Practical MACD Analysis

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Introduction

To keep consistency between the visual results, using the same graph is a good starter. In this case the graph of the 12:26MACD is superimposed on the price chart, with its scale on the left.

Look more closely at the graphs below and you will see that the moving averages align with the MACD and this alignment can be seen in where the two moving averages cross over each other and where the MACD crosses over the zero line – and the times (dates) are the same – so we now know that we are comparing associated terms.

It cannot be stressed strongly enough that like terms are the only terms to be compared. In this case the moving averages are both exponential and time constants the same as that in the MACD. Before comparing any indicators, always check. It really disappoints me on how many times that indicators are compared on false grounds and false claims are believed!

Now the fun begins. The switch/wave graph at the top of the above left picture shows when the two moving averages cross over, while the new (green) thick line on the price chart is the difference between the 12EMA and the 26EMA (the MACD).

To help clarify things, a zero reference line has been included and when the difference plot crosses over the zero line; the wave switches!

Now there is a very important thing to note on this graph. The difference line (MACD line) rises above the zero line and then peaks with the price peak and then comes down well before the two EMA lines cross over.

In other words, the MACD is a very sensitive line that acts very much like an electronic ‘leading angle’ compensation network. Such networks are included in machinery control circuits to partially anticipate a movement by providing feedback proportional to the change in output value with time. In Calculus (thank you Isaac Newton), an equation can be ‘differentiated’ to relate the dynamics to the statics. In this case a steadily rising price gradient is translated into a virtually constant positive value, apart from the trade noise ripples.

An MACD is far more sensitive than the two crossing moving averages, but it doesn’t have a comparative to work with. The trick is to apply a moving average to the MACD, and this (trailing) moving average will cross over the MACD producing ‘triggers’ to hold or sell. In this case the normal trigger line is a EMA9 of the MACD and it is shown below on the left hand side chart:

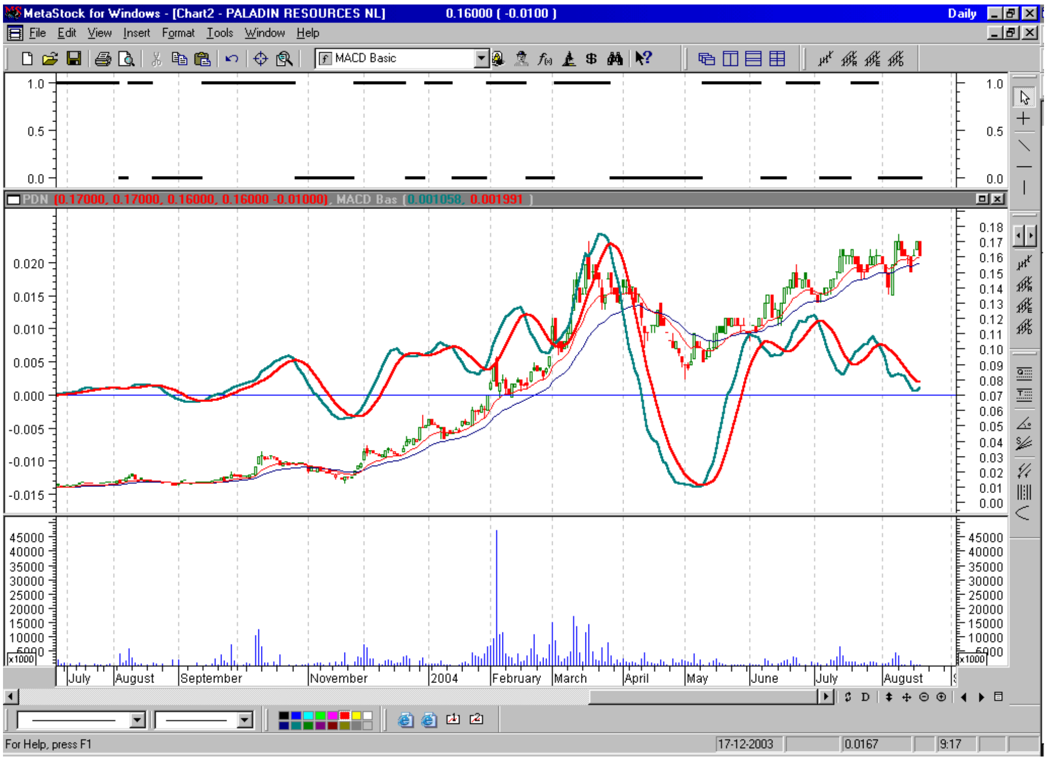
Now this is where it gets interesting. The time in ‘hold’ mode is a lot less and the return is considerably greater – in theory! Look a little closer and you can really see what is happening.

Once the share price has risen, the lagging EMA9 crosses under the MACD and that signals a buy (or hold). The share prices continue and peak then fall and only then does the EMA9 cross over the MACD triggering the ‘sell’. But the number and position of ‘sell’ triggers are both too high and too late, except for the major trend.

Tweaking the MACD

Currently the two moving averages are both exponential, and they sort of track each other, giving a relatively smooth (E)MACD plot.

If the moving averages are changed from EMA to SMA then they are more reactive, and ‘rounder’ due to the transient responses as shown below with an (S)MACD plot.



In hindsight, it is my educated guess that when these were worked on paper, the SMA was the standard and only when computers came in did the EMA become the ‘new standard’, because EMA is somewhat easier to implement in computing than paper.

Currently all the plots are based on Close values. If the Close prices are replaced with Open prices then the plot holds virtually the same shape but moves to the right by one day/timeslot (as it is actually now a little later – as the plot does not differentiate between time within the timeslots).

Averaging the Open and Close prices and using that has a negligible effect – other than slightly delaying the plot (slightly moving it to the right) and making the MACD slightly smoother.

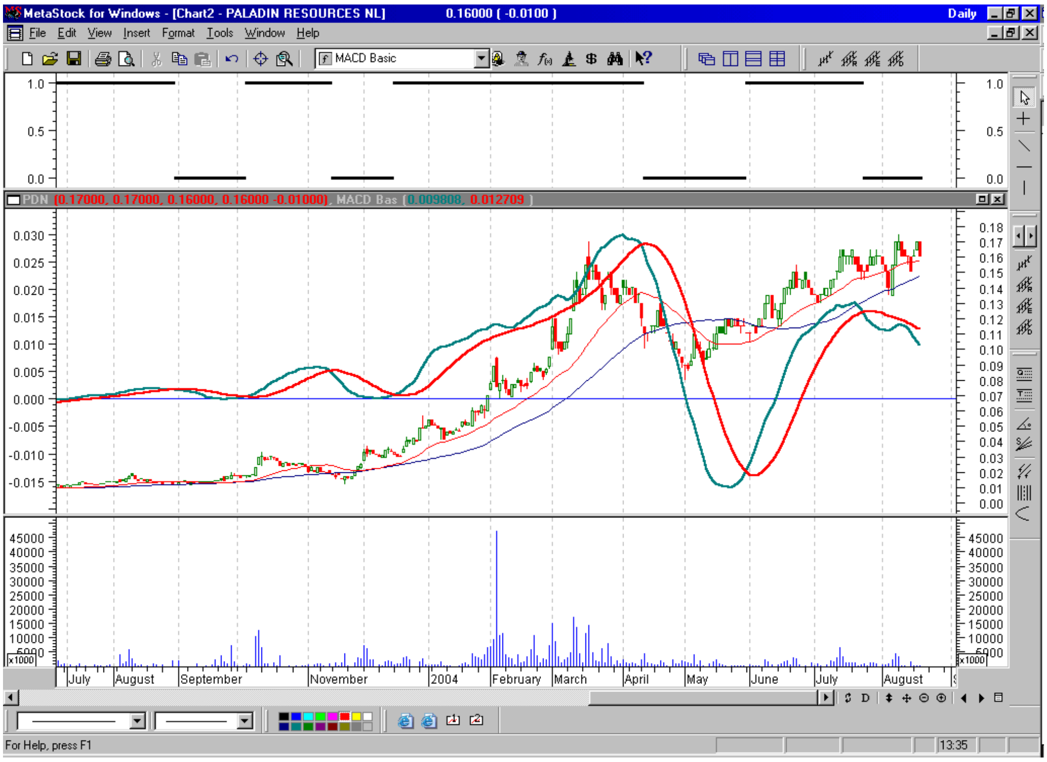
If the longer EMA is referenced to the Open prices instead of Close prices, then the MACD appears to slightly move forward, and be much more jagged, as the difference between the open and close prices is highly variable.

From that observation it is better to use common prices in the MACD expression. In this case, stick with Close prices. The jagged plot resulted in numerous “sell – buy – sell – buy” situations that are not good for structured trading.

Optimistically, the Close price is the best option for the fastest change in EMA plots, using EOD data.

With this in mind a few alternatives need to be considered like using longer time constants for the two moving averages. In this case with everything doubled; EMA12 becomes EMA24, EMA26 becomes EMA52 and EMA becomes EMA18, the chart takes on a new dimension, and is shown below.

To complete the picture the exponential moving averages are replaced with simple moving averages and the transient response is obvious. For consistencies sake the (E)MACD is on the left and the (S)MACD is shown below.



Both charts give roughly the same story in that the overall trend is now shown by the longer time constant MACD, whether it is simple or exponential. Looking at another way, the longer time constant moving averages attenuate the daily ripple in sales, making the plots for these smoother than those with shorter time constants.

The problem is that the moving averages introduce delays, and it is these delays that can cripple a good trade. The delays provided by a MACD are much shorter than the delays from a crossing over two moving average, making it a 'better' indicator than the 2EMA method.

Note that the (S)MACD seems to be less prone to false triggering.

There are two diametrically opposing problems here and it is time to take a stock of the situation and get a better understanding of what is actually going on. In looking at the actual MACD and not the associated trigger line, it has to be seen for what it is.

It is the difference between two moving averages, which are each an average of the price and an offset error and this offset error is directly related to the time constant of the moving average and the rate of change of the price.

So the MACD is in effect, the time domain based difference of two 1^{st} order system offsets, and we know that if the price is constant, then the offsets will settle on zero. What is not so obvious is that if the price increases at a constant rate, then the MACD will settle on a constant (and relatively small) positive value. Similarly, if the price decreases at a constant rate, then the MACD will settle on a relatively small but negative value!

Looking more closely at the price; within the constant rate of change, it usually has a ripple with a cycle time of between 10 to 20 days. Going back to the clinical (theoretical) results near the start of this chapter, the trigger to the 'standard' MACD crosses over typically 7 to 12 days after a rise, and gee, that is about half the typical cycle time of the price ripples on average.

So the standard MACD in fact force triggers a sale if the price has risen and is constant, or slightly falling, making the ripples even more pronounced. Now if that is not a prophecy making a fate happen, then what is it, as the standard MACD is very popular?

Also, looking closer again many candlestick bars themselves have whiskers on them indicating that there may be ripples even within a day, so there are at least three time related scenarios, and they all have to be considered.

If the MACD time constants are long enough, then the EOD close price ripples are lost; leaving a ripple that follows the general trend. The two examples below on the same security demonstrate the situation, and they also carry a trigger line – which will be discussed later!

This is shown using OmniTrader. On the graph below, the MACD is based on EMA10 and EMA20, and this is the plot with more ripples, and the flatter trigger line is an EMA4 of the difference.

Note how many times the MACD line is crossed by the trigger line, and note the MACD line initially peaks on the left hand side then falls away, then rises with the trend in prices and gradually falls away before really kicking in again.

On the chart below, the MACD is based on a EMA35 and EMA60 with a EMA12 trigger line the more-jagged ripple content line is the MACD and the delayed smoother line is the EMA12 trigger line. Note that the MACD now crosses down much later, and crosses up much later than its left hand side mate chart.

The reason that there are far fewer crossovers with the longer time constant MACD is because the ripples in the 10 to 20 day movements are now largely filtered out by the EMA settings but the overall trend remains, and therefore the significant cross-overs are still quite obvious.

The problem is one of conflict in that the shorter time constant MACD plots spell buying and selling at an almost weekly rate – if not faster, and the longer time constant MACD plots spell holding and selling over some months. How can both be right, or are both wrong!

It all comes down to timing with the relationship between the data supply rate, the time constants of the MACD and the crossover criteria.

A hidden problem set is related to the 'stop-band' filter characteristic and the time response of the moving average. It has been shown before that EMA filters are in effect 1st order IIR digital filters and a little further study in this area shows that to approximate a desired filter response, a sampling rate exceeding 50 times the maximum pass band edge is highly desirable, but impracticable.

Comments and Corrections are welcome