Fuzzy logic as a tool for solving economical problems

Ing. Zdeněk Brož

Brno University of Technology, Faculty of business and management, broz@fbm.vutbr.cz

Abstract

This paper discusses the problem of fuzzy logic and its application in economics. Market and the behavior of people is influenced by many factors. It is difficult to make future predictions based on imprecise parameters and guesses. The use of precise methods with imprecise variables leads to imprecise results. Fuzzy logic offers multiple ways how to work with imprecise variable and makes the problem solving and decision making easier. This paper sums up the basic information about variables in economics and about fuzzy logic.

Key words

fuzzy logic, solution, problem, decision, economics

Introduction

There is a difference between different fields of science. For example mathematics and physics have precise variables and relations. Social sciences like for example economics have also variable and relations but it is more difficult to measure and evaluate them. Physics has general laws and rules that are constant and valid at all times. Economics also has laws but the market environment is constantly changing. It is more difficult to make predictions about the future markets than it is to predict the behavior of a system which follows the precise rules of physics. There are many factors that influence the behavior of people who come to the market to satisfy their needs. Human behavior is very complex. Market consists of large number of individual customers but also from large number of businesses that compete with each other in order to earn profit. Market is a place where supply meets the demand. It is a very complex environment which is influenced by many factors. Some of these factors can be measured and predicted however there are many factors that are complex in nature and are difficult to predict or even to measure. Some events appear randomly and some events are caused by the decisions of the decision makers in subjects that operate on the market. Customers try to evaluate the situation on the market and plan their actions so they use the advantages that the market offers. Customers have to frequently analyze and compare large amounts of information in order to benefit from the differences that are present on the market before the market returns to balanced state. This steadily pushes the customers to use new methods, tools and new information. Customers have limited resources so they try to optimize their decisions in order to satisfy their needs with regard to their resources. Supply reacts to the behavior of customers and to the changes that appear on the market. Producers try to satisfy the needs of the customers for a price that is acceptable to the customers. Customers tend to compare prices and choose the products that provide the desired quality for the lowest price. This forces suppliers to lower the prices by lowering the costs of production. Competing producers use advertising to tell the customers about their products. Economics tries to understand the complex behavior of the customers and producers and formulates recommendations and methods that can be used by both managers and customers to optimize their decisions. This paper discusses fuzzy logic and its application in economics. Economics is an ideal field for the application of fuzzy logic as it has many variables that are difficult to quantify.

Discussion

Economics is a science with large number of imprecise parameters and factors influencing behavior of customers and managers of companies that create products. There are many ways to get information about the behavior of the customers but it is not possible to get enough information to understand and predict the behavior of all customers on the market. Therefore decision makers often have to use qualified guesses so that they are able to make decisions that require information that is not available. Qualified guess substitutes very expensive research that would have to be done to get the precise characteristic of some parameter. Market steadily changes so the resources spent on this research would not be used efficiently as the single parameter has only a limited value. But often this single parameter is required in some analysis. Qualified guess then saves a lot of time and resources even if is not precise. Statistics can be also used to measure the past and make predictions about the future based on the development of some variable in the past. Behavior of the customers is very complex and the methods that are successfully used in other fields tend to fail in economics. For example competitor can launch a new product with new features for a good price that makes all older similar products obsolete. This dramatically changes the situation on the market and this event cannot be predicted. If a decision maker creates a model which includes variables that calculate the occurrence of similar event into the model the results gained from the model are then more vague than without this variable. Occurrence of such events is not random but is influenced by decisions of managers in other companies on the market. Managers have to keep their plans secret and try to always surprise the competitors on the market. Therefore the predictions about the future development of the market are quite complicated and their reliability is usually very low. Furthermore there are predictable and unpredictable changes on the market. Predictable changes can influence the market to various degree just like the unpredictable changes. World markets are interconnected so it is not possible to say that during the next year some large foreign corporation will not enter a local market - these competitors are in most cases very strong and change the situation on the market dramatically. Therefore it is not possible to make reliable long-term predictions about the market. Fuzzy logic is a form of logic derived from theory of fuzzy sets. It is a tool that helps with the reasoning when input variable are not precise or "fuzzy". Unlike binary logic where variables are or aren't members of a certain set in fuzzy logic variables can be members of a set to a certain degree. This degree can be anything from zero to one. Fuzzy logic uses linguistic variables and dictionaries of these variables. Work with variables is slightly more complex because of the additional operations required by fuzzy logic. But this additional effort awards the decision maker by answers to questions that cannot be answered by other methods. The use of fuzzy logic requires additional work and the decision maker only gets correct results when all steps he does are made without error. Incorrect claims and incorrect input data will produce misleading results. It is necessary to input only relevant data and variables. Translated input variables are entered into the model along with the input statements. The process of fuzzy inference produces results which then need to be evaluated. Interpretation of these results requires some degree of experience. It is possible to use some basic methods of fuzzy logic without the sophisticated software however to gain all benefits of fuzzy logic it is necessary to create the model and use the software. Fuzzy logic provides very versatile methods and tools that can be used to solve many different problems. There are only few conditions that the problem has to meet so fuzzy logic can be used to solve this problem. Human behavior cannot be precisely quantified and so it is easy to work with it with word variables like for example small preference, medium preference, high preference of various product.

Conclusions

Fuzzy logic is a very useful tool that can help researchers and managers to analyze and evaluate various situations that are influenced by factors that cannot be easily quantified. Unlike other sciences economics has many variables and factors that are influenced by human behavior. The market environment is so complex that some of the changes influence customers who then change their behavior and change the situation on the market even further. To use fuzzy logic takes some time and skills. There are various software products that facilitate the use of fuzzy logic. It is necessary to collect enough information and determine which variables will be used. Fuzzy logic enables decision makers to analyze complex situations and solve complex problems. This is a clear advantage of fuzzy logic. There are also several disadvantages. One of the disadvantages is the complexity of the process. It takes certain amount of time to collect enough information to convert the variables, create the statements, create the model and in the final phase it takes effort to interpret the results. However the time spent on preparing the information returns as the ability to solve complex problems which are difficult to solve with other methods and approaches. Fuzzy logic has proven to be very useful for solving economical problems due to the nature of these problems a the character of the factors and variables that influence them. Decision makers have in most cases enough information to use fuzzy logic to solve the problems that they are facing. Sophisticated software is also available which makes the work with fuzzy variables and with the model much easier than in the past.

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Summary

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This paper discusses the problem of fuzzy logic and its application in economics. Market and the behavior of people is influenced by many factors. It is difficult to make future predictions based on imprecise parameters and guesses. The use of precise methods with imprecise variables leads to imprecise results. Fuzzy logic offers multiple ways how to work with imprecise variable and makes the problem solving and decision making easier. This paper sums up the basic information about economical variables and about fuzzy logic. Fuzzy logic is a very useful tool that can help researchers and managers to analyze and evaluate various situations that are influenced by factors that cannot be easily quantified. Unlike other sciences economics has many variables and factors that are influenced by human behavior. The market environment is so complex that some of the changes influence customers who then change their behavior and change the situation on the market even more. To use fuzzy logic takes some time and experience. There are various software products that facilitate the use of fuzzy logic. It is necessary to collect enough information and determine which variables will be used. Fuzzy logic enables decision makers to analyze complex situations and solve complex problems. This is a clear advantage of fuzzy logic. There are also several disadvantages. One of the disadvantages is the complexity of the process. It takes certain amount of time to collect enough information to convert the variables and to interpret the results. However the time spent on preparing the information returns as the ability to solve complex problems which are difficult to solve with other methods and approaches. Fuzzy logic has proven to be very useful for solving economical problems due to the nature of these problems a the character of the factors and variables that influence them.