Trading Fragmentation Methodology to Reduce the Capital Exposure with Algorithmic Trading

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This paper presents a practical methodology to reduce the capital exposure by early exits from the financial markets using algorithmic trading. The method called trading fragmentation uses several automated trading software applied on more unrelated markets and a particular risk management strategy to obtain a higher profit level with a lower risk. An advanced capital management procedure is used to integrate all into an unitary risk management system applied into a single trading account. It was found that the method presented here is the proper way to avoid large loss trades and to reduce the time when the capital is blocked into negative positions for the recovery process. In this way the efficiency of the capital usage is improved and the profit is made faster with lower risk level. The method was tested with real capital for more than five years and positive results were obtained. Comparative trading numbers will be also included in this paper in order to reveal the efficiency and the advantages obtained with the trading fragmentation methodology.
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1 Introduction

In the context of the electronic trading release and implementation all over the world in financial markets, algorithmic trading has become a major research interest theme nowadays. "With rapid advances in technology, enterprises today frequently search for new ways to establish value positions" [1]. Integrating the automated trading software in the business intelligence systems of the financial investment companies is a trend and a necessity today.

Modern methodologies to automate the trading decisions and the risk management offer more and more advanced solutions and advantages in order to make profit. "Business intelligence is the result of the natural evolution in time of decision support systems and expert systems, systems that aimed at replacing humans in the decision making process or, at least, at offering solutions to the issues they are concerned of" [2].

"The real-time data analysis for prediction and risk management in the electronic trading systems place the automated trading systems to be the main engine in the business intelligence system of a financial or investment company" [3]. The design and implementation of any algorithmic trading strategy into an automated software starts from the principles of the manual trading activity.

There are two major question marks in the trading activity: when to entry on the market and how to exit from the opened trades in order to obtain the desired profit with a minimal risk level.

For the first question there are a higher number of researches and studies testing and developing trading strategies with positive edge to locate the right moment to buy equities on financial market. Using the computers to process the price evolution in time, with the right data mining process applied for the time price series, the entry in the markets are built as trading signals and can be automatically executed by the trading software. This will not be the subject of this particular paper.

How to exit from the market in order to reduce the capital exposure is a subject less treated in the academic literature today. This article will present a methodology in order to exit from the markets. The new approach called "trading fragmentation" will permit to

decrease the capital exposure and to obtain the desired profit faster and with a lower effective capital risk. The paper will present the basics for this methodology that can be applied in any financial markets for any entry used strategy. One strong point is that this exit method can be completed automated in order to be integrated into an automated trading system for any business intelligence system applied for any investor or company type.

2 Classical exit methods

In this chapter it will be presented on short several classical known exit strategies to close a trade and to exit from the market. Once a trade was opened, the usual exit method is to close that trade when the profit is equal with a specified value a priori established before to open that trade. This is the most common exit method used in algorithmic trading and especially in high-frequency trading systems. The fixed target level (FTL) method sets the take profit level from the beginning and wait the market to evolve until the price reaches that price target. The method is very simple and good to test and optimize any trading strategy. For a specified profit target level, all functional parameters of the trading strategy will be optimized in order to maximize the profit level and to minimize the capital exposure. It was found that the third optimization criterion is "the Longest Time Trade period" [4] (LTT). "This factor makes the difference between trading and investment" [4] and is the main indicator to establish how long the capital is blocked into the recovery process of a trading strategy.

Other trading strategies use different exit methods become classical because they are used since years. As example it will be mentioned here the "Fixed Time Exit Strategy" (FTE) which "tells us to exit when a certain amount of time has passed" [5], "First Up Close Exit Strategy" (FUC) meaning to exit after the market "has its first up close versus the previous day" [5], "New High Exit Strategy" (NHE) is about to exit the position on the market "after it closes above a new high" [5], "Close above the Moving Average" (AMA) method that indicate simply to close the trade dynamically after the market "has closed above its simple moving average" [5] and "2-Period RSI Exit" (2PR) which indicate to exit the trade when the 2-Period RSI has a value higher than a specified limit value (65% or 70% according to the source [5]).

Other known exit method, applied especially for those trades that were opened using a trend indicator, is to close that trade when the trend indicator used tells us that the trend is no longer exists or the power of the trend is decreasing. Methodologies to measure the power of the trend are presented in [6] and [7] and can generate good exit signals.

With all of these exit methodologies any trading strategy can be optimized in order to have the proper functional parameters set to obtain the desired profit. It was found that, using several automated trading software in a single trading account, none of these exit methods assure the optimal solution. Each exit methods mentioned above can produce a solution for any trading strategy but all of them generate two types of trades. With a proper optimization the most of the trades can touch the exit criteria in a short period of time. Because there is no perfect trading method, each exit strategy will generate also a small number of trades that will last a longer period of time. In these cases, after the trade was opened, the market reversed and evolved against the direction of the open trade. Even the trade will be closed on profit, this process can last sometimes hundreds or thousand of trading hours. This is a case that must be avoided. In all this time the capital is blocked in that particular trade and cannot be used to make new profits. These cases reduce drastically the efficiency of the capital usage. The exit strategy presented later in this paper will solve the problem and will gives a method for capital efficiency optimization.

3 Diversification in financial trading

To trade on only one financial market is not a proper solution. To optimize the capital usage several markets must be traded in the same time. This is called diversification. It is recommended "diversifying into a minimum of three unrelated markets. At any point of time, one market might be in a major uptrend and one might be in a major downtrend, with a third trendless. The odds of catching major moves increase with the number of markets traded. One caveat: they should be unrelated markets" [8].

In the actual conditions of the high price volatility, "the price variations per time unit have become extremely fast and in order to capture and optimally use the price differences it is necessary a fast calculation for the buy and sell decisions and at the same time the transmission of these orders as fast as possible to the execution" [9]. To ensure the low-latency condition, each market will be traded by particular trading software using a particular set of trading strategies with particular optimization sets for the functional parameters.

In this point is obviously that we deal with "software on demand". "In the present time, when companies' businesses are growing more and more, the software developers may adapt to a change from the industry direction and must continuously analyze and optimize current solutions. By developing new strategies to automate services, the architects and developers contribute to more flexible and efficient solutions that provide support for business integration and agility" [10].

With all of these the design direction for the trading system is clear: we need to trade several unrelated markets to ensure the diversification with one special software especially designed and optimized for each of these markets to ensure the low-latency condition.

When it is about the exit decisions, the process to design, develop, test and optimize the trading software includes one of the classical exit strategies presented in chapter 2 of this paper. Usually the FTL exit methodology is a good and simple choice for this step. With this, the trade profit will be calculated using the natural formula:

$$P_t = V(p_t - p_e) \qquad (1)$$

where V is the traded volume, p_t is the target price and p_e is the entry price. Once a trade is opened, the V and p_e are known. For each P_t profit level wanted, the target price p_t can be calculated from the formula (1). Starting from these considerations, the exit decision can be automated using the exit signal for each i trade using the Boolean variables:

$$Exit_i = (p_i \geq p_t) \quad or \quad Exit_i = (P_i > P_t) \qquad (2)$$

where p_i is the current price level and P_i is the current profit for each trade. The trading software will continuously compare the current price level with the target level and will close the trades when the exit condition (2) is met. This is the classical FTL exit condition transposed in the Boolean variable in order to automate the exit decision. In the formula (2) it was included a second form for the exit decision variable to prepare the next considerations.

Once the diversification and the low-latency conditions were met in order to have a reliable and optimal trading system, using several automated trading software will not assure the capital is well used. Even each trading strategy is optimized longer trades will be always present in the trading reports. The practice shows us a drastically reduction of the trading efficiency for those trading strategies optimized to make very shorter trades. A case study was presented in [9]. By filtering the data mining processes to obtain only very short trades, "an algorithm has produced a profit of one hundred times smaller than its counterpart that performs ten times longer transactions" [9]. A new method was searched in order to prevent longer trades for the same profit level. This will be presented in the next chapter.

4 The trading fragmentation method

The trading fragmentation exit method starts from the principle "run your profits, cut your losses" [11], which is the most important principle in the trading psychology in the current paper author's opinion.

Before to define the method let's see how the trading activity is evolving when we use several trading systems in order to trade on more unrelated markets. All software will open one or more trades. The most of these trades will ran in the direction of the trends and will be close on profit in a short period of time after they were opened. Some of trades, fewer, will be on negative amount. These are the cases when the market changed the direction and goes against the trading methodology. Almost all trading strategies generate losing trades. Some of these trades will be closed on profit after the market will reverse again and will recover all that losses. Other part of these trades will be close on loss, after a significant number of trading hours, when the loss became higher enough to touch the stop loss used by each trading software. All of this process will block a part of the trading capital and will reduce the trading efficiency.

The trading fragmentation principles consist to close all opened trades once a specified small profit level was achieved into the trading account. Using a several number of trading strategies on more unrelated markets will generate a high number of small profitable trades and a low number of losing trades. Instead to wait to recover all that negative trades, once a specified profit level was achieved into the trading account, all the negative trades will be closed. In this way, the capital blocked in those losing trades will be released and will be involved by other trading strategies into new trades in order to make profit.

The profit level when all trades will be closed is called profit fragment and usual has a small value between 0.1% and 2% of the traded capital. The exit condition with the trading fragmentation method can be also automated using the formula:

$$Exit_i = \left(\sum_{j=1}^{N} P_j + \sum_{k=1}^{M} P_k > \xi \right) \qquad (3)$$

Pj is the profit value realized for all closed trades using the formula (2), M is the total number of the closed trades, Pj is the current profit of the open trades, N is the total number of opened trades and ξ is the profit fragment.

With other words we do not start the trading software and let them to open trades continuously and follow exits only by formula (2). Time to time, setting a profit fragment ξ, we will close all opened trades to avoid large period for loss accumulation. This will methodology will reduce the longest time trade for the entire trading system and will improve the capital efficiency usage involving the blocked capital into new trades.

A very important observation is that the trading fragmentation methodology works only if the traded markets are unrelated. This is because the loss trades closed at the moment when the ξ profit level is achieved are practically recovered by other positive trades made by other trading software in the same trading account. To be sure if two markets are unrelated it can be calculated the Galton-Paerson correlation coefficient [12] between the two time price series. If this coefficient is closed to zero, we will have unrelated markets.

The trading fragmentation methodology can be applied for correlated markets also, if the trading strategies involved in each trading system are different and use totally different principles. What important is, is to have a good coverage of positive trades to cancel the losses of the wrong trades.

There is not a general prediction for the valued of the profit fragment ξ. This is a functional parameter that must be optimized for each trading system.

5 Comparative results

In order to reveal the efficiency of the trading fragmentation methodology we present the next trading results obtained with the automated trading system theServer [13]. The system traded 12 financial markets using 20 trading software components which includes 60 different trading strategies optimized for each market. Each strategy has its own FTL level and all trades are individually closed using the (2) exit formulas. The risk management strategy used the "Global Stop Loss" methodology presented in [14] with a maximal capital exposure level of 1% for each trading software and with a 10% maximal capital exposure for the whole trading system.

The results presented below were obtained in a real time trading test organized in three different accounts. In one account the trading fragmentation methodology was not enabled (Table 1). In the second account the trading fragmentation methodology was applied with a profit fragment ξ=0.5% of the trading capital (Table 2). In the third account the trading fragmentation exit methodology was applied with a profit fragment ξ=1% of the trading capital (Table 3).

All accounts were hosted by the same brokerage company, they all had the same leverages, commissions and slippage taxes and all accounts had the same trading capital amount on the beginning. All the functional parameters of the trading system were the same and the latency of the price time series was the same. The purpose of this test was only to reveal the influence of the trading fragmentation methodology. For this reason, the only one parameter that was different between the three trading accounts used was the profit fragment value. The test was intentionally closed at a limited date, before touching the profit target in one of the three accounts in order to see the differences. Here are the trading results obtained:

Table. 1. Trading results obtained without trading fragmentation exit methodology

Start trading	01.01.2018
Stop trading	30.06.2018
Initial capital	50,000 euro
Profit target	50%
Profit fragment	not applied
Number of trades	634 trades
Total profit	16,423 euro
Longest trade	1,422 hours
Max. drawdown	4,842 euro
Abs. drawdown	2,104 euro
Maximal RRR	1:3.39
Absolute RRR	1:7.81

Table. 2. Trading results obtained with trading fragmentation for ξ=0.5%

Start trading	01.01.2018
Stop trading	30.06.2018
Initial capital	50,000 euro
Profit target	50%
Profit fragment	ξ=0.5%
Number of trades	852 trades
Total profit	18,861 euro
Longest trade	147 hours
Max. drawdown	2,214 euro
Abs. drawdown	811 euro
Maximal RRR	1:8.51
Absolute RRR	1:23.25

Table. 3. Trading results obtained with trading fragmentation for ξ=1.0%

Start trading	01.01.2018
Stop trading	30.06.2018
Initial capital	50,000 euro
Profit target	50%
Profit fragment	ξ=1.0%
Number of trades	784 trades
Total profit	19,283 euro
Longest trade	2097 hours
Max. drawdown	2,633 euro
Abs. drawdown	811 euro
Maximal RRR	1:7.32
Absolute RRR	1:23.77

The RRR is the risk to reward ratio. In the tables above were highlighted with red the negative part of the initial trading system (without fragmentation) and with blue the positive advantages obtained using the trading fragmentation methodology.

6 Conclusions

Looking at the Table 1, the negative factor that should be corrected is the longest time trade. Even the trading strategies included in each automated trading software were optimized in order to maximize the profit and to reduce the capital exposure level, the longest trade periods is still important. 1,422 hours means about 60 days and this time is due to the usage of six automated investment software included in theServer. In all this time a capital stake is blocked into the negative trade that it is waiting to be recovered by the trading software. In all this period that capital will produce nothing, and even that trade will be closed on profit, the efficiency of that capital will be low.

Looking to the results from the Table 2 we can see that using the trading fragmentation model, the maximal trade period was reduced by almost ten times. In this case, with ξ=0.5%, the longest time trade was 147 hours instead 1,422 hours in the first case. Using the new exit methodology those negative trades from the first case were covered by some positive trades made by other trading software. In this way the capital was blocked for a shorter period of time and a 14,84% supplementary profit stake was obtained. In addition, the maximal and the absolute drawdown were improved and by consequences the RRRs obtained numbers are significantly better.

Thinking to the trading fragmentation methodology we can suppose that the best case is to use a smallest ξ, but this is not the true case. Looking to the Table 3. we can see that using a ξ=1.0% a better profit level was obtained. The explanation is that with a larger ξ, some of the losing trades were recovered in time and produced a supplementary part of the profit. For the case with ξ=1.0% the profit is with 2,23% higher than the case with ξ=0.5% and with 17,40% higher than the case without fragmentation.

A first conclusion is that the trading fragmentation exit methodology is a significant improvement factor for an advanced automated trading system.

An important notice is about the profit fragment level. Even in the numbers presented above we have seen that the case with ξ=1.0% is the better case, this conclusion is good only for the trading system used as example. The profit fragment level must be optimized for each trading system. This factor depends on the trading strategies used, on the profit level used for each individual exit methodology by each trading software and it depends also on the capital exposure level allocated for each trading strategy. Further researches indicate that the ξ level depends also on the spreads, commissions and slippage taxes asked by the brokerage company.

Another factor hard to be predicted without tests is that the ξ level depend on the markets used to trade, on the correlation coefficient between those markets together and on the independence between the trading strategies used. With all of these considerations the ξ level must be optimized for each trading software and for each financial market used by the system.

Another important factor is that the ξ level cannot be optimized using simulation or back tests. We have the methodologies to simulate the functionality of any trading system but to simulate 10 or 20 trading software together is a very hard that can ask a huge computing power and time. To avoid these complications trading tests like those presented in the chapter 5 can be made using different valued for the ξ level.

Together with the “Global Stop Loss” methodology presented in [4], the trading fragmentation method is the best method I have found in my research to reduce the capital exposure and to increase the trading efficiency using algorithmic trading in any advanced automated trading system that trade in several unrelated markets.

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