

Using Rough logic for predicting price movements on financial markets

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Abstract

Financial markets and especially their movements are very difficult to predict. For this reason, it cannot be clearly concluded what market will do. We cannot use basic logical operators such as if A happens, then comes B. Since we cannot use simple decision rules and we work in high uncertainty we cannot easily build classical mathematical model because of uncertainty of each and every result. However to analyze this type of data we can use Rough logic which is design to work with uncertainty. The aim of this thesis is use of Rough logic to create a mathematical model, which will be able to some extent to understand and eventually predict individual market movements. Market uncertainty

Purpose of the article: Using Rough logic for predicting price movements.

Scientific aim: Rough Set.

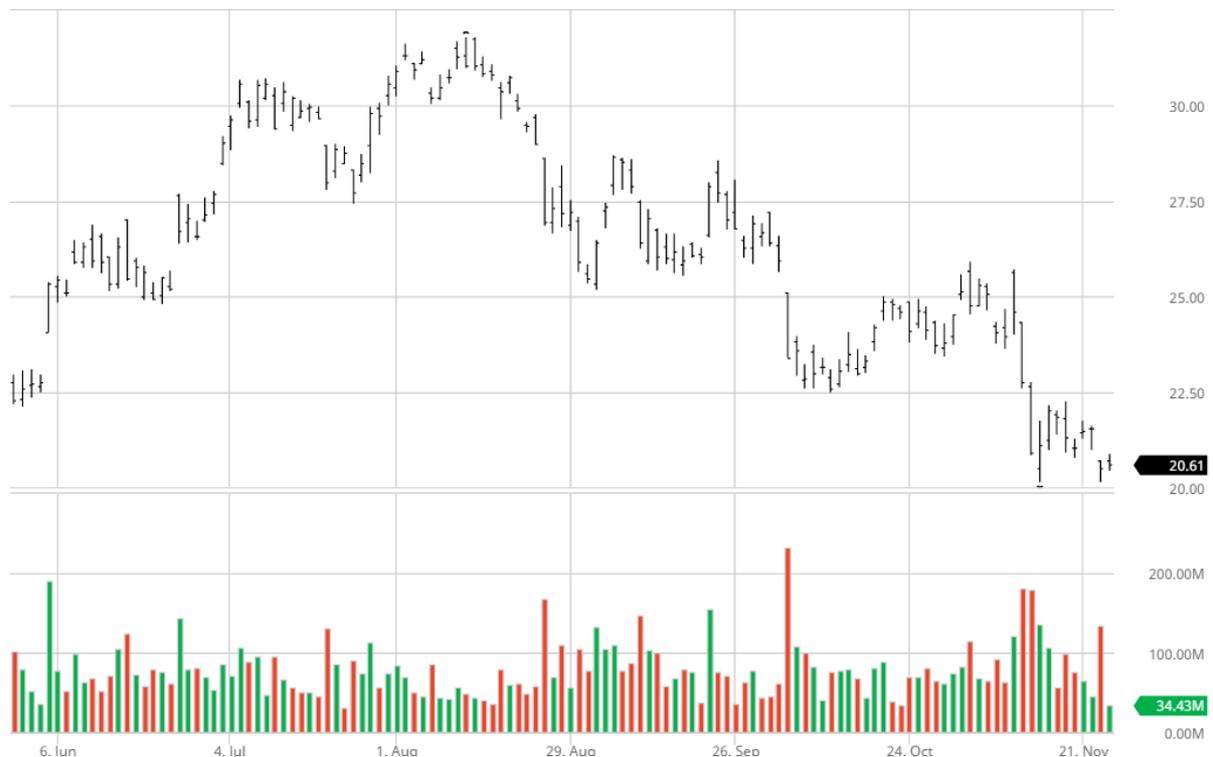
Conclusions: Methodology for using Rough set in financial markets.

Keywords: Rough, Logic, Financial Market, Market Price, Financial Market Prediction, Statistic

JEL Classification: C61, C63, C65, G11, G17

Introduction

In financial Markets there are a lot of uncertainty. One can say there is always known factors that affects price movement. There is a lot of truth in this statement but problem is that we as an independent investors get those information late. That means that every known factor is already reflected in price in the moment when we heard the information. That usually means that we are not able to profit from these type of information. There are also unknown factors that interfere with price. This factors are very hard to predict and are often referred as market risk or market uncertainty.



Picture 1 Gold OHLC graph (Source: Barchart.com)

This problem can be easily represent on previous picture which represent movement of the gold futures which include fundamental information about Brexit and US election. One can profit on these information but as we can easily see there are a lot of another unknown information which affect price movement.

If we separate these type of information we can establish term Efficient Market Price. This term means that price only reflect the known factors and then act rationally. Problem is that Efficient Market Price is nice theory but in real world is very hard to find. So if we aim to build any mathematical or logical system for price prediction we need to take two factors into consideration. These two factors are market risk and market uncertainty. Which brings is to Market Uncertainty Theorem.

Uncertainty theorem

This theorem represents Framework which takes into account market uncertainty and risk. Interesting part of this theory is an idea which collects all known information and because they are already reflected in the price and try to represent them into new information which are better suited to predict near future. This theorem strictly separate „known information set“, which represents all knowledge, information and experience available at the time. That means that there is also „unknown information set“, which represents all unknown factors. In Market Uncertainty Theory the unknown set cannot be in any way reflected in the price. As we already set in live market the price is based on both known and unknown information set and that is the key to correctly understand to market instability. Known information change on time some lose their relevancy and some new are obtain from unknown pool.

Doesn't matter how many known information we collect there will always be an unknown factor that create an element of uncertainty. Because we cannot have a complete picture of the price movement we always need to adjust our strategy and our Risk Reward Ratio.

Rough

Introduction

Rough set theory is a new approach which aims to build mathematical models with use of imperfect knowledge. Classical model which use known information were always used but they hardly represents real world. That means that there is a great need to build a framework which work with absent and uncomplete information. There is a few approaches which aims to resolve this problem. The most successful is Fuzzy theory published by Zadeh. Rough theory represent another solution but it overlap with another theories. This theory attracted a lot of attention especially in recent years because of research of AI and machine learning. One of the potential use is of course a financial market algorithms. The rough theory has many advantages. For example it does not need preliminary information about data like statistic, probability, membership.

Rough theory proposed approach:

- 1) At First we need to create efficient algorithm that is able to find hidden patten in data. In financial market it allow trader to see even pattern and data combination which are too complicated to realize or see by eye.
- 2) Find and set a minimal set of data for analysis. In financial market there is theoretically possible to use all the data of all the market. This approach would be very challenging in matter of computing power. More importantly we realize that not every data is relevant. So the goal is to find a minimal set of data which gives us required result.
- 3) Evaluation of data. On each source of data we chose we need to measure the significance. That means how important is that source for required result.
- 4) Representation of result. Is the result easy to understand? Does the model create a required result? Does the model answer the question we ask? This question requires detailed testing.

Fuzzy Logic

In classical theory there is an element which definitely belong or not to e set. Lotfi Zadeh proposed new propose which use vagueness and it is called fuzzy set theory. In this approach the element belong to set to certain degree k ($0 \leq k \leq 1$). Even that it is an elegant solution it raises the question where to set the values of degree.

Rough Logic

Another approach that represent data in vague way. It is not try to be alternative to classical theory or fuzzy inset it embedded both theories.

Example

Let us suppose that we are given an object M which represent a financial markets. Than we can create indiscernibility relation $R \subseteq M \times M$ that represents the lack of knowledge about particular market M . Now let's create X which is a subset of M . Now we need to specify basic concept for rough theory.

Lower approximation = a set X in respect to R . That means all the set that are certainly X in respect to R .

Upper approximation = a set X in respect to R . This represent all set which is possibly X in respect to R .

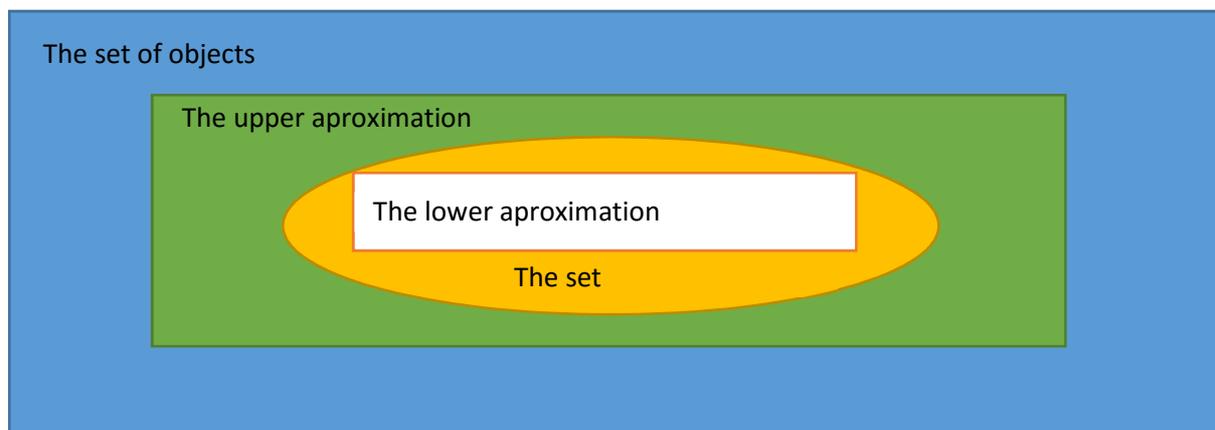
Boundary region = a set X in respect to R . That means all the set that cannot be classified as X in respect to R .

Now we need to define rough sets

X = precise if boundary region is empty

X = rough if boundary region is not empty

That can be graphically represent as follows:



Picture 2 Rough Set Graphicaly (Source: own production)

Granularity

Rough set philosophy work with the idea, that we can have some additional information about observed element. Some elements may exhibit the same information which makes them similar. Those similar object can be form into block which is called granules. For example we can have futures market of certain grains which have similar behavior on weather.

Attribute dependency

Conclusion

As we see that classical mathematical set cannot precisely describe real worlds problem such as financial markets. Markets operate with level of uncertainty which is represent by unknown data. This means that we are not be able to always know every information so there can be always some risk involved. That means that with every strategy and every algorithm we use in financial market we need to have a good Risk Reward Ratio. Because we will not be able to predict every movement.

To describe real live models as a mathematical model we need to use a vague approach that can work with incomplete data set. The process of finding result will be as follows:

- Define algorithm that search for pattern.
- Create a minimal data set
- Evaluate data
- Represent result

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Statement of originality

I Petr Kutnar, do hereby declare that all contain of this thesis is my original work.
This paper has not been submitted for any other purposes.

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