SPS2F(S2F) a Simulator for a Novel Approach on Single Stock Futures Margin Calculation in Iran capital market

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Abstract
This paper focuses on designing and simulating of an innovative strategy for calculating the related margins of Iran Future Market. It is quite obvious that using margin in the mentioned market is crucial because it can decrease the risk of entire market and all stakeholders including customers, brokers and pillars hence one of the most influential ways to enhance the quality of future market is using a custom-designed algorithm. The paper proposes an innovative model which is named BIG including its simulation for demonstrating the impact of a qualified approach for solving the weaknesses of the current models. In order to test the algorithm, we designed and developed a powerful simulator which is named Special Purpose Simulator for Futures "SPS2F". Using this simulator we simulated the Absolute and Net algorithms beside or new one which comparative results has verified our achievements.

Keywords: Futures, Capital market, Margin Strategy, Simulation.

1. Introduction
In general, every economy can be divided into two main parts; real economy and financial or paper economy. Real economy is related to physical assets economic transactions and contracts while paper or financial economy has been established based on real one. Financial instruments or financial assets are one of the essential elements in every financial economy and derivatives essentially have been created as risk hedging instruments in financial markets and they have a crucial role in them. Nowadays derivatives market with huge market capitalization and volume can be utilized as a considerable financial market with a wide range of products (securities), suppliers (sellers) and demanders (buyers). With regard to necessities for market participants to play their roles efficiently, having a good strategy for margin calculation strengthens the market efficiency because of significance of margining in the case of derivatives.
Although many researchers are interested in using new ideas in such applications, there has been few articles focuses on simulating their approaches. Our predefined goal in this research is concentrating on both theoretical and practical aspects of the problem. In this we study and implement some kinds of famous strategies for assessment and comparing with our proposed strategy using the domain of historical and random simulations. To test the efficiency of our model we run the simulator for both random and real Futures Market data. This simulator gives the opportunity to everyone to test and improve his strategies as well as participating in developing tuneable scenarios.
The main difference between *SPS2F* and other simulators developed so far is that its services is easily configurable according to the market evaluation parameters in different viewpoints such as customers, brokers and pillars. The simulation results of novel strategy are presented in section ….. The results indicate the efficiency of BIG approach in comparison among other strategies and the specification of each policy is extracted.

2. The statement of problem

When an option trade is made between a buyer and a seller the buyer receives the right to buy or sell the underlying commodity at the strike price at a given time in the future. On the other hand the seller of the option has made an obligation to buy or sell the underlying commodity at the strike price at a given time in the future.

In the case of a forward or future both the buyer and the seller have made an obligation to buy or sell the underlying commodity at a predetermined price at a given time in the future.

In the option case the buyer faces a risk that the seller fails to fulfil his obligation in case of an unfavourable change in the price of the underlying commodity. In the case of a forward or a future both parties face this risk. Such possible failures give rise to questions about the credit worthiness of the counterparty.

This problem is solved by the existence of a clearinghouse. One of the main functions of the clearinghouse is to guarantee that all contracts traded are honoured. The clearinghouse serves as counterparty in all transactions, that is, the clearinghouse becomes the buyer to every seller, and the seller to every buyer.

Acting as counterparty and guaranteeing all transactions, the clearinghouse eliminates any questions about credit worthiness of the original counterparty. This also permits a secondary market for the contract to work more efficiently, since a market participant can close a position without recourse to the original counterparty.

However, the clearinghouse will now face the risk that a member or a client may fail to fulfil his obligation in case of an unfavourable change in the price of the underlying commodity. In case of a member failing to fulfil his obligation the clearinghouse is obliged to neutralise the position of the failing member.

To protect the clearinghouse in such cases each participant with an obligation has to pledge collateral. The collateral could be cash, stocks, bonds or other financial instruments. The amounts of collateral to be pledged is called margin requirement.

Important demands on the margin requirement are:

- Not too small, since the clearinghouse may then loose money
- Not too high, since this may discourage trading.

To determine the margin requirement one uses a margin calculation algorithm. There are several algorithms in use by clearinghouses around the globe. Three of these margin calculation procedures are to be analysed in this thesis. These are the most common one, Standard Portfolio Analysis of Risk (SPAN), developed by the Chicago Mercantile Exchange (CME), the Theoretical Intermarket Margin System (TIMS), developed by the Options Clearing Corporation (OCC), and the “Window Method”, developed by OM Technology.

2.1 Margin methods

The ideas of the three algorithms are basically the same. The cost to neutralise an account immediately is the account’s negative market value. If it were possible to close an account in the same time as a member fails to pledge collateral, this negative market value would equal the margin requirement. This is normally not the case, and during the time it takes to neutralise an account, a negative value can increase in a rapidly falling/rising market.

2.1.1 Standard Portfolio Analysis of Risk

The Standard Portfolio Analysis of Risk, or SPAN, method is a margin system developed by the Chicago Mercantile Exchange (CME) in 1988. In brief, SPAN calculates worst case loss scenarios on a contract portfolio, adjusting this loss for net premium cost or benefit from liquidating any option position, and finally adjusting for any offsetting profits generated by closely correlated portfolios in other contracts.

2.1.2 Theoretical Intermarket Margin System

The Theoretical Intermarket Margin System or TIMS method was originally developed 1986 in Chicago by the Options Clearing Corporation (OCC). It is used to calculate margin requirements on OCC's options and futures contracts, comprising a daily mark to market margin (or premium margin that equals the Net Option Value in SPAN) plus a cushion to cover the risk of an adverse price change (risk margin). It also contains a futures spread margin.

TIMS begins by organizing all securities contracts - equities, warrants, convertible bonds and shares of Closed-End Funds (CEF) and of Exchange Traded Funds (ETF) - and derivatives contracts – futures and options - relating to the same underlying asset into "class groups". TIMS organizes all classes of options and futures relating to the same underlying asset into class groups and all class groups whose underlying assets exhibit close price correlation into product groups.

2.1.3 OM "Window Method"

OMS II or the "Window method" or the "Vector method" is the OM risk calculation method for calculating margin requirements. It is included in the risk valuation or RIVA system within OM SECUR. It was constructed in order to handle non-linear instruments in a better way than SPAN or TIMS. OMS II calculates worst case loss scenarios, store these in vectors, adjust for spreading, and adds the vectors in a way that takes correlation in to account.

Regardless different margin calculation systems and approaches that some important of them are described in above, what is good margin behaviour? Of course this depends on whose view one takes. If we look from the member's point of view then we want as low margin requirement as possible. The clearinghouse on the contrary wants as high margin requirement as necessary to cover any potential losses. From this we see that one cannot rank the methods as being best or worst. What is important is however to highlight where the methods differ.

The main question of this paper is which of the customized strategies those are described in next lines is most effective according to S2F simulator.

2.2 The model

In this paper, the Future market model is a simple variant of real market. Figure 1 models the real relations between different beneficiaries in the context of IT infrastructure in Iran futures market.

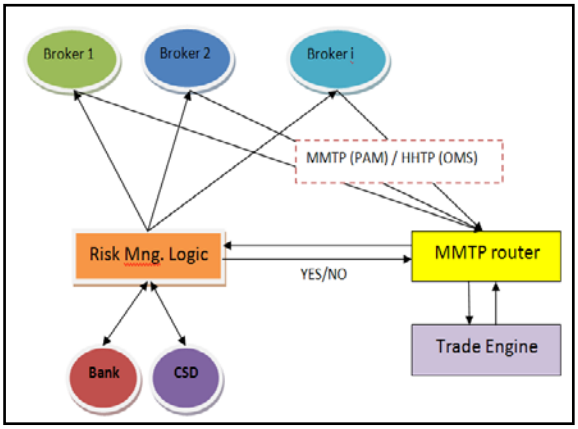

Fig. 1 a Sample of a Real Market

3. Strategies

In this section two well-known strategies are introduced and the third is our proposed one which is especially modelled for Iranian Future market.

3.1Absolute

According to this method, all positions (short and long) are considereded together for cacluation of margin.

3.2Net

Based on net strategy all positions are netted and the net position that is short or long will be the basis of margin calculation.

3.3BIG

In the big strategy, the positions those are more in the comparison of long and short positions, will be the basis of margin calculation.

4. Special Purpose Simulator for Futures (SPS2F)

The main difference between SPS2F and other simulators developed so far is that it is especially designed for Futures Market and its service is really customizable according to the user. Making private users strategies and test results needs to apply flexibility in design and development. So it needs little effort to providing this service via web in near future. SPS2F has been implemented by C# programming language under .Net framework technology. Simulation consists of 3 steps. In the first step SPS2F scans the content of the uploaded file which is the contract creator for Future market including order amount, order type, customer selection, broker selection and symbol. Using this file two model of simulator can be generated based on the use of randomness or real historical data. We should mention that the margin calculator is a part of Central Logic Engine (CLE). In the next step simulation starts and the Futures contracts will be generated after a while. Finally the main program returns data as a numeral file which SPS2F can change it to graphical forms to be more self-descriptive. For starting the simulation users should upload his/her file and selects the strategy which he/she wants to submit such as Absolute, Net or BIG. They should choose the model of simulator based on the randomness or historical. Then he/she observes result as a pictured file.

In future, SPS2F will be capable of providing configurable scenarios in multiple parameters so it it could be used to announce and manage a public competition and inform registered users for detailed score standing among competitors for proposing a new strategies. Figure 3 shows a sample run of Historical-Model in SPS2F.

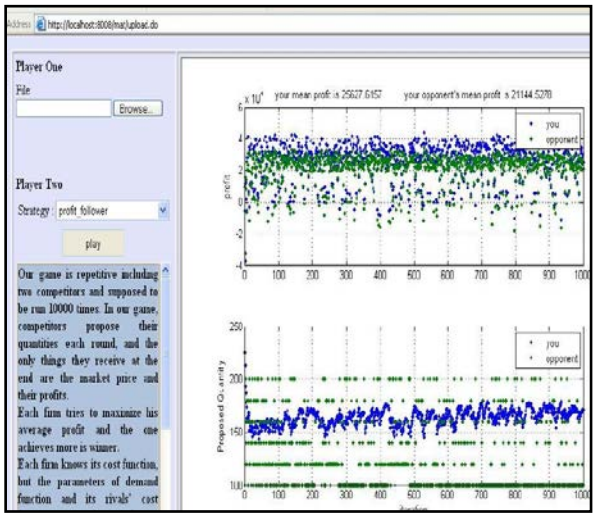

Fig. 2 A Sample of SPS2F runs

4.1 Simulation Scenarios

The scenarios of the simulation are based on two main types of simulation which is randomized and real historical. In the former, SPSF is capable of generating randomized Future contracts without any intelligible pattern. It really helps to warm a market up from scratch by inserting a fully random data file from customer names, brokers, symbols and etc. The second one is based on the real market data of 5 months including the request which may never turns to real order. So the loss of real data decreased a lot and the simulation shows the real market behaviour. There for the type of simulation will change in the second mode and a file a real data with predefined format is needed.

For assessment of three strategies we used the following data for generating the scenarios which is depicted in Table 1.

Table 1: The Data file of two mode scenarios.

	Random	Real Historical
# of Brokers	2	14
# of Customers	4	50
# of Requests	150	342
# of Days	50	150

4.2 Experimental Results

To test the efficiency of each strategy, we defined our metrics which are amount of margin, number of getting margin, the number of margin calls, cash flow management and etc.

Table 1 shows the average positions those have to settle based on the two mode scenarios.

In economic point of view, stable behaviour in different conditions is an important factor of efficiency. For this purpose, we normalized each column of Table 2 to put them in a similar range and make them comparable, and then we calculate the variance of rows as a factor of good strategy. It showed that the BIG strategy had a minimum variance of number of margin calls.

Table 3 shows the average profit of each strategy and the variance of its normalized profit as two factors of efficiency.

Table 2: The Mean Profit of Strategies.
The Participants are: 1Absolute 2.Net 3. BIG

	Absolute	Net	BIG
1	24340	35605	29393
2	26667	42108	40674
3	26671	41748	39029
4	27288	42398	38836
5	23750	34788	28826
6	26330	41478	39248
7	17752	31809	24914
8	2792	19487	12444
9	25483	42013	36972

Table 3: The Average Profit and Standard Deviation

Strategy	Average Performance	Variance
Absolute	29831.82	0.0530
Net	37533.64	0.0232
BIG	36557.18	0.0039

It can be seen clearly that Absolute strategy works conservatively and save the clearing house while it brings lots of un-satisfaction according to customers' viewpoints. Basically BIG strategy overcomes his rivals, but in some circumstance it acts like other approaches while its results in worst case is remarkable. While Net strategy gets the least amount of margin, it increases the risk of clearing house dramatically. All in all BIG has an acceptable performance which shows it has some kind of wise behaviour.

The advantage of BIG method is that it requires minimum information from market. In fact, the only thing that is needed is the market price and the profit according to mark to market in each round but the disadvantage of this method is not covering the worst case scenario in comparison with absolute strategy. This strategy is completely robust in accordance with changing parameters of the market.

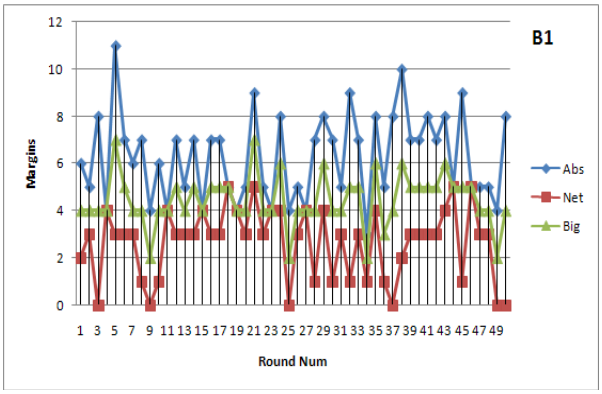

Fig. 3 Random umbers for different margin methods (first round)

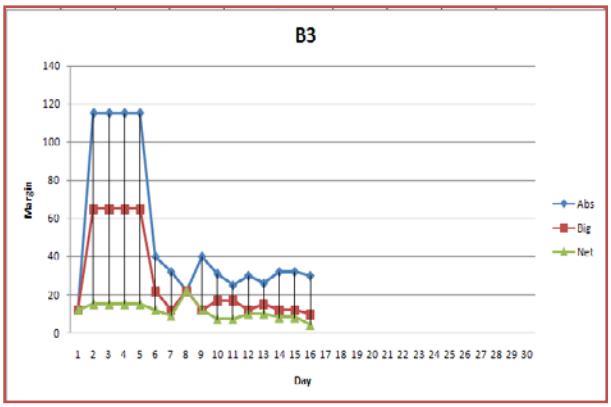

Fig. 4 Different margin cal methods in different days (first round)

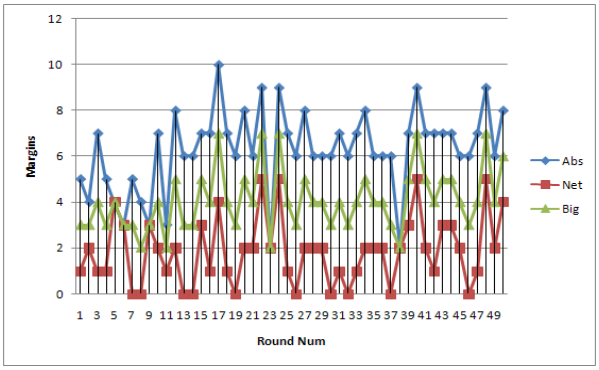

Fig. 5 Random umbers for different margin methods (second round)

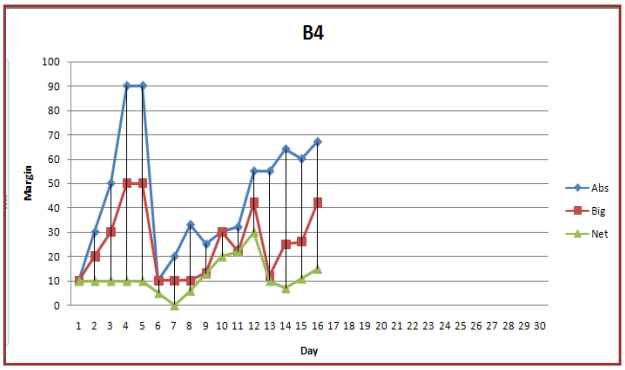

Fig. 6Different margin cal methods in different days (second round)

7. Conclusion

In this paper we introduced 3 customized strategies for calculating the margin for single stock futures. As can be seen from simulation results, BIG strategy has made the most profit in competition with other candidates. On the other hand, since Table 3 shows BIG approach has the lowest variance, this means that its behaviour doesn't change versus different circumstances. This unique method is admirable in capital market it is an adaptive form of margin calculation that reduces the number of margin calls. Beside that it is far better than Net approach for preserving the clearing room according to the risk factor. It is totally a moderate approach in compression with Absolute and Net strategies.

From another point of view, this study can be used an alert line for brokers for informing them the risky customers and unreliable situation.

With the help of simulation we can be sure about the methods and strategies and it really help us move forward beyond the boundaries of theoretical phenomenon and put the ideas in practice.

8. Future Works

According to the velocity and fluctuations which is inherent in Future markets we want to model a new approach for margin calculation which is dynamic and works based on the market feedbacks in near future. We believe that using a closed loop feedback can helps all the stakeholders to gets better positions in unexpected situations.

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