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Basics Of Trading Systems

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Introduction

It seems that everywhere you look, you see advertisements for software promising accurate buy and sell signals and profits with every trade - all with minimal time and effort. Ads like these can make trading systems look like scams aimed at your pocketbook. Is this stereotype justified? Or can trading systems offer viable methods of trading?

This tutorial addresses these questions and defines what a trading system is, and what it takes to design and implement one. If you are thinking of adopting a trading system, this is the place to learn about the skills and resources you'll need to do it.

The next section starts our study off by defining what trading systems are, outlining their components and discussing their advantages and disadvantages.

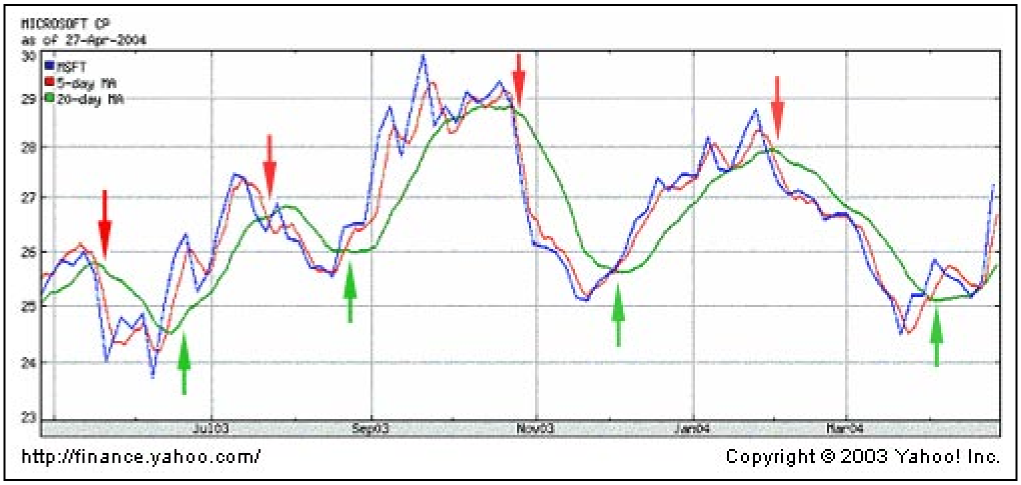
What Is A Trading System?

A trading system is simply a group of specific rules, or parameters, that determine entry and exit points for a given equity. These points, known as signals, are often marked on a chart in real time and prompt the immediate execution of a trade.

Here are some of the most common technical analysis tools used to construct the parameters of trading systems:

- Moving Averages (MA)
- Stochastic
- Oscillators
- Relative Strength
- Bollinger Bands

Often, two or more of these forms of indicators will be combined in the creation of a rule. For example, the MA crossover system uses two moving average parameters, the long-term and the short-term, to create a rule: "buy when the short-term crosses above the long term, and sell when the opposite is true." In other cases, a rule uses only one indicator. For example, a system might have a rule that forbids any buying unless the relative strength is above a certain level. But it is a combination of all these kinds of rules that makes a trading system.



MSFT Moving Average Cross-Over System Using 5 and 20 Moving Averages

Because the success of the overall system depends on how well the rules perform, system traders spend time optimizing in order to manage risk, increase the amount gained per trade and attain long-term stability. This is done by modifying different parameters within each rule. For example, to optimize the MA crossover system, a trader would test to see which moving averages (10-day, 30-day, etc.) work best, and then implement them. But optimization can improve results by only a small margin - it's the combination of parameters used that will ultimately determine the success of a system.

Advantages
So, why might you want to adopt a trading system?

- ***It takes all emotion out of trading*** - Emotion is often cited as one of the biggest flaws of individual investors. Investors who are unable to cope with losses second guess their decisions and end up losing money. By strictly following a pre-developed system, system traders can forgo the need to make any decisions; once the system is developed and established, trading is not empirical because it is automated. By cutting down on human inefficiencies, system traders can increase profits.

- ***It can save a lot of time*** - Once an effective system is developed and optimized, little to no effort is required by the trader. Computers are often used to automate not only the signal generation, but also the actual trading, so the trader is freed from spending time on analysis and making trades.

- ***It's easy if you let others do it for you*** - Need all of the work done for you? Some companies sell trading systems that they have developed. Other companies will give you the signals generated by their internal trading systems for a monthly fee. Be careful, though - many of these companies are fraudulent. Take a close look at when the results they boast about were taken. After all, it's easy to win in the past. Look for companies that offer a trial, which lets you test out the system in real-time.

Disadvantages
We've looked at the main advantages of working with a trading system, but the approach also has its drawbacks.

- ***Trading systems are complex*** - This is their biggest drawback. In the developmental stages, trading systems demand a solid understanding of technical analysis, the ability to make empirical decisions and a thorough knowledge of how parameters work. But even if you are not developing your own trading system, it's important to be familiar with the parameters that make up the one you are using. Acquiring all of these skills can be a challenge.

- ***You must be able to make realistic assumptions and effectively employ the system*** - System traders must make realistic assumptions about transaction costs. These will consist of more than commission costs - the difference between the execution price and the fill price is a part of transaction costs. Bear in mind, it is often impossible to test systems accurately, causing a degree of uncertainty when bringing the system live. Problems that occur when simulated results differ greatly from actual results are known as "slippage". Effectively dealing with slippage can be a major roadblock to deploying a successful system.

- ***Development can be a time-consuming task*** - A lot of time can go into developing a trading system to get it running and working properly. Devising a system concept and putting it into practice involves plenty of testing, which takes a while. Historical backtesting takes a few minutes; however, back testing alone is not sufficient. Systems must also be paper traded in real time in order to ensure reliability. Finally, slippage may cause traders to make several revisions to their systems even after deployment.

Do They Work?

There are a number internet scams related to system trading, but there are also many legitimate, successful systems. Perhaps the most famous example is the one developed and implemented by Richard Dennis and Bill Eckhardt, who are the Original Turtle Traders. In 1983, these two had a dispute over whether a good trader is born or made. So, they took some people off the street and trained them based on their now-famous Turtle Trading System. They gathered 13 traders and ended up making 80% annually over the next four years. Bill Eckhardt once said, "anyone with average intelligence can learn to trade. This is not rocket science. However, it is much easier to learn what you should do in trading than to do it." Trading systems are becoming more and more popular among professional traders, fund managers and individual investors alike - perhaps this is a testament to how well they work.

Dealing with Scams

When looking to purchase a trading system, it can be difficult to find a trustworthy business. But most scams can be spotted by common sense. For example, a guarantee of 2,500% yearly is clearly outrageous as it promises that with only $5,000 you could make $125,000 in one year ... and then through compounding for five years, $48,828,125,000! If this were true, wouldn't the creator trade his or her way to becoming a billionaire?

Other offers, however, are more difficult to decode, but a common way to avoid scams is to seek out systems that offer a free trial. That way you can test the system yourself. Never blindly trust the the business boasts about! It is also a good idea to contact others that have used the system, to see whether they can affirm its reliability and profitability.

Conclusion

Developing an effective trading system is by no means an easy task. It requires a solid understanding of the many parameters available, the ability to make realistic assumptions and the time and dedication to develop the system. However, if developed and deployed properly, a trading system can yield many advantages. It can increase efficiency, free up time and, most importantly, increase your profits.

Designing a Trading System - Part 1

The preceding section of this tutorial looked at the elements that make up a trading system and discussed the advantages and disadvantages of using such a system in a live trading environment. In this section, we build on that knowledge by examining which markets are especially well-suited to system trading. We will then take a more in-depth look at the different genres of trading systems.

Trading in Different Markets

Equity Markets

The equity market is probably the most common market to trade in, especially among novices. In this arena, big players such as Warren Buffett and Merrill Lynch dominate, and traditional value and growth investing strategies are by far the most common. Nevertheless, many institutions have invested significantly in the design, development and implementation of trading systems. Individual investors are joining this trend, though slowly.

Here are some key factors to keep in mind when using trading systems in equity markets:

- The large amount of equities available allows traders to test systems on many different types of equities - everything from extremely volatile over-the-counter (OTC) stocks to non-volatile blue chips.
- The effectiveness of trading systems can be limited by the low liquidity of some equities, especially OTC and pink sheet issues.
- Commissions can eat into profits generated by successful trades, and can increase losses. OTC and pink sheet equities often incur additional commission fees.
- The main trading systems used are those that look for value - that is, systems that use different parameters to determine whether a security is undervalued compared to its past performance, its peers, or the market in general.

Foreign Exchange Markets

The foreign exchange market, or forex, is the largest and most liquid market in the world. The world's governments, banks and other large institutions trade trillions of dollars on the forex market every day. The majority of institutional traders on the forex rely on trading systems. The same goes for individuals on the forex, but some trade based on economic reports or interest payouts.

Here are some key factors to keep in mind when using trading systems in the forex market:

- The liquidity in this market - due to the huge volume - makes trading systems more accurate and effective.
- There are no commissions in this market, only spreads. Therefore, it's much easier to make many transactions without increasing costs.
- Compared to the amount of equities or commodities available, the number of currencies to trade is limited. But because of the availability of 'exotic currency pairs' - that is, currencies from smaller countries - the range in terms of volatility is not necessarily limited.
- The main trading systems used in forex are those that follow trends (a popular saying in the market is "the trend is your friend"), or systems that buy or sell on breakouts. This is because economic indicators often cause large price movements at one time.

Futures

Equity, forex, and commodity markets all offer futures trading. This is a popular vehicle for system trading because of the higher amount of leverage available and the increased liquidity and volatility. However, these factors can cut both ways: they can either amplify your gains or amplify your losses. For this reason, the use of futures is usually reserved for advanced individual and institutional system traders. This is because trading systems capable of capitalizing on the futures market require much greater customization, use more advanced indicators and take much longer to develop.

So, Which Is Best?

It's up to the individual investor to decide which market is best suited to system trading - each has its own advantages and disadvantages. Most people are more familiar with the equity markets, and this familiarity makes developing a trading system easier. However, forex is commonly thought to be the superior platform to run trading systems - especially among more experienced traders. Moreover, if a trader decides to capitalize on increased leverage and volatility, the futures alternative is always open. Ultimately, the choice lies in the hands of the system developer.

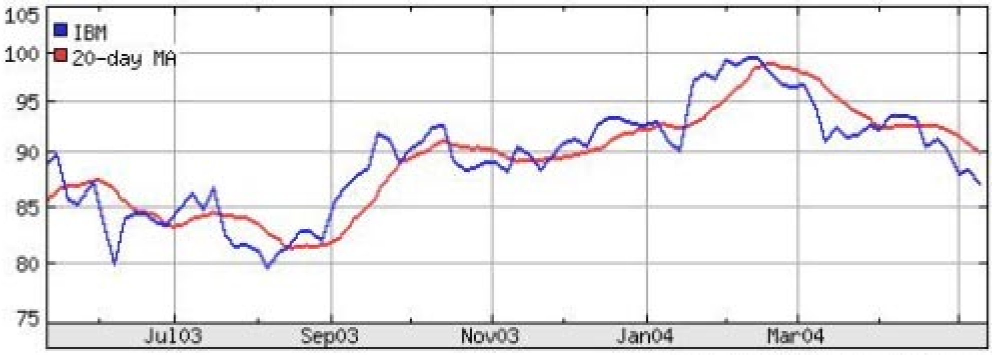
Types of Trading Systems

Trend-Following Systems

The most common method of system trading is the trend-following system. In its most fundamental form, this system simply waits for a significant price movement, then buys or sells in that direction. This type of system banks on the hope that these price movements will maintain the trend.

Moving Average Systems

Frequently used in technical analysis, a moving average is an indicator that simply shows the average price of a stock over a period of time. The essence of trends is derived from this measurement. The most common way of determining entry and exit is a crossover. The logic behind this is simple: a new trend is established when price falls above or below its historic price average (trend). Here is a chart that plots both the price (blue line) and the 20-day MA (red line) of IBM:



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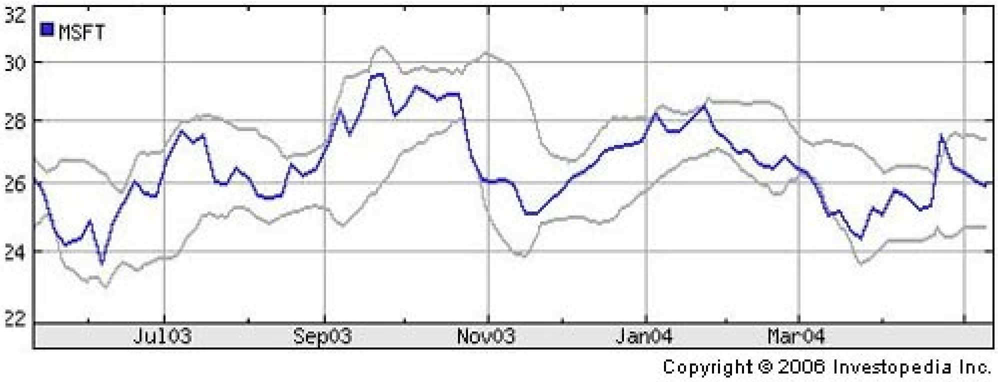
Breakout Systems

The fundamental concept behind this type of system is similar to that of a moving average system. The idea is that when a new high or low is established, the price movement is most likely to continue in the direction of the breakout. One indicator that can be used in determining breakouts is a simple Bollinger band overlay. Bollinger bands show averages of high and low prices, and breakouts occur when price meets the edges of the bands. Here is a chart that plots price (blue line) and Bollinger bands (gray lines) of Microsoft:



Disadvantages of Trend-Following Systems:

- ***Empirical Decision-Making Required*** - When determining trends, there is always an empirical element to consider: the duration of the historic trend. For example, the moving average could be for the past 20 days or for the past five years, so the developer must determine which one is best for the system. Other factors to be determined are the average highs and lows in breakout systems.
- ***Lagging Nature*** - Moving averages and breakout systems will always be lagging. In other words, they can never hit the exact top or bottom of a trend. This inevitably results in a forfeiture of potential profits, which can sometimes be significant.
- ***Whipsaw Effect*** - Among the market forces that are harmful to the success of trend-following systems, this is one of the most common. The whipsaw effect occurs when the moving average generates a false signal - that is, when the average drops just into range, then suddenly reverses direction. This can lead to massive losses unless effective stop-losses and risk management techniques are employed.
- ***Sideways Markets*** - Trend-following systems are, by nature, capable of making money only in markets that actually do trend. However, markets also move sideways, staying within a certain range for an extended period of time.
- ***Extreme Volatility May Occur*** - Occasionally, trend-following systems may experience some extreme volatility, but the trader must stick with his or her system. The inability to do so will result in assured failure.

Countertrend Systems

Basically, the goal with the countertrend system is to buy at the lowest low and sell at the highest high. The main difference between this and the trend-following system is that the countertrend system is not self-correcting. In other words, there is no set time to exit positions, and this results in an unlimited downside potential.

Types of Countertrend Systems
Many different types of systems are considered countertrend systems. The idea here is to buy when momentum in one direction starts fading. This is most often calculated using oscillators. For example, a signal can be generated when stochastics or other relative strength indicators fall below certain points. There are other types of countertrend trading systems, but all of them share the same fundamental goal - to buy low and sell high.

Disadvantages of Countertrend Following Systems:

- ***Empirical Decision-Making Required*** - For example, one of the factors the system developer must decide on is the points at which the relative strength indicators fade.
- ***Extreme Volatility May Occur*** - These systems may also experience some extreme volatility, and an inability to stick with the system despite this volatility will result in assured failure.
- ***Unlimited Downside*** - As previously mentioned, there is unlimited downside potential because the system is not self-correcting (there is no set time to exit positions).

Conclusion
The main markets for which trading systems are suitable are the equity, forex and futures markets. Each of these markets has its advantages and disadvantages. The two main genres of trading systems are the trend-following and the countertrend systems. Despite their differences, both types of systems, in their developmental stages, require empirical decision making on the part of the developer. Also, these systems are subject to extreme volatility and this may demand some stamina - it is essential that the system trader stick with his or her system during these times. In the following installment, we'll take a closer look at how to design a trading system and discuss some of the software that system traders use to make their lives easier.

Designing a Trading System - Part 2

The preceding section on designing a trading system examines the different types of markets in which to trade, and takes a look at the two basic genres of trading systems: trend-following and countertrend systems. These two strategies form the foundation on which all trading systems are built, and the markets provide the medium. In this second section on designing a trading system, we break down the two genres into individual components, examine the empirical decision-making process and, finally, take a look at how software has revolutionized system trading.

Basic Trading System Components

As mentioned in the introduction, trading systems are constructed using parameters - the groups of specific rules that generate entry and exit points for any given equity. Both trend-following and countertrend trading systems adhere to four basic principles that govern the construction of any trading system. These principles are also the essential characteristics of an effective system:

- ***The system must make money*** - This is easy to say, but hard to do. Maximizing the percent return should be your primary objective while designing a trading system.

- ***The system must be able to limit risks*** - It's difficult to use a system that fluctuates between extreme highs and lows; not only does it inhibit your ability to liquidate, but it can also be psychologically taxing. Furthermore, by limiting risks, you are able to decrease the effect of a "bad entry" (for example, going long during a downward fluctuation).

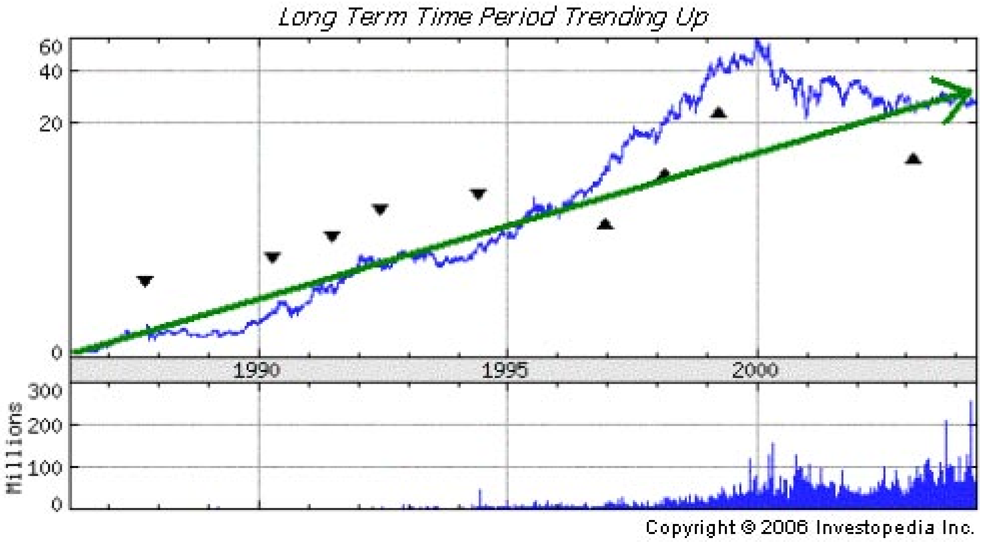
- ***The system's parameters must be stable and feasible*** - Trading systems cannot rely on coincidence or luck! The system designer can fulfill this principle of stability by broadening the parameters and not optimizing too much in an effort to increase his or her chances of success. The feasibility of parameters, including 'slippage', is discussed in the second section of this tutorial. Again, it is very important to take slippage into account when designing a system.

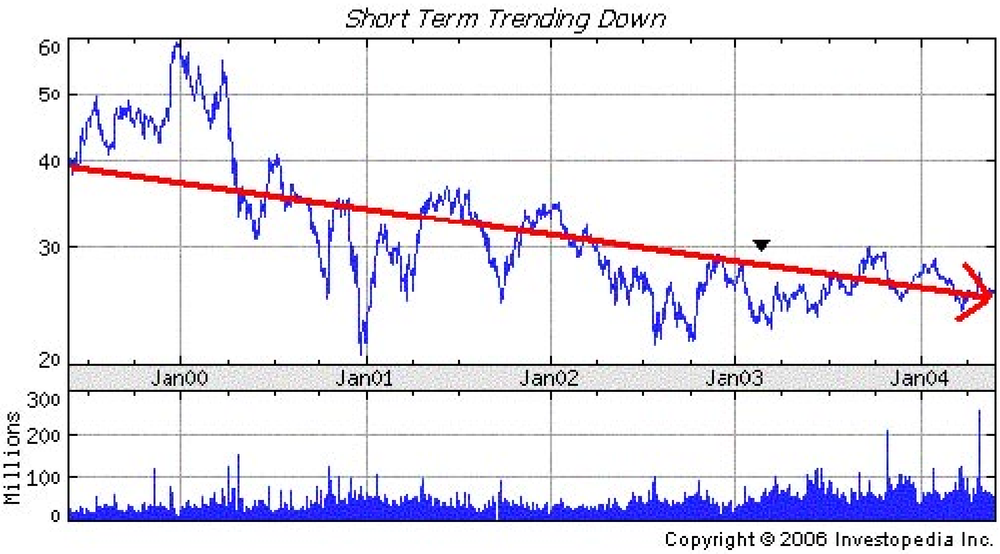
- ***The system's timeframe must be stable and feasible*** - For a system's timeframe to be successful, coincidence and luck should not play a factor. Feasibility must also be considered in this instance. If timeframes are set too close together, the resulting amount of trading frequency may not be possible due to software limitations and/or market-side limitations.

Empirical Decision Making

A trading system requires the designer to make some empirical decisions that directly affect the system's performance - if there was no need for this decision making, everyone would be rich. Here are some basic factors that system designers must decide on and some guidelines:

- ***What time period should I use?*** All equities can be analyzed from multiple perspectives of time periods, ranging from one minute to one decade (or more). Deciding which time period to test can drastically affect the performance of the system. More reliable results generally come from longer time periods, while short periods can be misleading when judging real market conditions. However, this does not mean that only extremely long price periods should be used. It is important to keep in mind that the longer the time period, the longer it may take for profit to be realized. Observe the following example of Microsoft's long term, a period of more than 20 years, compared to its short term, a period of a few weeks:





We can clearly see that the short term is not an accurate representation of the long term, and vice versa. As a general rule of thumb, five to 10 years is a good target for medium- to long-term system traders, and six months to five years is a reasonable range for short-term traders. Again, it depends on when you plan to liquidate.

- ***What price series should I use?*** Most equities are charted on an unbroken price series - that is, the charts are continuous. When trading futures and some other equities, however, there is an option to use actual contract data instead of continuity. Futures contracts themselves only last a few months, and system backtesting often requires a year or more of data; therefore, system traders often utilize continuous futures, which are a series of contracts combined to create a continuous stream of data. As a general rule of thumb, long-term traders should stick to continuous futures, while short-term traders should use actual contract data.

- ***What parameters and settings should I use?*** We explore this further in subsequent sections that address the construction of a trading system. Basically, parameters are selected by "guessing-and-checking," or producing "blind" simulations, or presetting a group of parameters, and then using the average to determine performance.

  Again, many of these factors can be influenced by desired liquidity, time until liquidation, risk and a multitude of other factors, so it is important to take the time to decide which works best for you.

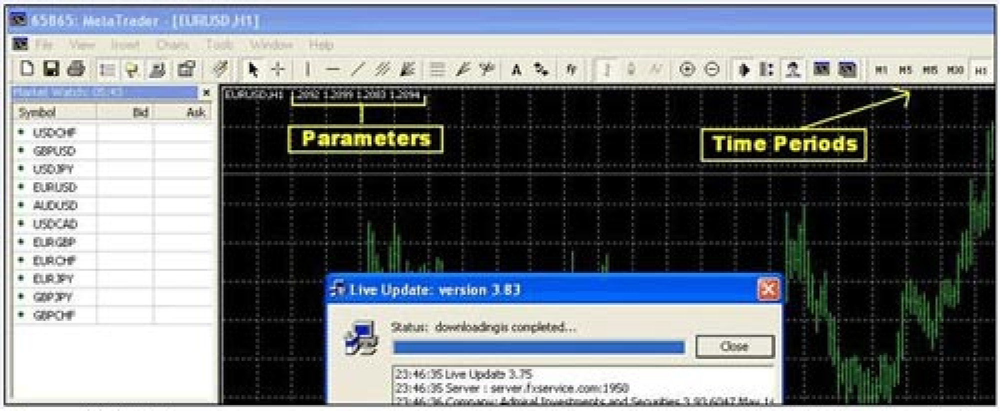
Software and System Trading

The evolution of the computer is perhaps the greatest driving force behind system trading. Originally, computers were just used to crunch the numbers;

eventually they acquired the capacity to conduct simulations, generate signals in real-time, and even place trades for the trader! Some software is designed simply as a platform from which a system developer can build a system; other software uses neural networks to "learn" from the markets and enhance itself. Some software is installed on the user's hard drive; other software is provided only online. Here are a few of the basic programs used by system developers:

Client-Side Software

Client-side software must be installed on the user's computer. It is often connected to the internet and is able to obtain real-time data (including prices, news, etc.). Note: some companies charge you not only for the software, but also for the data. These applications typically allow the user to specify the time period, types of parameters, and more. One of the most crucial features, however, gives the user the ability to program a system. This is done using a simple programming language (often specific to the application used) with which you can set up rules to generate buy and sell signals - these then appear directly on the chart. Here is an example of a client-side application called MetaTrader:



Symbol	Bid	Ask
USDCHF		
GBPUSD		
USDJPY		
EURUSD		
AUDUSD		
USDCAD		
EURGBP		
EURCHF		
EURJPY		
GBPJPY		
GBPCHF		

Status: downloadingis completed...

```
23:46:35 Live Update 3.75
23:46:35 Server : server.fxservice.com:1950
```

Source: MetaTrader

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Server-Side Software

Server-side software is installed on a remote server. Often, these applications return signals that are displayed to the public by means of a webpage (or a subscriber base). This eliminates the need for any client-side software other than a web browser. Furthermore, the user pays a small subscription fee as opposed to buying a program and paying for a data subscription. Finally, the user does not have to develop the system, only receive generated signals. But you should remember that this kind of software is often susceptible to scams, while the client-side software is not.

Conclusion

Now you have a basic understanding of trading systems: you know what they are, the different types of systems that exist, the factors to keep in mind while designing them, and the software used to make system trading easier on you. Next, we will examine how to actually construct a trading system and put it into use!

Constructing A Trading System

So far, we have discussed the basic components of trading systems, the criteria they have to meet, and some of the many empirical decisions that a system designer must make. In this section, we will examine the process of constructing a trading system, the considerations that need to be made, and some key points to remember.

The Six-Step System Construction

1. Setup - To begin constructing a trading system you will need several things:

- Data - Because the system designer must use extensive backtesting, past price history is essential to constructing a trading system. Such data can be integrated into trading system development software, or as a separate data feed. Live data is often provided for a monthly fee while aged data can be obtained for free.

- Software - Although it is possible to develop a trading system without software, it is highly impractical. Ever since the late '90s, software has become an integral part of building trading systems. Some common features enable the trader to do the following:

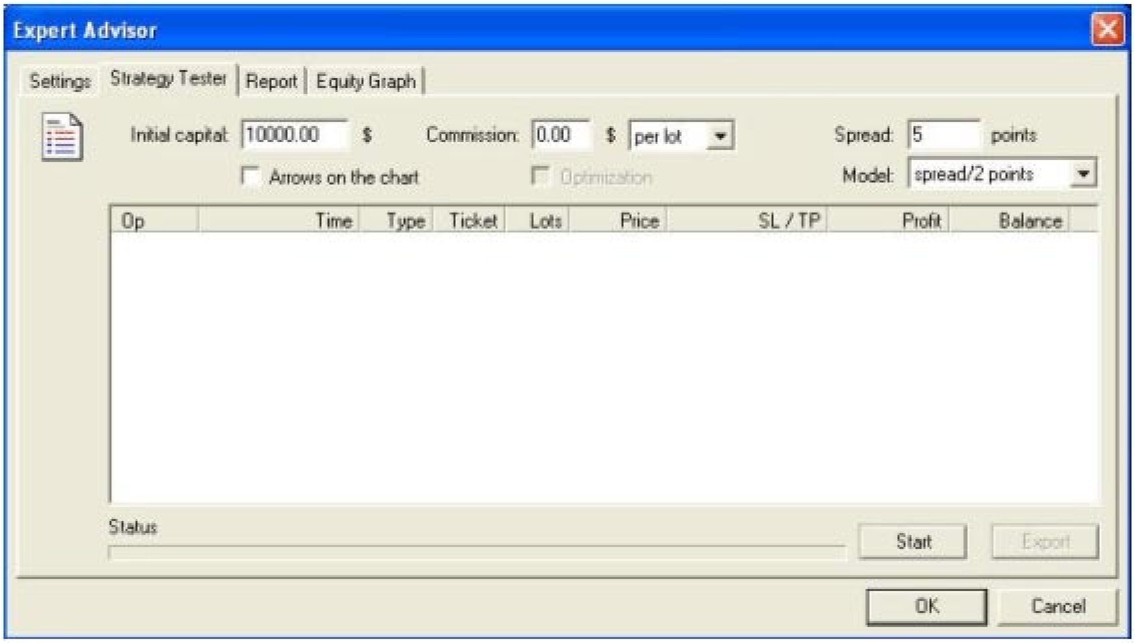
    - Automatically place trades - This often requires permission from the broker's end because a constant connection must be in place between your software and the brokerage. Trades must be executed immediately and at exact prices in order to ensure conformity. To have your software place trades for you, all you need to do is input the account number and password, and everything else is done automatically. Please note that using this feature is strictly optional.

    - Code a trading system - This software feature implements a proprietary programming language that allows you to build rules easily. For example, MetaTrader uses MQL (MetaQuotes Language). Here's an example of its code to sell if free margin is less than $5,000:

      ```
      If FreeMargin < 5000, then exit;
      ```

Often, just reading the manual and experimenting should allow you to pick up on the basics of the language your software uses.

- Backtest your strategy - System development without backtesting is like playing tennis without a racquet. System development software often contains a simple backtesting application that allows you to define a data source, input account information, and backtest for any amount of time with the click of a mouse. Here is an example from MetaTrader:



Initial capital: 10000.00 $

Commission: 0.00 $ per lot

Spread: 5 points

Model: spread/2 points

☐ Arrows on the chart

☐ Optimization

Op	Time	Type	Ticket	Lots	Price	SL / TP	Profit	Balance

Source: MetaTrader

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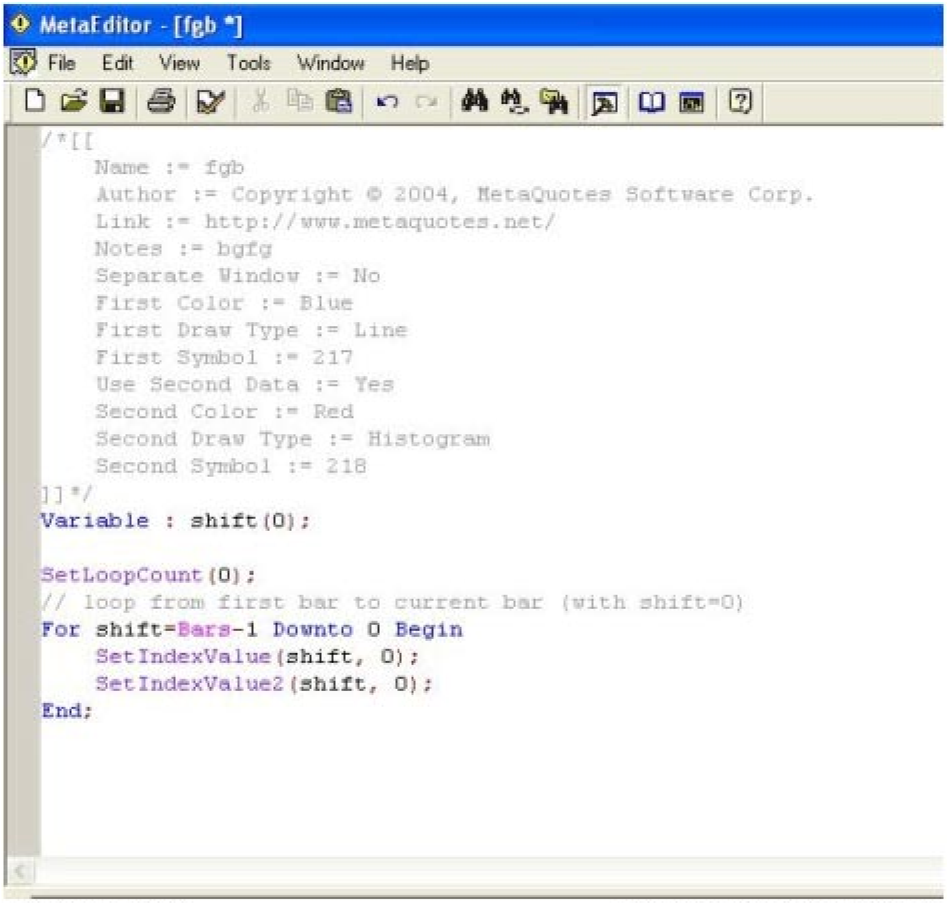
- After the back test is run, a report is generated that outlines the specifics of the results. This report usually includes profit, number of un/successful trades, consecutive days down, number of trades, and many other things that can be helpful when trying to determine how to troubleshoot or improve the system. Finally, the software usually creates a graph showing the growth of the investment throughout the tested time period.

2. Design - The design is the concept behind your system, the way in which the parameters are used to generate a profit or loss. You implement these rules and parameters by programming them. Sometimes, this programming can be done automatically via a graphical user interface. This allows you to create rules without learning a programming language. Here is an example of a moving average cross-over system:

If SMA(20) CrossOver EMA(13) then enter;
If SMA(20) CrossUnder EMA(13) then exit;

Rules like these that are put into code allow the software to automatically generate entry and exits at the points when the rules are applicable. Here is what the design interface looks like on MetaTrader:



```
/*[[
    Name := fgb
    Author := Copyright © 2004, MetaQuotes Software Corp.
    Link := http://www.metaquotes.net/
    Notes := bgfg
    Separate Window := No
    First Color := Blue
    First Draw Type := Line
    First Symbol := 217
    Use Second Data := Yes
    Second Color := Red
    Second Draw Type := Histogram
    Second Symbol := 218
]]*/
Variable : shift(0);

SetLoopCount(0);
// loop from first bar to current bar (with shift=0)
For shift=Bars-1 Downto 0 Begin
    SetIndexValue(shift, 0);
    SetIndexValue2(shift, 0);
End;
```

Source: MetaTrader

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The system is created by simply typing the rules in the window and saving them. References for the different functions available (for example, oscillators and such) can be found by clicking on the book icon. Most software will have a similar reference available either within the program itself or on its website. After creating the desired rules and coding the system, you simply save the file. Then you can put it into use by selecting it on the main screen.

3. Decision Making - There are many decisions to be made at this point:

- What market do I want to trade in?

- What time period should I use?
- What price series should I use?
- What subset of equities should I use for testing?

Keep in mind that trading systems should consistently make a profit in many markets. By customizing the time period and price series too much, you may taint the results and produce uncharacteristic results.

4. Practice - Backtesting and paper trading are essential to the successful development of a trading system:

- Run several backtests on different time periods and make sure that the results are consistent and satisfactory.

- Paper trade the system (use imaginary money, but record the trades and results), and again, look for consistent profitability.

- Carefully check for errors in the program, or unintended trades. These can be a result of faulty programming or failure to foresee certain circumstances that have undesired repercussions.

5. Repeat - Repetition is necessary. Keep working on the system until you can consistently make a profit in most markets and conditions. There are always unforeseen events that occur as soon as a system goes live. Here are some factors that often cause skewed results:

- Transaction costs - Make sure that you are using the real commission, and some extra to account for inaccurate fills (difference between bid and ask prices). In other words, avoid slippage! (To review what this is and how it occurs, see the preceding section of this tutorial.)

- Watchfulness - Don't ignore losing trades; keep an eye on all trades.

- Optimization - Don't over-optimize the system. In other words, don't tailor the system to a very specific market environment; try to be profitable in as broad of an environment as possible.

- Risk - Never ignore or forget about risk. It is very important to have ways to limit losses (otherwise known as stop-losses), and ways to lock-in profits (take profits).

6. Trade - Try it out, but expect unintended results. Be sure to use nonautomated trading until you are confident in the system's performance and consistency. It takes a long time to develop a successful trading system, and before you perfect it, you may have to endure some live trading losses to detect glitches: back testing cannot perfectly represent live market conditions, and paper trading can be inaccurate. If your system loses money, go back to the drawing board and see where it went wrong (see step 5).

Conclusion

These six steps give you an overview of the entire process of building a trading system. In the next section, we will build upon this knowledge and take a more in-depth look at troubleshooting and modification.

Troubleshooting and Optimization

Even after successfully designing and constructing a working trading system, a trader may find that his or her system is imperfect. There may be some problems, such as an event that keeps generating losses; or maybe the rules are too broad and need to be optimized. What's the easiest way to fix the problem? How effective is optimization? This section will show you how to troubleshoot and optimize your trading system to maximize profits and minimize losses.

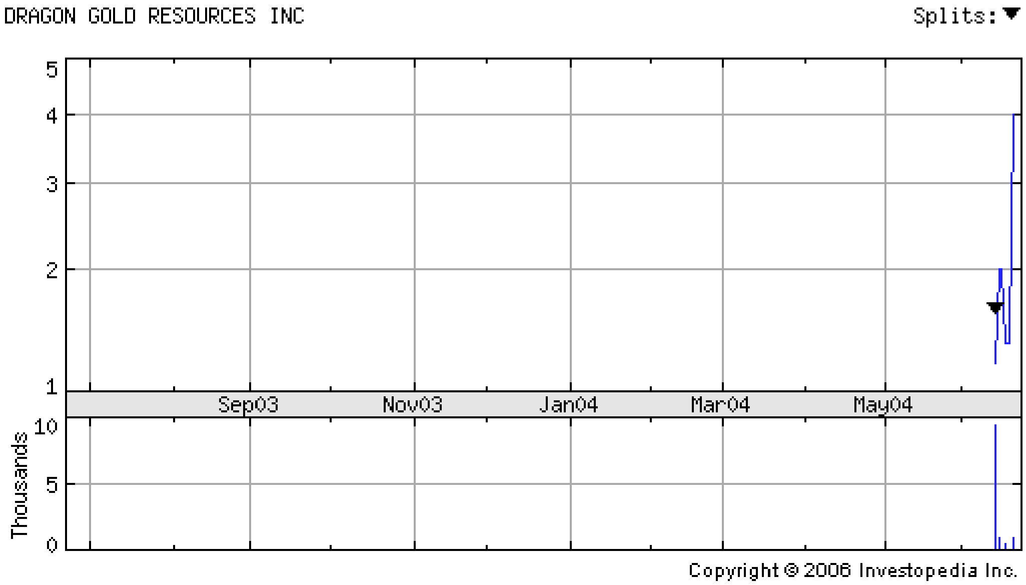
Troubleshooting

Troubleshooting is a very important aspect of system development. A decent trading system will be profitable in most market conditions, but if it occasionally renders large losses, you can work to identify and solve the problem. Here are four easy steps:

1. Identify the problem - Find all instances in which the problem occurred during your backtesting, and/or start recording when the problem occurs during live trading. During each instance, take note of any tendencies of the following four factors:

1. Chart pattern or price series - Spike in the prices.
2. Volume - Large volume initially and low volume thereafter.
3. Bid/Ask spread - Spike in price on low volume often indicates a large spread.
4. Margin (if used).

These are some of the areas in which problems can occur, which we can see by analyzing the chart below. Note the price spikes on low volume by the green arrow. Also note the large volume (near the blue arrow) followed by low volume thereafter. If none of these turns out to be the culprit, there are other factors that can be analyzed, such as block-sizes and advanced chart patterns.



2. Evaluate the problem - Use the information you gathered to determine what exactly caused the system to malfunction or to generate a loss. This is often done by using common sense, or by analyzing transaction logs (provided by your broker). Here are examples of how some conditions of the four factors listed above may be the reason for an identified problem:

1. Chart pattern or price series - The system is unable to sell during sharp declines or buy during steep climbs. Perhaps the system did not have ample time to buy or sell.

2. Volume - The system is unable to sell during declines or buy during increases. Perhaps the equity has such a low trading volume that the system is unable to buy or sell at one price. During these instances, the price can be misleading without a consideration of volume and bid/ask.

3. Bid/Ask spread - The system makes a purchase but doesn't profit as much as it should when selling. This could be due to the fact that the trader forgot to consider bid/ask spreads. If a system is programmed to buy and sell at the "current price" it actually pays the ask, and when sold, it doesn't sell at current price but at the bid price. Sometimes the differences between the bid and ask can be large, leading to undesired losses.

4. Margin - The system suddenly sells for no apparent reason. If this occurs, you may have forgotten to consider margin calls.

3. Consider the alternatives - Simply try some solutions to the problems you have identified. Consider the following alternatives corresponding to the above problems.

1. Chart pattern or price series - One alternative is simply to tell the system to wait until the price stabilizes before buying. This can be done by using the differences between the previous prices and the current price to create a rule.

2. Volume - To solve this problem, you could create a rule that requires the equity to have a certain amount of volume before executing a trade.

3. Bid/Ask spread - Here you might want to buy and sell based on the bid and ask prices instead of the current price.

4. Margin - Using margin can be profitable if risk is managed effectively. Limiting downside should keep you from receiving margin calls. This can be done with trailing stop loss points or other similar tactics to limit downside.

4. Implement a solution - Finally, we need to apply the solution and see how it works. Paper trading or back testing again before live trading is often a good idea after applying a solution because sometimes solutions have unintended consequences. For example, additional rules may limit these down days, but also decrease overall profits (due to missed opportunities).

Optimization

Optimization simply means finding the best sets of parameters for a given market. This process can marginally improve results. However, it also carries many risks because its underlying assumption is that past performance is indicative of future price movements. Optimization can be accomplished by changing the values of the parameter you would like to optimize and then back testing these changes. Keep in mind the other parameters must remain constant for the effects of the changes to be determined. Once you find the value that yields the highest performance in the back testing, implement it into the trading system.

Let's consider an example. Say a trader analyzed the S&P 500 and found that he or she could optimize the system by using a daily chart. This same process can also be taken to a higher degree. For example, if a simple moving average of 6 works better than 8 for an MA-crossover strategy in a given market, then 6 would be used. The problem here is not only in the assumption, but also in the fact that the system may perform worse in many other markets, thereby making it less universal.

Many system developers forgo the optimization stage for these two reasons:

- Optimization often overstates results. This is because the parameters are so specific and non-universal that any change in the market (that is, the future) can cause instability.
- In many cases, optimization will not improve performance by a meaningful degree. Slight improvements may be apparent; however, the forfeiture of universality is a high price to pay.

As a general rule, optimization should only define broad settings for parameters rather than set up specific rules - even if it was successful in backtesting and paper trading.

Conclusion

Troubleshooting is crucial to making your system work the way you want it to. It is important to identify any problems by observing the instances in which they occurred and then evaluating how certain conditions of several factors - such as price pattern, volume, bid/ask spread, and margin - may have caused the problem.

Optimization can improve your results, but it is important to remember that it has its limitations. Not only is it based on the assumption that past performance indicates the future, but it is not the stage at which the trader creates specific rules - optimization is only about defining broad settings. In the next and final installment, we will provide an overview of everything we've covered along with some advice and resources to help you gain a working knowledge of trading system design and development.

Conclusion

Let’s recap what we’ve learned from this tutorial:

- A trading system is a group of specific rules, or parameters, that determines an entry or exit point for a given equity.
- Combinations of technical analysis indicators and oscillators are often used to create the rules used in trading systems.
- Once they are created and working properly, trading systems can take all emotion out of trading and save you a lot of time; however, they can be difficult and time consuming to construct and perfect.

- Many trading systems have proven to be effective over time. But some of the trading systems sold on the market have been scams. Most scams can be detected by looking at the promises they make - if it sounds too good to be true, it probably is!
- Trading in the currency market can offer more liquidity and lower transaction costs, but also more volatility and a limited selection. Equity markets have limited liquidity and high transaction costs, but a more diversified nature. The futures market - although typically reserved for advanced traders - offers high leverage and potential profits, but is more difficult to tame with a trading system.
- There are two main types of trading systems: those that follow the trend and those that go against the trend. Although similar in terms of risk, they offer different ways of profiting.
- Your trading system must make money, limit risk, be composed of stable parameters and have a stable time series.
- Software can help you speed up system development and automate trading.
- The six steps involved in creating an effective trading system include (1) set up, (2) design, (3) decision making, (4) practice, (5) repeat and (6) trade.
- Optimization should be avoided in most circumstances.
- The four steps in the process used to troubleshoot any problems with your trading system include (1) identifying the problem, (2) evaluating the problem, (3) considering the alternatives, and (4) implementing a solution.

http://www.metaquotes.net - Free technical analysis software.

http://www.tradestation.com - Most popular paid automated trading platform.

http://www.esignal.com - Paid data source.