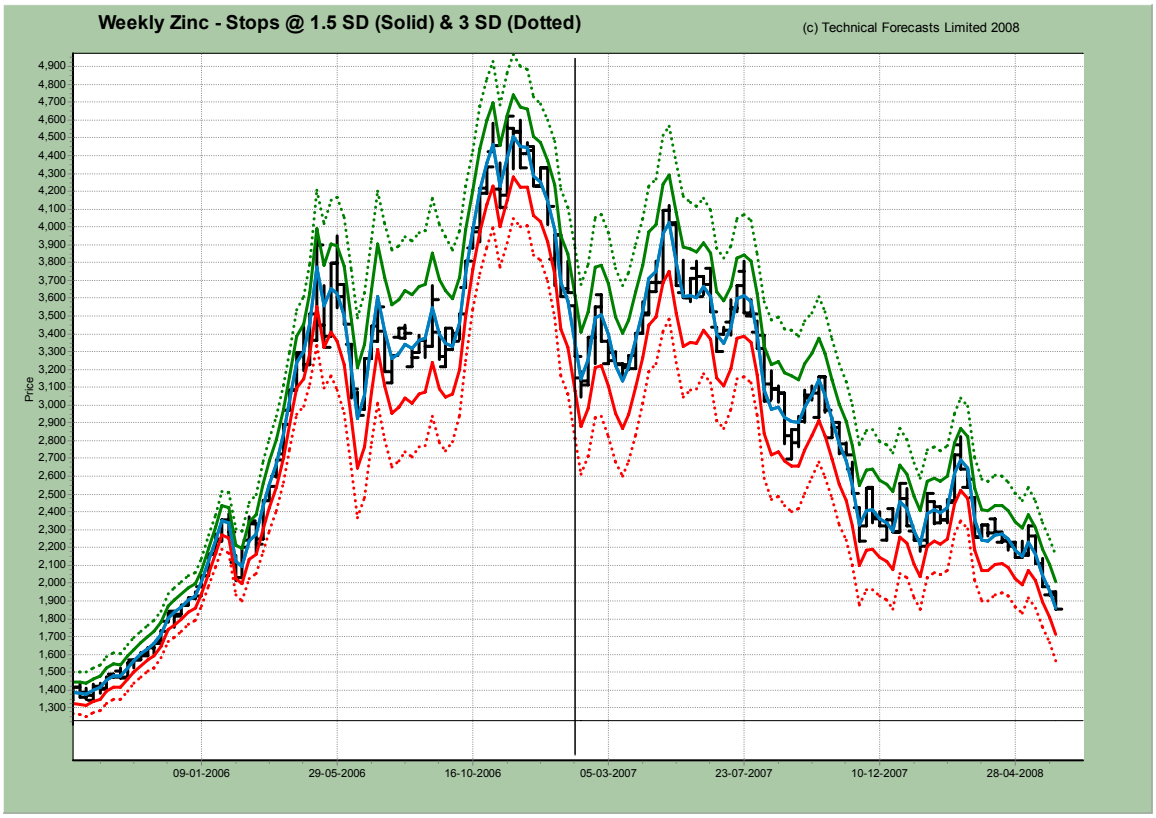


Low by-pass filters (solid lines) on this weekly chart for lead are compared with EMAs (dotted lines) of the same length. Key differences between the two are:

1. Low by-pass filter lines tend to follow price much more closely;
2. Turning points with low by-pass filters can be slightly ahead of those in equivalent EMAs;
3. Low by-pass filters tend to "wiggle" less than their EMA equivalents;
4. Low by-pass filters generate crossover signals much earlier than their EMA equivalents;
5. Low by-pass filters have a useful high by-pass filter dual, which can act as an oscillator.

The claim made for low by-pass ratio filters is that their gradients offer an "instantaneous trend". Trend definitions tend to be subjective, but on the basis of charts seen to date, gradients of low by-pass filters do seem to offer a more reliable indication of trend than gradients of their EMA equivalents.

UNDERSTANDING STOPS & RISK



The central (blue) line on this weekly zinc chart shows a filtered interpretation of closing prices, and acts as a datum around which a confidence interval for price fluctuations can be constructed. A consequence of calculating stops in this way is that they also offer a measure of the immediate risk of prices moving one way or another. That risk can be monitored by re-calculating confidence intervals as new information becomes available.

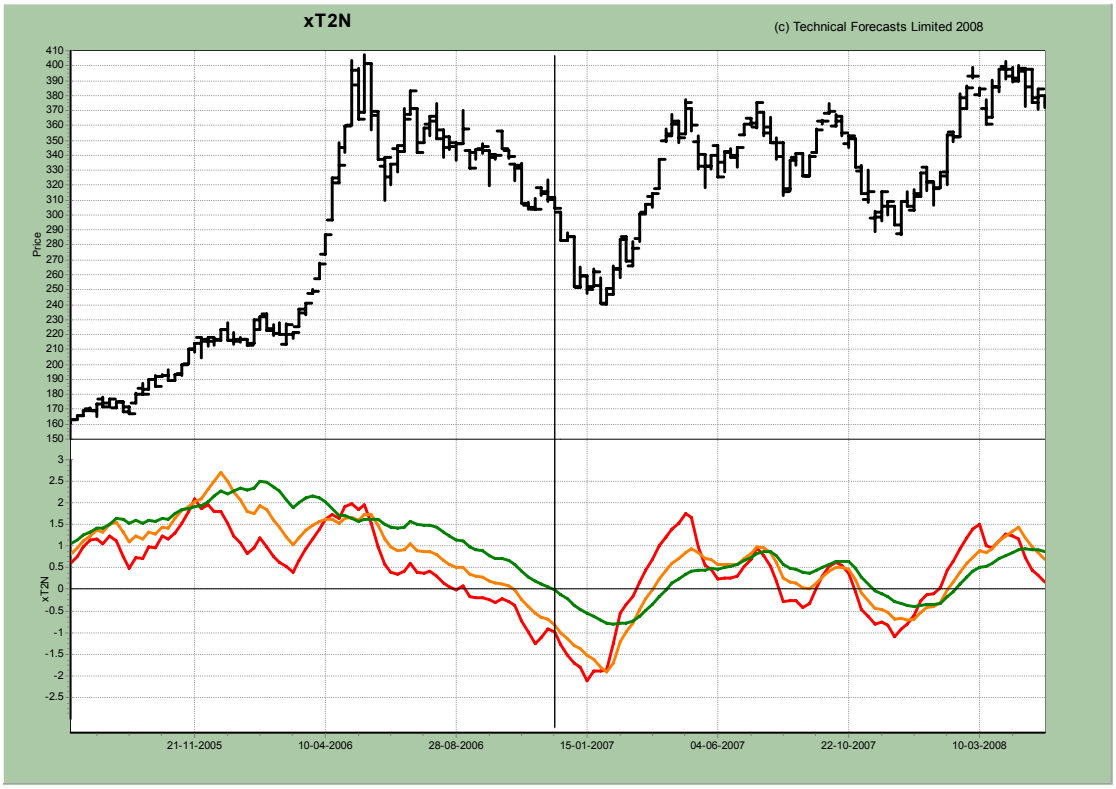
Confidence intervals are based on multiples of standard deviations of price fluctuations around the datum line. Two such intervals are shown:

- solid red & green lines for 1.5 standard deviations and
- dotted red and green lines for three standard deviations.

Users choose their confidence interval (e.g. narrow or wide stops) and a stop value would be calculated. Typically, values used would lie somewhere between the solid and dotted lines shown.

If prices move to yield a paper profit, stops are often moved in steps to follow price, in the expectation of maintaining a breathing space for the trade but realizing some of the paper profit in the event of an adverse price move.

UNDERSTANDING INDICATOR DEVELOPMENT – XT2N



The chart is for weekly copper.

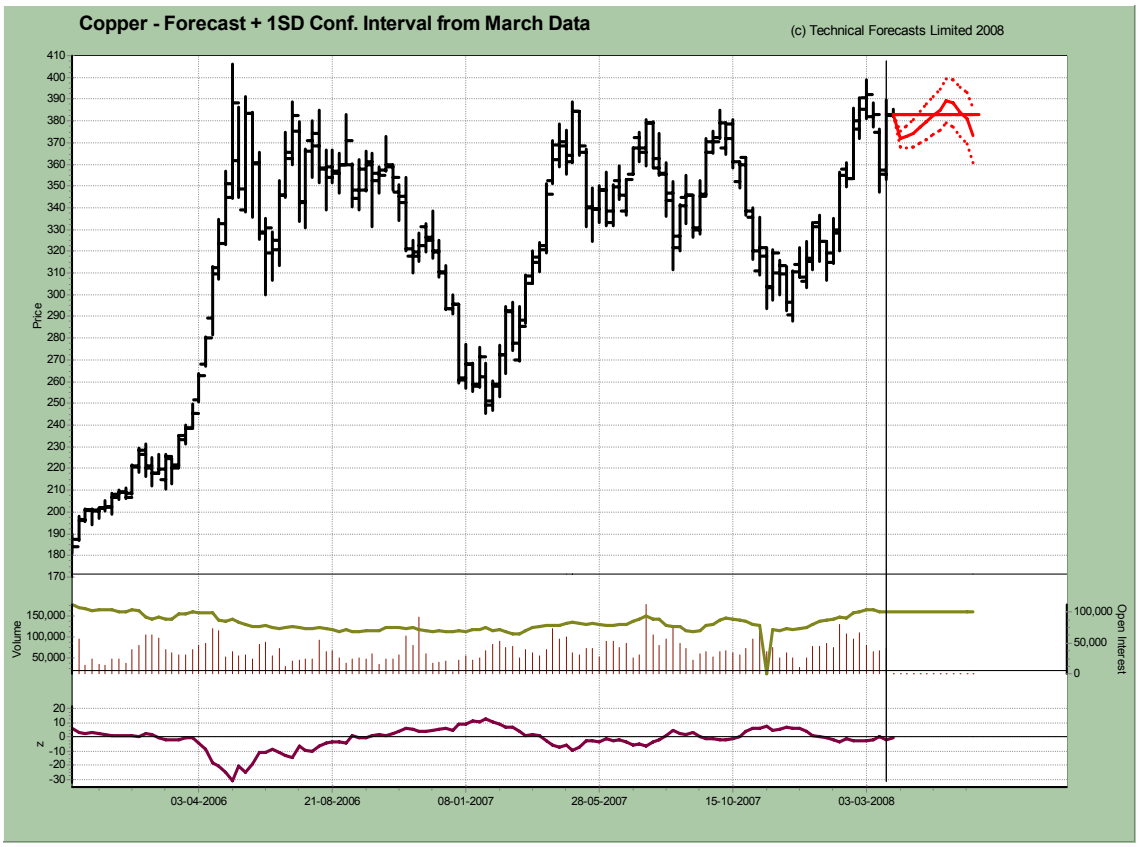
The process of developing indicators can be tortuous. The image shows work in progress on an experimental version of TFL's Trend2Noise Indicator. This type of indicator is based on price momentum, but with adjustments for price range.

Non-dimensional indicators such as these are useful for quantitative assessments of sideways markets and defining overbought/ oversold levels.

This particular indicator needs further development before we consider it ready for use, but is presented here to indicate the intermediate steps that our bespoke indicators are required to satisfy before being considered of merchantable quality.

Note that references are listed in the final slide of the presentation.

UNDERSTANDING FORECASTS



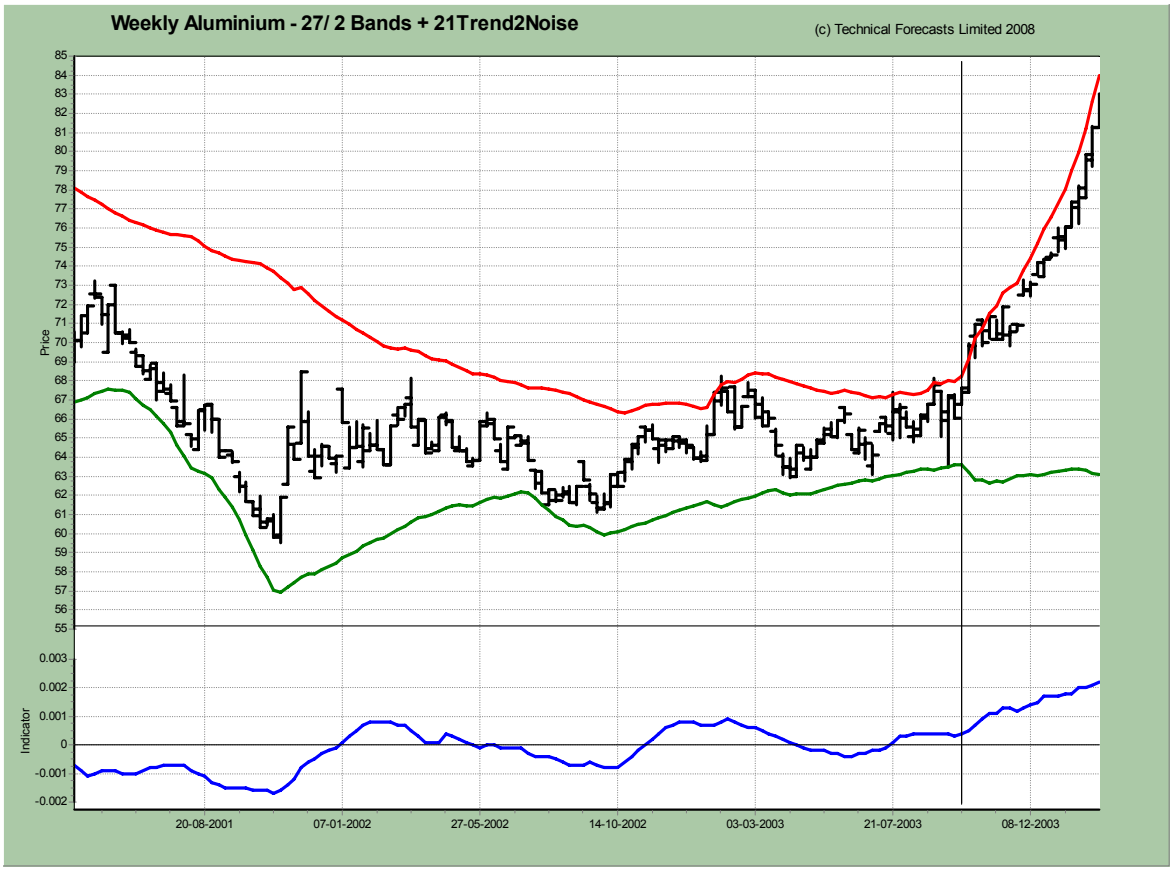
There are many caveats that must accompany forecasts. They **must** be used with care, and (in general) a technical signal be received before any action is taken on a forecast turning point.

The above forecast was made from high grade copper futures data, ending in March 08, using a 26-week sliding window.

Dotted lines indicate one standard deviation confidence interval around this forecast. Within its horizon, the forecast indicates that no major changes are expected. Broadly, that was proved correct: the previous graph (xT2N) shows copper prices during the forecast period.

For a better appreciation of the caveats that accompany use of forecasts, see TFL's "Leapfrog" manual.

UNDERSTANDING BANDS



"Bands" around price are a concept normally credited to John Bollinger.

The idea is to use a window (normally around 30 wide) of closing prices, compute a moving average and then a standard deviation. Bands are then plotted two standard deviations above and below the mean (i.e. moving average). In the present case, we show TFL's exponential variant of this method, provided in Leapfrog, which avoids difficulties due to past price "shocks" dropping out of the window of values used.

When they are moving more or less horizontally, bands can be found which offer useful support or resistance. They are less effective in this role when they are moving strongly in the same direction as price.

Also note that bands converge when markets enter a sideways period, and diverge as they exit it. A 21-period Trend2Noise (blue) line is plotted on the lower set of axes for comparison.

Towards the right of the graph, prices rise from their sideways period, the bands expand and Trend2Noise rises. This is indicative of a time to buy.

UNDERSTANDING A DISCRETIONARY DECISION

Discretionary decisions are made in a wide variety of ways; only one will be described here.

Firstly, there is an appraisal of fundamentals, such as supply/demand imbalance. In the case of aluminium, as in the following chart, energy costs may be an important component of production costs, and must be considered when assessing future prices.

Looking at prices in the chart below, there is no obvious immediate trend, which suggests that prices are vulnerable to news. This also suggests that bands are more likely than moving averages to be useful for assessing resistance and support, so bands are displayed on the price chart.

Prices also suggest the existence of a past-trend continuation triangle pattern, which pattern-recognition expertise would take as a buy opportunity; but for various reasons, such as those below, it might pay to be cautious here.

Previous resistance (derived by inspection of past turning points) has been found at 146 and previous support around 128 and 108. If a long position were to be taken at a current price of around 134, the upside potential is around 12 points. Were prices to fall, they could easily pass through the near-support level of 128 and drop to below 110 – giving a downside potential of more than 24 points, or more than twice the upside. The bands broadly support figures for resistance and support, which have been derived by inspection from past turning points.

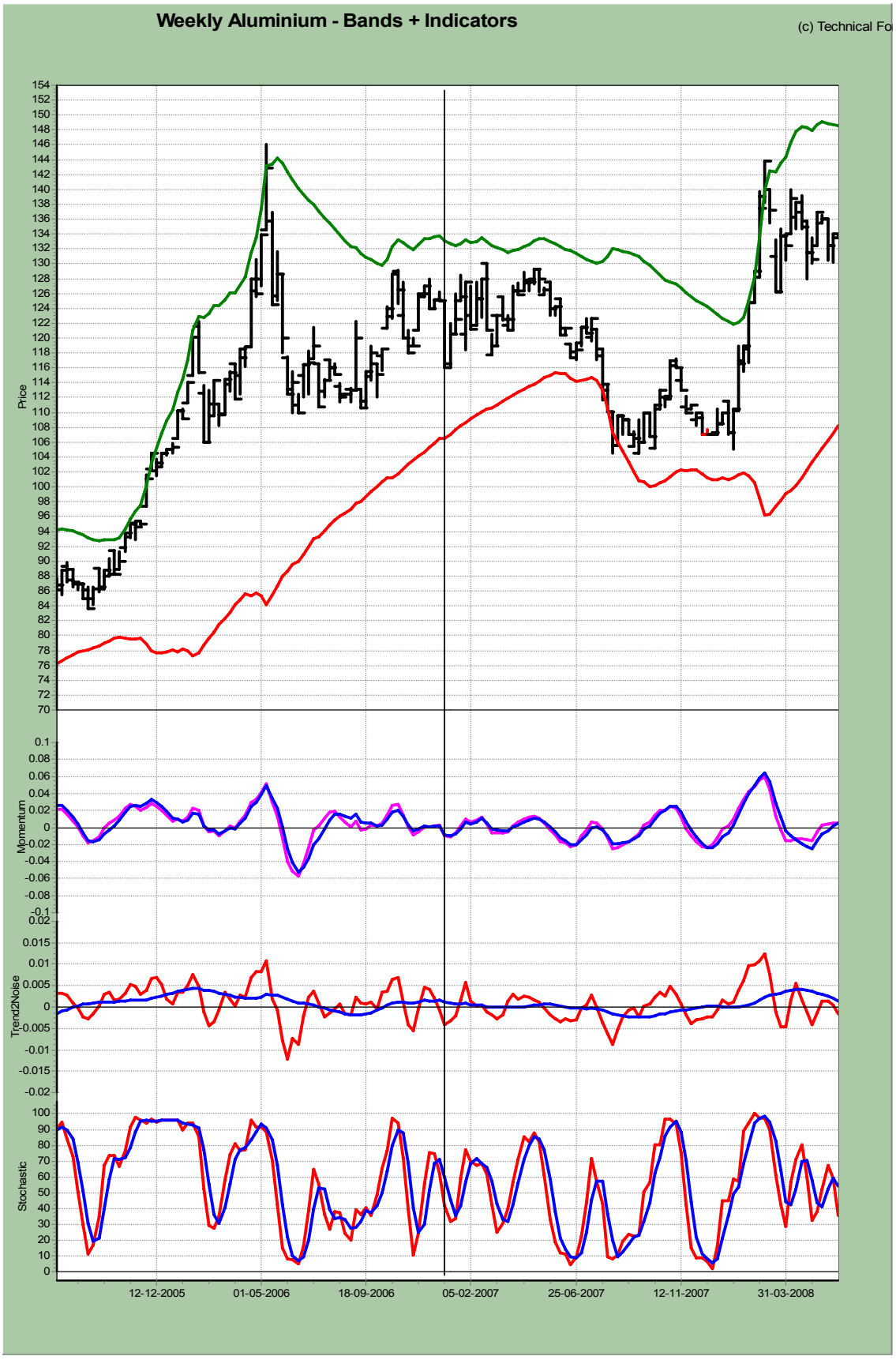
Given the sideways character of the market, indicators selected are: Momentum, Trend2Noise and Stochastic.

Conclusions from indicators are:

1. **Momentum**: there is almost none, and the least regularized (violet line) is flat, although the more heavily regularized (blue) line is heading upwards.
2. **Trend2Noise**: there is very little, but the little that exists is heading downwards.
3. **Stochastic**: this is exhibiting small oscillations, and currently heading downwards.

All three indicators are consistent with a sideways market lacking any immediate trend, but with a potential for a large breakout. A long or short position would be difficult to justify at this time.

Given that a breakout looks imminent, this type of market might be exploited with option trades instead. One such strategy might be to buy a put option at a strike price below current, and a call option at a strike price above. If a large breakout occurs, the profit on one option should exceed the cost of the other. Should the initial breakout direction then reverse, the initially unprofitable option is available to deliver a profit.


Weekly Aluminium - Bands + Indicators
(c) Technical Fo
Price
Momentum
Trend2Noise
Stochastic
12-12-2005
01-05-2006
18-09-2006
05-02-2007
25-06-2007
12-11-2007
31-03-2008