Quantechnics

Quantifying Investor Sentiment

Understanding The Process

- Statistical
- highly variable
- Lower Probability of
  Success

Current Price
Behaviour → Future Price
Behaviour

- Psychological
- Less variable
- higher
  probability of
  success

Quantechnic
Evaluation → Investor
Sentiment

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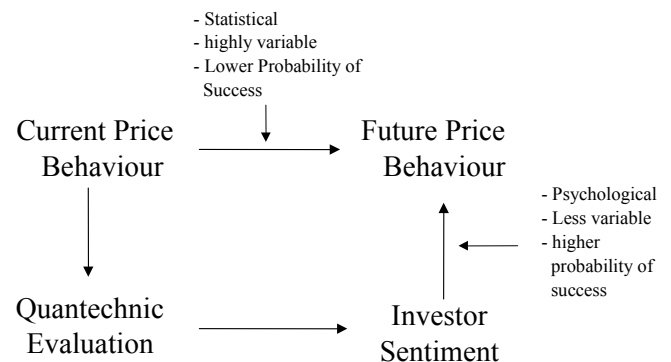
Quantechnics - The overview

Quantechnics is the quantitative analysis of investor sentiment. Quantifying the degree of bullishness or bearishness that investors feel today about a security helps predict how they will react with respect to that security in the future. Human behaviour is one of the only near constants in the investment markets and provides a valuable tool to make future price forecasting

The past few years have seen volatility levels increase substantially. The window of opportunity on investments opens and closes faster than ever before. Quantechnics examines behaviour and attempts to identify when windows will open and close. We believe that these fast-paced equity market conditions will continue for the foreseeable future. This creates both unparalleled risk and opportunity. We believe that our product is ideally suited for this environment.

Our focus is on tactical decision-making so that whether your horizon is two weeks, two months or two years, our goal is to help with entry and exit as well as with security selection.
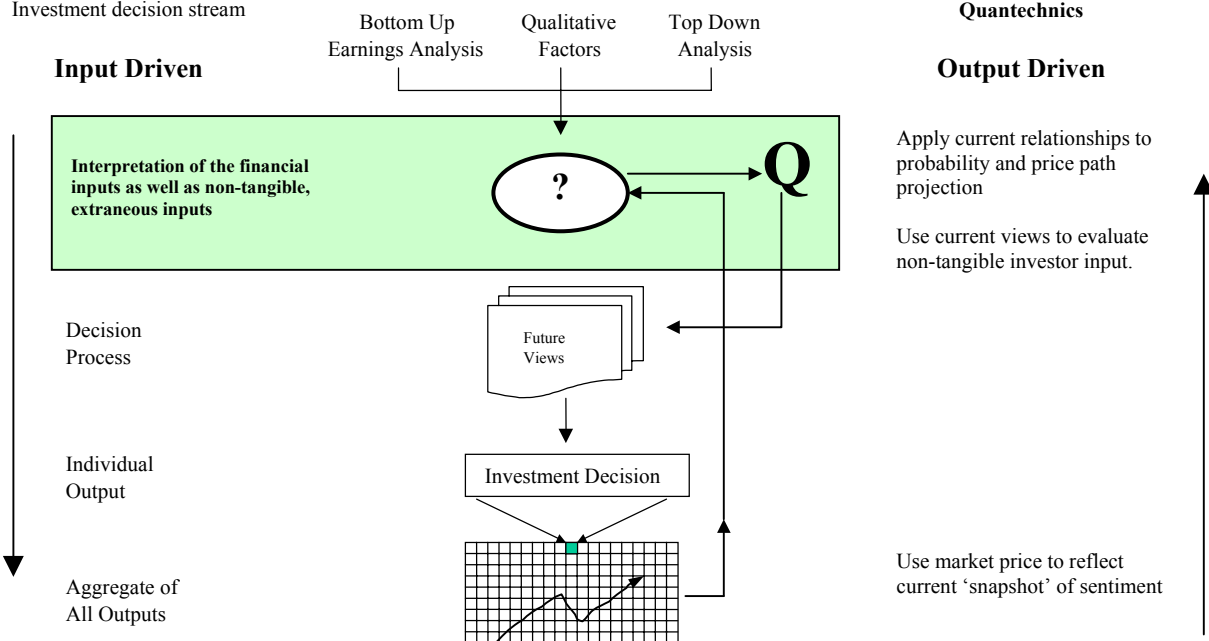
Most financial information is in the known universe and substantial increases in technology over the past few years have dramatically increased the ability to receive and process such information quickly. This has had the effect of effect levelling the playing field across most investment markets in terms of quantitative analysis. What is not known however, is future financial information. Investors must use current information to make predictions about future financial data and, in turn, determine the impact on prices from current levels. This is the critical point in the investment decision-making process because although the inputs into the decision making process are very similar to most investors, especially industry professionals, the manner in which they are interpreted will ultimately produce the investment decision results. Financial information is just one of the primary inputs into a complex decision-making process that can yield many different outputs.

We believe that the manner in which such information is interpreted and not the information itself that is important. Investors' level of either bullishness or bearishness, based on their interpretation of current financial data, will be reflected in their investment selection decisions.

The aggregation of all singular investment decisions, dollar-weighted, into one is the output of the process. This is more commonly known as the market price. The stronger the consensus amongst investors, the stronger the directional price consensus and vice versa. Since investment markets are constructs of the forces of supply and demand relationships, the dominant force rules 100% of the time. The key however, is that the dominant forces are constantly changing. Investment markets are in constant states of disequilibrium and move from periods where supply dominates demand and vice versa. Our proprietary models analyze this ongoing process using a 'reverse price engineering' approach in order to infer the level of investor sentiment. We then use this data to predict the future behaviour of investors, which ultimately predicts security price behaviour.

Traditional Fundamental Investment decision stream

Bottom Up Earnings Analysis   Qualitative Factors   Top Down Analysis

Reverse Engineered Modeling
Quantechnics

Input Driven

Output Driven

Interpretation of the financial inputs as well as non-tangible, extraneous inputs

?

Q

Apply current relationships to probability and price path projection

Use current views to evaluate non-tangible investor input.

Decision Process

Future Views

Individual Output

Investment Decision

Aggregate of All Outputs

Use market price to reflect current 'snapshot' of sentiment

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Understanding The Quantechnic Process

Our Quantechnic process is broken down into two components. The first involves using a snapshot of current sentiment conditions to predict future investment-related behaviour. We do this by first establishing levels of investor sentiment that are inherent within the stocks. This is where our sentiment cycle measurement data comes into use. At that point, we run the data through an algorithm, which compares this data with our historical modeling of how price behaves given a defined level inherent investor sentiment. The result of this is a probability of absolute gain based on a two to three-month outlook. We then bring into our model some relative price behaviour data. Our belief is that markets are generally efficient and as such, price movement in the recent past is very indicative of how price movement will evolve in the near future. The next step in the process is to create a behaviour prediction. This is called a price path projection. The price path projection is forward looking regression path that we expect the price to follow over the coming two to three months. This path is a function of relative price activity in the recent past as well as current levels of implied investor sentiment. The final step in the process is the monitoring of the price path projection and/or updating based on changing variables. This is a key step because the level of deviation above or below our price path projection indicates that a structural change has developed in the investor behaviour pattern and will likely lead to significant changes in our outlook going forward.

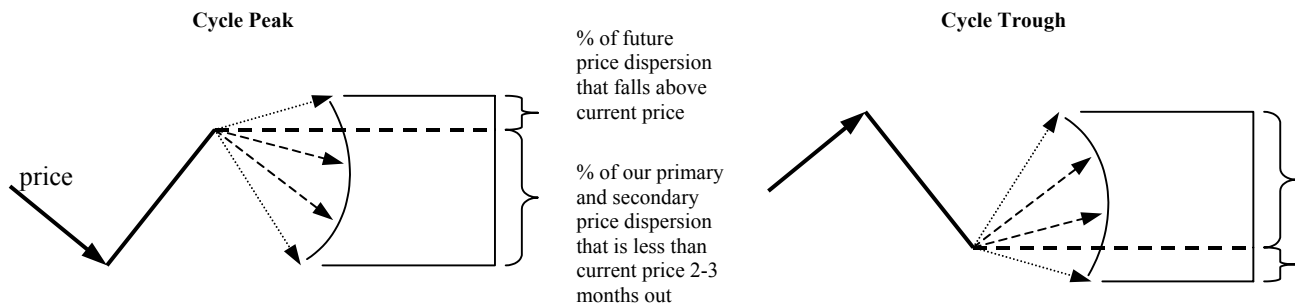**Understanding PAG – Probability of Absolute gain – 2-3 months**

Our Quantechnic approach was created in three steps. The first was to develop models that would help define investor sentiment based on how the price of a security behaved. We did this by defining characteristics of how investors behaved at critical points in a price cycle. We then developed algorithms that would identify this behaviour and quantify it so that we could rate it on a measurable scale.

The second was to analyze a large amount of historical data in order to define relationship between past cycle developments and wave behaviour. The final step was to develop algorithms that use the most recent wave and cycle data and then apply them to formulas developed from the historical data analysis to make the future price appreciation.

Although one of our foundations is the concept of previous price behaviour influencing future price, we do not believe this relationship is precise. Our data clearly indicates that given equal levels of peak and trough sentiment readings, our future prices show considerable dispersion. Our intent was nevertheless not to be able to use sentiment to generate an accurate price projection model but rather as a tool to provide the probability of positive future price movement. By taking the average price in the future based our data points and computing ranges that constituted one and two standard deviations from this average price, we were able to get what we call our arc of dispersion. This arc of dispersion represents approximately 83% of all of the prices in our data sets. For purposes of PAG (probability of absolute gain), we use this two-standard deviation arc. We can see this graphically below in Figure 1.A.
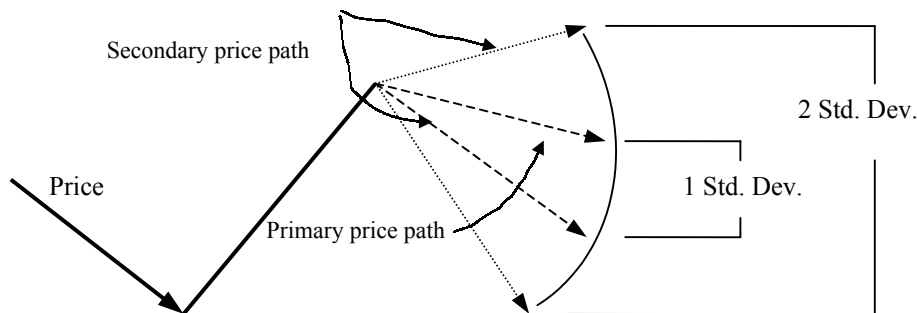
The extent to which the top of the arc dispersion was greater than the current price indicated the amount of future prices that were greater than the current price. The extent to which the arc of dispersion lay below the current price indicated the number of prices that fell below the current price. Therefore, to calculate the probability of future price being higher than the current level, we took the percentage of the arc of dispersion that lay above the current price. This can be seen graphically below in 1.b.

Cycle Peak

Cycle Trough

% of future price dispersion that falls above current price

% of our primary and secondary price dispersion that is less than current price 2-3 months out

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Understanding the relationship between the peak and trough readings of the sentiment cycle

Since our approach is based on the idea that understanding how investors act today will help us determine how they will act tomorrow, we fully expected the relationship between inferred sentiment and probability of future price gains to have a positive correlation. Although this was proven to be the case, the real issue was what level of sentiment equated to what probability of absolute gain. As the sentiment cycle peak and trough readings rise and fall, the future price dispersion paths will change. As would be rationally expected, the stronger the measured level of positive sentiment (the higher the peak sentiment reading), the higher the total of the dispersion path that fell below the peak prices. The same is also true for the higher trough readings. As the trough readings rose on the sentiment cycle, the higher the percentage of future price dispersion path that lay above the trough cycle price.
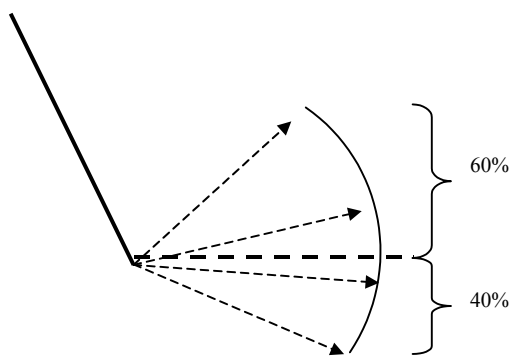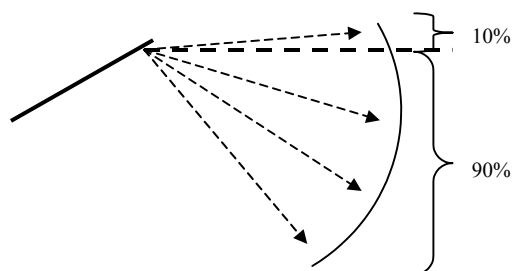
Peak
Sentiment
Reading
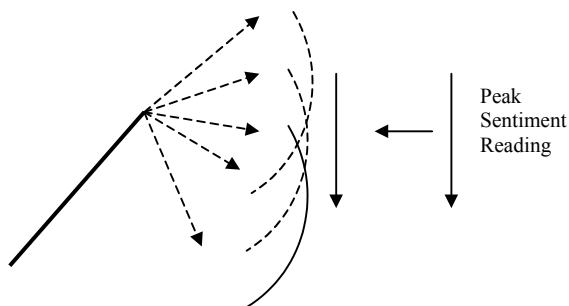
As the peak sentiment cycle readings fall, the price path dispersion range will also decline. This leads to the percentage of positive future price gains declining = lower probability of absolute gain.

Below are two examples of how probabilities are calculated based on varying dispersion rates:

40%

60%

90%

10%
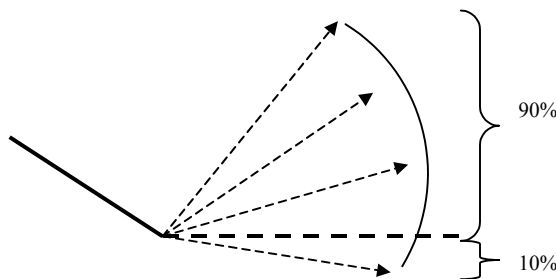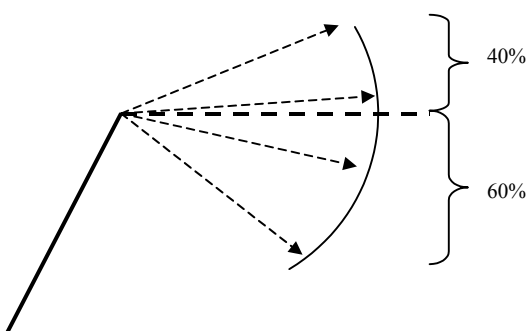
Cycle Bottom - Buy   Strong sentiment readings
High probability of absolute gain, as the majority of the price dispersion occurred above the current trough price.

Cycle Top   - Hold   Stronger sentiment readings
The probability of higher prices is not as low as the picture below with almost half the dispersion above the current price. Hold.

10%

90%

60%

40%

Cycle Top   - Sell   Weaker sentiment readings
Low probability of absolute gain, as the majority of the price dispersion occurred below the current peak price.

Cycle Bottom - Hold   Weaker sentiment readings
The probability of higher prices is not as high as the picture above, which has almost half of the dispersion above the current price. Hold.

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Relative Price Behaviour

The second process that we analyze is the relationship of price itself. When we calculate the sentiment data, we are assigning a value to price activity. Our view of sentiment is that it is not how much a security goes up or down that is key, but rather how it acts within the parameters of the cycle. As explained, sentiment is a great tool to help us obtain probabilities of absolute gain looking forward. The primary weakness with sentiment alone is that it does not tell us how much of a gain we should expect. For this we need to look at the price patterns themselves. This takes us to our next Quantechnics concept: relative price movement.

The concept of relative price movement is based on the idea that how a security's price behaved in the most recent cycle will be reflective of how it will behave in the future. In order to project future price activity, we take the most recent price trend activity or wave direction and skew it based on the relationship from the most recent cycle.

The theory here is twofold. First, several factors will determine how a price reacts, including large market capitalizations, index participation, the number of market makers, the float, the level of short-term volatility and the attractiveness to professional traders. All these factors form a conduit through which investment decisions must flow. Index leading stocks like MSFT and INTC both have significant markets caps, institutional ownership and as such, there is a very liquid, large market-maker contingent involved in the trading of the stock. The result of this is that the amplitude or cyclic price fluctuation of INTC and MSFT is much smaller in relation to other smaller stocks in their respective peer groups.

The second and more important factor, has to do with the basic forces of supply and demand. Our view is that sentiment is a cyclic event. Investors go through periods where demand to own a security dominates supply, creating an upward sloping wave of price activity. As this demand gives way, the wave direction or trend begins to reverse. A period then ensues when supply dominates demand. The fact that this is a constant process allows us to compare these two opposing periods in a cycle on an ongoing basis to see which force is the more dominant. In more simplistic terms, the degree to which investors are willing to drive prices higher during the high demand dominant phase of the cycle versus how much investors want to get out of a security during the supply dominant phase of a cycle will dictate how the price should behave on the next up wave.

Angular linear regression - ALR
In order to calculate our wave ratio more efficiently, we need to convert the slopes of the waves into degrees. We do this by using some basic trigonometry. After we convert the slope to degrees, we need to normalize it so that all securities are equal. The result is what we call Angular linear regression, or ALR. ALR is the normalized conversion of the slope of the regression line of the wave into degrees.

This relationship is demonstrated graphically below. We can see that there are three complete waves, A-B, B-C, C-D. Combining wave A-B and wave B-C we get cycle A-C. Wave C-D is our projected wave. Our wave projections are based on our ALR values of each of the waves. Our formula for the projected wave is written as follows:
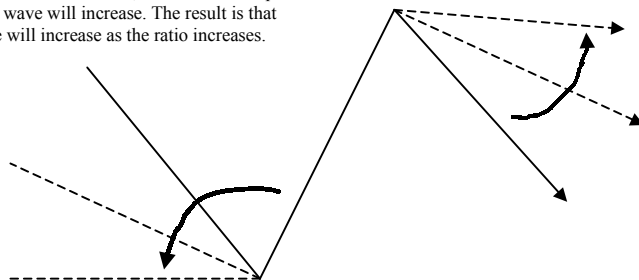
$$W_p = f\{ W_{a\text{-}b} , WR_{a\text{-}c}\}$$

Where

W_p = ALR of Projected Wave $_{C\text{-}D}$
$W_{a\text{-}b}$ = ALR of Wave$_{A\text{-}B}$
$WR_{a\text{-}c}$ = Wave Ratio of ALR of Wave$_{A\text{-}B}$ to ALR of Wave $_{B\text{-}C}$ or Cycle$_{A\text{-}C}$
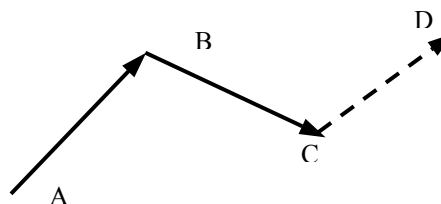
Understanding the wave ratio.
The wave ratio measures the two waves that constitute a cycle. The wave ratio is always measured up to down, regardless of whether the cycle is peaking or troughing. The steeper the up wave versus the down wave, the more bullish the ratio and the more bullish the outlook on price. The flatter the up wave in comparison to the down wave, the more bearish the ratio and the more bearish the outlook.

As the ALR of down wave declines, the ratio of the up wave to the down wave will increase. The result is that the expected price will increase as the ratio increases.

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Additional information available on request

The examples below show different examples of wave ratio analysis

Example 1

INTC – Bullish Wave Ratio

In example one we see that from October 1998 to January 1999, the slope of INTC was very steep. The subsequent profit taking was not anywhere near as intense that measured by the ALR values (the slope was relatively flat in comparison to the up wave. This is shown mathematically below. The end result when the new up wave began was a very strong and steep movement in price.

ALR values for the waves
Upwave : $Wave_{A-B}$ = 57 degrees
Down Wave: $Wave_{B-C}$ = -32 degrees

Wave $Ratio_{A-C}$ = 1.78:1

Example 2

The above example shows INTC in a downward trend. As the graphic shows, the down wave that occurred from October 2000 to April 2001 was much steeper than the up wave that ensued. This was clearly a case where investors did not care for the stock. If they had, the up wave would have shown a higher slope. The result was a very bearish sell wave that followed.

ALR Values for the
Upwave : $Wave_{B-C}$ = 8 degrees
Down Wave: $Wave_{A-B}$ = -38 degrees

Wave $Ratio_{A-C}$ = .21:1

Combining Relative Price Behaviour With Sentiment To Produce Price Path Projection

As we have discussed, we have two core concepts that we use for our forward price analysis: the sentiment cycle analysis and the relative price behaviour analysis. The final product is the combination of these two ideas, which provides a much more effective tool for forward price projection. The concept of relative price behaviour and forward-looking price path provides us with a good starting point and is a very good tool to project future prices. The primary drawback, however, is that the markets are in a constant state of disequilibrium and although the relative price behaviour analysis may point to one outcome, the internals of the price behaviour may not. This is where we get a distinct advantage by introducing the peak and trough sentiment analysis to our approach. The sentiment data is primary based on the idea that investors must show their cards as they participate in market activity. Sometimes how price behaviour takes place can tell two completely different things about two different stocks with two different sentiment readings. Below we have demonstrated this graphically.
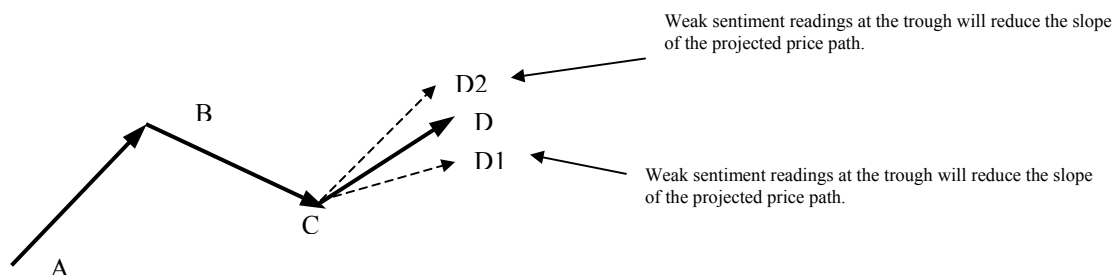
If you recall, our formula for the wave path is:

$$W_p = f\{W_{a-b}, WR_{a-c}\}$$

Now we introduce a new variable into the formula, S = investor sentiment:

$$W_p = f\{W_{a-b}, WR_{a-c}, S\}$$

The sentiment data will skew the wave path projection either positively or negatively based on the readings. The original wave path projection was wave C-D. For cases where sentiment data was extremely bullish, the wave path or slope would be positively adjusted. This would be represented by D1. For cases where the sentiment data was bearish, the wave path or slope would be adjusted lower. This would be represented by the wave C-D1.

Weak sentiment readings at the trough will reduce the slope of the projected price path.

Weak sentiment readings at the trough will reduce the slope of the projected price path.

The rationale behind the sentiment-based skew is that price behaviour provides clues to changes in sentiment that may not be apparent by simply comparing relative movement in prices. This is particularly true at major turning points. As with all major tops or bottoms, there are always investors who end up buying into a stock at or very near the top of the cycle or selling stock at or very near the bottom. It is our view that the actions of the smart money lead the pack and it this 'smart' activity that our sentiment models measure. If our readings indicate that there is a significant deterioration in the sentiment, then the peak or trough values will move down. The opposite would be true their was a significant increase in our sentiment readings.

Practical

The primary thesis of our quantechnics analysis is that price action is very good at relaying data about the human element of the market – sentiment. Our discussion thus far has focused on the static interpretation of investor sentiment and forward price projections. In reality, investor sentiment is constantly changing. It would be ideal if we could produce a tool that was extremely accurate to a point; however, few quantitative models are. The primary reason is that we are using current sentiment data to forecast future behaviour. The future is unknown and, undoubtedly, events will occur that significantly affect sentiment in ways not predicted by previous data. The events of 9/11 are a classic example of a major event. There will also be more subtle events that begin to affect investor sentiment. This is why we treat the sentiment cycle as a dynamic process.

The ability to make predictions about future behaviour allows us to monitor our predictions and determine if our model analysis was in fact correct. The idea here is that significant deviations from our projected price path will indicate significant changes in the underlying sentiment, which in turn will affect prices. The major advantage to following the projected price dynamically is that it allows us to see in advance when significant changes are about to take place and thus to adjust our asset weightings accordingly.

Some deviation should be expected and in fact, deviations from the projected price path are the rule and not the exception. It is important to distinguish between acceptable and unacceptable levels of deviation. For this we go back to the concept of a primary price path that we discussed when talking about the probability of absolute gain. The primary price path encompassed a much smaller range of values around and average price path, based on a given level of peak or trough sentiment. Values for wave paths that fall below or above these levels will be considered normal and the only adjustments that are needed would be accounted for in the wave path algorithm. The problem, however, is that significant deviations in the WPP represent significant changes in underlying sentiment and as such, will require more adjustment than we would normally get from our model. This is where we add the final input into our wave path projection model.

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The 4th variable to our algorithm is the factor of wave path deviation - W_{dev}

$$W_p = f\{ W_{a-b}, WR_{a-c}, S, W_{dev}\}$$

The function above is the process we use to make future price projections. Although we would like this to be a price tool, like all other quantitative models, it is only a best-guess product. Our view is that of the 'grenade' approach. We only need to be near the target to be effective.

Positive Deviation

The above graphic shows INTC showing very strong selling but the following buy wave was much stronger than projected. The projected price line for INTC was very flat and had a target price near the $24 level; however, INTC hit that level within the first weeks of starting the new up wave. This clearly demonstrated that underlying sentiment had changed. This will change our forward outlook on the stock and we would project weaker selling and more upside on the next medium term up wave.

Negative Deviation

The above graphic shows the opposite case where a stock shows a substantial downward deviation from the projected price path. Based on the strength on INTC at the peak of the cycle, the expectation would have been for more flat selling followed by more upside; however, the selling came in much stronger than anticipated. This clearly signalled a shift in sentiment. The result was a flatter projection of upside on the bounce and more weakness after the bounce occurred.

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