

AOS
trading

HANDBOOK OF SUCCESSFUL EXCHANGE TRADING

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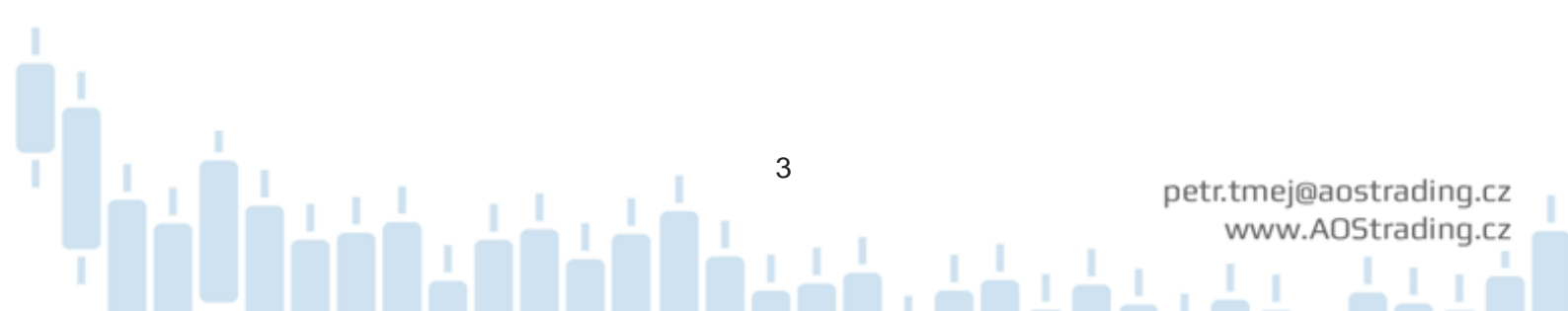
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1. Passive Appreciation

Anyone who wants to start trading on the markets exchange should first ask himself the question: "What is the main motivation of people who start with broker-mediated trading?" Most of you would surely reply: the maximum possible appreciation of my savings with the maximum saving of time. And I definitely agree. Many of my readers already know that I have been successfully using trading algorithms for a long time. However, in my opinion, before one decides to trade really seriously on exchange markets, he or she should get it clear in his or her mind which other possible alternatives of a partly passive appreciation of savings are there:

Investing in real estate – flats

Some time ago I flirted with the idea to invest my hard-earned money in real estate in the form of purchasing flats and land. Then I applied the classical pros-and-cons method and I realised that this form of investment was not for me. The following example speaks for itself. During the economic boom (mainly in the first half of 2008) many of my friends from Ostrava (Czech republic) where I come from, were purchasing flats in bulk. At that time real estate prices in my hometown were rising sharply because demand was significantly exceeding supply. Sentiment was extremely positive. Ostrava and the entire Moravian-Silesian Region was spoken of as the region of the future. But then the global economic crisis struck and the real prices began to fall.



Fig. 1: Housing prices development in the Czech Republic from 2005 to the third quarter of 2014. Source CSO

In Fig. 1 you can see the development of average prices of flats from 2005 to September 2014. The chart shows that the realised price considerably differed from the supply price.

You can see that in the third quarter of 2008 average prices started to fall. Base value of the index, which is equal to 100 and which you can see on the vertical axis, was set to the beginning of 2010. So if you, for example, bought a flat in the Czech Republic in the third quarter of 2008 when the index value was 123.1, you would be able to sell it these days, when the index value is 98.6, for a 24.84% lower price. It should be noted that Ostrava has been affected by the crisis much more than other regions and the percentage slump in housing prices was extremely significant there. And as usual in life, a lot of my friends bought real estates in Ostrava just before the outbreak of the crisis when housing prices were historically high. Of course, there is still an absolutely relevant argument that flats may lose on their prices, yet they can still generate a stable rental income (if we see a flat purchase as an investment). This is true and for example today, at the end of 2014, when housing prices have been stagnating for many years (and therefore there may be a higher probability of commencement of a period of growth), purchasing flats may be an interesting investment opportunity. If you buy for example a one-room flat in Ostrava today and you find a tenant, your annual return from rents may vary between 8-10% after taxation. Yet I see one big BUT here and it is the risk of default on rent payments and the related complicated administration. The law is not much helpful to flat owners and it takes a lot of nerve to evict a tenant nowadays. So if your tenant will not pay for a couple of months, you have a real problem. In this situation the expected profitability will remain only on the paper. Other aspects that must always be considered are the flats wear and tear, maintenance requirements and other planned expenditures. For these reasons it is no surprise that I meet more and more flat owners who bought flats in order to appreciate their savings and then rather decided to sell these flats after several years. Of course, there are many variables that play an important role. I do not say that an investment in housing cannot pay off, but considering the risks of the necessary administrative duties and defaulter tenants I came to the conclusion that real estate investments are not a passive form of appreciation of savings. In a nutshell, the achievable return compared to the time spent is not too interesting for me. Not to mention flats in Prague which are perceived as a safe investment harbour, yet they offer a return of approximately 3 to 5% per annum.

Investing in art and valuables

Art and valuables (e.g. paintings, antiques and so on) may certainly be an interesting investment area. Yet this area is completely beyond my knowledge and therefore it is not appropriate for me to express any opinions. However, it is more than clear that if you want to succeed in this sphere you must devote yourself entirely to it and be highly educated in it (as in anything else in which you want to be successful). I knew only one person in my life who earned fortune thanks to his deep knowledge of art (namely paintings). So if you have a feel

for art and if you are well familiar with it, it is certainly one of the alternative ways of generating considerable earnings.

Investing in physical commodities (for example gold)

It was not so long ago when investing in gold seemed to be the safest harbour against the threat of high inflation caused by mass quantitative easing (QE - activity of the central banking system of the United States during which government bonds and other toxic assets are being purchased from commercial banks so that these banks have sufficient resources to provide other loans the aim of which is to temporary "recover" economy). A direct consequence of such operations is an increase in the amount of currency in circulation which leads to a risk of inflationary pressures (which is further enhanced by the low interest rate environment). In an effort to boost the economy the FED can therefore easily "overshoot" and increase the amount of money to such an extent which could bring inflation out of hand. When inflation reaches very high levels, it is very difficult to get it back under control. And that is one of the reasons reason why many people began to buy gold as gold has been historically seen as a means to protect against high inflation. In September 2011, mass media began to spread the information that gold is approaching the record high of USD 2 000 for 100 troy ounces. Articles compared the situation to the gold rush.



Fig. 2: Development of price of gold from 2004 to December 2014

At this time there was a panic spreading from various alternative sources. Media was afraid that the quantitative easing of huge amounts of dollars would lead to hyperinflation. But as it is so often in the investment world, when the public begins to be interested in a particular commodity, stock, or other item, professional investors who bought this underlying asset before usually start to sell in bulk in order to generate profits. What a cliché, yet we can see this over and over again, only the financial instrument changes. There is a typical example of Bitcoin – the public started to buy in bulk this cryptocurrency in November 2013 and in December 2014 its value dropped. Obviously, the public was aware of Bitcoin at that time and thus intelligent investors were able to line their pockets again as they had buyers for their Bitcoin.

Investing in mutual funds or directly in equity indices?

Before you let yourself be blindly convinced by active sales representatives of banks who will tell you that investing in mutual funds is the right thing for you, read the following reasons why it may be more profitable to invest in equity indices such as S&P 500, NASDAQ 100, Dow Jones, or Russell 2000, or their equivalent in the form of ETFs. According to [SPIVA](#) (S&P Indices Versus Active Funds –Association comparing results of the stock indices against results of mutual funds), mutual funds often have disappointing results compared to equity indices. According to [these statistics](#), 66% of all mutual funds in the US underperformed S&P 1500 in 2012. Just for clarification, S&P 1500 includes the value of approx. 90% of all stocks traded on the NYSE (New York Stock Exchange). In 2011, even 84% of all mutual funds lagged behind this index. In 2010 it was "only" 57% of all mutual funds. These are pretty poor results of what should be highly professionalised institutions to whom you entrust your hard-earned capital, don't you think?

Which may be the main reasons of the fact that mutual funds are unable to systematically and consistently outperform share indexes?

- **Fees**

According to data from the Investment Company Institute, the average fee that mutual funds charge for managing your money is 1.44% per annum. These fees usually range from 1% to 2.5% per annum. They often discourage individuals who seek for quick speculative profits from short-term investing in mutual funds. 1 - 2.5% per year may not seem to be a high fee yet be sure that this is one of the main reasons why investing in stock indices may be the better choice.

Mutual funds' reserves

Managers of mutual funds must keep certain financial reserves for, for example, unexpected purchase opportunities. The amount of these reserves ranges from 3% to 7% of the total financial resources of the fund.

So does it make sense to buy and hold equity indices?

I think that absolutely yes, but it is essential to have a good timing and plan. Let me elaborate this thought a little more: If you would have bought S&P 500 in October 2000 (see Fig. 3), you would had to wait 13 years until 2013 to get out of the loss and only in the last two years you would have gained some profit. On the other hand, if you would have bought the index in March 2009, the largest and totally unprecedented growth in the index's history would have been in front of you. Timing plays a great role here. Buying stock index after a six years' essentially constant growth would be, in my opinion, a complete madness. Especially when we add the aspect that this growth was largely caused by the already mentioned FED's

quantitative easing (QE) and not by a systematic development of sound economic fundamentals. One would have thought that the further decline of the stock indices may be much sharper than the one that we could observe from October 2007 March 2009 when the indices got to their very bottom. So if I considered investing in stock indices, I would wait for a major correction or even for a "free fall". However, description of my specific purchase tactics is beyond the scope of this text.



Fig. 3: Development of price of e-mini S&P 500 from 1998 to December 2014

Long-term investments in physical commodities, mutual funds, or stock indices are based on the "Buy-and-Hold" principle, i.e. buy assets and hold them for a long time (often for a few years). This form of investing may certainly have a significant potential for capital appreciation. This strategy may usually pay off if we timed the purchase and sell of the asset well. Advice about when to buy and when to sell can be found in many books and it is not subject of this manual to analyse them. Logically, I would not buy physical commodities, stock indices, or mutual funds at their historical highs. These investments seem much more interesting to me during periods of significant price corrections (i.e. price collapses).

Trading

Every day I see that the public tends to perceive trading very negatively and likens it to gambling. In the next chapter **Exchange trading - casino or path to independence?** I explain that trading can be a very effective way to a significant appreciation of your capital (in tens of percent a year). Just to illustrate: **In 2013 I increased the value of my account by 82% and in 2014 by 20%. It means that my average account appreciation was more than 50% per year**, which I consider a great success. So what makes trading a potentially more profitable business (even at the cost of acceptance of a potentially higher risk) than investing in real estate, art and valuables, physical commodities such as gold, mutual funds, or stock indices (via the "buy-and-hold" strategy)? It is mainly because of the following factors:

- **Trading with leverage**

Transactions in commodity futures markets are performed with margin which means that you dispose of far greater sums and your potential return is much higher although you are actually trading with only a small deposit – **margin**. Of course, the risk also proportionally increases in the same way, but when you apply a proper money management you can have the risk under control. This style of trading is called leverage trading.

- **Trading system using statistics and probability theory**

If you are sufficiently motivated and trading will become your passion, if you will honestly study and work on yourself, you will gradually build a trading system (strategy) the strict observance of which will bring you success and substantial regular earnings. Trading system is a set of rules or parameters (such as entry into the long position after crossing of two moving averages) determining conditions of opening and closing positions within trading a specific underlying asset. You can ascertain whether your system has the potential to be profitable in live trading by using various robustness tests and other analyses of historical data (**backtesting**). The point is that the scales of probability must tilt in your favour. In trading it is absolutely essential to use a robust trading system because only such a system will bring you long-term profits. If you are not sure whether you have such a system there is nothing easier than sign up for our individual or group **course** [Building Winning Trading Strategies with TradeStation](#). Here you will find out which robustness tests are necessary. Within the course I will also give you program codes of my trading systems which I have been successfully using in my live trading for a long time.

- **Algorithmization of trading systems**

The key advantage of trading is the possibility to employ fully automated trading systems (ATS) which enable the most efficient and strict observance of long-term trading rules (that were transformed into an algorithmic code). The algorithmic code performs execution of trading orders.

2. Exchange trading is not casino

It's omnipresent – stocks, commodities, currency pairs (Forex). Day by day we keep watching media, that dollar depressed against euro and vice versa, and that year by year gold gradually reached its new highs to subsequently experience the most powerful decline in many years history. We see shares of numerous enterprises rising and falling. For the last few years we have experienced the whole world being frightened of fluctuation of stock market indices (e.g. S&P 500, German DAX, French CAC40, Japanese Nikkei 225 etc.). Therefore, we are constantly observing price movements in time. And there is no doubt that every time these significant movements occurred, someone filled his pockets and on the other side someone else went bankrupt.

So why do you read this handbook? The purpose is to support you open your eyes and approach the world of successful exchange trading. I shall try helping you to find out that a path to your dream wealth and financial independence can turn real thanks to this wonderful business.

We are living in the age of endless opportunities. Nowadays, thanks to the Internet the data can be transmitted across the world literally in hundredths of seconds. And that is the main reason why trading has become available to almost anyone.

In the past (still in early 90s) trading was based on phone calls and brokerage by a person who was present on an exchange floor executing traders' orders. In the present electronic trading is prevailing. Thus, we can trade anything we wish from a comfort of our home: commodities, stocks, options, pair trading. We are not limited by any location which means a magnificent advantage compared to the past!

So, the location barrier is not an issue anymore. The important thing is to surpass other possible obstacles of trading. One of the major obstacle is the fact that we live in the negative environment where many discouraging articles and stories consider trading to be nothing more than just a form of gambling in casino. The paradoxical fact is that this is declared by those who have not even did trading yet or those who did try but did not succeed. Those people compare trading to roulette, slot machines or even betting on sports. The fact is that in case of casino and slot machines, it is the owner who has winning probabilities. Have you ever heard of gambler who was consistently gambling for living in a long run? Of course, there could be someone having his lucky day in the casino with a remarkable profit. If he was conscious enough not to go to casino again, he would become one of the few who made profit. If you go to casino on regular basis and bet frequently, you will definitely empty your pocket sooner or later, as the winning probability will always play against you.

It is critically important to realize that “rules of the game“ in trading are not determined just by a single person such as a casino owner. Everyone trading buy or sell orders on stock or commodity exchange is taking part on the price change. Thus, the goal is to have a winning probability on your side and set the rules.

The good news is that it is possible. Why? Take your time and look for serious traders who do trading for a living. However, trading is like in any other entrepreneurship and demand self-determination self-discipline. It means that trading is very time demanding because of intensive studying, self-education and will.

The unique opportunity in the trading is that it is possible to practice simulated trading as long as you want without placing your hard earned money at risk. So you can train the trading. Would you be able to say anything like this in common business?

It is unwritten rule that only about 1 of 10 companies succeed in business in the long run. Honestly, success rate of exchange traders is more or less similar. You have to take into account that exchange is a very competitive environment. To distinguish yourself from the losers and reach an imaginary throne of success and wealth, it requires, as mentioned earlier, the self-discipline, perseverance and long-term education. Only this way you can become real specialists in trading. One of the biggest advantage of trading is its full transparency. You never have to wait for a customer to finally pay for your services. The money from your profitable trade will be immediately credited to your bank account and no one can take it away from you.

Let’s now summarize main advantages and disadvantages of trading:

ADVANTAGES	
Relatively low initial investment	You can start trading with a very low equity capital (e. g. thousands of dollars) and make very good money. For electronic trading you just need an ordinary computer (preferably a laptop), the Internet and a quality software platform.
High return on investment	No bank can offer a possibility of such an increase of of your capital value. It can be tens of percent of interest per year or even more if you belonged to the top traders Of course the risk has to be taken to consideration.
Independence	Trading is an independent business and you can literally earn a fortune without labour.
Transparency	Trading is a fully transparent, regulated and legal source of income. In the U.S. there are several institutions (e.g. CFTC), which strictly control regularity and transparency of exchange trading.
Immediate profit from profitable trade	Trading income is immediate. You do not need to wait for your invoice to be paid. You do not have to worry about your customer’s company to go bankrupt as it often happens in ordinary business life.
Flexibility	Trading does not need to be time demanding. You can do trading whilst being employed or having another business. Trading can then become a good source of increasing value of your income. There are types of trading (you can read more about them in further chapters), that will take only a few minutes of your time a day. Really, just few minutes a day for checking the market development and taking the right steps, and you are done for the day.

DISADVANTAGES	
Endless journey	You need to learn trading such as any other business, professional sport or anything else. It will be a thorny path to your success. You can not expect to become a professional trader overnight. Unfortunately (or "thank goodness"?) life does not work this way. The most important is your discipline and determination. Trading must become your passion, hobby and a fascination. You need to devote to trading, to keep learning and never to lie back on your laurels. You should slowly but surely move forwards to your desired success.
Inevitable losses	Probably the most difficult and tricky in trading is to learn and love your losses. If we compared trading to ordinary business, it would be like loving your labour costs, software, administration, etc. in. But the truth is that these costs are the essence of success. Losses from unprofitable trades must be considered costs in trading. However, it is important for these losses to be efficiently spent. In other words, you need a good quality and robust trading system (you can read more about trading systems in further chapters of this Handbook). In the long run (> 1 year), the trading system can be considered successful if a sum of losses in your account is less than the sum of your profits.

Tab. 1 and Tab. 2: Advantages and Disadvantages of Trading

3. What Are Commodity Markets and Futures?

In my trading I primarily focus on **commodities** that are traded through "**futures contracts**". In this chapter I will explain what led me to this way of trading and what are the principles of commodity trading.

Commodities, like most other underlying assets, are traded on exchanges. Basically, there are the following types of exchanges:

- **Exchanges**
 - foreign currency exchanges,
 - financial derivatives exchanges (e.g. options or futures exchanges)
 - securities exchanges (stocks, bonds)

- **Commodity exchanges**
 - for trading commodities



FOREX is also often, yet incorrectly, classified among exchanges – Forex is an OTC system for trading currency pairs.

I have met many traders during my career. Many of them traded Forex, which is a system for trading currency pairs such as the euro against the dollar and so on. Forex traders mostly use software platforms that offer opening of several-hundred-dollar trading accounts for ridiculous fees. The fact is that I have never personally met anyone who gained long-term profits in Forex.

Another category of traders with whom I have met were traders oriented on stocks. Here I have met some successful individuals, yet appreciation of their invested capital reached only a few percent (few percents per year at most). The main problem which I see in the stock markets are the strict rules for traders who want to perform intraday trading. If you are trading through a US broker (like me - I work only with US brokers – as I will describe later in this handbook), the minimum deposit for opening an account is USD 25,000.

So far, I took the most from traders oriented on commodities, i.e. "futures". The turning point for me was meeting with one trader who managed to increase the balance of his trading account by several hundred percent per year for several consecutive years. That was such a strong motivator for me that I decided to fully concentrate my attention on futures and I can say today that it was the right decision. On the other side it is very rare example - one of thousands I would say.

Let's explain what futures trading actually is:

Futures trading is a type of investment based on speculation that in a specific moment in the future the price of a selected commodity will be higher or lower than today. Futures are classified among "**derivatives**" which are trades within which we agree on a transaction for the purchase or sale of an underlying asset, yet the transaction itself will take place in the future (on the contract date).

It is important to know that in the case of futures we can profit both on increases and decreases of commodity prices. That is the difference between futures and stock trading. First, here is an example of trading stocks. On the stock market you can trade shares of individual companies, i.e. buy or sell securities of individual companies in the form of stocks. Stocks are certificates confirming the real ownership of a certain share of the company. The size of the share depends on the number of stocks you own. If the market value of your stocks rises, you profit because you can sell these stocks on the stock exchange at a higher price compared to the purchase price. Therefore, stock traders in principle speculate on their stocks' price increases. It is also possible to speculate on a decrease, but it is a complicated process which we are not going to describe in detail in this chapter. In futures contracts you can speculate either on a price increase or decrease thanks to the fact that the particular commodity will be physically delivered in the future (in the case of stocks the purchase/sale and the delivery are performed at the same time and therefore you always lose on a price decrease and you will not primarily speculate on it). For example, you can open a position with one corn futures contract today with the condition that this corn will be physically delivered to you in December 2013 for USD 463. After a few days you decide to close this position because the corn price reached USD 493 per contract and the futures exchange will credit the profit to your account. In the same way you can speculate on a price decrease - if you open a trading position with the conditions that you will physically deliver corn in December 2013 for USD 463 per contract. If the market price of corn decreases, it will be advantageous for you to close this position and take the profit from the price difference.

Compared to the stock market in futures you trade with particular commodities, such as oil, corn, gold, and other possible underlying assets. I will explain the principle later. Let's start with the information that you **trade with futures contract of a certain commodity**.

What is a commodity?

Commodities are almost everywhere, here is the list of some of them:

- **corn**- one of the essential world crops, it is contained in almost every product in the supermarket (in the form of corn starch). Moreover, it is the most common fodder crop for cattle and other breeding animals.
- **cotton** – it is used in many more areas than just the textile industry
- **gold** - jewellery, decorative items, and also essential electronic components
- **currency** – currency pairs can be traded not only on Forex, but also through futures
- **oil** – oil is used virtually everywhere, even for the production of toothpaste
- and many other commodities with which you will get gradually acquainted during your studies of commodity markets.

These commodities are traded every day by millions of investors, among which are:

- **banks** – they strive for appreciation of their extensive capital
- **speculators** – ordinary traders who are not interested in the physical delivery of a commodity and who only speculate on price movements (in the future maybe you will become one of these traders)
- **funds** - for example mutual and other funds that manage capital entrusted to them by passive speculators. This means that the speculators indirectly give their money to someone who trades for them and tries to appreciate the entrusted capital,
- **producers** of commodities - mining companies, farmers, growers, and others.
- **processors** of commodities - they need commodities for their business purposes, e.g. corn starch producers buy corn, electronics manufacturers buy silver for production of the necessary components, and so on.

If we speak about "**speculators**", trading with futures contracts actually means abstract and speculative investments. It is abstract because the trader (speculator) does not want (and never will) to physically own the commodity. And it is speculative because the trader is trying to profit on the selected commodity's price increases or decreases. The speculator opens trading position in a futures contract under conditions that are agreed at the moment of the opening the position.

4. Specifics and Terminology of Futures Contracts

The essential and unchangeable principle of futures contracts is that they are **termed**. This means that they will expire on a certain date in the future and the commodity will be physically delivered. This date is called the **expiration of the contract**. But be careful! As we have already explained in Chapter 3, you can close your position in commodity futures any time before expiration. In other words, you do not have to wait for the contract's expiration date. In fact, there are many "short-term" traders and speculators who open positions for a few hours only, some of them even for a few minutes or seconds. **The previous sentences can be clearly illustrated by the following example:** On August 3, 2013, our market analysis (we will explain various types of analyses in the next part of the handbook) gave us a signal to buy one contract of corn. Expiration months of corn futures are March, May, July, September, and December (this information can be found both on exchanges' websites and in your trading platform). We plan to have our position open for approximately three months because according to our analysis the price of corn should reach the expected value at the end of this period - it is thus a long-term position. If we add three months to the date of August 3, 2013, we get the date of November 3, 2013. We will therefore buy corn with expiration in December because the September contract would not meet the condition of a 3-month position. If we wanted to open our position for a few days only and not for 3 months, we could buy the contract with expiration in September.

The length of the expiration of a futures contract is usually directly proportional to its liquidity. **Liquidity** in trading terminology means that the futures contract is traded by a sufficient number of traders and that you will be most likely able to buy or sell it for the price you want. In other words, we can say that the more traders trade the commodity at the given moment, the more liquid the market is. Traders usually trade futures contracts with the closest expiration date. By doing so they avoid the problems related to order execution.

Execution of orders means filling of your trading orders through your broker, i.e. realisation of your entry to or exit from the trading position. Remember that if you want to sell your contract (for a certain price given by your plan), there must always be the counterparty – buyer. In most commodities you will be most probably able sell contracts with the earliest expiration for the desired price since their liquidity is usually high. Otherwise the price could be much lower which would substantially reduce your projected profit.

Futures contracts and standardisation

All futures contracts are "**standardised**" which means that **commodities are traded in units with a standardised quantity and quality**. For example, one gold futures contract consists of 100 troy ounces of 24-carat gold. One corn futures contract consists of 5,000 bushels of corn (i.e. 127 metric tons).

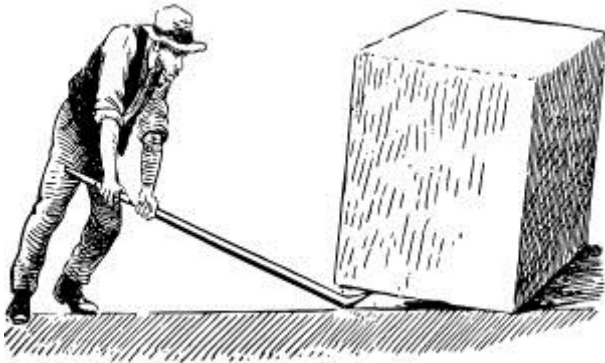
Futures contracts - First Notice Day (FND)

Many of you may already have asked yourselves questions like: What if I am unable to sell a futures contract on the expiration date? Does it mean that if I don't sell the contract somebody will heap up 127 metric tons of corn in front of my house? I can calm you down here, it is actually impossible not to be able to sell your futures contracts before their expiration. However, it is advisable to keep an eye on the First Notice Day. It is a date on which the trader receives a notice that he owns a contract for the purchase of a commodity the trading of which will end soon. But be careful - some commodities do not have their First Notice Day at all! FND differs in each futures market but generally it is 1-5 days before the expiration date. Therefore, most investors are closing their positions before the FND because their aim is not to physically own the commodity but to profit on its price movements. Information about individual contracts' FNDs can be found in most software platforms, trading platforms provided by brokers, or on exchanges' websites. I therefore recommend that you always close all your futures positions by the FND. Furthermore, in the period before the FND there is always a sufficient market liquidity (this applies to all commonly traded commodities). After the FND liquidity, i.e. the immediate ability to sell the contract, begins to fall very fast.

Futures contracts - Last Trading Day (LTD)

Honestly, as speculators you should always avoid the LTD like the plague. If you do not get rid of your contract by this date, you will have to accept the delivery obligation. This means that you would be responsible for acceptance of the physical commodity the contract of which you bought and did not sell before the FND. Settlement of contracts is supervised by the commodity exchange's clearing centre which is subject to a stringent regulation. Thanks to the high liquidity in commodity markets it is unlikely that you would not be able to sell a futures contract before its FND. In addition, many brokers (e.g. Interactive Brokers) do not allow you to hold an open position after the FND because their clients are typical traders - speculators. For this reason these brokers automatically close positions of their clients on the FND. However, it is necessary to keep FNDs and LTDs in mind and have them indicated in your trading calendar with a distinctive colour!

5. Leverage Trading



Futures trading has several significant advantages over trading with conventional underlying assets such as stocks. The first one is that futures trading inherently includes **leverage**. The term leverage means that you can control large amounts of assets (corn, gold, and others) via only a low marginal amount. Let's explain this principle on an example.

At the time of writing this chapter, crude oil futures contract with expiration in September 2013 cost \$ 106 per barrel. **Margin** for one crude oil futures contract was \$ 4,500. The amount of margin for each underlying asset is determined by the exchange.

In this model example we buy one crude oil futures contract. The standardised size of one oil futures contract is 1,000 barrels. In order to be able to buy one oil futures contract we need to have at least \$ 4,500 on our trading account. In fact, you should have much larger amount at your disposal because if the price of oil went in the opposite direction than your business strategy you would begin to lose and you would receive a "**margin call**". Margin call is a notice from your broker that you must add funds to your account. Margin call is sent in a situation when your account balance falls below a certain limit laid down by the broker. If you ignore the notice, the broker closes your positions at his discretion (you cannot influence which particular positions will be closed and it is therefore possible that the broker closes just the most profitable ones).

So let's rather imagine that we have at least \$ 20,000 on our account. If we buy a futures contract for oil, our broker blocks the margin (deposit) of \$ 4,500 on our account. But you do not have to worry that you would lose this money. As we have already explained before, the principle of trading with futures contracts is that we agree upon delivery time and cost of a future contract in the moment of its purchase, while the financial settlement and the commodity's physical delivery takes place on an agreed date in the future. Therefore, when buying a futures contract we do not pay any money, only the margin is blocked on our account. When we sell the contract, the margin will be unblocked and the amount of \$ 4,500 will appear on our account again. At the same time, the achieved profit will be credited or the suffered loss will be deducted.

So we bought one oil futures contract for \$ 106 and thus we have an open trading position and a margin was blocked on our account. The actual situation on our account with the initial balance of \$ 20,000 is: $\$ 20,000 - \$ 4,500$ (blocked margin) = \$ 15,500,

i.e. we bought one futures contract for oil for \$ 4,500 margin. We have already said one futures contract consists of 1,000 barrels of oil. On the futures exchange's website you can find the information that the value of a one-point price movement of a barrel of oil is \$ 1. Our futures contract, which we bought for \$ 106 and with \$ 4,500 of blocked margin, has a total value of 1,000 barrels * \$ 106 = \$ 106,000.

And that is the point! We needed only \$ 4,500 to open a position with the value of \$ 106,000! Do you see the difference? Our leverage is therefore $\$ 4,500 / \$ 106,000 = 1:23.55$. Thanks to the leverage the appreciation potential is huge. Let's explain why.

Imagine that after some time after buying of our oil futures contract its value rises by 3% to \$ 109.18 per barrel. We decide to sell our futures at this price. The actual value of a futures contract containing 1,000 barrels of oil is $\$ 109.18 * 1,000 = \$ 109,180$, i.e. we gained $\$ 109,180 - \$ 106,000 = \$ 3,180$ profit. Needless to say that a 3% price increase may be a matter of a few months (or even a week) in commodity markets. Regarding our margin \$ 4,500, you can see that we managed to achieve a 70% profit. Yet objectively, we could also lose 70% of the margin if the price fell by 3% and thus went against the direction of our business strategy.

To avoid such losses we have many risk management instruments available, as will be explained in later chapters. For now you should only remember that margin is an amount that is blocked on your account when you open a trading position. When you close your position and exit the market, your broker will unblock the margin and the funds will become available again. Therefore, you need to be careful and do not open too many positions. Each newly opened commodity futures contract means blocking of a margin and a lower balance of your account until the position is closed. Thus be careful about the margin. **Margin Call** should ideally remain a theoretical concept for you, a hypothetical situation in which you will never get. This is because after margin call your broker would release the blocked margins by closing even those positions which should remain open according to your business plan. You should therefore manage your positions in such a way that margin calls remain only something which you hear about from other traders or read about in books like this.

Remember that you will start as novices and that in trading applies that (with three exclamation marks): **Who wants more ends up with nothing.** You should pay attention to the very essentials and have realistic objectives and plans. If you think that you open an

account with a few thousand dollars and become fabulously rich, then you should rather bet lotto. There is the same 99.9% probability that you will lose your money and it will cost you no effort and time. Of course, you can generate very nice profits with your few-thousand dollar account, even tens of percent a year, but you always have to have the risk under control and you must keep sufficient reserves on your accounts. The spectre of margin is often more real than the beginners like you are willing to admit.

6. History of Futures Trading

As we have already said, commodity trading is based on the principle of trading "termed" futures contracts. This means that they expire on a certain date in the future (and the commodity is physically delivered on this date). We have also explained that we can sell the purchased futures contract anytime before the expiration date. As traders we can profit on this principle. Take the example of corn with delivery in December next year. As a participant in this market you can buy corn futures contract consisting of a clearly defined amount of corn (about 127 metric tons) in the required quality at the agreed price and with delivery in December of the next year. Paradoxically, in this way you can buy 127 tons of corn which has not grown yet (and you already know its price)! On the basis of this futures contract (a contractual relationship) the supplier is obliged to deliver you the above-



mentioned quantity of corn in December of the next year. But you already know that you will actually not be obliged to accept these 127 metric tons of corn in December next year because you can sell the futures contract any time and profit on increases of its price.

But what actually led to creation of such a mechanism? Why would someone be interested in buying corn that has not been grown yet? And conversely, who would be interested in selling a non-existent corn? We can find answers to these questions when we look into the history of commodity futures contracts. The first ever recorded mention of commodity futures contracts relates to Japan, to approximately the 17th century. The Japanese growers' basic need was to secure the necessary finance for seasonal rice cultivation. They needed some initial capital to ensure production. Regarding rice cultivation it is the capital for covering the cost of seed, wages for employees, harvest, product quality control, etc.

The problem, however, was that banks were not willing to lend money for rice cultivation. You surely know from your own experience that every bank wants guarantees that it will get its lent money back (together with an appropriate interest). Thus, if a farmer did not have the sufficient capital for rice cultivation, he could sell the yet-ungrown rice. By doing so the farmer took some risk and assumed that he would be able to grow, for example, 500 tons of rice of a certain quality. The buyer who, for example, produced rice rolls knew that he would need just these 500 tons of rice in December of the next year. Thus the two entered into an agreement (futures contract) that in December of the next year the farmer would deliver the rice-roll producer 500 tons of rice for an agreed price and at the required quality. The farmer

obviously knew very well at what price he could sell the rice because he knew the cost structure of cultivating a certain amount of rice. As they say "You don't get something for nothing", so the farmer of course added a proper profit.

Surely you already begin to understand the underlying motivation of both the farmer and the buyer of his production for entering into this form of agreement. It is a certain mutual **guarantee, which is the essence of the relationship called a futures contract these days**. The farmer could be very happy – he had a buyer before he even sowed the first seed. So now he could go to his bank with a signed futures contract and borrow capital for cultivating rice. Or maybe he even did not need the bank. The trader, on the other hand, knew in advance what rice-roll related costs he would have in the next year.

But as they say: "There are always two sides of the coin." Over time it began to be clear that concluding futures contracts in this form is not always really favourable for both sides. Imagine a situation that the following year, when the farmer grew rice for the pre-agreed customer, there was an extreme crop failure in Japan. Thus, the price of rice skyrocketed. The farmer was surely very frustrated because he was obliged to sell his 500 tons of rice to the rice-roll producer for the pre-agreed price. The producer, on the other hand, was happy because he bought rice for a price that was much lower than the market price. A logical consequence of such situations was the idea of trading with futures contracts and speculating on future commodity prices (rice in our case).

Let's imagine a situation that the farmer knows that due to a bad weather during the year the harvest will be poor and the price of rice is very likely to significantly rise. The farmer therefore decides to sell a futures contract to another farmer with due profit. The second farmer's motivation to buy the futures contract may be, for example, to avoid the need to borrow money from the bank to finance the production of his own rice.

Now, Let's put ourselves in the position of the producer of rice rolls. He could also foresee that the price of rice was going to rise. Therefore he speculated and bought more futures contracts than he actually needed. Now he can sell these contracts to other rice processors with profit. The rice-roll producer himself keeps only the amount of futures contracts that he needs for his own production. Many people very soon realised that futures contracts may be a perfect way to get rich. The imaginary rice market started to have new participants - people called traders or speculators in modern terminology. These people were buying commodity futures contracts if they assumed that the next year there would be a bad harvest and thus they would be to sell their contracts for a higher price, i.e. with some profit. Yet if their assumption of bad harvests failed and there was a rice surplus, these speculators would sell their futures contracts at a loss.

So how you can see, the primary historical purpose of futures contracts was hedging of risk. Producers are motivated to sell futures contracts and buyers to buy them. These basic motivations led to the creation of a central location (exchange) which regulated and facilitated bulk purchases and sales of commodity futures contracts. The point is that if there are many producers and buyers in one place, they can compete with each other which leads to establishing of a balanced price reflecting current market trends. Yet a problem arises when there are few producers and buyers in the market and thus there is an insufficient supply and demand for commodity futures contracts.

This is where we, traders, start to play an important role. The more participants a commodity exchange has, the higher supply and demand there is and the better buy and sell opportunities for a price acceptable for all participants there are. In other words: Traders provide the sufficient **liquidity** to markets. The more liquid a market is (i.e. the more participants trading with the most contracts it has), the higher chance for all market participants, including producers and processors, that they will be able to sell or buy futures contracts for the desired price.

We, traders (speculators) play a role of mediators in futures exchanges as we can first buy and then sell or, on the contrary, first sell and then buy futures contracts. In the first case our aim is to buy cheaply before a price increase and then to sell the contract and generate profit. In trading terms this is the **long position, or "Long"**. In the second case we want to sell the contract first for a higher price (like we were for example in the role of a coal-producing company concluding a contract to supply coal) and to close the position by buying the contract back for the lowest price possible (as would do a heating company that buys coal). The trading terminology calls this the **short position, or "Short"**.

Yes, it is indeed so. On commodity markets, you can earn a lot of money also when the prices are falling!

7. What Can Be Traded on an Exchange?

In this chapter we will explain what can be traded on an exchange. It is various types of **underlying assets and their derivatives**. Underlying assets are mostly traded in a way that you buy or sell them for current market prices (the "spot price") and the trade is settled at the same time. For example, if you buy the underlying asset in the form of stocks of a particular company, the transaction will be concluded and physically settled right away. I. e. you become the owner of the stocks immediately after the purchase.

In the case of derivatives, which belong to "termed" instruments, the situation is different. By purchasing derivative of a certain underlying asset you also conclude a business transaction with specific conditions (price, quantity, quality), yet the real settlement of this transaction will take place in the future, on a precisely specified date. We will address the issue of derivatives in detail in the next part of this chapter. First, let's look at Table 3 containing the **most common types of underlying assets**.

TYPES OF UNDERLYING ASSETS	
Stocks	Stocks represent shares that their owner has in a stock company. Thus they represent the right to participate in the company's profit (in the form of dividends). The stockholder is not liable for company debts. Stocks of some companies are traded on stock exchanges where the supply and demand for these stocks determine their market value. For example, you can buy stocks of Apple or Facebook on the New York Stock Exchange or ČEZ on the Prague Stock Exchange.
Stock indices	A stock (equity) index (also known as stock exchange index) is an indicator of the development of the stock market as a whole. It reflects both the current state of the market and the long-term development tendencies (trends). Every stock and over-the-counter market has its own index. The index value is calculated by various methods from the value of all stocks belonging to the index. Among the best-known stock indices in the US are S&P 500 (weighted average of stock prices of 500 selected US companies) and Dow Jones Industrial Average. In Europe the best known and most traded stock indices include German DAX. It is calculated from 30 largest and most liquid German companies, such as Allianz, Commerzbank, Siemens, Volkswagen, etc., which are traded on the Frankfurt Exchange. Stock indices are traded via futures derivatives.
ETFs (Exchange Traded Funds)	ETFs are exchange-traded funds, yet be careful, they are not the classic mutual funds which offer various banks. ETFs are stock market funds which unlike the conventional mutual funds issued their own tradable stocks. By buying an ETF you get the entire portfolio of stocks belonging to a stock exchange index. ETFs also usually closely follow the development of the indices. However, they are cheaper since there are not so significant price movements. Trading with ETFs is suitable for beginners because it does not require a high initial capital.
Commodities	Market-traded goods with no difference in quality. The quality is guaranteed and deliveries from various suppliers are therefore interchangeable. In other words, commodities are products

	<p>produced in large quantities by many different producers. They include, for example, energies (oil, natural gas), agricultural products, meat, cattle, and so on. Commodities can be traded directly as underlying assets on the spot markets ("cash markets") where trades are concluded in cash at current market prices. Within such transaction the commodity is delivered within several days, not later than one month. Much more common, however, is trading commodities through derivatives called futures. The issue of commodity futures will be explained in detail in the following chapters.</p>
Bonds	<p>Bond is a debt security that reflects the issuer's obligation to the creditor. It is a substitutable security connected with the right to the payment of the outstanding amount, payment of a specified yield, and the issuer's obligation to meet his bond-related obligations. You can buy government bonds or corporate bonds. Investments in government bonds are considered a safe investment with a low rate of return.</p>

Table 3: Types of underlying assets

Let's repeat once again that if we trade directly with the underlying asset (for example, if we buy stocks of a company), transactions are concluded and settled in the present moment. But we can also trade derivatives of the underlying assets. These derivative instruments are called futures contracts (fixed contracts or options) and the principle of trading them is that you conclude a transaction defining conditions of a future purchase or sale of the underlying asset. The individual types of derivative financial instruments are described in Table 4.

TYPES OF DERIVATIVES	
Futures	<p>Futures is a derivative in the form of a termed exchange-tradable contract which gives the holder the right to buy or sell the underlying asset on a future date for a specified price and in a standardised amount and quality. Such transactions involve energies, agricultural products, currency pairs, stocks, indices, etc.</p>
Forwards	<p>Forward contracts are very similar to futures contracts. They also represent an agreement between two parties on purchasing or selling an underlying asset on a certain date in the future for a spot-set price. However, forward contracts are not standardised (unlike futures where the quality and quantity are precisely defined) and are traded on OTC markets. Farmers, for example, use forward contracts to fix prices for the coming harvest.</p>
Options	<p>Option is a contract that gives the buyer the right (but not the obligation - unlike futures where the parties are obliged to settle the transaction after the expiration date) to buy or sell the underlying asset (such as stocks) for the agreed price and within the agreed period or on a specific date. Options are "conditional deals" because the buyer of the option may or may not exercise his right to buy or sell the underlying asset in the future. If the buyer exercises his right, the seller (writer) of the option must meet his obligations. The writer receives "premium" for writing the option. Options essentially work like reservations - e. g. when you buy a house which hasn't been finished yet. If you plan to buy a house, you pay an advance to your real estate broker. This gives us the right (option) to buy the house for the agreed price in the future. However, if you decide not to buy the house, you lose the paid advance and it becomes the real estate broker's profit. In the option trading terms the real estate broker is actually the option writer and the advance payment is the premium. Options are a very popular source of income with many professional traders because they offer many combinations and variations of interesting trading strategies.</p>

<p>Spreads</p>	<p>Spread is the difference between buying and selling price of an underlying asset. The underlying assets may be stocks, bonds, currencies, commodities, futures, options, etc. Speculators here are trying to anticipate changes in the price difference. A very interesting variation of spreads are commodity futures spreads or seasonal futures spreads (seasonality increases the probability of correct speculation). Seasonality, if identified in long-term historical data, can serve as a very good basis for predictions of decreases or increases of the price difference.</p>
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Table 4: Type of derivatives

Finally, we must mention a separate category called **Forex**. Forex is an international trading system for exchange of currency pairs. Forex has no exchange and the trading is not centrally regulated. Regarding the daily volumes of transactions, however, it is without doubt the biggest and most liquid market in the world. Forex rates are mainly influenced by the relative strength, inflation, and interest rates of individual economies. The most traded currency pairs include the US dollar against the euro (USD/EUR) and the US dollar against the Japanese yen (USD/JPN).

8. What is Trend?

Trend is a very important aspect of trading. Without trends it would be extremely difficult to earn money by trading. Trend can be defined as a long-term and quantitative change in the price of the underlying asset (e.g. a particular commodity futures contract) in time. Trends may last for minutes, days, weeks, or even years. Trends can have the following character:

a) Upward trend



Fig. 4: Upward trend Source: TradeStation

b) Downward trend



Fig. 5: Downward trend Source: TradeStation

If the market trends upward (see Fig. 4) the price of the underlying asset increases and in the trading terminology we speak about a **Bull Market** (or **Bullish Market**, or **Uptrend**.) The explanation of this designation is simple: When the bull attacks, it thrusts its horns up into the air. When traders speculate on the bullish side of the market they try to buy at a lower price and then sell at a higher price and cash profit, in trading terminology they enter into a "**Long Position**".

On the other hand, if the market is decreasing for a longer time (see Fig. 5), we speak about a **Bear Market** (or **Bearish Market**, or **Downtrend**). Imagine a bear that stands up on hind

paws and attacks by swiping its pawns down. Many people are unaware of the fact that a trader can speculate on the bear market and thus **profit on price decreases**. When doing so the trader sells a contract first and then tries to buy it back for a lower price. In this case we say that the trader entered into a **Short Position**. Speculation on market declines are typical for derivatives, including futures. In underlying assets, such as stocks, it is somewhat more complicated to open short positions.

There are usually (but not always) differences in the trending intensity between the bull and the bear trend, especially for example in stocks or stocks indices (S&P 500, etc.). Bull markets tend to grow in a mild, long-lasting way, while bear markets often fall steeply and for a shorter period. An example of such a steep decrease may be the crisis in 2008.

Besides increasing and decreasing markets there are also periods when markets "**go the side**" (see Fig. 6). Supply and demand in such a stagnant market (called **Chop Market**) are balanced and the market tends to form long-term horizontal **price channels**.

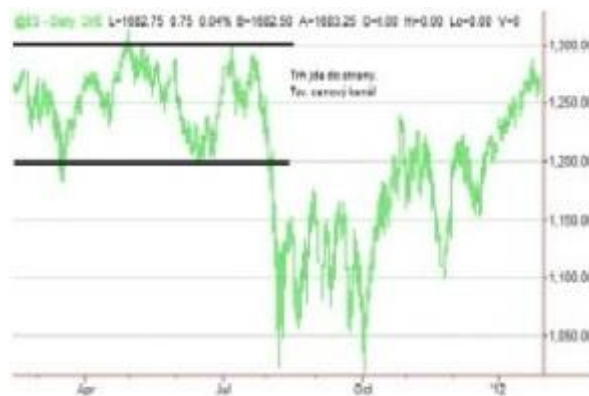


Fig. 6: Chop - a non-trading "sideways" market, Source: TradeStation

There are traders who have profitable trading systems based on trading in the chop and who earn very respectable sums of money in these markets. However, as beginners you should rather focus on **trend utilising trading systems**. Look at markets and see when they trend in Long or Short direction and when they go sideways. Learn to perceive the overall structure of the market. In this way you will begin to understand how markets actually work and start to see various interesting circumstances that affect the market development. These circumstances will help you later in building your own trading systems.

If we look at trends in terms of time, we can divide them into several categories, namely:

- **Short-term trend** – it lasts for a few minutes only, at most a few hours. In the context of a long-term market development (matter of weeks) the market can go in the opposite direction than the medium or long-term trend is for a short time.
- **Medium-term trend** – it lasts for a few days, at most a few weeks. In the context of a long-term market development (matter of months or years) the market can temporarily trend in the opposite direction than the long-term trend is.
- **Long-term trend** – it lasts for many weeks, months, or even years

Why should we distinguish between short, medium, and long-term trends? The general definition of a functioning trading system says that it is best to trade with the trend. We can only agree with the well-known traders' slogan "**follow the trend**" or "**trend is our friend**". Our trading systems make profits thanks to the accurate and timely identification of different types of trends. For this reason many traders monitor overall long-term market developments and enter only into positions in the direction of the market's long-term trend. Such approach often increases probability of profitable trades. So be very cautious when trading against the trend. Always keep in mind that thanks to trends we, traders, achieve long-term profits.

9. Who Else Participates in Price Formation in Commodity Markets

As beginner commodity traders you should definitely be aware of who is involved (and how much) in the formation of price movements in individual markets. There are two basic categories of traders – **Hedgers** and **Traders** each of which having somewhat different interests in the context of commodity trading.

Let's look at their interests a little closer:

Hedgers

Hedgers are producers and buyers of commodities and they are the big players in each market. Hedgers are those who have the power and the upper hand in the market. Unlike us, their aim is not a speculation on commodity price movements and profiting on increasing or decreasing prices of futures contracts. If hedgers see an opportunity in the market and decide to enter into a trading position, they are able to buy really large amounts of futures contracts.

They are undoubtedly the best capitalised market participants. As producers or buyers of commodities they know the structure and rules of the markets much better than we – traders. It is important to realise that the market is not a place for speculation for them, it is their basic business. Their main and most fundamental concern is to minimise their potential losses, while we, traders, primarily want to generate profit. You can say: "What on earth means - to minimise losses?" I will explain it right now.

A hedger's trading activities are always aimed at the commodity itself. In other words, a hedger has a genuine interest in the physical commodity because he needs it for his business activities. Let's show this on an example from the chapter History of futures trading. If the rice-roll producer knew that the following year he would need 500 tons of rice and based on his assumptions he was convinced that the price of rice was going to rise, he would be logically forced to buy the rice as soon as possible, before the price increased. On the other hand, when the producer of rice rolls concluded that the price of rice was going to decline the following year, he wasn't so keen on buying the rice. The fact is that despite the unfavourable current market rice prices the rice-roll producer had to buy a certain amount of rice because he needed it to ensure a sufficient amount of reserves for maintaining a smooth and reliable production of rice rolls (here we might apply the saying: „A bird in the hand is worth two in the bush.").

Unlike us, traders, the core business (the essence of business activities) of hedgers is not profiting from speculations on increases or decreases in market prices. Their profits are guaranteed by their main business activities, i.e. by sales of commodities or products made

from these commodities to end customers. Always keep in mind that hedgers are the biggest players in the market. It is said that they control 60% of the market. Hedgers are usually a few large corporations that actually form market prices. However, there are two opposite poles in this respect. On one side there are the commodity producers the interest of who is to sell the commodity for the highest price possible. On the other side there are their customers who want to buy the same commodity as cheap as possible because they use it as a raw material for their products.

Traders

Are you beginning to see the major advantage that we, traders, have against hedgers (large producers and buyers of commodities)? It is the right to choose when we enter and exit the market. It is a luxury that hedgers cannot afford. Hedgers must engage in exchange trading every day, whether they want or not, because they need to buy or sell commodities to ensure viability of their companies. We, however, have an invaluable possibility to choose the market and the time and volume of our engagement. This gradually leads us to the key finding: It's all about the right timing and patience. You have to be able to wait for the right moment.

Traders can be further divided into two types – Small and Large Traders. **Small traders**, among which I include myself, have really only a marginal influence over market movements. **Large traders** can be funds or banks that do business in many markets within their diversified portfolios. Large traders represent a substantial part of the market structure. Their strategies are generally based on the "Follow the Trend" principle.

On the US markets boundaries between small and large traders are determined by the CFTC's (Commodity Futures Trading Commission) regulations. The decisive aspect is the number of contracts that a trader buys or sells. The numbers of contracts defining large traders can be found at www.cftc.gov. CFTC is a commission that aims at ensuring clean and transparent trading in commodity markets. It monitors behaviour of large traders and hedgers (whether they are in long or short positions). In other words, Large Traders and Hedgers must send the CFTC weekly reports about their market behaviour – if they were buying or selling. Every week the CFTC publishes "CFTC report" in which you can see how the large traders approached the market. You can analyse their trading decisions and trade in the same direction as them. This is because large traders have a thorough knowledge of the markets and thus their behaviour can support or disprove our business analyses. You cannot have this unique advantage in Forex, nor in stock markets. In order to maintain affordable and realistic prices the big players' activities are regulated. It's a question of a higher interest –if the basic raw materials were too expensive, poverty would spread in the

US and around the world. This gives us, small traders, a huge opportunity because we can actually "look under the hood" of the big players' strategies. The truth is that we can make money in the markets via other and much easier analyses. We will tell you more about this in the next chapters of this handbook.

10. What is a Commodity Exchange and What Are Pit and Electronic Markets

In previous chapters we focused on market participants who contribute to creation of commodity prices. As we already know commodity markets are traded on commodity exchanges. Remember that as traders you have to concentrate on highly liquid markets. Yet before we introduce the main commodity exchanges and the potentially attractive markets, we must clarify some basic concepts – Commodity Exchange, Pit and Electronic markets – and briefly explain why they are important.

Commodity Exchange is a highly organised and regulated market where a variety of underlying assets can be bought and sold (mostly commodities) through futures contracts. The exchange allows meetings of buyers and sellers and conclusions of bilateral agreements. If such an agreement is concluded and the buyer and the seller agree on a price, their orders are **"paired"**. The final price of traded commodities is always a result of the **current supply** (Bid) and **demand** (Ask). Most of you probably have probably come into contact with the environment of an exchange, most likely in some American movie. Thus you may think that an exchange is a place with a lot of guys standing with papers in their hands, shouting at each other, and closely watching electronic boards with constantly changing numbers showing the current state of supply and demand.

The exchange environment may be a great unknown for you if you do not understand the principle on which it is based and how the exchange prices are actually formed. Neither the media will help you in understanding this phenomenon as they only spout information about the ratio of the euro against the Czech crown and the dollar, values of stocks of Facebook, Apple, and other corporations, and then about those damn meaningless indices – S&P 500, Czech PX, German DAX, and so on. Who should sort all this? Before I started to trade on the exchange I was also confused. I asked myself questions like: "What makes the prices in charts move? What is the purpose of this entire exchange circus? What are those derivatives? How is it possible that the development of an artificial index, something as abstract as e. g. "S&P 500", can have such a major impact on economic development?" And then there was the most important question: **"How do people actually make money here?"** Be sure that as a prospective **trader** you do not necessarily know the answer to any of these questions. Well, except the last one. I believe that after reading this handbook you will be able to answer this crucial question. The rest will be up to your hard work and effort.

In order to understand the current exchange environment, the first thing we have to explain is the difference between the **"pit"** and **"electronic"** trading.



Pit vs. electronic trading

Pit and electronic trading are two main ways of trading at today's exchanges. **Pit trading** is performed on a "**Trading Floor**" which is a place in the exchange's building (also called "Pit"). It is a place where people physically conclude individual trades. In English terminology these people are

called "Floor Traders". A typical Floor Trader is a big man with a strong resonant voice. In the trading jargon their communication (in the form of gesticulation and shouting all at the same time) is called the **Open Outcry**. Pit trading was the predominant type of trading until the end of the 90s of the 20th century when it was superseded by electronic trading. However, even today some futures contracts of certain commodities are traded on pits. Yet it is only a fraction of the total volume of all traded markets and contracts.

Electronic trading has been gradually gaining in popularity since the beginning of the 21st century and today it is without doubt the dominant method of trading in commodity, stock, and foreign exchange markets. This type of trading is entirely performed outside the trading floor – the whole process takes place on exchange servers. Electronic trading (or online trading) in stocks or commodities has much more advantages than the traditional pit trading. Here are the fundamental ones:

- You do not need to be physically present at the exchange (unlike pit trading). Thanks to the massive technological boom and development of the Internet in recent years and its availability across the world trading became available actually anywhere and almost to anyone. Thus the markets became much more interesting also for small traders and trading on major exchanges worldwide ceased to be a privilege of affluent elites.
- Faster execution of entry and exit orders. In other words, you have a much higher chance that you will enter and exit your trading positions at the intended prices. Possibility to trade many different markets at once. A pit trader, on the contrary, can usually trade only one pit market.
- Much lower broker fees (**Commissions**).

11. Futures Contracts Traded on Major Commodity Exchanges

In the previous chapter we explained the differences between electronic and pit trading. This chapter will be devoted to individual exchanges and markets that are traded on them. Therefore, we will be interested in places where, as I sincerely hope, you will be able to significantly appreciate your capital one day, also thanks to studying this handbook. We will explain the essential details of commodity exchanges in the US. Why exactly the US? It is because the US markets have a high and stable liquidity and thus are attractive for traders. The beginning of the futures trading in the US dates back to the mid-19th century. In 1848 was established the renowned CBOT (Chicago Board of Trade). Nowadays there are 10 major commodity exchanges in the US. Among the largest belong: The Chicago Mercantile Exchange (CME), The New York Mercantile Exchange (NYME), and The New York Commodity Exchange (NYCE).

We can say that the modern futures trading dates back to the 70s of the 20th century when financial instruments began to be traded via futures. The point is that futures contracts do not have to be used for physical commodities, such as corn and gold, only, but also for other underlying assets, even those of an intangible nature. In the 70s the Chicago Stock Exchange introduced currency futures contracts, namely for the Swiss franc and the Japanese yen. Then futures for interest rates, such as United States Treasury Bonds and T-Bills, became very popular. In the 80s began trading with futures on stock indices, such as the S&P 500. Although futures contracts on agricultural crops are still very popular these days, financial instruments and their futures contracts absolutely dominate. In the area of physical commodities prevails trading with grains and the volume of traded futures contracts in metals, minerals, and energies remains relatively small.

The following table lists the most significant world commodity exchanges. The other tables include the basic specifications of individual commodity futures contracts.

NAME OF EXCHANGE	SYMBOL
Chicago Board of Trade	CBOT
Chicago Mercantile Exchange	CME
COMEX, NYME division	COMEX
European Exchange	EUREX
Intercontinental Exchange	ICE
Commodity Exchange, NYMEX division	COMEX
New York Mercantile Exchange	NYMEX

New York Stock Exchange LIFFE	NYSE LIFFE
Kansas City Board of Trade	KC
London International Financial Futures Exchange	LIFFE
Sydney Futures Exchange	SFE
Singapore Exchange Ltd.	SGX

Table 5: The most well-known commodity exchanges

MEATS (CME)			
Description	Ticker	Initial Margin	Day Trading Rate
PORK (LEAN HOGS)	LH	\$1,688	NONE
BEEF (LIVE CATTLE)	LC	\$1,350	NONE
BEEF (FEEDER CATTLE)	FC	\$2,430	NONE

Table 6: Meat (CME)

STOCK INDICES			
Description	Ticker	Initial Margin	Day Trading Rate
E-MINI S&P 500	ES	\$3,850	25% of the margin
E-MINI MIDCAP 400	EMD	\$4,950	25% of the margin
MINI RUSSELL 2000 (ICE)	TF	\$5,280	25% of the margin
E-MINI NASDAQ 100	NQ	\$2,420	25% of the margin
MINI DOW JONES (\$5)	YM	\$2,750	25% of the margin
S&P 500 (CME)	SP	\$19,250	NONE
NASDAQ 100 (CME)	ND	\$12,100	NONE
DOW JONES (\$10) (CBOT)	DJ	\$5,500	NONE
NIKKEI (\$ BASED) (CME)	NK	\$5,775	NONE
VIX	VX	\$4,950	NONE

Table 7: Equity indices

INTEREST RATES (CBOT)				
Description	Ticker	Initial Margin	Day Rate	Trading
30-YR T-BOND	US	\$2,750	NONE	
10-YR T-NOTE	TY	\$1,623	NONE	
5-YR T-NOTE	FV	\$990	NONE	
2-YR T-NOTE	TU	\$248	NONE	
EURODOLLAR (CME)	ED	\$220	NONE	
EUREX				
Description	Ticker	Initial Margin	Day Rate	Trading
DAX	FDAX	€15,395	25% of the margin	
DJ STOXX 50 INDEX	FESX	€2,001	25% of the margin	
DJ STOXX 600 BANKS	FSTB	€ 630	NONE	
DJ STOXX 600 INDST G&S	FSTG	€1,370	NONE	
EURO-SCHATZ	FGBS	€ 390	NONE	
EURO-BOBL	FGBM	€1,050	NONE	
EURO-BUND	FGBL	€2,020	25% of the margin	
EURO-BUXL	FGBX	€4,700	25% of the margin	
DJ STOXX 600 UTILITY	FSTU	€ 935	25% of the margin	

Table 8: Interest rates (CBOT), Eurex

CURRENCIES (CME)			
Description	Ticker	Initial Margin	Day Trading Rate
AUSTRALIAN DOLLAR	AD	\$2,013	NONE
BRITISH POUND	BP	\$1,815	NONE
CANADIAN DOLLAR	CD	\$1,265	NONE
EURO (EURO CURRENCY)	EC	\$2,750	NONE
JAPANESE YEN	JY	\$3,850	NONE

MEXICAN PESO	MP1	\$2,035	NONE
NEW ZEALAND DOLLAR	NE1	\$1,925	NONE
SWISS FRANC	SF	\$2,640	NONE
DOLLAR INDEX (ICE)	DX	\$1,760	NONE
MINI EURO	E7	\$1,375	NONE
MINI YEN	J7	\$1,925	NONE
E-MICRO AUD/USD	M6A	\$201	NONE
E-MICRO GBP/USD	M6B	\$182	NONE
E-MICRO EUR/USD	M6E	\$275	NONE

Table 9: Currencies (CME)

METALS			
Description	Ticker	Initial Margin	Day Trading Rate
GOLD (COMEX)	GC	\$8,800	NONE
GOLD (NYSE LIFFE)	ZG	\$10,000	NONE
SILVER (COMEX)	SI	\$12,375	NONE
SILVER (NYSE LIFFE)	ZI	\$11,655	NONE
COPPER (COMEX)	HG	\$4,400	NONE
PALLADIUM (NYMEX)	PA	\$4,400	NONE
PLATINUM (NYMEX)	PL	\$3,465	NONE
MINI GOLD (NYSE LIFFE)	YG	\$3,320	NONE
MINI SILVER (NYSE LIFFE)	YI	\$2,331	NONE

Table 10: Metals

ENERGIES (NYMEX)			
Description	Ticker	Initial Margin	Day Rate Trading
CRUDE OIL	CL	\$4,510	NONE
NATURAL GAS	NG	\$2,585	NONE
HEATING OIL	HO	\$4,290	NONE
RBOB GASOLINE	RB	\$5,500	NONE

E-MINY CRUDE OIL	QM	\$2,255	NONE
E-MINY NATURAL GAS	QN	\$647	NONE
E-MINY HEATING OIL	QH	\$2,145	NONE
E-MINY RBOB GASOLINE	QU	\$2,750	NONE

Table 11: Energies (NYMEX)

AGRICULTURAL CROPS			
Description	Ticker	Initial Margin	Day Trading Rate
WHEAT	W	\$3,240	NONE
HARD RD WINTER WHEAT	KW	\$3,125	NONE
CORN	C	\$2,700	NONE
OATS	O	\$1,350	NONE
SOYBEANS	S	\$4,590	NONE
SOYBEAN OIL	BO	\$1,688	NONE
SOYBEAN MEAL	SM	\$2,700	NONE
ROUGH RICE	RR	\$1,350	NONE
MILK (CME)	DA	\$1,755	NONE
BUTTER (CME)	CB	\$1,620	NONE
MINI WHEAT	YW	\$648	NONE
MINI CORN	YC	\$540	NONE
MINI SOYBEANS	YK	\$918	NONE

Table 12: Agricultural crops

SOFTS (ICE)			
Description	Ticker	Initial Margin	Day Trading Rate
COFFEE	KC	\$2,750	NONE
COTTON	CT	\$2,200	NONE
FROZEN ORANGE JUICE	OJ	\$1,595	NONE
COCOA	CC	\$880	NONE
SUGAR #11	SB	\$825	NONE
OTHER			

LUMBER (CME)	LB	\$2,400	NONE
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Table 13: Softs (ICE) and others (CME)

Let's stop for a moment and explain tables 6-13 in a broader context. As you can see, today it is possible to trade futures contracts on both physical commodities (gold, oil, corn, etc.) and intangible underlying assets (stock indices, currencies, interest rates). I know that after reading the previous chapters you wonder what would happen if you bought for example a contract of a stock index and kept it until the date? You would receive a pack of stocks of companies included in the index at the price at which you purchased the futures contract. However, you do not have to worry. Remember that commodity markets are liquid enough and if you submit a sale order, ideally before the FND, you are always able to sell your futures contract!

Maybe you've noticed in the tables that different futures contracts are traded on different exchanges. In the left column of the tables there is the description, or the name of the commodity. In the second left column there is the commodity's symbol - the "**Ticker**". Basically, it is an abbreviation identifying various futures. Each broker may use slightly different tickers. Tickers may also differ depending on whether we trade on the pit or electronically. We enter these symbols into various platforms when analysing markets, creating charts, and, of course, submitting trading orders.

12. Specification of Futures Contracts

In the previous chapter we looked at the various markets and exchanges where we can trade these markets. Now is the time for us to clarify everything related to the detailed **specification of contracts**.

Specification of a contract basically means a summary of essential and very important information about the commodity futures contract in a comprehensive and transparent form. You can find the specifications on the website of the exchange where the given futures contracts are traded, or directly by using some of the Internet search engines. For example, if we seek specification of a corn futures contract, we can type "**corn contract specification**" into the search engine. The required information always appear on one of the first positions.

Let's take a look at a specific example of a corn futures contract specification.

Corn Futures

Contract Size	5,000 bushels (~ 127 Metric Tons)	
Deliverable Grade	#2 Yellow at contract Price, #1 Yellow at a 1.5 cent/bushel premium #3 Yellow at a 1.5 cent/bushel discount	
Pricing Unit	Cents per bushel	
Tick Size (minimum fluctuation)	1/4 of one cent per bushel (\$12.50 per contract)	
Contract Months/Symbols	March (H), May (K), July (N), September (U) & December (Z)	
Trading Hours	CME Globex (Electronic Platform)	Sunday – Friday, 7:00 p.m. – 7:45 a.m. CT and Monday – Friday, 8:30 a.m. – 1:15 p.m. CT
	Open Outcry (Trading Floor)	Monday – Friday, 8:30 a.m. – 1:15 p.m. CT
Daily Price Limit	\$0.40 per bushel expandable to \$0.60 when the market closes at limit bid or limit offer. There shall be no price limits on the current month contract on or after the second business day preceding the first day of the delivery month.	
Settlement Procedure	Daily Grains Settlement Procedure (PDF) Final Corn Settlement Procedure (PDF)	
Last Trade Date	The business day prior to the 15th calendar day of the contract month.	
Last Delivery Date	Second business day following the last trading day of the delivery month.	
Product Ticker Symbols	CME Globex (Electronic Platform)	ZC C=Clearing
	Open Outcry (Trading Floor)	C
Exchange Rule	These contracts are listed with, and subject to, the rules and regulations of CBOT.	

Fig. 7: Specification of a corn futures contract

Now let's explain step by step all the information shown in Fig. 7:

Contract Size: Information about the quantity of the commodity in one futures contract. In the case of corn it is 5,000 bushels, or about 127 metric tons.

Pricing Unit: This is the price unit used for the given futures contract. Pricing units are usually cents. In the case of corn it is Cents per Bushel.

Tick Size - Minimum Fluctuation: This is the minimum price movement of the futures contract on the given market. In the case of corn it is Quarter Cents per Bushel. In the **Contract Size** field we found out that the size of one futures contract is 5,000 bushels. If the minimum movement is $\frac{1}{4}$ cents per bushel, the price of one futures contract is calculated as follows:

$$5,000 \text{ bushels} * 0.25 \text{ cents} = 1\,250 \text{ cents, i.e. } \$12.5$$

One tick (i.e. the lowest value by which the corn futures contract price may change) **will thus have a value of \$ 12.5.**

The value of one point of the corn futures contract price **will have a value of:**

$$(1/0.25) * \$12.5 = \$50.$$

Example:

Imagine that you buy a corn futures contract at a price of 456 $\frac{3}{4}$ and sell it for 460 $\frac{2}{4}$.

Thus the price movement was: $460.5 - 456.75 = 3.75 \text{ points}$

We know the value of one tick from the exchange's websites. So how many ticks did the corn market move? We can simply divide $3.75 / 0.25 = 15 \text{ ticks}$.

*So how much did we earn? $15 \text{ ticks} * \$ 12.5 = \$ 187.5$*

Contract Months Symbols

As you can see, corn futures contracts have 5 expiration months - March (H), May (K), July (N), September (U), and December (Z). For traders, whose only interest is speculation on the increase or decrease in market prices, it is the most important information regarding a futures contract. Before we start to deal with expiration months in a more detail, let's explain the symbolism of expiration months.

MONTH	ABBREVIATION
January	F
February	G
March	H

April	J
May	K
June	M
July	N
August	Q
September	U
October	V
November	X
December	Z

Table 14: Symbols of futures contracts' expiration months

Table 14 shows that each individual expiration month has a unique symbol. For example, March has the letter H. This symbolism is uniform for all commodity futures that are traded in the US.

Corn futures contracts have the following expiration months - H (March), K (May), N (July), September (U), and December (Z). These letters unify submissions of trading orders to brokers and displaying of price charts of commodity futures. In the next part of this chapter you will learn how to use the symbols in practice. Yet first we have to clarify what a "ticker" is.

Trading Hours (business hours/session):

This is also a very important information which says us on which days and times the corn market opens and closes.

As you can see, the CME exchange divides corn trading sessions into two categories. The main trading session for the **CME Globex** electronic market (**Electronic Platform**) is from Monday to Friday, from 8:30 AM CT (Central time for the Chicago area, where the exchange is located) to 1:15 PM CT.

In Central European Time (CET) it is 14: 30 to 19:15. In case you were interested in trading corn, this would be a crucial information for you because during these hours there are the most interesting market moves with the greatest profit potential. However, as the corn market is very popular (in Europe and other regions), the electronically-traded corn futures contracts can be bought or sold also during night sessions, i.e. from Sunday, 1:00 a.m. CET

to Friday 1:45 p.m. CET. Yet I do not recommend to open or close positions at night because there is only a small liquidity and your orders may be executed with a "Slippage". This means that you cannot buy or sell at the desired price, or close to this price, and the execution slips to far distant value. This can lead to unnecessary losses which may disrupt your trading plan.

Daily Price Limit

Daily limit price movements can be a double-edged sword. But first let's explain what a limit movement is. As the term suggests, a daily limit movement is a price range within which the market price can oscillate during trading hours. This means that the market price cannot increase or decrease beyond the daily limits. In the case of corn it is \$0.40 per Bushel. In terms of one futures contract, which includes 5,000 bushels of corn, the daily price limit is: $\$0.40 * 5,000 = \$2,000$. Such price ranges occur when there is a huge supply and demand. The cause may be unexpected news, disasters, etc. In such situations the exchange stops trading. So if the price of corn futures contracts exceeds the \$ 2,000 price range when we are in a position, we will not be able to get out of this position. In case the price went against our long or short position we may face a high loss. In the case the limit movement was in line with our position, we could look forward to a very nice profit after the reopening of the market. Under normal circumstances we are able to control our risk for most of the time - we simply set the maximum loss we are willing to risk on each contract and if our position gets to this loss we immediately close the position. However, in case of the limit movement against our position we would simply have to cope with the loss. Remember that your trading plan (yes, you must have the same plan as in any other business) should count with this possibility.

However, the good news is that limit movements are truly unique events and you don't have to worry about them too much. You can go through historical corn prices and see how many limit movements there were during the last few years. You will find that they are really exceptional events which will not threaten you very often. The point is that you must always take this variant into account. The good news is that despite the occasional complication of limit movements we can make long-term profits in the markets.

But why are the boundaries in the form of limit movements even there? I will answer this question with another question: Can you imagine an unlimited increase in the price of wheat or corn? It could have disastrous consequences in the form of world famines. Moreover many producers and manufacturers (not to mention individuals) would bankrupt. The limit movement principle lies in the fact that the exchange regulates the potentially uncontrollable price growths.

So what should you keep in mind regarding limit movements?

- Learn the daily limit values for the commodity markets you intend to trade. If the daily range gets near to the limit value, do not open positions. If you are already in a position, rather close it.
- As I have already advised you, check the history and search limit movements in charts. Then integrate limit movements in your trading system and take them into account in your trading strategy.
- There are some markets, such as the US indices, which do not have limit movements. If you want to avoid limit movements, trading the US indices is definitely a good choice.

Settlement Procedure (contract settlement procedures)

This is mostly unimportant information for traders. As we have mentioned many times in this handbook, there will be no physical delivery of the commodities and the related financial settlement. The main and primary objective of traders are speculations on an increase or a decrease in the futures contract's price.

Last Trade Date

Remember that you should never hold a commodity contract on the last day of its trading. We have already explained this issue ([Last Trading Date](#)). If you look at corn futures contracts, the last trading day is always on the day prior to the 15th calendar day of the expiration month. For example, if you had bought a futures contract that expired in March 2013, the last trading day was March 14, 2013.

Last Delivery Date

Again, as traders you are not much interested in this information because you do not produce or buy commodities.

Product Ticker Symbol (ticker)

This is a very important information. Here you can see the asset's symbol used in trading. It serves, for example, for displaying price charts in software platforms or for entering trading orders. You can find examples of tickers in the chapter Futures contracts on commodity exchanges in the US. Since you will surely trade on electronic markets, in the case of corn futures you will use the symbol ZC.

Exchange Rule (rules of exchange)

This is not an important information in terms of practical trading.

13. Technical Analysis in Trading

Whether you use automated trading systems or trade discretionary and whether you concentrate on stock indices, commodity spreads, or other underlying assets, you probably know that the technical analysis instruments serve for building quality trading systems and defining the enter and exit conditions. Technical analysis uses indicators that say the trader when to enter and exit the market so that trader can get the probability of profitable trades on his side or, in other words, obtains a "consistent statistical advantage". Technical indicators help us to obtain a broad overview of the current market structure and activity so that we could be able to assess when and to what position we should enter in order to maximise the likelihood of winning trades. If we worked with bar (or candle) price charts only, i.e. with "**Price Patterns**", our market analysis would be, in my opinion, quite narrow and limited. On the other hand, there are traders who successfully trade by using price patterns only.

Each indicator is essentially a program that tells the computer what data to use, how to calculate, and how to display the results. Nowadays, there are hundreds, if not thousands of available indicators. The most basic ones are included in almost all software platforms. Then there are also highly specialised indicators that can be found only in some of the software. From time to time I meet traders who create their own indicators and use them in their trading systems. They believe that they gain sort of competitive advantage over the other traders. From my own experience I learned that we can usually manage with the indicators included in professional software platforms.

To get a better overview we will divide the technical analysis components into several categories and explain each category in detail.

- **Price indicators**
 1. Trend indicators using averages – e.g. Simple Moving Average (SMA)
 2. Oscillators – e.g. Relative Strength Index (RSI), Commodity Channel Index (CCI)
 3. Volatility indicators – e.g. Average True Range (ATR)
- **Intermarket indicators** (e.g. Market correlation)
- **Market Internals**
 1. Volume indicators (e.g. Volume)
 2. Open Interest indicators (e.g. COT Reports)
- **Trend lines, Supports and Resistances, Patterns**

Before I explain each category of technical indicators, I would like to remind traders that every coin has two sides. And this is doubly true in technical analysis. Therefore, I think I should summarise the essential advantages and disadvantages of technical analysis:

Disadvantages:

- **Technical analysis is not an exact science**

Remember that there are no 100% probabilities in trading. If you think that you can identify all the profitable signals by using various technical tools and correctly predict the future market development you are very much mistaken. Technical analysis helps us to sway the probability to our side, i.e. to ensure that the sum of our profitable trades will be always higher than the sum of losing trades. Each trader is comfortable with somewhat different technical approaches and tools. The point is not to underestimate the preparation and training, paper trading, and backtesting. Exchange trading is not an exact science, there are no changeless laws. The only long-term law is the application of statistical advantages based on the probability theory.

- **Time required for studying technical indicators, trend lines, supports, resistances, and patterns**

Every trader was a novice once. Like in any other business there are no "shortcuts". Therefore, you have to spend enough time studying technical analysis so that you would be able to find your own long-term profitable technical trading approaches. Do not rely on others and develop your own trading style. If you want to be a discretionary trader, draw support and resistance lines, trend lines, and other formations in charts. Also observe how your favourite indicators behaved in individual cases. You will see that you will begin to create your own strategies and tactics, i.e. your own trading system, for winning the tough battle called live trading!

In you are interested in automated trading systems (ATS), starting with the same observing the markets like the discretionary traders will definitely not be amiss. It is necessary to get a certain feeling for markets and be able to see certain nuances that you will then convert into a clearly defined algorithm. Be honest with yourselves and give the study its time. Concept, preparation, and planning always eventually decide on the final success or failure. This is true in trading and anywhere else. Keep it in mind!

Advantage:

- **Technical analysis gives us the order and consistency**

Whether you are a discretionary trader or you prefer ATS, the best thing on exchange trading is that you have the freedom to choose your individual trading approach. Everybody is unique and it is wonderful that you can take the full advantage of your uniqueness in the market. The market is actually a summary of hundreds, thousands, or even millions of different trading systems with various elements of technical analysis. Some of these systems are successful and some are not. A frequent paradox in trading is that the simpler technical analysis tools we choose, the more successful we often are. Technical indicators can bring us order in the chaotic market environment (in case we sufficiently verified and backtested their readings). They help us to wait for the right moment for entering or exiting the market. Each of the signals sometimes also leads to a loss. Yet we know that the sum of losses will be lower than the sum of profits. This knowledge will keep us "above water" and technical analysis and the variety of its tools (when properly applied) will bring us the longed-for success in the long run. The proper application of technical indicators may, for example, consist in appropriate combining of indicators and using them in a certain symbiosis.

Today we will focus on indicators based on price ranges. We call them "Price technical indicators". The aim of this chapter is not to teach you how to calculate various indicators but how to understand their values and how to use them in practice. Values of price indicators are derived from the price of the underlying asset. We classify them into:

a) Trend indicators using averages – e.g. Simple Moving Average (SMA)

SMA is calculated as the average asset price over a selected period in our chosen timeframe (e.g. daily timeframe, 5 min timeframe, etc.). The underlying asset's price can be considered the, for example, OPEN, HIGH, LOW, or CLOSE price. In Fig. 8 you can see the 10-day moving average of the CLOSE price in the oil futures market.



Fig. 8: Oil market CLOSE price, 10-day moving average (blue curve)

In Fig. 9 you can see the significant difference after changing the length of the SMA period to 100.



Fig. 9: Oil market CLOSE price, 100-day moving average (blue curve)

You have surely noticed the fundamental difference between the 10-day and 100-day SMA. The 10-day SMA much more closely copies the current market price development, while the 100-day SMA is an irregular, nearly horizontal line.

SMA is a typical trend indicator designed to filter trades. It is definitely not a suitable indicator for timing position entries. Position entries are mostly timed by the use of oscillators about which we will talk later. As you can see in the charts (see Figs. 8 and 9) SMA indicators help us to identify the future market direction. If the current price is above the SMA (blue curve) we should consider entering into Long positions. In other words, we would speculate on a bull market (price increase). If the current price is below the SMA, we would speculate on a bear market (price decrease).

Moving averages definitely belong to each trader's arsenal because as you could hear from me many times, the amazing thing about trading is that each of us can use a little different approach and yet be a successful trader. What might work for one trader may be an obstacle for another and vice versa.

Many discretionary intraday traders that I know work mainly with longer periods, i.e. SMA 100 and more. These long periods are used for identification of the long-term direction of market development. Such an identification helps them not to enter too often into positions and wait for the right opportunities.

Remember that saying "Trend is our friend." is an essential prerequisite for a successful trend trading system and that SMA may be one of the tools that can help you to identify the

trend with a certain probability. If you want to use SMA for timing of entering and exiting positions, you can try what many traders do – use crossing of SMAs with different periods (see Figure 10). However, in most cases these signals should be combined with other types of indicators which will be introduced in other paragraphs.



Fig. 10: Identification of position entries and exits by crossing of two SMAs - period 10 (blue curve) and 40 (purple line)

b) Oscillators – e.g. Relative Strength Index (RSI)

As an example of oscillators I chose the Relative Strength Index (see Figure 11). In Figure 11 you can see that the oscillator is usually displayed under the price chart. Numerical values of most oscillators range from 0 to 100. RSI measures the relative strength of the underlying asset and it is one of the oscillators that are very commonly used for timing of opening and closing positions. RSI is calculated according to this formula:

$$\text{RSI}(n) = 100 - [100 / (1 + U(n) / D(n))]$$

U(n)...sum of positive price changes over a period of length n

D(n)...sum of negative price changes over a period of length n



Fig. 11: Price chart of sugar (the upper part) with the RSI oscillator, period 14 (the lower part)

Oscillator readings are typical by "**overbought**" and "**oversold**" areas. In terms of technical analysis overbought means that the price of the underlying asset price climbed to such a level that the oscillator curve touched a certain predefined threshold. Overbought area (see Fig. 11) is the area above the level 70, oversold area is the area below the level 30. We can choose these levels at our discretion according to our own experience. In our case, (see Fig. 11) if the curve climbs above the threshold 70, the sugar market gets to the overbought area. Generally the overbought area is interpreted as a signal that the price of the underlying asset is overvalued and is very likely to fall in the near future. For the oversold area then applies a reverse analogy. Thus, if the oscillator curve falls below the specified threshold 30, the price of the underlying asset is probably undervalued and there is a high probability of a turnover, i.e. that the underlying asset price is likely to rise.

We can see in the chart (Fig. 11) that the RSI curve fell into the oversold area only once (the red part of the curve), as well as into the overbought area (the blue part of the curve). In both cases the price development really took the direction predicted by the oscillator in the following days. Combinations of oscillators and trend indicators can be used for building quality trading systems. However, I do not recommend to employ oscillators only, because such a view on the markets would be too simplified and it would lack other additional important information about the trend direction, which is provided just by trend indicators.

c) Volatility indicators – e.g. Average True Range (ATR)

Volatility reflects the potential uncertainty or risk regarding the intensity of future changes in the price of the underlying asset. A higher volatility means that the price of the underlying asset may have a large range. In other words, the price of the underlying asset may change

dramatically in any direction in the near future. A lower volatility then means that the price of the underlying asset does not dramatically fluctuate and is likely to change in a calm manner. A classic indicator measuring market volatility is undoubtedly the ATR. Its value is calculated as the exponential moving average (EMA) of values within the "True Range". True Range is calculated as the largest of the following three values:

- Price difference between HIGH and LOW of the current bar
- Price difference between CLOSE of the previous bar and HIGH of the current bar
- Price difference between CLOSE of the previous bar and LOW of the current bar

ATR's period is often set to 7 or 14 yet of course many traders choose another value based on their own detailed analyses. The advantage of the ATR indicator is that it is variable in time and reflects the current market dynamics. It can be applied in various ways to many strategies, such as for determining Profit Target or Stop Loss (usually as a multiple of the indicator's value). Many traders use ATR for determination of entry values - for example in "breakout strategies" you set a "breakthrough area" (e.g. BUY on the Simple Moving Average (SMA) for the last 10 CLOSE values plus ATR (7)). It can be also used for timing of entering into positions. If we see that the current market volatility is high (see Fig. 12), we will not enter the market. If, on the contrary, we see that the market volatility is currently low, there is a fair probability that we will be able to enter the market on the desired price (slippage may be lower than in a highly volatile market).

I use the ATR indicator in my own trading systems a lot. I appreciate the most its ability to adapt to the nature of the current market. This indicator helps me to define robust trading systems – i.e. entry and exit signals – because I adjust my Profit Targets and entry areas to the current market dynamics.



Fig. 12: Sugar market, price development of sugar in the upper part and development of ATR in the lower part

d) Intermarket indicators (e.g. Market correlation)

Intermarket indicators are used for assessment of relationships between markets. As they say, in today's globalised world of the Internet "Everything is connected to everything, something more, something less". Correlations between markets help traders to determine the future direction of the markets they trade. Yet as it is already a very advanced technique, we will keep this issue for some of the future publications. As novice traders you should only be aware of the fact that intermarket analyses exist and that they are performed via various useful indicators.

For now we will focus on indicators the basis of which is not the price of the underlying asset. We call them "**Market Internals**". The essential indicators belonging to Market Internals are **Volume** and **Open Interest**. Let's introduce these indicators in more detail.

Market Internals

e) Volume indicators (e.g. Volume)

Volume is an indicator reflecting the number of contracts traded during a specific period of time within the chosen timeframe. In the chart (see Fig. 13) you can see the Volume indicator in the form of red columns. The question of course is what does the Volume indicator serve for? For traders, volume is one of the basic guidelines about the market liquidity. We have already said that the higher the market liquidity is (the more transactions there is), the higher the probability that you will be able to buy or sell a commodity or other underlying asset for

the desired price (i.e. without an unnecessary slippage). The question is which daily volume guarantees a sufficient liquidity? Based on my experience, any commodity market with the number of traded contracts between 10,000 and 20,000 per day is sufficiently liquid. Yet it really depends on your trading style (positional traders are able to cope with a higher slippage, but intraday traders need to have their orders executed at the specified price). There are traders who are able to earn a lot of money on illiquid commodity markets despite significant slippages. This is because they optimised their trading systems ("tailored") for such market conditions. In other words, based on the historical data testing these systems take the high slippage into account. We definitely recommend beginner traders to thoroughly study volumes of individual markets. By doing so you will gain a global awareness about commodity markets – or about the markets which may offer interesting opportunities in the form of low slippage. Many traders use Volume for identification of entry and exit conditions for their trading systems. Of course, each trader can see slightly different relations between the behaviour of Volume and price. Regarding my live trading, Volume plays a very important role in some of my trading systems. I consider it a very important indicator because unlike all price indicators it is not only a mere price derivative and when sophisticatedly applied it brings a significant added value.



Fig. 13: Daily chart of sugar including Volume indicator, each column represents the total daily Volume

f) Open Interest

Open Interest (OI) is often misinterpreted as Volume. OI represents the total number of futures contracts that are not closed or physically delivered on a given day. In other words, it is the number of open contracts in a given time period. It says how much open positions

there are at the moment. I know that it may be difficult for you to distinguish the real difference between Volume and Open Interest, so let's try to explain it on a concrete example: On September 1, the value of OI before the market opening was 200,000. Thus we knew that before that there were a total of 200,000 opened futures contracts from previous days. Before the market opening the value of Volume = 0 because obviously no futures contract have been traded yet. Now imagine that on September 1 you were the first speculator and you bought 50 futures contracts (you opened a Long position). Now because for every buyer there must be a seller, and vice versa, there was a counterparty that sold us these 50 contracts (they opened a Short position). Please note that this trader did not enter into the Short position with aim to close an opened position. OI thus consisted of 50 Long futures contracts and 50 Short futures contracts, i.e. its value increased from the original 200,000 by 50 to 200,050. At this moment, the value of Volume on September 1 was 50. Then if you sold these 50 futures contracts and the buyer also closed his Short position by these contracts, the value of OI would return to 200,000 and the value of Volume would increase from 50 to 100.

Let's show OI and Volume in the graphical form. On Fig. 14 you can see the daily chart of E-mini S&P 500 with OI (purple line) and VOLUME (red bars) in the lower part.



Fig. 14: E-mini S&P 500 daily chart showing the daily Volume (red bars) and Open Interest (purple line)

We can see one interesting phenomenon here. On some days the OI value exceeds Volume, i.e. the red bars are higher than the purple curve. This gives us a clear information about the E-mini S&P 500 market – there are many short-term speculators who open and close their positions within a single day which logically does not increase OI. This is because E-mini

S&P 500 offers a very attractive liquidity and thus low slippages. This liquidity is created by "Market Makers". I will tell you more about these entities further in this chapter. Now let's have a look at the wheat market (see Fig. 15) where on the contrary OI is many times bigger than Volume. This gives us a clear information that the wheat market, like all markets of physical commodities, is dominated by producers, raw material processors, and long-term speculators who hold their positions for many days.



Fig. 15: Daily chart of wheat showing the daily Volume (red bars) and Open Interest (purple line)

However, Figures 14 and 15 have one thing in common. As you can see, when a futures contract is nearing its expiration, OI rapidly decreases. In E-mini S&P 500 this decrease occurred basically overnight, whereas the wheat contract's OI was decreasing for several days. In charts chronologically joining contracts a sharp sudden rise in OI indicates transition to the next expiration period.

Discretionary traders do not use only indicators, but also the trend lines, support and resistance lines, or patterns. These tools are incorporated into charts shown in software platforms. They serve for identification and definition of position entries and exits. For traders using automated trading systems (ATS) trend lines and support and resistance lines have no practical use. Patterns can be used by ATS traders because they are relatively easy to program, i.e. to transfer into an algorithmic code.

Let's introduce all three aforementioned elements of technical analysis in a little more detail.

g) Trendlines

A trend line is basically a straight line connecting major highs (in case of downtrend) or lows (in case of uptrend) in a chart. Drawing of trend lines is a very subjective matter which requires a long-term training and practice. Trend lines help us to visualise trends. Trend line breakouts may indicate opportunities for opening or closing positions because they often prefigure a trend reversal. In Fig. 16 you can see an uptrend trend line and a breakout signalling beginning of a downtrend. In Fig. 17 you can see a downtrend trend line and a breakout signalling beginning of an uptrend. Trend line breakouts thus represent buy or sell signals. In order to be able to confirm the trend's validity, it is necessary to see at least three or more points where the price touched the trend line. Of course, the touches do not have to be accurate. Trend lines are frequently used elements of technical analysis and they have been known for decades.



Fig. 16: Uptrend, trend line and crossing signalling transition to downtrend



Fig. 17: Downtrend, trend line and crossing signalling transition to uptrend

h) Support and Resistance lines (S/R)

We can say without exaggeration that S/Rs are the very basic and essential elements of discretionary technical analysis. Basically, S/R determine points where the price bounces back and rejects to move further up (in the case of uptrend) or down (in the case of downtrend). When a price decrease of an underlying asset stops at some point and the price rebounds upwards we speak about a "**Support**". It means that traders are not willing to sell under this price. On the contrary, when a price increase of an underlying asset stops at a certain point and then rebounds we speak about a "**Resistance**". Trader are not willing to buy above this price.



Fig. 17: Partial Supports and Resistances



Fig. 18: Strong Supports and Resistances

In Fig. 18 you can see the individual Supports and Resistances. Fig. 19 shows also a "Flip" which is a point from which a Support starts to act as a Resistance, or vice versa.

S/R can serve for optimisation of position entries and exits, setting stop-loss and profit targets. Beginners who would like to profile themselves rather as discretionary traders should definitely learn to analyse S/R in the charts first. They need to learn to perfectly perceive and recognise S/Rs. The more markets a beginner "gets familiar with", the easier it should be for him to identify S/R and set suitable entry and exit points, profit targets and safe stop-losses. Of course, it is ideal to combine S/R with for example indicators for identification of the best entry and exit points.

Please note that S/Rs are the essential elements of technical analysis for many discretionary traders (often also for ATS traders who can program S/R). Significant past S/Rs, as shown in Figure 4, are often important for our future trading. It is because the market has a tendency to return to these important prices.

There are always only two options when the price reaches S/R: It can either bounce or break the S/R. The key is to understand that due to an increased supply and demand in the historically strong S/R these points often prefigure upcoming major movements with strong momentum which may have a high profit potential.

i) Patterns – e.g. Gap

Patterns are graphic price formations that repeatedly occur in charts. Each trader must "get them under the skin". The ability to see formations is very different from trader to trader. The classic patterns include Double Bottom, Double Top, Head & Shoulders, and Gaps.

For now we will explain only Gaps. You can easily find Gaps in nearly every chart. Gaps are spaces that can be seen between the individual price bars in the chart. It is an area in which practically no trades were made. Gap represents the difference between the closing price of the previous day and the opening price of the current day. Gaps can be found especially in daily charts, but they also appear in for example one-minute charts of not too liquid markets (where large Bid-Ask spreads appear). Daily-chart gaps appear when an unexpected event, such as a natural disaster or a sudden change in the weather, appear during the night when the futures market is closed. Lots of traders then begin to submit their orders for the next business day's open even before opening of markets. This huge amount of trading orders then causes that the opening price is higher or lower than the previous closing price. Gaps often appear after weekends when the markets were closed and some unexpected and unplanned fundamental event appeared.



Fig. 19: Daily chart of sugar

Fig. 20 shows a gap resulting from a major event (e.g. a natural disaster, change of weather, etc.) and caused by a huge amount of orders submitted in advance to market open.

Gaps can be a very valuable technical help for traders because they usually get filled in the future. It often turns out that the order accumulation caused by various unexpected fundamental influences was a false alarm and markets return to their yesterday's closing prices, i.e. the gap is filled – see Fig. 20. Yet this is definitely not an unchangeable rule. Remember that there are no 100% rules in trading. It is always about the ability to get long-term probabilities on your side. However, each trader should be aware of the fact that gaps occasionally appear. Especially in multiple-day positional trading you need to have the

possibility of gaps incorporated in your trading system. Gaps can be good friends if your open positions are in their direction, but otherwise they are really an enemy to your account. I. e. they can bring you good profits, but also unexpected losses. Many traders base their trading systems purely on a speculation that gaps will be filled again in the future when the panic in the market ceases. You can be very successful with this approach as there are many paths to the desired success in trading. You will encounter almost no gaps in intraday trading of futures on stock indices, largely because of the high liquidity of these markets.

Above we have explained the basic principles of the discipline which can be an essential part of our successful trading. We have also divided indicators according to their intrinsic characteristics into several categories and clarified what are the basic advantages and disadvantages of using technical analysis. Then we have explained the importance of various types of price indicators which constitutes one of the fundamental pillars of technical analysis. In my trading I insert price indicators into my automated trading systems (ATS) via algorithmic codes.

We have introduced two very important indicators which are essential for each trader – Volume and Open Interest. Even if you do not use them in your trading system, you have to know these indicators in order to be able to monitor market liquidity. The final part of the chapter contains introduction to Trend Lines, Supports, Resistances, and Price Patterns, specifically Gaps. These tools are primarily used in discretionary trading systems, often in combination with indicators. However, there are also traders who claim that a successful trader can get by only with chart, trend lines, supports, resistances, and possibly with some price patterns. Another group of traders takes the view that one cannot do without indicators in trading. Technical analysis must be seen as a means to get long-term statistical advantage called "edge" and not as a holy grail that will always tell you the future direction of the market.

14. Algorithmic Trading via Automated Trading Systems

Many discretionary traders (manual style of trading when you open and close positions solely on the basis of your own opinions and analyses, without assistance of a programmed code) demonise and execrate Automated trading systems (ATS). The main argument of discretionary traders is that a programmed code can never accurately identify certain nuances in markets which can only be detected by the human eye and processed by the human mind. I believed this argument for a very long time, perhaps simply because I wanted to believe it. I never programmed anything by myself, I studied rather statistical processes and programming gave me a wide berth. Therefore I thought that programming was definitely beyond my abilities and that I could not handle it because I'm not an exceptionally intelligent person. But to my own detriment I was actually robbing myself of precious time. At the beginning I blindly believed in the discretionary access (of course, it can be very profitable if applied properly) and I missed the huge potential of ATS. Honestly, I do not remember when the breaking point came, but after this moment everything happened very quickly.

During my personal meetings with foreign traders and reading foreign discussions I always found out that advanced traders used the analytical platform TradeStation. So I decided to study this platform in detail. I found a promo offer on the Internet within which you could download a 60-day trial version of TradeStation. After this my life of a trader completely changed. I began to thoroughly study all aspects of the software. Its basis is the EasyLanguage programming language so I started to intensively study this language by the use of various tutorials, articles, and books. I was surprised by the speed of my progress. Today, I am able to program most of my ideas that I get through observation of markets. The knowledge of the programming code brought me new possibilities of my systems' robustness verification, such as **Walk Forward Cluster analysis, optimisation tests, sophisticated performance evaluation of trading systems, and so on.** A completely new world of unprecedented possibilities opened to me and I would like to share these possibilities with you. Discretionary trading is based on combination of various visual and technical tools (such as trend lines, supports and resistance, double bottoms and double tops, crossings of different moving averages, various indicators, and oversold or overbought areas) for evaluation of trading opportunities according to fulfilment of predefined entry conditions. Of course, also exiting from markets works on the same principle here. Positions are opened and closed by manual submissions of orders. In other words, if you want to execute an order you must be physically present at the computer. I. e. the trader decides about executions of his orders in real time. This technical analysis is usually complemented with the trader's subjective view when the trader evaluates the overall market situation – whether the market

trends or stagnates (is in a "chop"), whether it grows (bull market) or declines (bear market), and so on. A disadvantage of this approach is a very slow and limited backtesting of our trading strategies. However, it is necessary to say that this approach can be very profitable.

Automated (also called systematic or algorithmic) approach to trading, on the other hand, is based on creation of a programmed code defining entry and exit conditions that are then applied on a particular market or group of markets. This approach allows fully automatic executions of trades, i.e. trading without the physical presence of the trader and the necessity to manually enter orders. An advantage against the discretionary approach is the possibility of a very fast and accurate backtesting and the possibility of carrying out a large amount of arithmetic operations that ensure quality of optimisation and robustness tests (a robust trading system is a system that is likely to be profitable in the future, i.e. during the yet unknown price development). A disadvantage of this approach may be a distorted or inaccurate setting of entry and exit conditions which may result in failure of the programmed strategy. And it is the correct definition of conditions for executions of individual trades that determines profitability of each automated system. We obtain these conditions by long-term observations of various nuances in individual markets and by extensive backtests and optimisations. I believe that if you are new to this area you are still not clear about many things. For this reason I have prepared for you a demonstration of several differences in building automated and discretionary trading systems. In the following table you can see a typical procedure of building, testing, and implementation of a trading system.

PROCEDURE	AUTOMATED	DISCRETIONARY
1. Observation and market analysis	This step is common to both approaches. The point is to define the basic ideas for achieving edge = a set of rules the application of which will result in achieving a long-term and stable statistical advantage in the market. Example: At the beginning of the day's trading session we see a sharp increase in the number of traded contracts (volume) in comparison with a defined number of the previous days. At the same time the market significantly moves to the Long side and it has a tendency to grow until the end of the trading session.	
2. Specification of rules for the subsequent backtest	It is also common to both approaches. After we have identified a certain tendency in the market we have to give our assumptions a concrete form. Example: If during the first 30 minutes after the session opening the highest number of contracts (volume) over the last X days is traded and at the same time the price increases during these 30 minutes, we enter into a long positions by the MARKET BUY order and we close the position at the end of the trading session by the SELL MARKET order.	
3. Backtest - testing of the	At this stage traders using ATS must define the algorithm in the programming	A discretionary trader must manually go through price charts in his software

<p>trading system</p>	<p>language used by his software platform (e.g. EasyLanguage in TradeStation). After a successful writing of a fully functional code a trader using ATS gains a huge advantage over a discretionary trader. It is because the code of a trading system can be applied to many markets and it is possible to immediately verify whether the system can be profitable in a long-term and under different conditions of individual markets.</p>	<p>platform. This process is time-consuming because it is necessary to manually scroll bar by bar. The trader must be very concentrated and do not make any mistakes in order to secure statistical relevance of the results. "Manually" means that all trades that meet the selected criteria must be recorded in the trading diary (e.g. in Excel). He has to record entry and exit prices and the resulting profit or loss for each trade.</p>
<p>4. Optimisation - searching for entry and exit rules' optimal values</p>	<p>In our particular example it is the highest number of contracts (Volume) over the last X days. No problem for a trader using programmable algorithms. He just defines the range of the entry parameter values in his software platform. In our case, it may be for instance a value from 1 to 100 (the number of previous days). The software platform then performs the calculations and sorts the parameters by a certain performance indicator (from best to worst results).</p>	<p>In our particular example it is the highest number of contracts (Volume) over the last X days. A discretionary trader would have to manually go through charts over and over again in order to find the values of individual parameters. It is a time-consuming and laborious process that would take years, maybe longer. In other words, it is virtually impossible to optimise parameters in discretionary trading. On the other hand, we must note that many discretionary traders achieve great results and do not need any parameter optimisation.</p>
<p>5. Trading system performance and robustness evaluation</p>	<p>In programs using the EasyLanguage programming language you can very easily display performance results for multiple markets, even if you set different ranges of entry parameters in each of them. Furthermore, professional platforms include various verification tests for assessing the statistical robustness (in other words, sets of many In-Sample and Out-of-Sample tests). The aim of these robustness tests is to verify whether the strategy is likely to generate profits even in real trading, i.e. in the future. This topic is closely related to</p>	<p>If a discretionary trader conscientiously records each transaction in an Excel-type spreadsheet, it is not a problem to define functions displaying performance evaluation. But it requires an advanced knowledge of working with spreadsheets.</p>

	the WALK FORWARD ANALYSIS.	
<p>6. Real-time application of simulated and live trading strategies</p>	<p>The trader practically does not have to sit at his computer. Execution of both the entry and exit orders is performed automatically by the predefined code.</p> <p>There are traders who deliberately do not watch their trading strategies during trading sessions. It may be for several reasons – they may prefer to spend their time in a different way than by sitting at their computer, or they avoid the tendency to interfere in trades under emotional pressure.</p>	<p>Time-demandingness of trading depends on its style. If you keep your positions open for longer periods, i.e. for several days or weeks, you are "positional traders". You check and analyse markets usually once a day and, if needed, you adjust your positions. The second style may be the intraday trading where you open and close your positions within one day. In this style of trading your physical presence is required throughout the trading session. It is therefore a very time-consuming approach which, however, may bring accordingly higher profits.</p>

Table 15: The classic approach to building, testing, and real implementation of a trading system.

As we have already said, there are two groups of traders the approaches of which are completely different. Those who believe that discretionary trading is the right way to a stable and long-term profits. These traders usually do not trust algorithmic trading because want to have everything under their control. And then there is the second group which maintains that trading via ATS has many substantial benefits in terms of backtesting speed, optimisation, and statistical robustness tests which can be never achieved by a discretionary trader. But of course we must mention traders who trade both by using discretionary approach and ATS.

Novice traders usually fully believe in the discretionary approach and it is the prevailing style of individual traders. Various authors (often purposely) strengthen this belief. Moreover not many of us studied programming. I also hear many arguments like: *"Traders who try to define algorithms for their ATS cannot program delicate nuances and the overall context of the market. It brings a huge advantage to discretionary traders because they, unlike traders using ATS, "get a feel" for the markets through numerous observations"*.

And what should we imagine under the "feel for the markets"? In essence, it is the concept of understanding the market's structure, i.e. understanding the principles of price charts gained through long-term observations and evaluations. A discretionary trader with such a feel should be able to predict the probability of the further price development and thus gain a strong edge in the extremely competitive environment of exchange markets. Of course, discretionary traders should be also able to convert these market nuances into clearly

defined entry and exit conditions for their trading systems and perform adequate **backtesting** and **papertrading**.

The problem lies in the innate human tendency to idealise things. Backtesting or papertrading should be precise and accurate enough, actually you cannot afford such a luxury as a bad backtest in today's competition. Yes, you can artificially worsen the results by 30-40%, but how can you know that the worsened results correspond to reality? I recommend a very useful book by David Aronson that deals with this topic: Evidence-Based Technical Analysis, which provides extensive and statistically relevant studies proving that traders tend to distort the results of manual backtests. It is simply their natural characteristics - an exaggerated optimism and belief in own abilities and luck.

Yet I do not say that the discretionary approach does not work! There are many people who earn a lot of money by exchange trading thanks to their strong will and self-discipline. They are honest and strict to themselves and they are able to see and analyse the market sentiment and patiently verify their observations on historical data. For example, discretionary trading strategies such as long-term trading of commodity spreads and options can be very profitable. In addition, today's software unfortunately does not offer automation of commodity spread trading and therefore you have no choice but to trade them in a discretionary manner.

I admire intraday discretionary traders who keep their positions for minutes or hours only and who are able to adapt to the constantly changing market dynamics and volatility. In terms of managing your emotions during trading this is absolutely the hardest trading approach. It is also probably the reason why I know so little successful intraday discretionary traders.

Each novice trader realises very soon that, willing or not, he will have to face his own ego and the two biggest enemies - his own greed and fear of losing. Traders often experience greed when they have an open profit, i.e. when they are in an open position on the right side of the market. It is because they often get into a situation when their system says to take the profit but they don't do it in expectation of a further market movement and even higher profit. Yet the market suddenly turns against their open position and they suffer a loss instead. Imagine that you experience such several times. Your losses will reach thousands of crowns or even more (depending on your trading approach).

In contrast, a trader using ATS lets the computer to perform all the calculations and trading actions. He just watches the markets from afar. Traders utilizing ATS often let their systems to run completely independently and only check the results in the evening. Thus they do not have to deal with the emotions that adversely affect the actual trading. Of course, they may

experience an inner emotional struggle if they suffer several consecutive losses and their account balance decreases. This is an aspect that relates both to discretionary and ATS-using traders. It is important to be sure about your trading system's logic, robustness, and statistical relevance so that you know that you will overcome these unpleasant losing periods (which are experienced by all traders) and generate profits that will exceed the losses in the future. The most important thing it is to manage your own emotions. One of the main reasons why many traders fail (including traders using ATS) is a failure to stay disciplined. When getting afraid of failure traders begin to interfere in their trading systems so that they lose the edge they found by a previous tests and verified on historical data. It is no surprise then that they get into a vicious circle of failure within which they open completely random positions without any statistical relevance.

A discretionary trader must stay emotionally calm during the whole time he has an open position, i.e. he faces his emotions during the trading session. In contrast, a trader using ATS usually faces his emotions after the end of the trading session. It is not difficult to assess who has a better starting position.

On the other hand, there is one unshaken evidence that discretionary trading can be very profitable. The most famous discretionary traders like George Soros, Warren Buffett, or Bruce Kovner are multibillionaires. Yet it is clear that these people have an extraordinary talent in terms of knowledge of markets' principles combined with an extraordinary emotional resistance. The decisive argument why to choose ATS is the incomparably higher speed of building, backtesting, optimisation, and robustness testing of trading systems (for example by employing genetic algorithms). We will explain all these issues later.

Successful discretionary traders are characterised by an in-depth knowledge of markets and trading approaches and the ability to choose the most ideal approach at any moment. They are able to quickly respond to the dynamically changing market environment and they never act under duress. Executions of their trades are precise and very well planned. They are true masters at managing their emotions. You could say that a successful discretionary trader should always stay on top of things and do not act according to his emotions.

In contrast, traders using ATS do not have to solve their emotions regarding proper executions of trades. It is ideal to monitor markets only briefly. Of course, it is necessary to be aware of what is happening in the markets but it is certainly not a good idea to watch them constantly. This is the domain of discretionary traders. Another advantage of using ATS is the possibility of building, backtesting, optimisation, and robustness testing of trading systems. We will tell you more about these procedures in the following chapters.

15. Statistical Analysis in Exchange Trading

Traders exploiting automated trading strategies have probably the most significant advantage over discretionary traders in the possibility of using comprehensive and accurate statistical analysis. Nowadays, traders can execute many statistical operations within few seconds thanks to large range of analytical and programming trading software (such as TradeStation , Multicharts, Microsoft Excel, Matlab etc.) which are widely accessible for the individual traders. Every professional trader who wants to fully exploit the potential of algorithmic trading has to understand statistics and to know the most widely used statistical methods which can be useful for evaluating the potential robustness of trading strategies.

It has to be pointed out that no statistical methods are needed where there is no uncertainty. If all students from the high school "A" successfully graduated whilst all the students from the high school "B" did not, then there is no need for statistical analysis. However, when the potential consequences of observed data are uncertain, the statistical analysis is the only way to outline reasonable conclusions. In such a uncertain environment as the exchange is the statistical analysis is the only way to differentiate between the rules that are statistically significant from those that are not. Technical analysis in trading aims to identify the recurrent rules based on historical data in the form of price patterns or various indicators and then to extrapolate them on future data. Nevertheless, the inherent characteristic of extrapolation is uncertainty. When speaking real money trading, the uncertainty is not the word the trader wants to hear. If we, however, understand which statistical methods are relevant and how to use them, the probability of successful and profitable trading gets significantly increased.

The basic principle of all statistical methods is statistical hypothesis testing. It allows assessing if experimentally retrieved data comply with the presumption defined before the testing. When testing statistical hypothesis, it is always necessary to compare two hypotheses. One hypothesis, so called null hypothesis H_0 , is the hypothesis which is undergoing the test. For example, it can be testing of hypothesis that all high school students in Czech Republic will have better final exam results of English language than technical school students in Czech Republic. On the other hand, the alternative hypothesis H_1 presumes that the high school students will not have better results in final exam of English language than technical school students in Czech Republic. For testing the null hypothesis H_0 against the alternative hypothesis H_1 we shall use so called T statistics which is called the testing criterion. The testing criterion is the function of random selection. This function is related to the null hypothesis H_0 . The distribution of this function is known provided that the null hypothesis is not rejected. Let's now demonstrate the statistical hypothesis testing and its meaning in exchange trading:

The Null Hypothesis H0

This hypothesis is based on the presumption that none of the rules of technical analysis (no matter if he uses price patterns, indicators, etc.) has predictive power and that the profitable backtest was nothing more than a coincidence. For our purpose the coincidence means positive but accidental conformity between the rule's signal and subsequent market trends on the historical data sample (so called in-sample data) used for testing the rule.

The Alternative Hypothesis H1

On the other hand, if market observations are contrary to predictions made by the null hypothesis, the null hypothesis got rejected. Instead, the alternative hypothesis H1 gets accepted and is based on the presumption that the rule of technical analysis has predictive power. The alternative hypothesis H1 serves as an evidence that the rate of return is too high to be reasonably assigned to coincidence. If the rule of the technical analysis had no predictive power, the rate of return would be less or equal zero on unknown data (so called out-of-sample data). If using detrended data, the rate of return would equal zero. The principle of testing detrended data and why to use detrended data will be explained in following articles.

In this chapter, we introduced the importance of using statistical analysis in trading. The basic presumption of statistical analysis in trading is that technical analysis aims to reveal recurrent rules from historical data in the form of patterns or various indicators and then to extrapolate them to the future. The Null Hypothesis H0 presumes that all rules of technical analysis are without predictive power. It is a contrary to alternative hypothesis H1 which presumes that the rule does have predictive power. In the next article we will focus on explaining the principle of testing criterion.

16. Backtesting of Automated Trading System

Backtesting (or backtest) is the process of testing a trading system's efficiency (profitability) on historical data of a particular market or a group of markets. Backtests are used before the trading system's application in live trading. Obtaining of usable results by testing of trading systems and sets of trading rules on the current market data would require too much time, therefore we use the method of backtesting instead. Backtesting enables application of our system's trading rules on historical market data. The objective of backtesting is to find out whether our strategy has the potential to generate profits in live trading. Traders should take backtesting really seriously. Each trading system that is intended to be employed in live trading should always and in all circumstances be subjected to quality backtesting.

There are the following two basic methods of backtesting:

a) Manual backtesting which is used within discretionary trading. A trader manually applies the predefined entry and exit conditions on historical data. This means that he manually goes through historical charts and searches for potentially profitable trades that comply with the trading system's parameters. Then records these trades and their results into a predefined table. The objective of manual backtesting is to evaluate whether the trading system had good enough performance characteristics in the past (such as the net profit and minimal loss) and whether it has a clear potential to be profitable in the future within the live trading with real money. The advantage of manual backtesting is that you really "get acquainted" with the market and learn its inherent laws. Manual backtesting is suitable for traders who like having everything under control. A disadvantage of manual backtesting, on the other hand, is its' time-consumingness and innate tendencies of each trader to "improve" their trade results. As they say, it's easy to be wise after the event - everybody can see winning trades on historical data. It is therefore necessary to worsen the results of manual backtests at least by 30%.

b) Automated backtesting which is used by traders employing Automated trading systems (ATS). The trader defines the trading system's entry and exit conditions in the form of an algorithmic code and then applies the code to selected historical data of a particular market or group of markets. The advantage of automated backtesting is that unlike in the manual backtesting you immediately get a summary of the system's performance characteristics. A disadvantage, however, is that you have to create a functional program code of input conditions.

Automated backtesting falls into more advanced areas of trading. In this chapter we will first explain the principles of manual backtesting.

Manual backtesting

Let's show step by step how to perform a manual backtest:

1. We define the market (or markets) on which we will perform backtesting.

For example, we are interested in intraday trading of stock index futures, thus we choose E-mini S&P 500 for backtesting.

2. We choose the timeframe and trading sessions - i.e. the market's timeframe and from when to when we intend to trade every day.

Suppose we decided to trade the E-mini S&P 500 market on the 15-minute timeframe during the main trading session. It means from 8:30 a.m. to 4:15 p.m. Chicago time. In the Czech Republic it is from 15:30 to 22:15. The reason for choosing the 15-minute timeframe may be, for example, that we want to take advantage of highly profitable opportunities that we found on higher timeframes than, for example, the 5-minute chart. You can see an example of the 15-minute E-mini S&P 500 chart in Fig. 21.



Fig. 20: 15-minute chart of E-mini S&P 500

Created in TradeStation

3. We choose the length of the historical time period to be backtested. In other words, how many days, months, or years back we want to test our trading system.

There is one general rule that we should take into account - the longer the backtested period, the better. It is because the backtesting will include many different situations. We can thus verify if the system works well in for example periods of steep growths or declines in market prices, periods of stagnation, or periods of high turbulences when the market behaves crazily and rises steeply in one moment and then suddenly falls, or vice versa. When testing, for

example, 1-minute data it is ideal to choose about 10 years of historical data - i.e. for example from August 2003 to August 2013. If we wanted to backtest such a period manually, it would take us a lot of time. However, we recommend to backtest intraday systems by the use of at least 3-year historical data. In the case of positional trading it is suitable to use 20-30 years of historical data for backtesting.

4. We define a set of rules specifying entry and exit conditions.

In order to be able to perform backtesting we need to define the rules for opening and closing individual positions. We can employ technical analysis, namely various indicators, price patterns, or S/R levels.

Now we know which market and timeframe we are going to backtest. We also know how many years of historical data we are going to use and we have defined the entry and exit rules both for Long and Short positions. We can say that we have built a trading system. The aim of our backtest is to determine whether the system was sufficiently profitable and stable in the past. Ideally, the system should be profitable in each tested year.

5. We search all trades corresponding to the parameters of our trading system – the actual backtest.

Now we have to do a very lengthy, yet necessary and useful work. We have to go through the entire tested period day by day, bar after bar (or candle after candle) and search for situations when our entry conditions were met. We can scroll the chart manually or we can use the function for accelerated trading on historical data. This function is part of many software platforms – for example in Sierra Chart this function is called **Replay**. It allows us to accelerate our trading by a certain time ratio and even to simulate opening and closing of positions.

In case we find a situation where the entry conditions were met, we record it (i.e. the trading position) in a predefined table – we keep a **Trading diary**. Then we also record the exit from the position. As I mentioned earlier, a problem in the manual backtesting is the fact that traders often "cheat" about their successful entries into profitable trades. For this reason backtests often do not entirely correspond to reality and it is necessary to worsen their results by at least 30%. Yet as you will see soon, this problem does not concern traders using ATS.

What basic information should a trading diary contain?

Number of trade	Numerical value showing the trade's order
Market	Specification of the traded market (e.g. ticker), including the expiration month
Type of position Long (1) / Short (-1)	Specification of the position - long (1) or short (-1). The number in parentheses indicates the number of contracts in the position (see Chapter Money Management).
Date and time of entry	Position entry date and exact time.
Entry price	The price at which we entered the market.
Date and time of exit	Position exit date and exact time.
Exit price	The price at which we exited the market.
Stop Loss in \$	Stop Loss value set by the trader on the basis of the defined rules. We will deal with the issue of Stop loss in detail in Chapter Management of closing trading positions.
Profit / Loss in \$	Gross profit or loss excluding commissions and slippage.
Slippage + Commissions in \$	The total estimated amount of slippage and commissions summed together.
Total Profit / Loss in \$	The overall trade's result including slippage and commissions.

Table 16: The basic trading diary entries

How can the trading diary for, for example, E-mini S&P 500 look?

Number of trade	Contract	Entry date	Long (1) / Short (-1)	Entry Price	Exit date	Exit Price	Stop Loss	Profit Loss	Slipp. Comm.	Total Profit Loss
1	ESZ03	8/9/03 9:00	1	1055.5	8/9/03 15:15	1061	\$250.00	\$275.00	\$17.22	\$257.78
2	ESZ03	9/9/03 9:00	-1	1056	9/9/03 15:15	1054.5	\$250.00	\$75.00	\$17.22	\$57.78
3	ESZ03	10/9/03 9:00	-1	1049	10/9/03 15:15	1044	\$250.00	\$250.00	\$17.22	\$232.78
4	ESZ03	11/9/03 9:15	1	1047.5	11/9/03 10:30	1047	\$250.00	-\$250.00	\$17.22	-\$267.22
5	ESZ03	12/9/03 9:00	-1	1041	12/9/03 14:00	1048.5	\$250.00	-\$250.00	\$17.22	-\$267.22
6	ESZ03	16/9/03 9:00	1	1049	16/9/03 15:15	1059.5	\$250.00	\$525.00	\$17.22	\$507.78
7	ESZ03	22/9/03 9:00	-1	1054.75	22/9/03 15:15	1053	\$250.00	\$87.50	\$17.22	\$70.28
8	ESZ03	29/9/03 9:00	1	1031.75	29/9/03 10:00	1036	\$250.00	-\$250.00	\$17.22	-\$267.22
9	ESZ03	30/9/03 9:00	-1	1029.75	30/9/03 15:15	1026.25	\$250.00	\$175.00	\$17.22	\$157.78
10	ESZ03	1/10/03 9:00	1	1032.75	1/10/03 15:15	1048	\$250.00	\$762.50	\$17.22	\$745.28
11	ESZ03	2/10/03 9:00	-1	1043.5	2/10/03 9:15	1051.75	\$250.00	-\$250.00	\$17.22	-\$267.22
12	ESZ03	3/10/03 11:45	1	1067.5	3/10/03 14:15	1057.5	\$250.00	-\$250.00	\$17.22	-\$267.22
13	ESZ03	7/10/03 9:00	-1	1057.75	7/10/03 10:15	1067.75	\$250.00	-\$250.00	\$17.22	-\$267.22
14	ESZ03	9/10/03 10:15	1	1076.25	9/10/03 13:30	1066.25	\$250.00	-\$250.00	\$17.22	-\$267.22
15	ESZ03	13/10/03 9:00	1	1075.5	13/10/03 15:15	1076.25	\$250.00	\$37.50	\$17.22	\$20.28
16	ESZ03	14/10/03 9:00	-1	1071.25	14/10/03 13:00	1081.25	\$250.00	-\$250.00	\$17.22	-\$267.22
17	ESZ03	20/10/03 9:00	1	1071.75	20/10/03 9:45	1077.25	\$250.00	-\$250.00	\$17.22	-\$267.22
18	ESZ03	22/10/03 9:00	-1	1065.5	22/10/03 15:15	1062	\$250.00	\$175.00	\$17.22	\$157.78
19	ESZ03	24/10/03 10:45	-1	1053.25	24/10/03 15:00	1061.75	\$250.00	-\$250.00	\$17.22	-\$267.22
20	ESZ03	27/10/03 9:00	1	1066	27/10/03 13:15	1062	\$250.00	-\$250.00	\$17.22	-\$267.22
21	ESZ03	28/10/03 9:00	1	1066.5	28/10/03 15:15	1076.25	\$250.00	\$487.50	\$17.22	\$470.28

Table 17: Trading diary containing 21 trades from September 3, 2003 to October 28, 2003, E-mini S&P 500

In Table 17 you can see 21 trades that were manually recorded within the backtest of the period from September 8, 2003 to October 28, 2003.

6. Evaluation of trading system's performance

After we finished the backtesting there is another next piece of work ahead us - we have to evaluate the trading system's potential. We must calculate various indicators of the system's profitability, such as the equity curve, total net profit, Risk Reward Ratio (hereinafter "RRR"),

or the maximum drawdown. You will learn more about the issue of evaluating a trading system's performance in Chapter Trading System Performance Evaluation.

We have shown on the example how a manual backtesting can be performed. This kind of backtesting is a typical instrument of discretionary traders. Now we will focus on the method used by traders employing programmed algorithms.

Automated backtesting

We have said several times within the guidebook that traders using ATS employ both for backtesting and live trading programmed algorithms. Thus an ATS trader is inherently also a programmer. I know that many novice traders get scared at this point. I myself belonged among those who are frightened by programming. Programming was always a kind of abstract and difficult concept for me, something that was completely alien to my nature. Yet one day I decided (and now I'm really glad that I did it) to try to study the **EasyLanguage** programming language. This programming language was created purely for the purposes of trading. It allows programming of simply defined entry and exit conditions for mechanical trading systems and strategies. EasyLanguage is a part of the professional software and trading platform TradeStation. And we can also find it in the no-less professional software **Multicharts**.

I realised that programming may not be an obstacle. The thing is that the EasyLanguage programming language is very intuitive (because it was created for "non-programmers"). Furthermore, an appealing aspect of algorithmized trading for me was that uncomplicated trading systems and strategies with simple codes often work much better in the long term than complicated multi-parameter entry and exit conditions.

As we have already said, programming software platforms can greatly facilitate and accelerate all trading-related procedures. In Fig. 22 you can see a table containing backtest results. Such tables can be generated in programs like TradeStation or Multicharts in a split second. A manual processing of the same table would be a very lengthy process. Moreover software platforms provide other valuable information on the tested trading system's performance.

Buy	09/08/03 09:00		VstupLong	\$1,055.50	\$0.00	1	\$257.78
Sell	09/08/03 15:15	End of Day Exit		\$1,061.00		\$275.00	\$390.56
Sell Short	09/09/03 09:00		VstupShort	\$1,056.00	\$0.00	1	\$57.78
Buy to Cover	09/09/03 15:15	End of Day Exit		\$1,054.50		\$75.00	\$448.34
Sell Short	09/10/03 09:00		VstupShort	\$1,049.00	\$0.00	1	\$232.78
Buy to Cover	09/10/03 15:15	End of Day Exit		\$1,044.00		\$250.00	\$681.12
Buy	09/11/03 09:15		VstupLong	\$1,047.50	\$0.00	1	(\$267.22)
Sell	09/11/03 10:30	Stop Loss		\$1,042.50		(\$250.00)	\$413.90
Sell Short	09/12/03 09:00		VstupShort	\$1,041.00	\$0.00	1	(\$267.22)
Buy to Cover	09/12/03 14:00	Stop Loss		\$1,046.00		(\$250.00)	\$146.68
Buy	09/16/03 09:00		VstupLong	\$1,049.00	\$0.00	1	\$507.78
Sell	09/16/03 15:15	End of Day Exit		\$1,059.50		\$525.00	\$654.46
Sell Short	09/22/03 09:00		VstupShort	\$1,054.75	\$0.00	1	\$70.28
Buy to Cover	09/22/03 15:15	End of Day Exit		\$1,053.00		\$87.50	\$724.74
Buy	09/29/03 09:00		VstupLong	\$1,031.75	\$0.00	1	(\$267.22)
Sell	09/29/03 10:00	Stop Loss		\$1,026.75		(\$250.00)	\$457.52
Sell Short	09/30/03 09:00		VstupShort	\$1,029.75	\$0.00	1	\$157.78
Buy to Cover	09/30/03 15:15	End of Day Exit		\$1,026.25		\$175.00	\$615.30
Buy	10/01/03 09:00		VstupLong	\$1,032.75	\$0.00	1	\$745.28
Sell	10/01/03 15:15	End of Day Exit		\$1,048.00		\$762.50	\$1,360.58
Sell Short	10/02/03 09:00		VstupShort	\$1,043.50	\$0.00	1	(\$267.22)
Buy to Cover	10/02/03 09:15	Stop Loss		\$1,048.50		(\$250.00)	\$1,093.36
Buy	10/03/03 11:45		VstupLong	\$1,067.50	\$0.00	1	(\$267.22)
Sell	10/03/03 14:15	Stop Loss		\$1,062.50		(\$250.00)	\$826.14
Sell Short	10/07/03 09:00		VstupShort	\$1,057.75	\$0.00	1	(\$267.22)
Buy to Cover	10/07/03 10:15	Stop Loss		\$1,062.75		(\$250.00)	\$558.92
Buy	10/09/03 10:15		VstupLong	\$1,076.25	\$0.00	1	(\$267.22)
Sell	10/09/03 13:30	Stop Loss		\$1,071.25		(\$250.00)	\$291.70

Fig. 21: Automated trading system backtest results, period from September 8, 2003 to October 9, 2003, market E-mini S&P 500, 15-minute timeframe, main trading session

Created in TradeStation

Simulated trading - papertrading

After a properly performed backtesting when the trader verifies whether his trading system has a real potential for profitability, he should use the system within a **simulated trading-papertrading** (you can also see the terms Forward Testing or Virtual Trading). Both discretionary traders and traders using ATS should perform papertrading. Papertrading is essentially a verification of the trading system's functionality on live data in real time. It's the same like live trading with only one difference - you trade with virtual money. The advantage of papertrading is that it allows you to accurately simulate live trading thanks to which you can verify (to a certain extent) whether you can manage the psychology of trading. The length of the papertrading period derives from the number of trades. In order to be able to compare the results of the backtest with the results of papertrading you need to have a statistically relevant sample of the papertrading results, i.e. at least 30 trades. Ideally, you should use a sample of 50 to 100 trades. Such a sample is usually sufficient to confirm the correlation (similarity) between the trading system's performance in backtesting and papertrading.

Discretionary traders carry out papertrading much like backtesting. They also use trading diaries in which they record individual trades and their parameters. They trade live data in real time, yet they do so on simulated "demo" accounts. Traders using ATS simply apply their programmed trading system on the simulated account where trades are concluded in real time. Then they just check whether the entry and exit orders are correctly executed.

Backtesting and papertrading are still only simulations of the trading system.

In conclusion, the results of backtesting and papertrading have a real value, yet they do not always faithfully simulate slippage or failures to execute limit orders, i.e. phenomena that occasionally occur during live trading. This must be borne in mind both during backtesting and papertrading. In any case, I can say from my personal experience that a well-executed backtest and the subsequent papertrading are essential and fundamental prerequisites for a successful live trading. Therefore, do not neglect either of these steps. Only through them you can truly learn if your trading system has the potential to be profitable in live trading or not.

In this chapter we have explained the differences between the manual and automated backtesting. We have showed you how a trading diary in which you record individual trades that meet your system's entry and exit parameters should look like. You learned that the backtesting results are also used for evaluation of your trading system's performance (we will address the issue of trading systems in detail in the following chapter). The aim of backtesting is to determine whether a given trading system has the potential to be profitable in live trading with real money. We have also explained the concept of simulated trading (or papertrading).

17. Trading System's Performance Parameters

We have already explained that every backtest, whether automated or discretionary, is performed for the purpose of evaluation of trading systems' performance. In this chapter we will introduce the basic tools for assessing a trading system's performance. Our goal should always be to detect such trading systems the backtesting of which will then show stable profits.

Equity Curve

First have a look at an equity curve (see Fig. 23). We have mentioned this term already in the previous chapters. The equity curve gives us the initial signal that the system we are testing may be profitable.

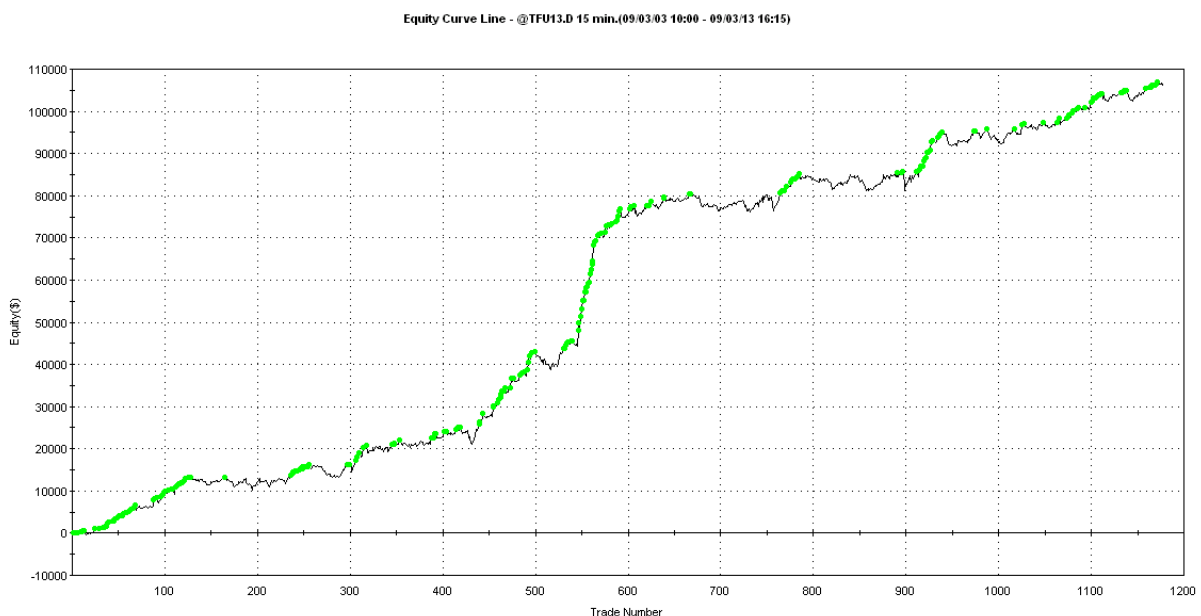


Fig. 22: Equity curve of a potentially profitable trading system

Created in TradeStation

In Fig. 23 you can see the historical equity curve of one of the systems which I use in my live trading. (And I should say that I have had a lot of success with using this system so far!) I added this system to my live trading portfolio in early 2013.

So what information gives us the equity curve?

- In the headline of the figure you can see that the curve covers trades carried out between September 3, 9. 2003 and September 3, 9. 2013, i.e. during the last 10 years.
- On the horizontal axis you can see that the system executed nearly 1,200 trades (namely 1,178) in the last 10 years.

- The vertical axis gives us information that over the last 10 years the system earned approximately \$ 110,000 (namely \$ 106,629) by a conservative trading of one futures contract.
- You can see that this system's equity curve tends to continuously create new peaks. It means that after periods of losses (drawdowns) the trading system has the power create new price peaks again, i.e. to enter into series of profitable trades.
- In the period between the trade no. 500 and the trade no. 600 the equity curve rose very steeply. It is a very interesting phenomenon because these profits were generated at the beginning of the crisis – from approximately June 2008 to March 2009 when markets were falling sharply.
- Since this system is based on utilising strong business trends, every economic bubble causing steep Long-side or Short-side movements is very favourable for it.
- You can also see that about the last 200 trades were very profitable (i.e. trades no. 1,000 - 1,200) and that the curve created new and new peaks. Such trading systems which show a steady growth also in the close historical periods give us a higher probability that they will work well in the future.
- We must not forget that within the backtesting this trading system executed nearly 1,200 trades during the last 10 years, which is a very good statistical sample. Here applies the rule: The more the better.
- Another positive fact is that we backtested 10 years of quality and accurate data. The data include all market situations - a crisis period, stagnation period, and a period of strong economic growth. It is not so easy to get quality historical intraday data these days as data providers usually charge considerable fees. But as you can learn in a series of articles on my web portal or in my courses, there are some very interesting and cheap alternatives. It is of course necessary to be familiar with this sphere and have a certain know-how. I will be happy to help you with both. Never underestimate the quality of data and the sufficiently long historical sample!

So you can see how much useful information can be read from the equity curve. From my perspective, it is one of the most essential and useful graphical tools for evaluating performance of trading systems. Strength of the equity curve lies mainly in the fact that it can show us very quickly whether our trading system is stable. That is, whether it tends to generate profits and created new and new price peaks in the long term.

Now we will focus on the basic parameters of a trading system's performance expressed in numerical form. If you are a discretionary trader and you keep your trading diary in e.g. MS Excel, it should be easy for you to calculate the individual performance parameters of your

system. If your trading approach is based on automated trading, then software platforms can save you a lot of time because performance evaluation reports are already their integral parts.

Let's explain what performance indicators we should pay attention to.

Net Profit (Total Net Profit)

Net profit is the sum of all winning (Gross Profit) and losing (Gross Loss) trades. Its value can be both positive and negative.

To illustrate, imagine backtests of two trading systems, both with 5-trade samples with the following results:

- \$320, \$260, \$50, \$400, \$720. **The total profit of \$430.**
- \$200, \$750, \$3 000, \$30, \$5 200. **The total profit of \$1,680.**

Question for novice traders: "Which of these two trading systems would you trade with a real account?" Many of you would, seemingly logically, choose the system with the higher net profit of \$1,680.

By this simple example I'm trying to explain that it is necessary to start to think in a broader context. Of course, our primary goal will always be to earn the most money possible. Yet trading, just like any other business, is also about a risk. So now let's look at the two examples from the perspective of the accumulated loss:

- In the first case you would be exposed to the accumulated loss of $-260 + 50 - 400 = \mathbf{-610}$
- in the second case the cumulative loss is $-750 - 3,000 = \mathbf{\$3,750}$

Now you surely understand that evaluating a trading system solely on the basis of a single indicator would be very short-sighted and could end by an early bankruptcy. It is always necessary to assess trading systems by the use of more information and indicators. Therefore, never and under no circumstances consider the net profit indicator as a decisive and the only relevant indicator of your trading system's quality!

Also remember that the net profit should reflect the costs associated with brokerage fees (commissions) and slippage in order execution.

Drawdown

Drawdown is the difference between the historical peak of our equity curve and the subsequent cumulative price decline. It does not necessarily mean a loss, it may be only a price collapse. It can be expressed as the amount of money or percentage of the largest cumulative decline in capital in our historical trades or backtests. Its value or a multiple of its value are often used to determine the size of the account for live trading in a particular

market and to determine the maximum acceptable risk and stop loss before we start to trade live. For example, if our maximum historical drawdown in a particular market was \$5,000, we can say that our business strategy requires an account with at least a triple drawdown value, i.e. \$15,000.

Profit Factor

Profit factor is the ratio of all winning (Gross Profit) and losing (Gross Loss) trades. Its lowest value is 0, the highest value is not limited. Yet from my own experience I know that strategies with a sufficient number of trades (more than 500) and the profit factor higher than 2 are rather exceptional. There are traders who use the profit factor as the absolutely essential indicator. For example, their rule is not to use a strategy with the profit factor lower than 2.5. However, I personally do not agree with this strict rule because I know from my own experience that also a strategy with the profit factor of about 1.5 can be very profitable. Therefore, perceive the profit factor as an indicator that is variable in time.

TradeStation Periodical Returns: Annual						
Mark-To-Market Period Analysis:						
Period	Net Profit	% Gain	Profit Factor	# Trades	% Profitable	
Last 12 month	\$8,062.50	4.65%	2.92	56	53.57%	
1/1/2013	\$875.00	0.49%	100.00	3	100.00%	
1/1/2012	\$7,612.50	4.41%	2.38	68	51.47%	
1/1/2011	\$9,250.00	5.66%	1.78	113	47.79%	
1/1/2010	\$2,525.00	1.57%	1.23	116	42.24%	
1/1/2009	\$10,212.50	6.77%	1.92	115	48.70%	
1/1/2008	\$9,862.50	7.00%	1.47	99	40.40%	
1/1/2007	\$14,012.50	11.04%	2.15	132	50.76%	
1/1/2006	\$7,650.00	6.41%	1.68	132	53.03%	
1/1/2005	(\$1,950.00)	(1.61%)	0.83	84	46.43%	
1/1/2004	\$6,837.50	5.98%	1.67	115	57.39%	
1/1/2003	\$14,387.50	14.39%	3.38	105	70.48%	

Fig. 23: Periodic Analysis of Performance Report

Created in TradeStation

In Fig. 24 you can see the annual backtesting results of a strategy traded for 10 years (from 2003 to 2013). An ideal robust strategy should have approximately the same profit factor every year.

Now imagine an extreme situation in which our strategy achieved a profit factor 6.5 in one year. But in the previous 9 years the profit factor was lower than 1. In other words, we were losing for 9 years. Only one year our strategy showed enormously good results. Therefore, the sum of all profits and losses would be a high profit, but only thanks to a single year.

Now imagine a strategy with a profit factor 1.5, but all 10 years were profitable with the profit factor higher than 1. Which of the two strategies would you choose for live trading? The strategy that brought you more money after 10 years but with which you were in a loss for 9 years? Or the lower-profit-factor strategy that was steadily generating smaller profits year after year?

In terms of statistical robustness you should choose the second (stable) strategy with the profit factor higher than 1 in each year.

Total Number of Trades

Please, always remember one crucial rule. The larger the sample of trades, the better. Those familiar with the probability theory and the basics of statistics do not need a further explanation. You surely understand that the larger statistical sample of data we have (backtest data in our case), the smaller the deviation from reality (live trading).

A classic example are surveys of election results. We all know the situation very well – an opinion research agency conducts survey on election results by the use of a statistical sample. Such a statistical sample typically contains a few thousand inhabitants, i.e. an insignificant part of the total number of inhabitants. The most important thing is that the sample contained all age groups, social classes, ethnicities, both genders, etc. in an even distribution. Based on this statistical sample are then estimated the overall results of the actual polling.

Please note that in these surveys they always speak about a few-percent **statistical deviation**. There is one inflexible rule here – the closer is the statistical sample (subset) to the total number (entire set), the smaller the statistical deviation. In the Czech Republic there are approximately 10 million inhabitants. Now imagine that for an election survey will be chosen two relevant statistical samples (subsets), the first with 10,000 inhabitants and the second with 100,000 inhabitants. It is clear the sample with 100,000 inhabitants will be more statistically relevant.

Similarly, now let's have a look at a trading system. You surely understand that a system with 30 trades has a completely different informative value than a system with 600 trades. I have met traders who in no case would trade a system with less than 500 backtested trades. This applies primarily to systems based on short-term trades (mostly for intraday trading). However, more advanced traders are well aware that it is virtually impossible to obtain such a large statistical sample for testing of positional systems. Thus it is necessary to be more benevolent in the case of positional trading. As a completely sufficient sample are considered 200-300 trades here.

The point is to always backtest:

- the longest period possible for the given market with the largest amount of trades possible,
- the largest sample of market situations possible (e.g. chops, strong trends, sudden price reversals, limit movements, high and low-volatility periods, extreme situations, etc.).

Risk Reward Ratio (RRR)

RRR indicates a ratio used by traders for comparisons of the expected profit per trade and the acceptable loss per trade. Mathematically, this ratio is calculated as the amount that we are willing to risk in one trade (for example, \$300 Stop Loss) divided by the expected profit if the market moves in the desired direction (\$ 600 Profit Target). When using the values in brackets the RRR would therefore be 1: 2. RRR is important for managing risks within trading strategies. The aim of the trader is to set SLs and PTs that are consistent with his strategy's RRR and that will bring stable profits. This ratio is independent on actual results of individual trades (i.e. whether they were winning or losing).

Percentage of profitable trades (Percent Profitable)

If we take the number of winning trades and divide it by the total number of trades and then multiply the result by 100, we get the percentage of successful trades. The question is to what extent this is a decisive indicator for us. There are strategies with only 30% of profitable trades that generate much higher profits in the long run than strategies with 60% success rates. There may be even strategies with 60% of profitable trades that are losing in total. The answer therefore lies more in the average profit and the average loss for all trades and their ratio.

Let's explain this on an example. We have two strategies each of which we tested on 1,000 trades:

- a) **The first strategy** has the average profit of \$1,000 and the average loss of \$400.

The profit-to-loss ratios $1\ 000/400 = 2.5$.

The Percent Profitable value is **35%**.

The total profit/loss is:

Total profit/loss = the number of trades * (average profit * 0.35 - average loss * 0.65)
 $= 1000 * (350-260) = \mathbf{\$90,000}$

Thus despite the low percentage of successful trades the strategy is profitable in the long run thanks to a high **ratio of the average profit to the average loss**.

b) **The second strategy** has the average profit of \$1,000 and the average loss of \$1 800.

The profit-to-loss ratio is therefore **0.55**.

The Percent Profitable value is **60%**.

The total profit/loss is:

Total profit/loss = $1000 * (600 - 720) = - \$120,000$

Although the strategy has 60% profitable trades, it led to a substantial loss after 1,000 trades due to the very low **ratio of the average profit to the average loss**.

The example clearly shows that like in other indicators, Percent Profitable cannot be seen in isolation, but always in the context of the **ratio of the average profit to the average loss**. It is therefore a very important indicator because the entire trading is about searching of a "Logical edge" (statistical advantage). A problem in strategies with a low percentages of profitable trades is that the trader asks a logical question: Is the low probability of a winning trade a result of a demanding exit strategy or is it a mere coincidence that occurred only in backtesting and will not appear again in the future?

There is no unequivocal answer. However, from my personal experience I know that it is possible to find strategies with a high percentage of successful trades and a sufficient **ratio of the average profit to the average loss**. From a psychological point of view, such strategies are far easier to trade. It is always psychologically easier to use strategies that generate more frequent, though smaller profits than strategies with high **ratio of the average profit to the average loss** and less frequent winning trades. But of course it depends on the nature and disposition of each trader.

Average profit/loss per one trade (Average Trade Net Profit)

This indicator can give us a lot of useful information in trading. It's calculation is very simple - it is the arithmetic average of all trades, i.e. both the winning and losing ones. It can be both positive and negative. If the indicator's value is positive it means that the overall backtesting result was a profit. If the value is negative, the backtesting showed that the strategy brought a loss.

There is one truly fundamental rule. The higher the average profit per trade, the better. Yet again, you must also take into account other indicators, like Profit Factor, standard deviation of the system, number of trades, drawdowns, etc. In no case you can simply choose a strategy because it has the highest average profit per trade!

In this chapter we introduced the concept of trading systems' performance evaluation. We have explained the equity curve and its purpose in trading. We also introduced the basic

numerical indicators that help traders to find out whether they are on the right way to creating a really good trading strategy. Do not forget to always compare these indicators within backtesting, papertrading, and live trading results. The results of a really good trading system should be more or less the same in all three cases. If backtesting of individual indicators or the equity curve brought the expected results but the results were not confirmed in papertrading, do not risk your capital by live trading via this system. Your goal is to eventually find such a trading system that proves its qualities in any conditions. As novice traders you do not need other indicators than those introduced in this chapter. In the long run, it is advisable to learn more about evaluating trading systems' performance.

18. Professional Software Platform and Broker - TradeStation

Open a trading account with TradeStation under the most favourable conditions all around the world. Completely free trading account for 12 months.

Prestigious trading magazines often call **TradeStation** one of the best providers of brokerage services in the field of mediation forex, commodity, and equity transactions. Its biggest advantage is a very sophisticated platform enabling **execution of automated trading systems (ATS)**. These ATS are programmed in the **EasyLanguage** language the programming environment of which is part of the TradeStation package. You can use any number of trading strategies in any number of markets through very simple and intuitive settings.

These are the key advantages and disadvantages of **TradeStation** over its competitors:

Advantages:

- **Really affordable platform (if you do more than 10 trades per month the platform is free).**

If you open a trading account only to try the TradeStation platform (see Fig. 25) and do not trade at least 10 round-turn futures contracts per month, you have to pay a relatively high fee (\$ 99.95 per month) for using the platform. The good news is that I have exclusively negotiated a 12-month free use of the TradeStation platform for you. So if you open a trading account and fund it with at least \$5,000 and then do not meet the condition of at least 10 round-turn futures a month for the first 12 months, you will save nearly \$1,200 thanks to AOstrading.cz.

If you do not want to open a trading account yet and you would like to try the TradeStation platform for 30 days, you can do it for the special price of \$ 50 (the standard price is \$ 249.95) thanks to AOstrading.cz. Send me an email to info@aostrading.cz and I will ensure this exclusive discount for you.

- **The platform also serves as a low-commission broker.**

When you get ready for live trading, **you will have one great advantage - for the first 90 days after opening your account you will pay at most \$600 in commissions regardless of how much trades you do.** Today, the round-turn commissions for, for example, equity indices futures contracts are \$4.72. If you trade more than 127 futures contracts (\$600/\$4.72) you will not have to pay for the other traded contracts in the first 90 days after opening the account.

- **The EasyLanguage programming language** is very easy to understand and user friendly. There are lots of literature and program codes available on the Internet, but mostly in English.
- **TradeStation contains a large amount of historical data** for intraday trading (more than 10 years in the major stock indices). For \$20 a month you can have access to a large number of major American stock indices. However, if you want a very popular TF (E-mini Russell 2000), you need to pay more - now \$75.
- **There is also an extensive discussion forum** where you can find lots of tips and advice. It is therefore a good online support.
- **TradeStation offers a complete package** – possibilities for live trading by the use automated trading strategies (very easy setup), some of the lowest commissions in the market, high reliability.
- **Sophisticated tools for robustness testing** – structured overview of performance parameters (Performance Summary), classic and genetic optimisation, sophisticated In-Sample and Out-of-Sample tests – Walk Forward Analysis and Walk Forward re-optimisation.
- **Data export for further analysis in Excel** – exports can be performed both manually and via EasyLanguage codes.

Disadvantages:

- **It is not possible to connect the TradeStation analytic platform to data provided by other brokers.** On the other hand, TradeStation as a broker offer high quality services at very competitive prices in terms of commissions for execution of trades.



Fig. 24: TradeStation platform

Conclusion

Very professional analytic platform with the following features:

- intuitive control,
- easy technical analysis of markets – from the simplest analyses to programming and application of own indicators,
- easy programming and deployment of automated strategies,
- excellent optimisation tests,
- robustness tests (In-Sample and Out-of-Sample, Cluster Walk Forward Analysis),
- virtual and live trading,
- easy data export to Excel via EasyLanguage functions.

In my opinion, the TradeStation platform is currently the best option you have in the market. TradeStation representatives told me that their developers very intensively work on, for example, testing of trading strategies on a portfolio of different markets. As for the computational speed, TradeStation is preparing a revolution in optimisation tests and very soon it should be able to take advantage of multicore processors which will substantially accelerate the whole process of ATS development and testing. Therefore, we may see some substantial improvements in the near future. Anyway, I am able to very effectively utilise the platform even in its today's form which is proved by my robust ATS that are able to generate real profits.

19. EasyLanguage - TradeStation's Programming Language for "Non-programmers"

We will now focus on the EasyLanguage programming language (see Fig. 26) which is part of the TradeStation software platform. Even its name implies that it is a programming language for "non-programmers". Its biggest advantage is that if you know the basics of English and you are familiar with conditional functions in Microsoft Excel, you can very easily learn the substantial part of this programming language. The basic motivation for creation of EasyLanguage was a vision that algorithmic trading should be available to traders who are not skilled in programming. I myself am a very good proof that EasyLanguage can be relatively easily mastered even if you do not have any knowledge of programming.



Fig. 25: EasyLanguage user environment

EasyLanguage allows you to create:

- **Functions** which are the backbone of EasyLanguage. Thanks to them this programming language is suitable even for "non-programmers". Functions contain programmed codes of technical indicators. Technical indicators are the essential building blocks of robust ATS.
- **Indicators** are technical indicators that are directly displayed in the price chart (see Fig. 27).



Fig. 26: TradeStation and the Stochastic Fast indicator below the price chart

- **colouring of bars (PaintBar)** – a function serving for colouring candles in case a condition predefined in the code is met (see Fig. 28).



Fig. 28: TradeStation and PaintBar function colouring bars in the price chart

- **automated trading system – ATS (Strategy)**– ATS enters and exits positions as defined in the programmed algorithm (see Fig. 29).



Fig. 29: TradeStation and an example of a simple strategy displayed in the price chart

EasyLanguage contains a huge number of pre-programmed functions and indicators which are the cornerstones of ATS. Therefore you can save many hours of work right from the beginning because you do not have to program these particular functions and indicators.

We have explained that there are software tools that can build almost unlimited number of ATS. Yet we should understand what the codes created by the genetic programming "tell us". In my courses I sometimes meet traders who use ATS the principles of which they absolutely do not understand. With regard to the stability of the psychology of trading this situation is very disadvantageous for the trader. And for that reason I prepared the course [Building Winning Automated Trading Strategies with TradeStation](#) in which I explain ATS codes in detail. Graduates of this course should be able to clearly identify the meaning of programmed algorithms. This helps them to increase the profitability of their trading as they get much more confident about the programmed ATS codes. Traders learn to understand the meaning and signs of:

- **Reserved Words** which are words that EasyLanguage reserved for specific tasks. Without these words we would have to laboriously program individual algorithms, such as BUY, MARKET, etc.
- **Remarks** which are words or opinions that the programming language completely ignores and that have absolutely no influence on the algorithm. Traders can use them for their own notes inside the code.
- **Variables** are user-defined words that serve for storing of certain information (that usually changes in time). Variables allow adaptation of ATS to the current market conditions (for example the current volatility). A variable may be, for example, the ATR indicator the value of which changes over time.

- **Input parameters (Inputs)** are numeric values that do not change in time. An example may be the length of the moving average of Close prices. Their value changes only if we, for example, periodically re-optimize our ATS according to the Cluster Walk Forward Analysis (CWFA). CWFA is the cornerstone of the robustness testing. It is incorporated in the TradeStation platform thanks to which the platform clearly beats its competitors.
- **Entry prices and Entry conditions** determine at what price and under what conditions to enter the market. An entry price is a predefined price breakthrough (e.g. Breakout) and the entry condition may be, for example, a crossing of two indicators after which the system enters the market at the Close price of the current bar.
- **Entry order type** says us whether we enter by Market, Limit, Stop Market, Stop Limit, or other order.
- **Exit prices and Exit conditions** determine at what price and under what conditions to exit the market. An exit price is a predefined price level and the exit condition may be, for example, a crossing of two indicators after which the system exits the market at the Close price of the current bar.
- **Exit order type** says us whether we exit by Market, Limit, Stop Market, Stop Limit, or other order.

In this chapter we showed you how complex the issue of programming algorithms in the EasyLanguage programming language may be. EasyLanguage is certainly not a perfect programming language (there are much better programming languages, yet their primary purposes are other than trading), but it offers a very user-friendly solution for traders "non-programmers" who want to seriously engage in building of robust ATS. The good news for each "non-programmer" trader is that this programming language and its basic features are relatively easy to master. For example, if you are familiar with the basics of MS Excel, there is no reason why you should not learn EasyLanguage (I think that EasyLanguage is easier than MS Excel in many respects). In our course, beginners as well as advanced ATS traders can very efficiently learn the basics of EasyLanguage codes and thanks to this understand the functionality of robust ATS. Within the 4-day course we will provide you 4 codes of robust ATS, we will also analyse in detail one of the codes and explain the logical functionality of the codes. Thus you have a unique opportunity to understand what work the codes can do for you in the markets.

20. Importance of Trading System Parameter Optimisation in TradeStation

I have met quite many traders lately who had very interesting ideas regarding building of automated trading systems (ATS) for algorithmic trading. Unfortunately, I often feel that many traders rely solely on the basic backtest result, as in the example of a trading system and its equity curve in Fig. 30. These days, there are many trading platforms, such as NinjaTrader, MetaTrader, AmiBroker, and TradeStation, that can perform this basic backtesting. Each of these programs has its own specific programming language by the use of which traders define entry and exit conditions of their trading systems. The reason why I chose TradeStation was the possibility to carry out advanced robustness testing. Such a possibility is not offered by any other commercial platform.

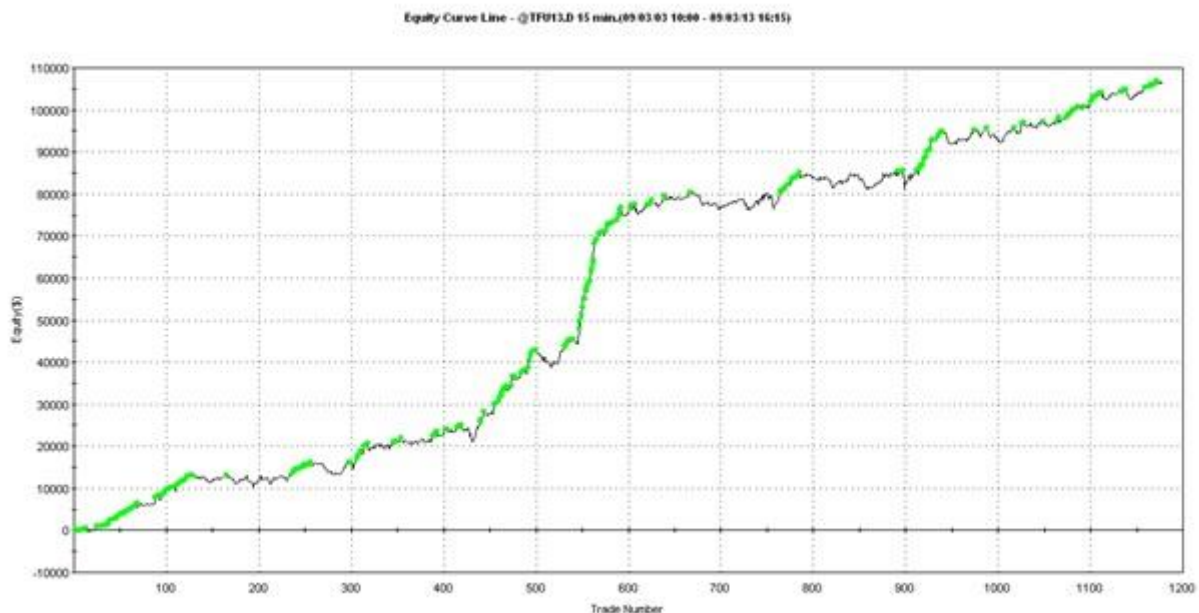


Fig. 30: Equity curve of a potentially robust trading system, source: TradeStation platform

A backtest itself may be the first indication of the system's quality, but by no means it is a sufficient analysis on the basis of which you should conclude that the system will be profitable also in real trading. You must perceive the basic backtesting as only one part of the entire system performance evaluation. For example, I regard backtesting only as a test that shows me the potential profitability of the trading system on the historical data for the selected market. The problem is that trading systems work for example with:

- indicators,

- open, high, low, close of a certain number of bars for the selected market and timeframe,
- numeric constants, and so on.

In the following example I will explain why the basic backtest never sufficiently evaluates the quality of a trading system:

Imagine that you have created a trading system the basic entry and exit conditions of which are crossings of two moving averages (MA). In Fig. 31 you can see two examples of such crossings:



Fig. 31: Example of crossing of two moving averages

The "Fast" moving average (FMA) calculates and draws into the chart the arithmetic average of the last 15 CLOSE values (blue line) and the "Slow" moving average (SMA) draws the average of the last 30 CLOSE values (purple line). On the left side you can see that if FMA crosses above SMA, the trading system enters into a long position (LONG) by the BUY MARKET order on the CLOSE price of the bar. In the opposite situation, if FMA crosses below SMA, the system closes the long position by the SELL MARKET order and at the same time opens a SHORT position on the CLOSE price of the bar. Thus we are actually constantly in a position because we enter into long or short positions at every crossing of FMA and SMA. Of course, I definitely do not recommend you to trade via such trading system. I mentioned it here only as an illustrative example.

As traders we must think critically and we should ask ourselves whether our automated trading system (ATS) is sufficiently profitable regardless of periods (e.g. 5, 10, 15, etc.) of the used moving averages. Here we use a simple premise that we want to trade via such a system the backtesting of which with various indicator settings showed a sufficient profitability. Since markets are unsteady time series and historical data is always unique, we must be sure that the ATS's backtests show profitability with most parameter settings. We

cannot afford to make such a decision without a well-founded expectation that the parameters for which we have built our trading system will be profitable in the future. But if the backtesting shows us that the ATS was profitable with various parameter settings, we get an indication that the trading system is **robust**, i.e. able to generate profits in live trading regardless of setting of its parameter values. Coming back to our example, the FMA 15 and SMA 30 setting seems to be profitable at first glance, thus we need to test whether the system would still be profitable with other parameter values (for example FMA 10 and SMA 40). We will test different combinations of the system's parameter values on historical data. For example:

FMA: 5 10 15 20 25 30 35 40 45 50

SMA: 55 60 65 70 75 80 85 90 95 100

	fovAvg2Lin Cross LE: FastLength	fovAvg2Lin Cross LE: SlowLength	Test	All: Net Profit	All: Gross Profit	All: Gross Loss	All: Total Trades	All: % Profitable	All: Winning Trades	All: Losing Trades
1	5	65	21	50,980.00	277,680.00	226,700.00	6,305	39.24	2,474	3,715
2	5	70	31	47,860.00	247,280.00	199,420.00	6,021	39.51	2,379	3,540
3	5	75	41	40,640.00	208,930.00	168,290.00	5,825	39.85	2,321	3,395
4	5	55	1	37,200.00	349,200.00	312,000.00	6,971	38.36	2,674	4,170
5	10	75	42	29,100.00	093,790.00	064,690.00	4,781	40.28	1,926	2,794
6	10	80	52	27,440.00	077,380.00	049,940.00	4,629	40.76	1,887	2,669
7	50	55	10	25,920.00	332,630.00	306,710.00	6,569	41.44	2,722	3,607
8	5	80	51	25,800.00	175,130.00	149,330.00	5,622	39.91	2,244	3,288
9	10	70	32	24,740.00	137,660.00	112,920.00	5,026	39.79	2,000	2,956
10	10	55	2	21,300.00	238,370.00	217,070.00	5,862	39.25	2,301	3,484
11	5	60	11	20,080.00	307,660.00	287,580.00	6,643	38.45	2,554	3,950
12	10	65	22	11,190.00	161,430.00	150,240.00	5,243	39.42	2,067	3,106
13	50	60	20	10,480.00	166,020.00	155,540.00	5,158	41.64	2,148	2,851
14	10	85	62	5,490.00	035,870.00	030,380.00	4,469	40.64	1,816	2,594
15	5	85	61	4,140.00	151,210.00	147,070.00	5,470	39.91	2,183	3,188
16	25	60	15	3,540.00	045,150.00	041,610.00	4,246	41.26	1,752	2,389
17	25	75	45	1,820.00	932,790.00	930,970.00	3,562	41.58	1,481	1,999
18	10	60	12	1,100.00	200,560.00	199,460.00	5,558	39.02	2,169	3,310
19	15	55	3	580.00	142,430.00	141,850.00	5,198	40.07	2,083	3,023
20	30	60	16	240.00	045,020.00	044,780.00	4,188	41.31	1,730	2,356
21	15	60	13	-920.00	110,900.00	111,820.00	4,876	40.48	1,974	2,611
22	25	65	25	-1,120.00	006,410.00	007,530.00	3,964	41.27	1,636	2,221
23	15	75	43	-1,400.00	012,460.00	013,880.00	4,204	40.22	1,691	2,448
24	25	55	5	-1,640.00	061,230.00	062,870.00	4,638	41.18	1,910	2,617
25	30	65	26	-6,660.00	069,770.00	096,430.00	3,904	40.96	1,599	2,209
26	15	65	23	-6,820.00	071,500.00	078,320.00	4,596	40.25	1,850	2,659
27	35	65	27	-8,740.00	066,320.00	095,060.00	3,894	41.42	1,613	2,167
28	15	90	73	-8,960.00	018,390.00	027,350.00	3,690	41.14	1,518	2,104
29	45	55	9	-9,040.00	180,040.00	189,080.00	5,490	40.82	2,241	3,088
30	35	60	17	-11,220.00	032,760.00	043,980.00	4,228	41.23	1,743	2,362
31	15	70	33	-12,120.00	037,730.00	049,850.00	4,378	40.45	1,771	2,527
32	20	55	4	-12,160.00	067,730.00	099,890.00	4,806	40.43	1,943	2,756
33	25	80	55	-15,360.00	096,290.00	091,650.00	3,400	41.56	1,413	1,911
34	20	75	44	-17,980.00	051,500.00	069,480.00	3,802	40.93	1,556	2,155
35	30	70	36	-20,180.00	039,720.00	059,900.00	3,602	42.25	1,522	1,993

Table 18: Optimisation results of a trading system using crossing of two exponential moving averages

The example clearly shows that from the total of 100 FMA and SMA values there were only 20 profitable ones (see the black Net Profit column in Table 18). I. e. only 20% of the

combinations were profitable, which is clearly not a sufficient value. The aim is that most combinations within the optimisation were profitable. The presented example is really very simplified and inapplicable in practice. Precise optimisation tests represent a very substantial know-how and to my surprise, many traders are not familiar with this important part of trading system evaluation at all, or they do not understand it properly. I explain the specific procedures and methods which I use for evaluation of optimisation tests my course [Building Winning Automated Trading Strategies with TradeStation](#).

In this chapter, we explained that optimisation tests represent one of the basic tools for robustness testing beyond the basic backtest. High-quality optimisation tests can be performed in the TradeStation platform. If you would like to learn more about this platform, click [here](#). For me it is absolutely the crucial software for my algorithmic trading.

21. Out-of-Sample Testing and Optimisation in TradeStation

In the previous chapter we addressed optimisation tests which are the essential tool for robustness testing. We spoke about the optimisation tests primarily in relation with the sophisticated software platform TradeStation. Another tool which I use very often in this platform and which I perceive as the platform's major competitive advantage is the **Cluster Walk Forward optimisation (CWFO)**. Before I explain the principle and the greatest advantages of CWFO in some of the next chapters, it is necessary that you fully understand the principle of testing and validation on Out-of-Sample data. It is because that the Out-of-Sample testing is in fact the fundamental basis of CWFO. First you have to understand the difference between In-Sample and Out-of-Sample historical data. When you backtest on historical data, it is always good to set apart a certain period for testing the results' validity. So if we have a 10-year data set of historical data, we split the data in a certain ratio. Everyone can choose the ratio at their individual discretion. There are many traders who use, for example, the ratio of 70% for In-Sample data and 30% for Out-of-Sample data. Thus if we have historical data covering 10 years, we split it into 2 parts:

70% = 7 years of In-Sample historical data

30% = 3 years of Out-of-Sample historical data

In Fig. 32 you can see the graphical division to In-Sample and Out-of-Sample data.



Fig. 32: In-Sample and Out-of-Sample testing

We have set the ratio of our In-Sample and Out-of-Sample data and now we backtest our trading system on the In-Sample data (the first seven years of data). If the backtesting on the In-Sample data with a certain parameter setting (we explained the parameter values in the previous chapter) gives stable and profitable results, we perform the same backtesting with the same parameter values on the Out-of-Sample data (the remaining three years). In case the trading system is stable and profitable on the Out-of-Sample data as well, we have validated its functionality on unknown data. In other words, the division of data into two samples is a very important step in evaluation of an automated trading system's (ATS) potential profitability because it allows us to test the system settings on an unknown data sample (Out-of-Sample) that was not used in building of the system. This is called the ATS

optimisation. One of the testing criteria can be, for example, the condition that the Out-of-Sample (OOS) results are equally profitable as the In-Sample (IS) results. Given that the In-Sample and Out-of-Sample data always have different percentages (e.g. 70% IS and 30% OOS, 60% IS and 40% OOS, or 80% IS and 20% OOS), we have to standardise the ATS's efficiency by calculating the profitability per day. Otherwise, for example, the 70% IS results will obviously be always better than the 30% OOS results. The result then show a certain efficiency percentage of the Out-of-Sample results (0% and more). If an OOS data efficiency is 55%, we can say that the ATS has a 55% performance on the OOS data in comparison with the IS data. In TradeStation you can find this percentage ratio under the Robustness Index value. If the Robustness Index reaches 120%, it means that the ATS is more efficient on the Out-of-Sample data. The exact calculation procedure of Robustness Index is not the subject of this chapter. You can find the calculation procedure in Chapter 24.

Let's add another tool to the In-Sample and Out-of-Sample testing – the ATS optimisation. In the previous chapter we have explained the optimisation on the example of an ATS based on crossing of two moving averages. Yet there are never enough examples. This time, I am going to combine the issue of parameter value optimisation with the In-Sample and Out-of-Sample data division.

We will call our trading system HIGHLOWCLOSE CONDITIONS. To make the example more illustrate, we will focus on the entry conditions only and we leave all the exit conditions aside. The entry condition for the Long side is: If the current today's Low is higher than the previous day's Close, then enter the market at the current High by the MARKET BUY order. Now consider a situation that we changed the previous-day-Close condition to a Close two days back, Close three days back, or Close 4 days back. Why should we be interested in trying such an optimisation? Obviously, our goal is always to find the most efficient ATS, i.e. the highest Robustness Index, because our premise is that these systems have the greatest profit potential for the future live trading. The point is that Out-of-Sample data simulate live trading, because it is an unknown data for our trading system. In order to be able to perform a trading system optimisation by In-Sample and Out-of-Sample data, we first have to set some testing criteria and methodology by which we will choose the best In-Sample parameter settings to be validated on Out-of-Sample data. This methodology for evaluation and selection of ATS parameter settings is called the Fitness Function. It may be, for example, the highest Profit Factor, Net Profit, Net Profit/Max Drawdown, etc. It is virtually impossible for discretionary traders to optimise their systems on In-Sample data because it is an incredibly time-consuming process. Yet for a trader using automated trading systems such an optimisation is definitely not an insolvable problem. The trader simply sets the Close

variable to X days back and then test various values of X (from 1 to any number of days). If the trader sets the variable X values from 1 to 10, TradeStation automatically performs all optimisation tests (i.e. 10 tests in this example). Optimisation tests showed that the best results of backtesting In-Sample data for the selected Fitness Function (in this example the Net Profit/Max Drawdown) has the setting "Close two days back" because it showed the highest profitability and the lowest drawdown of the 10 tests. Now we apply the HIGHLOWCLOSE CONDITIONS trading strategy with the Close two days back condition on the Out-of-Sample data. Out-of-Sample data substitutes the future data and gives us important information about whether the trading is likely to generate profits in live trading in the future. The metrics for this assessment is the already mentioned Robustness Index. In other words, if a trading system shows good results in terms of Fitness Function in time within In-Sample data backtesting and Out-of-Sample testing confirms the system's stable profitability, the trader gets a very good signal that the trading system may be **robust**. You can add the term robust to your trading glossary because you are going to meet with it very often. **Robust trading system** is a system that is able to adapt to changing market conditions and that has a potential of stable long-term profits. But be careful, robustness does not mean that the system may not have losing periods! The point is that losing periods do not exceed the level predicted and defined on the basis of backtesting. The combination of In-Sample and Out-of-Sample tests gives us a high probability of a successful identification of robust trading systems. Yet it would be foolish to think that all we need is a common IS and OOS data sample. We should definitely employ also another very complex and sophisticated tool available in the TradeStation platform –Cluster Walk Forward Optimisation (CWFO). CWFO performs a huge amount of In-Sample and Out-of-Sample tests with different In-Sample/Out-of-Sample data ratios (e.g. 80% IS and 20% OOS, or 70% IS and 30% OOS) for various time periods. CWFA is such a complex instrument that we will address it in detail in other chapters

In conclusion, let's have a look at two equity curves divided into In-Sample and Out-of-Sample data. In Fig. 33 you can see a promising Out-of-Sample test with potentially high Robustness Index and in Fig 34 you can see an Out-of-Sample test which clearly indicates that the ATS is not profitable on unknown data and therefore has a low Robustness Index.

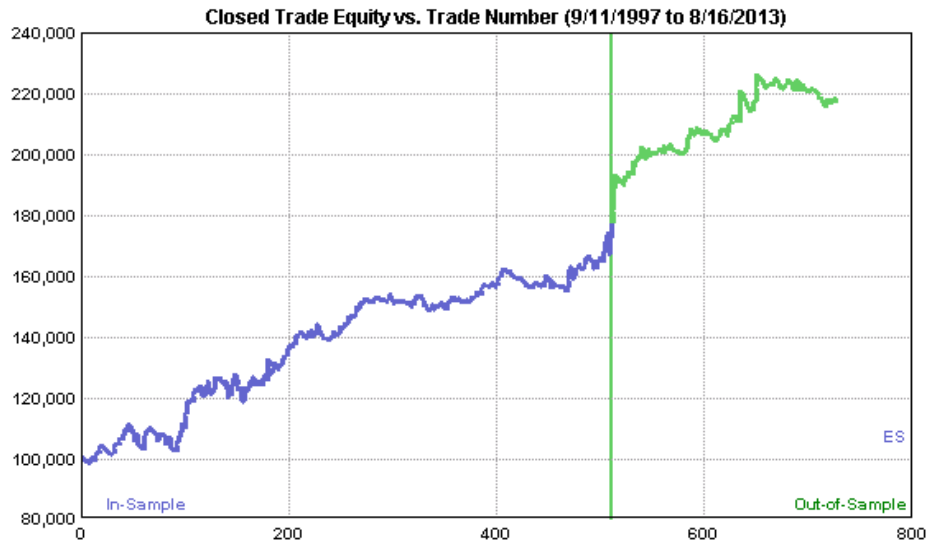


Fig. 33: In-Sample and Out-of-Sample test

The In-sample test (blue curve) of the trading strategy shows promising results because the equity curve tends to reach new and new peaks. In this case, the Out-of-Sample test (green curve) indicates that the ATS has the potential to generate profits on future data in live trading because on unknown data in the form of Out-of-Sample test it showed stability and correlation (similarity of distribution of profits and losses) with In-Sample data. Of course, we need to carry out further tests via the Cluster Walk Forward Analysis.

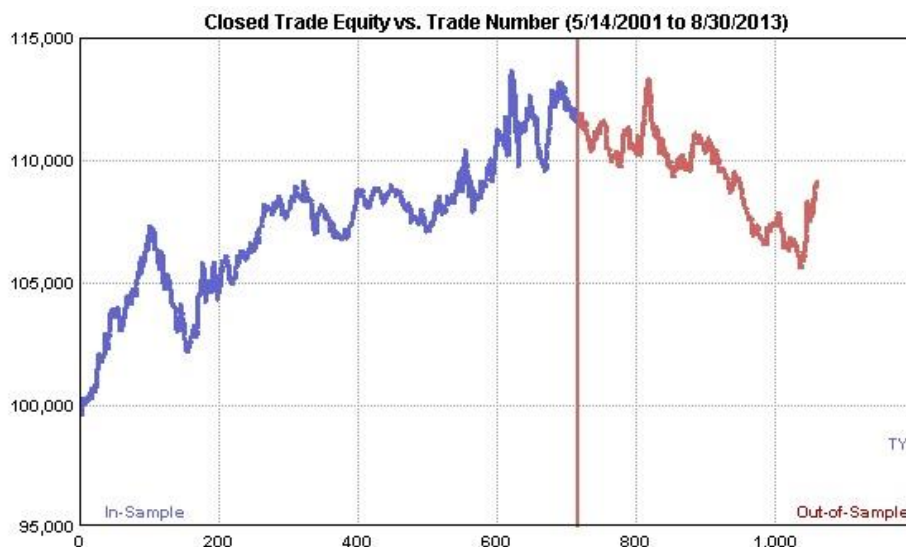


Fig. 34: In-Sample and Out-of-Sample test

The In-sample test (blue curve) of the ATS shows promising results because the equity curve tends to reach new and new peaks. However, the unsatisfactory Out-of-Sample test (red curve) has clearly indicated that the trading system has not the potential to generate profits on future data in live trading.

We explained the principle of In-Sample and Out-of-Sample testing combined with optimisation tests and the basic concepts relating to this topic, such as test criteria and Fitness Function. It is necessary that you get acquainted with these concepts as much as possible because we are going to use them within the Cluster Walk Forward optimisation in some of the following chapters.

22. Walk-Forward Analysis in TradeStation – Basic Tool for ATS Robustness Testing

TradeStation Walk Forward Optimizer (WFO) is an advanced tool for optimising automated trading systems (ATS) which automates the very complex multilevel process of statistical Walk Forward testing of ATS input parameters (Inputs). Where the possibilities of most classical optimisation tests end WFO enables performance of set of walk-forward analyses on optimised In-Sample historical data against the unknown and non-optimized Out-of-Sample historical data. The purpose of these tests is to simulate the unpredictability of live trading. The purpose of this simulation is to determine whether the ATS is likely to be profitable in live trading or not. We discussed a lot the principle of optimisation of input parameters and Out-of-Sample testing in the last and last but one chapters so we will not return to these issues.

We will concentrate solely on WFO which is a universal tool for ATS robustness testing using the TradeStation backtesting engine, EasyLanguage, and the advanced backtesting performance reports. In order to help you to fully understand this tool, we must first explain what Walk Forward testing means (Walk Forward tests are the backbone of the Walk Forward Analysis – WFA). To illustrate this concept we drew up the following scheme in which you can see a WFA containing a series of In-Sample and Out-of-Sample Sample historical data with individual Walk Forward tests (8 tests in total).



Fig. 35: Walk Forward Analysis

In Fig. 35 you can see an example of WFA for 12 months (each trader can set the historical period by himself, I often use historical data older than 10 years). This WFA includes 8 In-Sample parts (blue fields) and 8 Out-of-Sample parts (green fields). Thus from the fifth month we actually simulate live trading conditions on unknown data.

Specifically how do we proceed in the analysis?

The basic principle is very simple: We perform optimisation tests for all In-Sample runs and after identification of input parameter settings with the highest In-Sample Fitness Function (FF) we apply these settings to the Out-of-Sample data. If you are not acquainted enough with the issue of FF and optimisation testing, please read again the previous chapters which I have already referred to at the beginning.

It is always good to repeat everything on a simple example:

Imagine that you trade via an ATS with two input parameters (Inputs) for a longer and a shorter moving average. For the longer moving average we use for example the range from 50 to 100 with increments of 10 (i.e. 6 combinations) and for the shorter moving period 5-45 also with increments of 10 (i.e. 5 combinations). In total we get: $5 \times 6 = 30$ possible combinations of the two input parameters. Now imagine that our FF will be the highest Net Profit. In the first In-Sample run, i.e. the first to the fourth month, we found out that the highest net profit achieved the combination 5 for the shorter moving average and 60 for the longer moving average. We will therefore apply the parameter settings 5 and 60 to the first Out-of-Sample testing, i.e. the fifth month.

In the second In-Sample run, i.e. the second to the fifth month, we found out that the highest net profit achieved the combination 15 and 80. We will therefore apply the parameter settings 15 and 80 to the second Out-of-Sample testing, i.e. the sixth month.

We apply the same principle to the next runs (Walk Forward), up to the In-Sample run 8 with application on the last Out-of-Sample data, i.e. the 12th month.

This principle is called WFA "Rolling". The point is that we divide the historical data into various parts thanks to which we obtain more Out-of-Sample data for evaluating of the ATS's robustness. Then we evaluate the robustness potential by the predetermined test criteria. We will introduce these test criteria in some of the next chapters. To start off, we just say that the fundamental test criterion for us should be that the Out-of-Sample results were profitable enough and at least half as profitable as the best In-Sample optimised parameters.

All the above findings show that the WFA analysis is the most realistic simulation of the ATS behaviour in live trading. WFA helps us to answer these basic questions:

- Will the ATS be profitable even after optimisation (the aim of which is to find the most suitable input parameters for live trading)?
- What performance characteristics should the ATS have in order to have the potential to be profitable on unknown data in live trading?

-
- What impact on the ATS's performance will have a change in trend, volatility, or liquidity in the future?
 - How often should we re-optimize the system's input parameters (Inputs)?

A much more advanced tool that goes beyond the possibilities of instruments offered by most software trading platforms and which is also included in the TradeStation platform is the Cluster Walk Forward Analysis. It is a set of many Walk Forward analyses the principle of which we will explain in the next chapter.

23. Cluster Walk Forward Analysis in TradeStation (Advanced Tool for ATS Robustness Testing)

In the previous chapter we explained what the Walk Forward Analysis (WFA) is. Now we are going to add a much more complex analysis – the Cluster Walk Forward Analysis (CWFA). CWFA is a very sophisticated tool that helps us determine whether the automated trading system (ATS) is really robust, i.e. able to generate profits in live trading. CWFA contains a set of many WFAs with different Out-of-Sample periods expressed as percentages and as different numbers of runs. In Fig. 36 you can see a classic example of WFA performed in TradeStation with default settings. This CWFA includes 30 WFAs with different Out-of-Sample periods (rows) - specifically 10%, 15%, 20%, 25%, and 30% - and with different numbers of runs - specifically 5, 10, 15, 20, 25, and 30 (columns). In Fig. 36 you can see that I chose an example in which all 30 WFAs have successfully passed the analysis. In other words, the system met the test criteria (which we will explain later within our series on CWFA). In this case, the overall results for the given WFA include a box saying "PASS". Yet in practice we will rather meet with the variant that most of the 30 WFAs will not meet some of the test criteria and in such case we will see a box saying "FAILED" in the WFA's results – see fig. 37. This is because CWFA is a very demanding robustness test and only few ATSS are robust enough to meet the test criteria. In Fig. 37 you can see a CWFA the results of which clearly show that the ATS is not sufficiently robust for the selected market and timeframe. In contrast, Fig. 36 shows a perfect example of an ATS that is potentially very robust for the selected market and timeframe. It must be said that this is a fairly rare phenomenon. Searching for a truly robust ATOS by CWFA can often be likened to searching for a needle in a haystack (if it was easy then the algorithmic trading could be performed by anyone).

What is the threshold for a robust ATS according to CWFA results? I'm leaving that as an open topic which I will address on my portal AOstrading.cz in the near future.

OOS% \ Runs	5	10	15	20	25	30
10	PASS	PASS	PASS **	PASS	PASS	PASS
15	PASS	PASS **	PASS	PASS	PASS	PASS
20	PASS	PASS	PASS	PASS	PASS	PASS
25	PASS	PASS	PASS	PASS	PASS	PASS
30	PASS **	PASS	PASS	PASS	PASS	PASS

Fig. 36: Cluster Walk Forward Analysis comprising 30 Walk Forward Analyses all of which passed the demanding test criteria (PASS)

OOS% \ Runs	5	10	15	20	25	30
10	FAILED	PASS	FAILED	FAILED	FAILED	FAILED
15	FAILED	PASS	PASS	FAILED	FAILED	FAILED
20	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED
25	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED
30	FAILED	FAILED	PASS	FAILED	FAILED	FAILED

Fig. 27: Cluster Walk Forward Analysis comprising 30 Walk Forward Analyses 27 of which did not pass the demanding test criteria (FAILED)

Since we have introduced many new terms, we should graphically show (see Fig. 38) the individual links between Walk Forward tests, Walk Forward analysis, and Cluster Walk Forward analysis. You can see that CWFA includes many Walk Forward tests that are the basis of WFA.

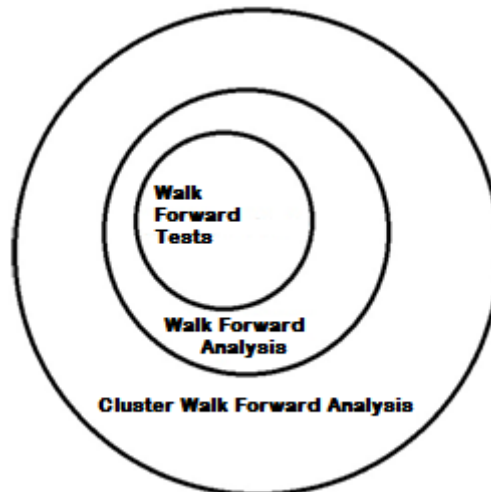


Fig. 38: The link between Walk Forward Tests, Walk Forward Analysis and Cluster Walk Forward Analysis

While one WFA can provide a preliminary and a very limited indication of an ATS's robustness (one successful WFA may be a coincidence), CWFA is able to prove or disprove (in great detail) the ATS's validity and robustness with a much higher degree of certainty (30 successful WFAs are not a coincidence but a valid statistical sample). CWFA, which is available in the TradeStation platform, is unique in its ability to execute a set of WFAs. It helps us to avoid the "Curve-Fitting" of results of the input parameter optimisation. Curve-Fitting is a phenomenon of overoptimisation and overvaluation of results. The problem is that after trying many different combinations we find a combination of input parameter values (Inputs) which captures the past trends very well and do not execute some crucial losing trades which would be executed with another input values. This combination of parameter

values generates wonderful and unique results (such as very high net profit with the minimum possible maximum drawdown). Unfortunately, such results are often totally accidental. This means that in live trading the system will most likely have very different results (often literally catastrophic). In order to eliminate Curve Fitting as much as possible we use CWFA which helps us to confirm that the good performance results for a selected In-Sample input parameter setting are not a coincidence. The ATS that succeeds in CWFA according to predetermined test criteria will most likely withstand the constantly changing market conditions thanks to its natural qualities and stability. In Fig. 39 you can see the individual test criteria that we use in CWFA in TradeStation.

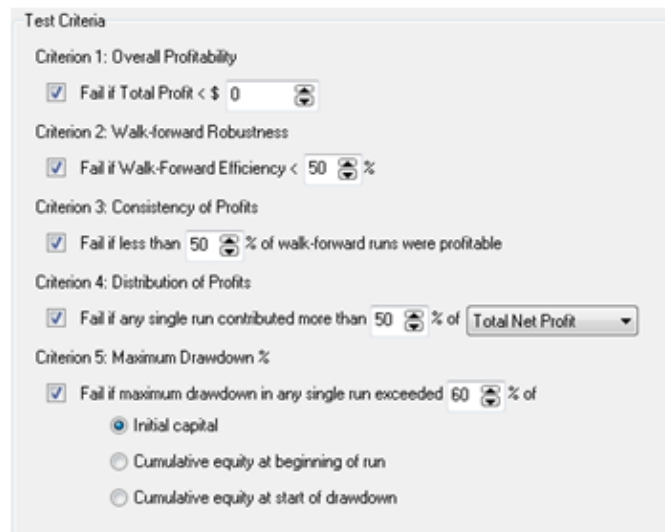


Fig. 39: Cluster Walk Forward Analysis Test Criteria in TradeStation

We have explained what CWFA is and showed examples of ATS that passed (PASS) and failed (FAILED) the demanding test criteria of individual WFAs. We have also explained the connection of Walk Forward tests, WFA, and CWFA. In the next chapter we will focus on the individual test criteria that must be met in order for the ATS to pass the individual WFA robustness tests within CWFA.

24. Testing Criteria of Cluster Walk Forward Analysis in TradeStation

This chapter's content follows the previous chapter in which we explained what the Cluster Walk Forward analysis (CWFA) is. Let's recall that in the ideal case we are looking for a CWFA where all 30 Walk Forward analyses (WFA) pass the defined test criteria. In such case, the overall results for the given WFA include a box saying "PASS" (see Fig. 40). If the test criteria are not met, the box for this WFA says "FAILED".

OOS% \ Runs	5	10	15	20	25	30
10	PASS	PASS	PASS **	PASS	PASS	PASS
15	PASS	PASS **	PASS	PASS	PASS	PASS
20	PASS	PASS	PASS	PASS	PASS	PASS
25	PASS	PASS	PASS	PASS	PASS	PASS
30	PASS **	PASS	PASS	PASS	PASS	PASS

Fig. 40: Cluster Walk Forward Analysis comprising 30 Walk Forward Analyses all of which passed the demanding test criteria (PASS)

In this chapter we will introduce the various test criteria that must be met within a WFA for the different number of runs and the Out-of-Sample (OOS) percentage in order to obtain the "PASS" result (box). There are five CWFA test criteria in TradeStation:

Test criterion no. 1: Overall Profitability

The default setting of CWFA is that the overall profitability of all OOS runs must be higher than 0. In Fig. 41 you can see that in total the selected ATS is profitable on OOS.



Fig. 41: Test criterion - overall profitability

Test criterion no. 2: Walk Forward Robustness

Walk Forward Efficiency is based on the "Robustness Index" which represents and compares the Out-of-Sample (OOS) and In-Sample (IS) results. In essence, it is an indicator of the trading system's quality. Robustness Index is calculated as follows:

$$\text{Robustness Index} = (\text{OOS profit} * 365 / \text{number of OOS days}) / (\text{IS profit} * 365) / \text{number of IS days}$$

The construction of Robustness Index shows that it compares the efficiency of OOS profits against IS profits. Since the time periods of IS and OOS differ (OOSs are shorter in CWFA), it is necessary to standardise the generated profits and therefore we recalculate them to per-day values. The test criteria include the requirement that Robustness Index for each Walk Forward analyse was at least 50%. This is the default setting of CWFA in TradeStation. Beginners may naturally ask the question: "Only 50%? Isn't it too little?" In my opinion it is not. After including commissions and slippage into the ATS's performance calculation I consider 50% for a WFA a realistic estimate. We must keep in mind that we search for the best input parameter setting within the IS period according to the selected Fitness Function (FF). Sometimes, a WFA's Robustness Index may exceed 100%. In such case we know that the OOS run was more profitable than the IS run in the same IS/OOS-days ratio. In Fig. 42 you can see the result of Cluster Walk Forward Analysis for 30 WFAs. You can see that the "Higher Average Cluster" chose the WFA 9 period in the 3 x 3 format with the highest average Robustness index's value of 88.4%. This is a very high value which implies a really highly robust ATS. Matrix Average then has the value of 78.2% which represents an average Robustness Index value for all 30 WFAs. Again, 78.2% is a very optimistic value. This CWFA was applied to the Intraday Breakout ATS which shows a high robustness on all markets with equity indices. Advanced traders will maybe find it interesting that the system had stable and symmetrical results both for Long and Short side.

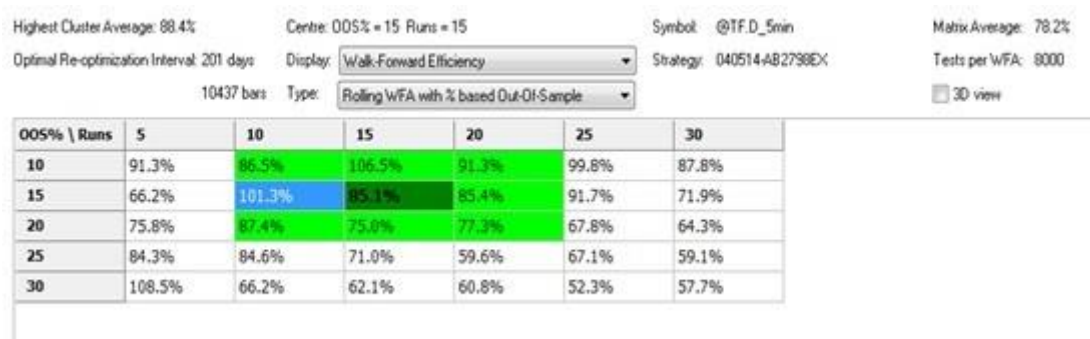


Fig. 42: Results of Walk Forward Efficiency within Cluster Walk Forward Analysis

Test criterion no. 3: Consistency of Profits

The test criterion is that each Walk Forward analysis must show the consistency of profits higher than 50%. In other words, we want more than half of the runs to be profitable. When looking at Fig. 42, all Walk Forward analyses easily complied with this requirement. You can see 100% in the selected blue box which means that all 10 OOS runs were profitable.

Test criterion no. 4: Distribution of Profits

The default setting of this criterion in TradeStation is that a single run may not contribute by more than 50% to the overall profit of all OOS runs. The logic behind this is clear. Of course, we do not want to use trading systems that do not bring stable profits throughout the testing period. The fact that one run contributes by 50% to the overall profitability is actually negative since such a run may be only a coincidence and may not repeat again. In Fig. 43 you can see that the Out-of-Sample run no. 4 (OOS4) brought the profit of \$10,229 while the total profit from all runs was \$17,338. In Fig. 44 you can see the Walk Forward Summary, which is one of the tabs that can be displayed in TradeStation's CWFA. In this tab you can find, among other important information, the exact values of profits/losses from individual WFA runs.



Fig. 43: Cluster Walk Forward Analysis and the Distribution of Profits testing criterion

Symbol: @TYD_15min Strategy: 030315-TYD-TRUERNGANG Rolling Walk-Forward Optimization (Out-Of-Sample = 25%) | All trades Initial capital: \$ 200000

Run	Inputs	Period	Days	Bars	NetProfit	MaxDD	MaxDD%	#Trades	%Profitable	Avg W/L	AvgTrd	StdDev	h
1	12 60 4 56 1 1 1 100	2005/11/02 - 2006/10/16	348	6,298	1,049.38	-2,492.50	1.25%	53	50.94%	1.10	19.80	366.65	
2	14 60 3.80 61 1 1 1 100	2006/10/16 - 2007/09/17	335	6,298	-710.63	-3,065.63	1.53%	41	48.78%	0.93	-17.33	387.19	
3	10 90 2.20 31 1 1 1 100	2007/09/21 - 2008/08/26	340	6,298	5,764.38	-2,201.88	1.10%	36	55.56%	1.73	160.12	532.01	
4	10 80 2.40 51 1 1 1 100	2008/08/26 - 2009/06/03	341	6,298	10,229.38	-4,156.88	2.08%	44	59.09%	1.31	232.49	976.79	
5	18 70 4.60 31 1 1 1 100	2009/08/05 - 2010/07/09	339	6,298	4,797.50	-2,201.25	1.10%	57	57.89%	1.11	84.17	479.12	
6	18 70 2.20 46 1 1 1 100	2010/07/12 - 2011/06/09	332	6,298	1,871.88	-2,881.88	1.44%	40	52.50%	1.11	-46.80	528.89	
7	18 70 4.60 31 1 1 1 100	2011/06/15 - 2012/05/17	337	6,298	381.88	-3,942.50	1.97%	52	59.62%	0.70	7.34	511.62	
8	12 50 4.20 51 1 1 1 100	2012/05/17 - 2013/04/12	333	6,298	235.00	-2,263.75	1.13%	57	52.63%	0.92	4.12	489.87	
9	18 20 2.20 46 1 1 1 100	2013/04/17 - 2014/03/25	342	6,298	-5,758.75	-6,181.88	3.09%	27	37.04%	0.65	-213.29	556.54	
10	8 50 4.40 31 1 1 1 100	2014/03/25 - 2015/03/02	342	6,298	-521.25	-2,176.88	1.09%	62	51.61%	0.88	-8.41	306.58	
TOTAL			3,389	62,980	17,338.75			469					
Largest					10,229.38	-6,181.88	3.09%	62	59.62%	1.73	232.49	976.79	
Average					1,733.88	-3,156.50	1.58%	47	52.57%	1.04	31.58	513.52	
Smallest					-5,758.75	-2,176.88	1.09%	27	37.04%	0.65	-213.29	306.58	
Annualized P/L					1,867.41								
Walk-Forward Efficiency					29.33%								

Fig. 44: Walk Forward Summary (Out-of-Sample)

Test criterion no. 5: Maximum Drawdown in %

The last test criterion is the maximum tolerable drawdown. There are actually three possible settings (see Fig. 45).

Criterion 5: Maximum Drawdown %

Fail if maximum drawdown in any single run exceeded 60 % of

Initial capital

Cumulative equity at beginning of run

Cumulative equity at start of drawdown

Fig. 45: Maximum Drawdown test criterion setting

- The first possibility is that the maximum drawdown is exceeded in any one of the runs by 60% of the initial capital. The initial capital value is set in the test criteria settings. Thus, if we had a capital of \$20,000, the maximum drawdown for each WFA should not exceed \$12,000.
- The second possibility is that the maximum drawdown exceeds the actual cumulative profit in any of the runs by 60%. For example, the tested system generated a net profit of \$40,000 before the Out-of-Sample run no. 8. The maximum drawdown for the selected WFA should not therefore exceed \$24,000.
- The third possibility is that the maximum drawdown exceeds the cumulative profit before the beginning of the drawdown by 60%. For example, the net profit in the middle of the 8th Out-of-Sample run was \$80,000. Thus the maximum drawdown would be \$48,000.

In order to have a quality CWFA we need to perform at least 5 WFA runs so that we avoid the risk of accidental and statistically invalid results. On the other hand, if the number of runs is absurdly high, we face the risk that we will have only few trades in individual Out-of-Sample and thus we get statistically invalid results. All these aspects must be taken into account when evaluating the CWFA results.

To sum it up, in this chapter you learned what testing criteria must a trading system meet within CWFA so that we can consider it robust for the selected number of runs and Out-of-Sample %.

25. The Biggest Myth about Algorithmic Trading and Automated Trading System (ATS)

In this chapter I would like to focus on one of the biggest myths and misinformation about algorithmic trading that exists among novice traders. I am in contact with lots of beginners who are focused on discretionary trading and it is amazing how often they demonise automated trading systems (ATS). Yet I dare say that they are totally unjustified. If I paraphrase these discretionary traders, their distrust in algorithmic trading is based on the opinion that:

"ATS can never replace human judgement and they have no human feelings and therefore they cannot work."

I, on the contrary, see the whole thing quite differently: Human judgements as such may be very a dangerous phenomenon in exchange trading in the long term! It is because the trader starts to feel that he can see formations, repeating situation, etc. in markets. In short, he is convinced that can already predict what will happen in the future, because he "got a feel" for markets. **But how can you measure feeling or judgement?** It is indisputable that one of the prerequisites for success of a company oriented on their product's or service's quality or customer satisfaction is the **decision making based on facts**. In order to be able to define the facts we must be able to quantify and measure them. This means that, for example, that it is not enough to conclude that we have a quality product, but there also must be some metrics (e.g. the correct length and width of a certain car component) that confirms or refutes the hypothesis about the product's quality by testing certain criteria. And if we want to be systematic in our trading, we must use the same approach to our trading systems. We must be able to confirm or refute the ATS's performance by the use of predefined testing criteria, whether via a robustness tests or other analyses. The problem of discretionary traders is that robustness tests and other computationally-demanding processes which are virtually unavailable to them, as we will explain later. **It is because discretionary traders have a fundamental disadvantage in these crucial aspects:**

1. They cannot perform relevant backtesting

Try to prepare an Excel spreadsheet and record individual trades in it (by manually going through the market candle after candle, or bar after bar, for the given timeframe). Firstly, it will be an incredibly large amount of work and, secondly, you will never obtain a relevant backtest. It is scientifically proven that people tend to distort backtest results. Many local and foreign lecturers who are fierce advocates of discretionary trading recommend to worsen discretionary backtest results by 30-40%. In my opinion this is totally incomprehensible and

ungraspable argument. Where did those 30 to 40% come from? Every person is so individual that everybody can perform the same backtest in a completely different way. In contrast, when you have a programmed algorithm that defines the precise entry and exit conditions of the trading system, you do not have any room for deviations. You can quickly and accurately see if your trading system may potentially have some statistical edge and if it is worth your time and effort to further analyse this system's behaviour by various robustness tests.

2. They cannot perform robustness tests

Robustness tests are so computationally demanding processes that they are virtually beyond possibilities of discretionary traders. A shining example of the computational complexity is the Cluster Walk Forward Analysis that is available in TradeStation. Yet robustness tests are the essential prerequisite for verification of a trading system's potential profitability. This concept is often misunderstood and fatally underestimated by discretionary or novice traders. Thanks to my profession I have the opportunity to meet with owners and employees of various hedge funds. These professionals quite strictly advocate the view that it is actually not possible to neglect algorithmic trading these days. And be sure that one of the main reasons is the possibility to perform a tremendous amount of robustness tests of individual ATS. Therefore, my advice to you is: Don't be foolish and do not think that a manual backtest on a couple of months of historical data can be of any relevance. Remember against whom you trade. Everyone on the exchange who speculates on the underlying asset's price increase or decrease are your opponents and if they consistently use better weapons than you, it is only a matter of time when you will be defeated in this relentless battle. Do not believe illusions and search what specific weapons in the form of trading systems' robustness testing do your opponents use.

3. They have a huge disadvantage regarding proper execution of trades which relates to the negative psychology of trading

If you have never manually executed any exchange trade, you may not consider this argument important or justified enough. But try to manually open a position in any market and watch how you are getting into attractive profits and then suddenly end up in even higher open loss. Markets are very dynamic and they tend to unexpectedly and rapidly change. And believe me, it can be very frustrating to emotionally suffer during individual trades. In algorithmic trading and ATS trading this problem is completely irrelevant. **A programmed algorithm executes trades for you and you actually do not have to even sit at your computer.** As for me, I rented a virtual server close to the exchange so that my trades were executed as precisely and quickly as possible and at the desired price. Yet do not think that

when you trade via ATS you will not deal with any negative psychological aspects. Within your long-term trading you will have to go through periods when your ATS will stagnate or have series of losing trades. The key is to have precisely defined and quantified these aspects:

- How long this losing period may be and
- what is the theoretically largest decline (maximum % drawdown).

Needless to say that without precise calculations, robustness tests, and Monte Carlo analyses you will not be able to obtain these important statistics about the nature of your ATS. And as I mentioned, the only way how to obtain these complex and challenging calculations is a defined and programmed algorithm that substantially accelerates historical backtests and the related analyses and gives us relevant results.

I tried to rebut the argument of many discretionary traders that the algorithmic trading cannot work because it is not capable of human judgement. I believe that this argument is unfounded and can be very dangerous for novice traders who cannot orient themselves enough in this issue. I am convinced that the trading should be approached as any other scientific field. In science, if you want to confirm or refute a hypothesis, you must be able to quantify and measure its subject-matter. In trading, our primary aim is to confirm or refute the hypothesis that our ATS has or has not a statistical edge. A mere manual backtest of several months of historical data is unfortunately not enough. We need to take many years of quality historical data and verify whether the ATS could have a statistical edge. If we see the profit potential, our work begins – we have to perform a lot of analyses and robustness tests of the trading system. The fact is that this area is beyond the capabilities of discretionary traders who backtest their trading systems manually. And maybe that's why they tend to demonise algorithmic trading and claim that it does not work. One gets mostly scared by what one does not understand or cannot do. **I perceive algorithmic trading as a great tool for passive capital appreciation by tens of percent. It can help you to regularly appreciate your savings regardless of the economic cycle.**

26. How Beginners Lose Their Illusions

There are many publications that over and over again discuss which **psychological aspects of exchange trading** one needs to cope with in order to be able to generate **long-term and stable profits by trading**. Even many seminars devoted to this issue are held around the world and, of course, there are also countless books. Millions of traders know that they need to work on their discipline. They keep various diaries in which they record their feelings and every detail of their strategies and individual trading sessions. Every day they try to "iron out the kinks" so that they do not miss any detail that could rob them of the delightful feeling of a long-term trading success. In books you can read that the mastered trading psychology contributes to the success in trading by 70%, 10% are good entry and exit rules, and the remaining 20% is thanks to the sophisticated money management. However, this should be taken with caution.

In my opinion, beginners should not take these publications too seriously and rather focus on a detailed and long-term study of statistical laws of trading, market behaviour, building of own trading strategies and approaches, and so on. Yet I do not deny that if I had never studied trading psychology I wouldn't be probably mentally prepared to properly employ my skills in live markets. As I see it a **mastered the psychology of trading means especially a long-term persistence and the ability to believe in yourself** and in your thoroughly tested and backtested trading strategy – or in your knowledge gained through a properly targeted long-term study. I have been trading live for quite a few months and I must say that I'm constantly reaching new and new profits. My capital is growing, but it also has its inevitable downturns, yes, I mean the typical losses (drawdowns) that inherently belong to trading. They are its inseparable part and only those who believe in their hard-won know-how can handle (especially mentally) these grim periods of losses. Despite the fact that you can find countless articles and tips how to cope with losses in literature and on the Internet, I would like to outline also my personal view on the matter. It is because each of us is unique and our experiences can help the others to move forward. That's why I focused on the long-term perspective of this issue on my website AOStrading.cz. You can find here a series of my articles in which I addressed the individual aspects of trading psychology. I sincerely hope that these ideas will help you to your personal success, inner satisfaction, and trading profits.

In the first part of a large series on trading psychology we are going to focus on one phenomenon that affects many beginners. The common scenario is this: The beginner learns about trading, he reads a few articles or a book, attends some seminar about trading basics and within three months, or even sooner, he opens a trading account and starts to trade live. What excitement! To his own detriment, his first few trades are accidentally profitable and he

earns good money. At this moment his ego starts to speak and a problem arises. The euphoria brings the beginner to a belief that trading is actually very simple and that he is just the one who is destined for success in the markets. Then the first series of losses comes and he starts to panic, he wants his money back! He starts to trade excessively and with increasing number of contracts. His indiscipline then causes that he wipes out his trading account. And then he ruefully leaves the scene and pulls the curtain. I would compare this to a footballer who manages to score three times during his first match in a new team. His character traits include pride, arrogance, and overestimation of own abilities. Soon he stops working on himself, he does not train and exercise regularly. He does not realise that he is actually at the beginning of a long and demanding journey. Then the competition sweeps him away and the footballer ends up sitting on the bench. This simplified example shows us three types of traders. Two of them are lost and they lose their money because they do not respect the basic rules without which nobody can succeed in trading. I have met with these traders many times. As an example of the third type of trader I chose myself. I am going to subjectively evaluate how I have been approaching trading for years, what mistakes I made and what I did (in my opinion) rightly because after

Trader Type 1 – Unprepared gambler

The example is a friend of mine who was engaged in trading. I had absolutely no idea about this until one day when we had a drink and he started to speak about his trading. We were in a totally different situation. He had already opened and wiped out his trading account. The first indication of his unpreparedness was the fact that he opened his trading account at an unnamed Czech bank which has incredibly high commissions (fees for execution of trades). There are much cheaper and more expedient brokers with a better service! Another mess was the fact that he borrowed approximately \$10,000 from his friend, which was really a major problem. The basic prerequisite for success in trading, and perhaps the most fundamental one, is the **self-discipline**. Can you imagine having your **emotions under control** if you trade in such a competitive and unforgiving environment as futures exchange with a borrowed capital? Another aspect of my friend's failure was an insufficient backtest. He said that he performed **backtesting**, but the question is to what extent. And in case he really **backtested** his trading strategy, the question is to what extent he adhered to it in real trading (considering the borrowed money). I do not know exactly how his career in trading continues, we haven't been in touch for a long time, yet I know that nobody is going to return him those \$10,000 and I dare say that he lost it due to his absolute unpreparedness and lack of know-how.

What can you learn from this deterrent example of the Trader Type 1?

- **If you are a beginner do not ever trade with borrowed capital.** If you are not able to earn at least \$10,000 as the initial capital, you should consider whether trading is really for you.
- I read a beautiful sentence in one book the title of which I unfortunately do not remember. I paraphrase: **"The money is the only value you can afford to lose"**. I have always adhered to this motto. Nothing can give us back our health, relationships, or moments in our lives. But why should we get into existential problems by trading? It would be a nonsense to save up several thousand dollars, leave our job and start trading and think everything will be just fine because are going to earn exorbitant sums. This does not work in trading nor in any other business or commercial activity. From my perspective, the essential aspect of success is a stable income. **You must perceive the money you can earn in markets as money that you actually do not need. When you lose it the world will not end, you'll be able to make a living for yourself and for your family, pay bills, and so on.** If you see your trading capital as money that you want to appreciate and that you actually do not need, then your emotional equilibrium gets at much higher level and your chances of capital appreciation proportionally increase!

Trader Type 2 – Non-systematic suicide

A friend of one friend of mine was a typical example of the non-systematic suicide. He had a huge monitor on his table and he was wearing earphones in which he was listening instructions of some "guru-trader". Needless to say that it was a paid service when the "guru" traded live and my friend was watching the price chart with technical analysis and commentaries on the "guru's" activities on his monitor. I did not want to disparage this study method of his. After all, everybody is different and has different preferences. After some time I met him and asked him about his trading results. I immediately realised that he definitely was not profiting. The same situation as in the previous case of the "wannabe" trader who also lost some ... thousand dollars. Also this trader, like many others, began to trade live without any training and the necessary knowledge. His knowledge on trading were absolutely inadequate. He did not backtest his trading "strategy" on historical data because in his words "it was not possible". But can you speak about a trading system when you cannot clearly define its entry and exit conditions? Not so long ago, I met this friend of mine again. Unfortunately, he is still a beginner because he does not work on improving of his trading approach and he still has not really adopted the term "backtest".

What can we learn from this deterrent example?

- Do not neglect **the most basic component of trading – a quality preparation** the inherent part of which is **backtesting of your trading system** and the related **robustness testing**.
- Learn everything about trading. Read publications and articles. Choose quality courses that will bring new and valuable knowledge. All in all, if you want to succeed in trading you must love it, study it with enthusiasm and **be always open to new knowledge**. Remember that trading, like any other field, is continuously evolving. It is definitely not advisable to rest on our laurels in this tough environment of relentless numbers!

I, [Petr](#) consider myself a typical example of such continually studying trader. I started to study trading during my university studies. I got to it through a friend of mine who started to study the issue of exchange trading a few months before me. Thanks to the knowledge of English (the vast majority of materials related to trading is in English) I started to read my first books and foreign articles about trading and I got really enthralled by this entire field. I felt since the beginning that there is a huge potential in trading and that it could suit my nature because I perceived it (and I'm still perceiving it) as a mixture of statistics, probability theory, psychology, and creativity (by creativity I mean building of your own trading systems), i.e. topics that have always appealed to me. Very soon I had a software platform (Sierra Chart in particular) installed in my notebook and started with my first manual backtest.

The following year and a half, or more, I was studying price charts and I was trying to build my own trading systems. I admit that this period may seem a bit long, but I was limited by the fact that I did not have a sufficient initial capital to open a trading account with which I could start a serious live trading. Today, I am convinced that if I had had the sufficient capital, I would have probably lost it very quickly because I definitely didn't have a proper know-how for live trading. I did not know the important aspects of trading systems' robustness testing.

Over time I was finding new and new books on various trading-related topics – from the psychology of trading to Money Management. In terms of backtesting, however, I was only marking time. It is because the manual backtesting proved to be very time-consuming yet inefficient process. A major turning point in my trading career came when I began to intensively study automated trading systems (ATS). Everything about trading started to get clearer contours for me. I learned many new things and employed my existing knowledge for programming codes. My marking time suddenly changed to a sharp shift. I spent more than a year and a half by preparations for live trading via ATS. Then I started to trade my ATS live.

But be careful! Before I started to trade live I had been putting aside part of my salary each month so I saved up a sufficient initial capital that allowed me to survive the inevitable drawdowns. Of course, I was also able to cope with drawdowns thanks to my studies of psychology of trading. In fact, the key to my success is the ability to think in probabilities. In other words, I can keep in mind that if I have a sufficiently funded account, I can overcome a series of losing trades.

What can we learn from this example?

They say that the man should not look back, but if I had to say what the biggest mistake was that I made during my trading career, it would certainly be my indecisiveness and fear of learning new things. I subconsciously deliberately ignored and condemned the incredible computing possibilities associated with robustness testing of ATS, although I intuitively felt that this approach has a great potential. As they say, everything has its time, but now I am convinced that I should have been more open to this sphere and not be afraid of new things. Everything new and innovative must first beat human indolence. I recommend you to think in the same way and if your intuition suggests that you see a new direction in trading that can shift you forward, do not hesitate to seize this opportunity.

We have explained that in trading, and also in life, nothing can be speeded up and it necessary to honestly study, like in any other field. We showed three types of traders, two of which unfortunately lost their capital. It's up to you whether you can learn not only from yours mistakes, but also mistakes of others and find the best way to the longed-for and regular profits. Before you start trading live you should be sure that you have done the maximum for your success. None of the top athletes became a professional from day to day. In trading, you can easily execute trades whenever you please. However, if you do not want to trade only on the basis of your "intuition" and without proven robust systems, I recommend you an easier way to lose your money – visit some casino.

27. Psychology of a Trader Using ATS

I noticed that some traders who are preparing themselves for live trading and focus solely on trading via intraday automated trading systems (ATS) tend to underestimate the psychological aspects of this style of trading. This underestimation has its logic – these traders learned from other experienced traders how to eliminate mistakes through automated execution of trading orders and emotions that do not belong to trading. Of course, this can be largely true, on the other hand, I know from my own experience that every trader will experience difficult moments in trading, sooner or later.

My style of trading are automated intraday trend-following trading systems. Anyone who is familiar with the concept of Trend-Following systems clearly knows which psychological "traps" should be expected. If you are trading via intraday ATS, there is nothing easier than to let your automated trading systems run and in the evening, after the end of the main trading session check the trading result for the day. Do not be foolish and do not forget that even ATS have their limits in terms of their reliability. There may be situations where, for example, you will have problems with your connection to your virtual or dedicated server, or your broker will have a problem with the Data-Feed. Although these are relatively rare situations, they can occur now and then. Thus I rather check my automated live trading at least 2 times a day – at the time of opening and closing of the main trading session in the futures market. Of course, it would be ideal for me if I needed to check my trading results once a month. In this case I would be able to partially avoid negative emotions connected with, for example, series of losing trades. Yet this does not mean that a losing month cannot come now and then. On the contrary, it is a natural phenomenon. However, you can save a lot of unnecessary frustration when your trading system gets into such a losing period. If I learned something during my live trading, it is without doubt patience and self-discipline. In my opinion, it is reasonable to make conclusions regarding the trading results within a one year period. On the other hand, even the best hedge funds ever have sometimes a losing year. Trading is like any other business, there may be poor years. It's about being profitable in the long run so you can fulfil your dreams of financial independence. I have met many traders who could not bear the psychological pressure and stopped trading after what they got to their first significant drawdown. And this was despite the fact that their trading systems suffered much higher drawdowns within the historical backtesting. How depressing it must be then for these traders when they see that they could sharply appreciate their trading accounts a few months later if they persevered with trading. These traders then often get into a vicious circle and make another unplanned impulsive decisions, for example in the form of an aggressive increasing of position sizing. They think: "I lost my profits because I stopped trading, so I will raise my position sizing now because now I know that my trading system is

able to generate profits on live data." Of course, this is the moment when another natural drawdown period usually comes. And this time it brings a fatal loss because the trader did not have a large enough trading account for so aggressive position sizing. I hear about such mistakes every day. Yet they still appear in less psychologically resilient traders. It seems that that setting yourself free from your own ego and greed is perhaps the hardest task in trading. Always keep in mind that there is no "me versus the market" in exchange trading. If your trading system is properly validated by robustness testing on historical data and also generates profits on live data within the simulated trading, you have the most powerful instrument in trading - the profitability probability is on your side.

In this chapter we focused on the pitfalls of negative psychological aspects that appear ATS-based trading. Do not think that by trading via ATS you completely eliminate the pitfalls related to the psychology of trading and the inevitable losing periods! If you fully understand and accept that in trading:

- a losing trade, if it is in line with your trading system, is a good trade,
- a winning trade, which we exited prematurely, is a bad trade,
- one profitable or losing trade does not mean anything but a hundred trades already have some informative value,
- everything is about robustness of the trading system and probability,

then you have a good chance of a long-term and well-deserved financial success. Good luck!

28. 10 Golden Rules of a Successful Trading

When you want to follow the rules of a successful trading which are listed below, you must have not only the self-discipline and discipline, but also the faith in yourself. This may seem like an empty phrase and cliché. But I swear that I would sign under these 10 golden rules with my blood. It is because I know how difficult it is to observe them. Yet every day I spare no effort to follow all of them. I know that if I breach any of them, the consequences may be worse than it may seem at first sight. Consider yourself whether you want to observe these rules. As for me, I know that it is thanks to them that I'm still "in the game" of trading. So which the golden rules of a successful trading are?

1. Never trade with a borrowed capital

The biggest mistake a novice trader may make is that he borrows the capital for trading from a bank or a private entity. Such an entity may be, for example, a person with extremely good persuasive skills. For example, one of my friends who was honestly preparing for trading for several years was unfortunately unable to earn a large enough capital for trading futures on stock indices. Due his impatience he now faces a lawsuit because his creditor already lost patience. You can imagine what will follow. Thus do not make the same mistake and start trading with your own capital. If you are not able to earn at least \$10,000, which it is deemed reasonable, or the minimum amount for trading futures on stock indices via one automatic trading system (ATS), then you should really consider whether trading is the right thing for you that can bring you decent profits.

2. At the beginning, keep your main income and perceive trading just as a potential extra income

As traders you can have a big problem, if you perceive trading as your potentially main source of income right from the beginning. In other words: Even though you might not admit it now, it is really not easy to experience drawdowns which can easily last for several months. Moreover from what financial resources do you think you will live in the first year of your trading if you do not have reserves? Your trading account must always be sufficiently capitalised! If you have income from your other business or employment, you have a great chance to mentally cope with the inevitable drawdown periods. That is a fact. Most successful traders with whom I have met so far started to trade Full-Time after three to five years. And in my opinion, this is absolutely right. Do you know any top athlete or a lawyer who became a leader in their field after one year? Remember that trading is a profession like any other. Everything has its time and you must be prepared for a tough journey. The more

you will appreciate the free time which the amazing career of a professional trader will bring you when exchange trading becomes your main profession.

3. Be sure that you are going to trade a trading system that has been successfully validated by robustness tests and papertrading (simulated trading)

This is perhaps the most important aspect that can never be underestimated if you are serious about trading. You need to have a robust trading system that will guarantee you a long and successful trading. If you're not sure whether you have such a trading system, there is nothing easier than signing up for our [group or individual course Buildings and optimisation of robust automated trading systems](#). Here you will learn which robustness tests are necessary and you will also get acquainted with my trading systems which I have been successfully using in live trading for a long time.

4. Always have your trading account sufficiently capitalised, be very conservative at the beginning and trade with moderation

In English-speaking countries they say "No risk, no fun". I agree, but only to a certain extent. In trading, an uncontrolled risk is the road to hell. It is unbelievable how many novice traders repeat the same mistake. At the beginning of their live trading they often experience a period in which their trades go extremely well. What happens then? Their ego grows to gargantuan proportions and they start with an aggressive Position Sizing in the form of a disproportionate increasing of their trading positions. And what usually follows? Margin Call (i.e. empty trading account) within a few weeks. If you use a fixed stop-loss, try to risk at most 1-2% of your trading account. If you use variable stop-loss, count with an average loss per trade (Average Loss) as a baseline for determining the maximum risk percentage for your trading account. Also here, the maximum reasonable level is 1- 2%.

5. Evaluate your trading results quarterly, semi-annually, or yearly (which is the best choice). Decide about the period on the basis of your trading style

If you trade intraday and you open and close several positions within one day and thus you may execute more than a hundred trades per month, you should check your results (and ideally be in black numbers) every month. It is because you execute large amounts of trades and you get a statistically relevant indication of your trading system's profitability after just a few weeks. But if you, for example, trade intraday and your system opens and closes a position on average 3 times a week, it is obvious that you can make relevant conclusions half-yearly, or ideally yearly. It can be difficult to follow this rule, but if you judged the success

of your trading system prematurely on the basis of several losing weeks in a row, your psyche gets quickly disrupted which makes you more prone to premature conclusions that could negatively affect your trading plan. Then you start to trade a completely different trading system than the one you have backtested and a big problem appears because all the robustness tests lose their significance.

6. Do not get discouraged by short-term losing periods

Do not listen to your wife, husband, girlfriend, friend, family member, or friends when a short series of losing trades comes and your system gets into a drawdown. Is it you or your relatives or friends who has been honestly studying trading for many months or years? You have to keep in mind that they know very little about trading compared to you. Many novice traders (and believe me that I wasn't different) make the fundamental mistake that they speak about trading with the people around them. If they are successful, these traders talk about trading with a great passion. But when a drawdown comes they are suddenly very silent. When their partners or friends ask about their trading after some time and they say that they are in a drawdown, the people who know nothing about the natural behaviour of trading systems in the market can really prey the traders' mind. They begin to get on a wrong way and ask themselves a lot of unnecessary questions like: "Can I really make money by trading?" Yet a correctly asked question at that point should rather be: "Despite the current drawdown, does my trading system behave in accordance with my backtests and robustness tests?" Believe me that nobody around you will ask you such a question. Therefore, keep your temporary successes for yourselves and speak only about your account's annual appreciations. Your trading psychology will only strengthen because only you are the expert who can rightly assess the success or failure of your trading system.

7. Keep in mind that your worst drawdown is still ahead

"Your worst drawdown is yet to come." This wise saying which may sound cruel is a harsh reality in trading to which we must be prepared. The point is that the worst drawdown you experienced within backtesting can be much worse in live trading. Fortunately, there are many modern tools based on the Monte Carlo analysis thanks to which you can find out which is the worst drawdown that you can expect in the future. The Monte Carlo analysis is part of, for example, an excellent analytic software Market System Analyzer. Many traders fund their trading accounts with double or triple amounts compared to the maximum drawdown calculated by the Monte Carlo analysis. This principle is explained in detail together with its specific procedure in my course of algorithmic trading

8. Continuously monitor performance of your trading system in live trading

Keep in mind that we do not evaluate a trading system's performance only in relation to its maximum historical drawdown. For example, I myself regularly monitor performance of my trading systems according to clearly defined rules trade after trade. Such a continuous monitoring can be performed via various tools of statistical analysis or regression analysis. I prefer the methods of statistical process control which were originally implemented mainly in manufacturing processes in companies in order to control the quality of products. These processes monitor process variability and thus help us to identify whether there are some striking variations that may mean that the trading system ceases to be functional. Thanks to this we can often discover that our trading system ceases to be functional before the worst expected drawdown comes. Again, you can learn more about these methods in my algorithmic trading course.

9. Educate yourself, be in the picture

Trading is constantly evolving at a rapid pace, like every other field in today's dynamic world. Many traders completely underestimate such important aspects as regular reading of literature, articles etc. from the area of trading. So be shrewd and keep learning. Even if you have a trading strategy that may work very well in current market conditions, you cannot be sure that this method will be still profitable after a few months or years. Do not underestimate this aspect since it is your self-education that can keep you in the game in the long term.

10. Create a community of traders with whom you will cooperate closely

The fact that will never cease to surprise us in trading is that traders are often "independently functioning units". It is probably due to the nature of this business where traders think that they do not have to be in daily contact with people. The problem is that they oftentimes turn inward. One of the amazing things which brought me the creation of the AOStrading.cz website is a huge number of new contacts with professional traders. Now we can enrich each other and share our know-how. A mutual inspiration is the best motivation that moves all of us forward.

Only few people are able to fully observe these rules. The natural human qualities are greed, craving, desire to be perfect, infallible, and ... surely you can add more. We love to boast about our successes but we are rarely willing to speak about our failures. Yet in a trading we cannot afford this because such a behaviour and the resulting lay opinions of people around us can undermine our trading system's robustness. Some internal defence mechanism commands us to believe that there will be no worse drawdown than the one we experienced

within backtesting. But the inevitable law of the market tells us clearly that such a drawdown will come. So do you still believe that trading is easy? Therefore, avoid confrontation with your own ego and think in probabilities. Only then will you become long-term winners in trading.

29. Courses

Sign up for our Individual or Group Webinars!

We offer **group and individual webinars and attendance courses of successful algorithmic trading.**

Our courses are aimed at basics of exchange trading with **focus on algorithmic trading and trading of US futures via automated trading strategies (ATS).**

Individual Webinars are held in Prague or on-line in a shared-desktop environment.

Group Courses are held in Prague.

Group Webinars are held on-line in a shared-desktop environment so that you do not have to travel and the tuition takes place in the comfort of your home!

Lecturer



The courses are held by Petr Tmej. In 2009, Peter graduated from the Technical University of Ostrava, Department of Quality Control in Czech republic. The studies were mainly focused on Probability Theory and Statistical Processes. He had an opportunity to start his PhD studies in Sweden Linköping University. In addition to his advanced studies of the statistical processes he was more and more fascinated by the unique world of trading. He has been successfully engaged in the U.S. exchange trading for a number of years and he specializes in developing robust automated trading strategies (ATS). Already during the first year Petr was able to increase the value of his trading capital by 82%. Thanks to ATS

Petr could spend even more of his time on increasing his knowledge, since all orders get executed by the automated systems. He is co-author of The Handbook of Successful Exchange Trading on Commodity Markets for Beginner Investor in Czech language. This book was published by Ekopress in 2014.

Not sure which course to choose and how to start trading on the exchange markets? Do not hesitate to contact me at info@aostrading.cz, I will gladly help you, even within a personal meeting, if you prefer.

Building Winning Automated Trading Strategies (ATS) with TradeStation



Learn how to create automated trading strategies (ATS) in TradeStation that will generate trading profits for you!

For ordering the course you need to be registered [on this website](#).

The course is also suitable for beginners who have no experience with ATS trading!

Duration: 4 days (8 hours per day)

Lecturer: [Petr Tmej](#)

Form:

- [Webinar](#) (you will get access to webinar by email)
- [Attendance Course](#)
- [Individual Course](#)

Bonuses:

- **Elaborated manual** with specific and detailed step-by-step procedures and screenshots
- Provision of unique **EasyLanguage codes of 4 of Petr's live trading robust trading strategies**

Program of the course:

The course's conception allows participation of even complete beginners who have no experience with ATS trading at all. During the course I will impart to you my valuable know-how together with a detailed printed manual describing step-by-step creation of long-term profitable automated trading strategies.

Day 1

You will learn how to work with TradeStation, use genetic algorithms for building of your own ATS. Thanks to genetic algorithms you don't need to know programming.

TradeStation, Adaptrade Builder and genetic algorithms for building winning strategies

- Hardware
- Introduction to the TradeStation platform

- Introduction to EasyLanguage
- Adaptrade Builder – basic controls
- Searching for profitable ATS by the use of genetic algorithms
- Analyses of specific trading systems and their codes
- Advanced functional elements of Adaptrade Builder used for evaluation of potential robustness of trading systems

Day 2

You will learn how to test your systems' robustness in TradeStation.

EasyLanguage, Exhaustive and genetic optimization, Cluster Walk Forward analysis, further testing the robustness of ATS

- Explanation of basic principles and functionality of EasyLanguage codes (TradeStation)
- Export of data from EasyLanguage to Microsoft Excel and to other analytical programs
- Demonstration and handover of Petr's codes of intraday trading systems for futures of equity indices
- Genetic programming for TradeStation in Adaptrade Builder
- Optimization in TradeStation and explanation of the over-optimisation principle
- Application of Cluster Walk Forward Analysis in TradeStation
- Interpretation of backtest and Cluster Walk Forward Analysis results
- Multi-time frame and multi-market Cluster Walk Forward Analysis
- Selection of market, timeframe and correct parameter values for live trading

Day 3

You will learn about advanced robustness testing which is a necessary complement to the Cluster Walk Forward analysis. These tests are not included in TradeStation platform, nor the Multicharts platform. You will also learn which unique methods Petr uses for continuous evaluations of his live-trading ATS. This method can help you with identification of the need to modify your ATS or replace it with another robust ATS before the worst possible drawdown occurs (predicted by the Monte Carlo analysis).

Robustness testing not based on analysis in TradeStation

- 3D optimization charts in Microsoft Excel and their interpretation
- Indication of ATS robustness in assessing optimization tests results in MiniTab
- Indication of ATS robustness in assessing trading history in Minitab
- Another unique graphical tools for assessing robustness of trading strategies
- Importance of stress testing for assessing robustness of trading systems
- Other unique approaches to ATS robustness testing
- Quick and clear portfolio analysis and ATS robustness assessment via advanced features of TradeStation in combination with Microsoft Excel

Day 4

Furthermore, Petr very closely examines possibilities of building a high-quality ATS portfolio which minimizes the risk and maximizes the profit potential. This is a very sophisticated approach based on very strong statistical methods.

Performance summary, Money Management, Risk Management, Portfolio Trading, Important aspects of Live Trading

- Trading systems performance evaluation
- Graphical tools for evaluation of trading systems' performance
- Setting of stop-loss and profit target for a trading system by the use of TradeStation graphical instruments
- Principles of Money Management and work with the Market System Analyzer software
- Implementation of a trading system's backtest results into Market System Analyzer's interface
- Determination of account capitalization through Monte Carlo analysis in Market System Analyzer
- Building of portfolio of trading systems in Market System Analyzer
- Tests of statistical significance in Market System Analyzer
- Correlation analysis of portfolio of trading systems
- Utilisation of TradeManager Analysis for monitoring of live trading in TradeStation
- Opening an account with TradeStation
- Setting of TradeStation to ensure a fully automated trading via programmed codes
- Utilisation of virtual servers for maximization of effects of live trading

Discounts for course graduates:

- Prolonged trials and discounts on software and other tools used in tuition
- Personal assistance in opening account with TradeStation and 12 months of free use of the platform

Software tools used in the course:

- TradeStation – if you are interested in demo version you can contact me via email: info@aostrading.cz and I will arrange the demo version for you for several weeks.
- Adaptrade Builder – you can download a fully functional 14-day trial version before the course. I recommend you to activate the program before the course.

Are you interested in private tuition?

- Email to: info@aostrading.cz and I will prepare an individual course for you tailored to your requirements.

What will you learn?

I often see a widespread misconception that you must know how to program if you want to trade via ATS. My course will show you that the opposite is true! Yes, it is an advantage to

learn to “read” the EasyLanguage codes. However, I will show you how the software and its genetic algorithms will do the programming for you.

The course’s conception allows participation of even complete beginners who have no experience with ATS trading at all. During the course I will impart to you my valuable know-how together with a detailed printed manual describing step-by-step creation of long-term profitable automated trading strategies. You will learn how to work with TradeStation and Adaptrade Builder, use genetic algorithms for building of your own ATS and test your systems’ robustness in TradeStation.

See reviews of course graduates:

- *I was more than satisfied, I can only recommend the course to anyone who is serious about ATS trading. Martin, Slovakia*
- *I am very excited about the whole course. The course greatly surpassed my expectations. Especially the high-quality colour manual which thoroughly step-by-step elaborates the entire content of the course. Thus you can find the exact procedure of building of ATS whenever you want. The seminar brought me a lot of inspiration and enthusiasm for building profitable ATS. I have been trading for 7 years and during this time I attended 80% of courses on trading available in the Czech Republic. However, this course is absolutely unique regarding the clarity and precision of the topic’s explanations. And there are even some additional bonuses. Stan, Ostrava, Czech republic*
- *The course fulfilled my expectations to 100%. Tuition was professional and comprehensible. Everything I was clearly explained and there was a sufficient space for questions. The course contained everything I expected! The quality of the course was higher compared with other companies’ courses which I attended before. Everything was more clearly explained than in other courses of a similar type. Andy, Moravská Třebová, Czech republic*
- *The course completely fulfilled my expectations, yet it is necessary to have all the software installed so that you can try out the individual procedures. Josef Šimek, Prague, Czech republic*

AOS trading



PETR TMEJ

The courses are held by Petr Tmej. In 2009, Peter graduated from the Technical University of Ostrava, Department of Quality Control in Czech republic. The studies were mainly focused on Probability Theory and Statistical Processes. He had an opportunity to start his PhD studies in Sweden Linköping University. In addition to his advanced studies of the statistical processes he was more and more fascinated by the unique world of trading. He has been successfully engaged in the U.S. exchange trading for a number of years and he specializes in developing robust automated trading strategies (ATS). Already during the first year Petr was able to increase the value of his trading capital by 82%. Thanks to ATS Petr could spend even more of his time on increasing his knowledge, since all orders get executed by the automated systems. He is co-author of The Handbook of Successful Exchange Trading on Commodity Markets for Beginner Investor in Czech language. This book was published by Ekopress in 2014.

