RELATIVITY PROBLEM IN DECISION MAKING

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Abstract

The paper focuses on discrepancy between two approaches to a decision problem; specifically the choice of an alternative based on evaluation of alternative consequences and also its changes (losses and gains). The discrepancy consists in opinion whether to evaluate losses and gains by comparing them to the original value or not. Hammond, Keeney and Raiffa advise to value incremental change on the basis on what we start with. It is one part of their even swap method. On the other hand, Tversky and Kahneman say the opposite. People assess value of money saved or paid extra in comparison to the original amount and not according to their real value. The authors don´t see it as rational. Which approach is the right one? Is it right to use relativity?

Key words: Relativity problem; Even swap method; Utility.

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Introduction

The term of decision making covers a variety of types of decisions. Different approaches, methods, procedures find their use for different decisions. This paper focuses on decisions based on a choice between small numbers of known alternatives. Attention is paid to a specific part of decision making – a decision based on evaluation of alternatives through criteria.

To decide what to do means to evaluate alternatives (the alternatives are locations for a new factory as well as level of inventory or a question of buying something). The evaluation of alternatives is subjective and influenced by a lot of factors. People usually compare things to set their values. The most evident examples are prices. The verdict about something being cheap or expensive comes in most cases from comparison to another thing. It is much easier to set the value of a thing by comparison (i.e. relatively) than in isolation. Ariely (Ariely, 2009) proved this statement with several experiments. It is a commonly known fact which is used by marketers to sell more expensive or less popular products. The same applies e.g. for someone´s attractiveness which is influenced by person standing beside.

The next two chapters describe two different opinions on using relativity for evaluating options – the first one is Even swap method presented by Hammond, Keeney and Raiffa, the second one is an experiment performed by Tversky and Kahneman and their findings and comments based on it.

1 Even Swap Method

The Even swap method was published by Hammond, Keeney and Raiffa in 1998 (Hammond, Keeney, & Raiffa, 1998) and it became very popular with decision makers. The main reason of its popularity is the simplicity (a decision maker is not forced to use advanced mathematics or statistics).

The Even swap method deals with difficulty of multi-criteria decision making. The hard thing about multi-criteria decision making comes from the nonadditivity of criteria (it is not possible to add up kilometres, percentages, litres etc. to find out which alternative is the best one). Some methods get over this problem by transferring criteria values into utility or some other quantities (especially money). Hammond, Keeney and Raiffa offer an easier solution – to eliminate alternatives and criteria step by step. An alternative can be eliminated when it has worse values at least in one criterion and no better values in any criterion then another alternative (when the alternative A has worse quality, higher prices and the same time needed then the alternative B). A criterion is not useful and can be removed in the case all alternatives have the same value in this criterion (when all alternatives have the same price). To achieve one of these possibilities a decision maker has to make trade-offs.

Let us demonstrate the above mentioned approach on a specific example: a luxury jewel retailer makes a decision about locality for a new shop in Prague. To choose the best places he uses criteria: month rent, shop size, average number of people passing by in a day, purchasing power of people who usually pass by (on a scale from 1 to 5 where 5 is the best) and competitors presence (on a scale from 1 to 5 where 5 is the best). Final decision is made between three alternatives Airport, Old town and Vinohrady (see Table 1).

Tab. 1: Even swap method

	Airport	Old town	Vinohrady
Month rent (CZK)	10 000	36 000	52 000
Shop size (m^2)	100	100	150
Average number of people passing by in a day (in thousands)	32	15	20
Purchasing power of people passing by	4	1	4
Competitors presence	4	3	5

Source: Author

Two alternatives have the same shop size (Airport and Old town). If the third option has the same value, it would be possible to ignore this criterion. The next step is to change value of one other criterion to reach shop size of 100 m^2. If the size of Vinohrady shop is 100 square meters, the rent would be e.g. 47 000 CZK. The process would go on with some other trade-offs to finally find the optimal alternative.

One of advices to use Even swap method is: "Value incremental change based on what you start with". (Hammond, Keeney, & Raiffa, Smart Choices: a practical guide to making better life decisions, 2002). It means that we should not evaluate just the change of value, but look at the whole value. "For example, adding 300 square meters to a 700 square meters shop may make the difference between being cramped and being comfortable, whereas adding 300 square meters to a spacious 1 000 square meters office may not be nearly as valuable." The same is valid for all criteria (of course with different values).

2 Relativity problem

Kahneman and Tversky and lot of others proved that people look at their decisions in a relative way. Figure 1 shows the experiment performed to find out if the relativity problem exists (Tversky & Kahneman, The Framing of Decisions and the Psychology of Choice, 1981). Respondents were asked to imagine they had two things to buy (a jacket and a calculator) for a certain price. Their decision was whether to accept an opportunity to get the calculator cheaper or not.

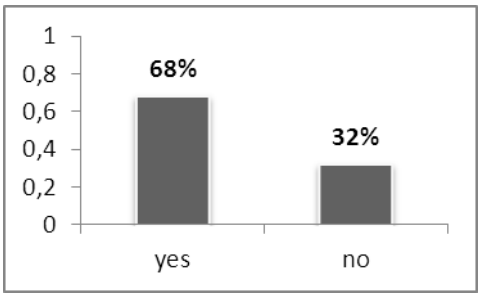
The experiment was performed twice. Two different groups of respondents were put before a choice with different parameters (version A and version B). The difference consisted in the prices. Cheaper calculator was for $10 in version A and $120 in version B. Although the discount was the same for the two situations (i.e. $5), the decisions made were markedly different (see charts in Figure 1).

68% of the respondents were willing to go to another branch of the store to save $5 on $15 calculator. Only 29% of respondents would make the trip to the other store when the price of the calculator was $125.

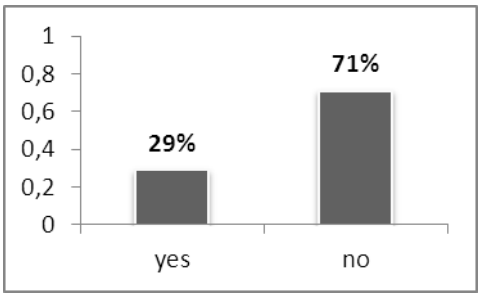
Deciding whether to go to the other store in the version A respondents compared two alternatives – a calculator for $15 and a calculator for $10, the whole values not only the difference. The discount made one third of the original price. The difference between these options was huge. In the version B they compared a calculator for $125 and a calculator for $120. The discount made only 4%. The decision not to go for cheaper calculator in version B doesn´t sound so unreasonable from this point of view.

Fig. 1: Relativity problem experiment

A: Imagine that you are about to purchase a jacket for **$125**, and a calculator for **$15**. The calculator salesman informs you that the calculator you wish to buy is on sale for **$10** at the other branch of the store, located 20 minutes' drive away. Would you make the trip to the other store?



B: Imagine that you are about to purchase a jacket for **$15**, and a calculator for **$125**. The calculator salesman informs you that the calculator you wish to buy is on sale for **$120** at the other branch of the store, located 20 minutes' drive away. Would you make the trip to the other store?



Source: (Tversky & Kahneman, The Framing of Decisions and the Psychology of Choice, 1981)

Dan Ariely presents a similar experiment (Ariely, 2009) with the same conclusion – people would go for a cheaper item to another store in much more cases if the original price is lower. In the experiment, a pen and a suit represented the items to buy (a pen for $25 and a suit for $455). First task was to decide whether it is worth to get the pen $7 cheaper in a shop that is 15 minutes away. Second task was whether to accept an offer to get the suit $7 cheaper in a shop also 15 minutes away. The discounts were $7 for a 15 minutes' walk in both cases.

What sounds illogical in these cases? The fact that in different situations the same amount of money to be gained in the same time frames is valued differently. In the experiment with the

jacket and the calculator was the offer to save $5 for 20 minutes. The value of $5 on the market is the same no matter from what value it comes from. People can by the same products for the $5. The only thing that should the decision maker consider is: Is 20 minutes of time worth $5?

Kahneman and Tversky used above mentioned experiment to illustrate the effect of embedding an option in different accounts (Kahneman & Tversky, Choices, values, and frames, 2000).

3 Comparison

Conflict between described approaches lies in usage of the original value to evaluate the change of the value. Some authors recommend an approach which is criticized by others. While Hammond, Keeney and Raiffa advise to relate the change to the whole value, Kahneman and Tversky and Ariely criticize this as an example of irrationality.

The difference between responses in the second experiment can be partly assigned to the unpopularity of buying clothes (in this case a suit). A pen can be bought very easily and quickly in the other store, just by looking at it while knowing the name or type. With the suit, the situation is different. Even though knowing the brand and size people would still try it on before buying. The idea of trying clothes on again makes people pay much more jut to avoid it. However, this idea doesn´t explain disproportion in responses in the first experiment with changed price of calculator for both groups. The general explanation comes with the utility function.

3.1 Utility function

The term utility is used in economics to denote subjective sensations – satisfaction, pleasure, wish-fulfillment, cessation of need – which are derived from consumption. (Gravelle & Rees, 2004). The utility is used in a little different way for decision making. In the process of comparing and choosing alternatives people assign utility even to costs. The utility is used to measure attractiveness, goodness or preferences of the values and consequently of an alternative. The crucial thing is to decide which alternative is better and more preferred then others, not to express the utility in exact numbers (although to calculate the optimal alternative with most methods, it is necessary to work with numbers). It means that the important thing about utility of costs is that lower costs have bigger utility than higher costs. The exact opposite is valid for the utility of profit (the higher profit the higher utility). The

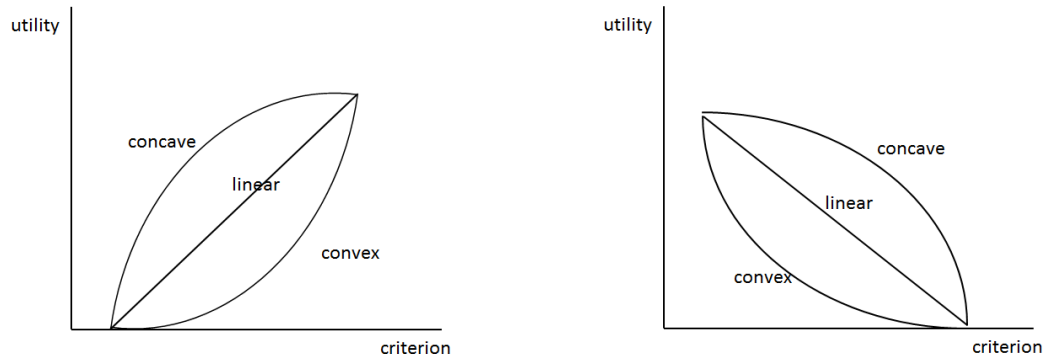
graphic interpretation of utility function has utility on vertical axis and values of criterion (i.e. costs or profit) on horizontal axis.

The shape of utility function is important. The choice between increasing and decreasing function is obvious and easy. For cases when higher value of criterion is preferred to lower value (like profit or number of customers) we use an increasing utility function. With criteria as costs or number of rejects, we generally prefer lower values (the function is decreasing).

The choice between concave, linear and convex utility function is based on the growth ratio between utility and values of criterion. Higher attractiveness of equal increases of the criterion value indicates convex utility function. If the equal increases of criterion are less attractive the function is concave. (Fotr & Švecová, 2010).

To demonstrate the difference on concrete example let us have a look on the criterion of shop size once again. The shape of utility function is based on how the decision maker thinks about the increases in the size. "Specifically, would a 100 square meters increase in floor area be more attractive if it fell near the bottom of the scale (e.g. 400 to 500 square meters), in the middle (e.g. 1000 to 1100 square meters) or near the top (e.g. 1400 to 1500 square meters), or would it not matter where the increase occurred?" (Goodwin & Wright, 2004).

Fig. 2: Utility functions



Source: (Fotr & Švecová, 2010)

In the experiment with the calculator is the version A in the bottom part of criterion values and version B in the top part of criterion values. The utility function would be for most people convex. Gaining the calculator for $10 instead of $15 adds more utility then the change between $120 and $125.

Conclusion

A decision maker deals with the need to evaluate alternatives in order to choose one. The theory comes with a bunch of methods and approaches how to do it. One of the popular methods is Even swap method, which is based on using relativity.

The normative theory of rational choice works with concept that preference between two options is independent of third option. Experimental evidence indicates that the principle of independence of irrelevant alternatives is often violated. (Tversky & Simonson, Context-dependent Prerefences, 1993)

A lot of researches have been done to prove human irrationality e. g. (Ariely, 2009), (Tversky & Kahneman, The Framing of Decisions and the Psychology of Choice, 1981), (Hammond, Keeney, & Raiffa, The hidden traps in decision making, 2006), (Švecová, Fotr, & Renner, 2011) and others.

People decide relatively. It has been proven by several researchers as well as the usage of intuitive judgment (Kahneman, A perspective on judgment and choice - Mapping bounded rationality, 2003).

People make decision subjectively and it is right thing to do. The aim of making a decision is to solve a problem or to use an opportunity. The problem and the opportunity is mostly related to the decision maker, it is not valid for all people. So it is right that the person uses his/her subjective value system. The subjective value system comes from comparing things.

The objective values in the case of shop space would mean to use the market value of 1 square meter in the city. Using objective values would not suit individual needs. I don´t see relativity in decision making as a problem. The whole concept of utility (in ordinal concept) is based on feelings not on rationality.

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