

EVALUATION OF DECISION EFFECTIVENESS OVER TIME

Viktor Nagy

Óbuda University, Budapest, Hungary, nagy.viktor@kgk.uni-obuda.hu

Abstract. In this paper, the results of my research are presented that was carried out on a large sample to investigate how people look back at their previous business decisions. After a short literature overview, considering the role of time, the paper deals with the primary research: how people judge their decisions in the short term and in the long run, that is, how confident they are that the right one was chosen applying the available knowledge of facts and conditions connected with or relevant to their situation. Using statistical methods, comparisons were made, for example, based on the respondents' gender, so it turns out whether gender has an influence on self-confidence or on exactness of judgement. Does the position, that is, the rank matter? Can it be assumed that the farther one gets up the corporate ladder, the more certainty can be observed about their decisions? And what about educational level? Does it influence judgement in a decision? Those who do not regret their decisions after a while, that is, after the original decisions were made, while being in possession of the information available later, can be more successful in business because they made the best decision. Trying to identify such characteristics or factors can be an advantage in the business life.

Keywords: Self-confidence in decisions, the role of time

JEL Classification: D83; J24

Introduction

The factors of production from classical economics in the second half of the 18th century and at the beginning of the 19th century (represented by Adam Smith and David Ricardo, e.g. Smith 2007, Ricardo 1817), the land, that is, natural resources, labour and capital stock cannot be treated as factors of competitive advantage any more, particularly in our globalised world. New factors have arisen such as access to information as well as human resource and time. While labour refers to a physical contribution to production, in the case of human resource, mental abilities also come into play – due to the fact that in developed countries and also in the developing world, the focus has shifted more and more from production to service delivery. ‘Services contributed 73.9% of the EU-28’s total gross value added in 2016 compared with 71.8% in 2006. The relative importance of services was particularly high in Luxembourg, Cyprus, Malta, Greece, the United Kingdom, France, the Netherlands, Belgium, Portugal and Denmark, where they accounted for at least three quarters of total value added. By contrast, the share of services was below three fifths in the Czech Republic and Ireland (EUROSTAT 2018). The other ‘new’ factor is time. A proverb says: ‘Time is money’. This means that time is a very valuable resource, perhaps the most valuable one and the scarcest. This can also mean that time can somehow be converted to money, and vice versa. The conversion rate can depend on a lot of factors. But once the decision is made on conversion, the die is cast. Whether it was worth making the conversion, can only be judged later. People’s attitude to their previous decisions can be evaluated in the light of new (and subsequently revealed) information or based on the real consequences. This research tried to reveal attitudes to the previous decisions.

The research attempts to find answers on how heavily people are convinced about their decision, that the right one(s) was (were) made over time: how time and different factors, such as gender, position and educational level influence the confidence. Those who show regret, doing so admit, that better options could have been chosen. Those who do not show regret, had presumably made good decisions, and thereby are more successful in business. A questionnaire survey was conducted to reach the aim, which

was to investigate to what extent the previously mentioned factors influence the conviction and thereby the success in business.

Literature Review

The increasing importance of this topic is justified by the fact that the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel was awarded to the representatives and/or researchers of behavioural economics many times. The prize went to (Nobelprize.org 2018):

- Herbert Simon in 1978, for his pioneering research into the decision-making process within economic organizations (see, e.g., Simon 1969);
- Daniel Kahneman in 2002, for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty. He carried out most of his work with Amos Tversky, but the latter had already passed away by 2002 (see, e.g., Kahneman & Tversky 1979);
- Richard H. Thaler in 2017, for his contributions to behavioural economics (see, e.g., Thaler 2016).

However, the increasing importance of behavioural economics does not mean that a wide range of research has moved to this field. Still, understanding personal decisions requires taking more account of descriptive theories than at present.

An important factor is the time horizon of obtaining information: when it's available or how long it takes to get it. Already Kaufmann discusses the shortening of time as the consequence of the acceleration of communication speed and the role of decline in waiting time (Kaufmann 1968).

The widely-known discounted utility (DU), associated with Samuelson (Samuelson 1937), emphasizes the role of time itself. Based on the theory that a (c_0, \dots, c_T) consumption is preferred to (c'_0, \dots, c'_T) than and only if

$$\sum_{t=0}^T \delta^t u(c_t) > \sum_{t=0}^T \delta^t u(c'_t) \quad (1)$$

where $u(c)$ is a concave utility function interpreted on ratio scale, and δ is a discount factor for a given time period. This model has been criticized on a number of issues on an empirical basis. One is known as the common difference effect, for example. Suppose there is a person who is indifferent about increasing his consumption by x units at time t , or increasing his consumption by $y > x$ units at a later time t' . A constant c basic consumption is given in all time periods, so the following connection can be set up:

$$u(c + x)\delta^t + u(c)\delta^{t'} = u(c)\delta^t + u(c + y)\delta^{t'} \quad (2)$$

From this, the following is concluded:

$$u(c + x) - u(c) = (u(c + y) - u(c))\delta^{t'-t} \quad (3)$$

That is, the choice between two consumption points depends only on the absolute time interval between them. In practice, however, the choice between two delayed outputs is often interchanged when both are increased by the same constant. Some (Loewenstein, Prelec 1992) quote Thaler, who notes that people prefer today's one apple to tomorrow's two, but at the same time, they prefer the choice of two apples 51 days later rather than one apple after 50 days.

The same problem is approached differently by Read and Roelofsma. Smaller-sooner (SS) outcomes at time t_1 and larger-later (LL) outcomes at time t_2 will be equally desirable, if $SS = \delta^{t_2-t_1} LL$, where δ is a constant discount factor between 0 and 1. Contrary to the former authors, they sharply separate the

time interval and the delay. As shown in Figure 1, in this approach, the interval is the distance between (SS) and (LL), that is, $(t_2 - t_1)$, while the delay is the distance between the present position and (LL), that is, $(t_2 - 0)$.

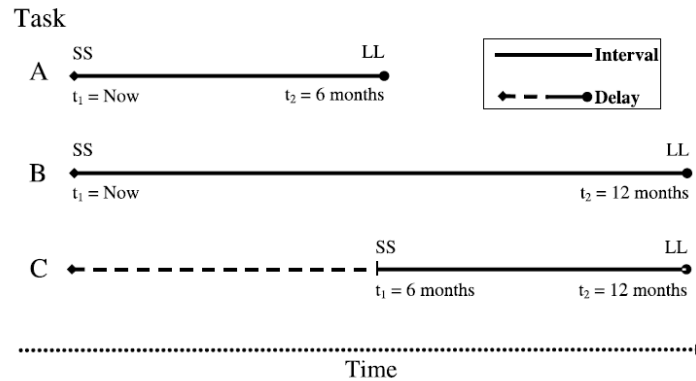


Fig 1. The time interval and the delay (Source: Read, Roelofsma, 2003 p.142)

Earlier research focuses mainly on comparing A and B tasks. Increasing patience means that the longer the interval, the smaller the δ . They also point to the weaknesses of experimental evidence of hyperbolic discounting (Read, Roelofsma 2003).

The fact that people use hyperbolic discounting has been rejected by experiments (e.g., Sopher, Sheth 2006).

Should one investigate the discounting factors for time, it cannot be interpreted in fully-mathematical way in a given situation. The question of saving is a typical time dilemma. People usually do not make such decisions like economists, however, they could get better off. Thaler and Benartzi examined the topic by setting up a real experiment, and based on this, they confirmed their theory called ‘Libertarian paternalism’; that is, ‘a philosophy that advocates designing institutions that help people make better decisions but do not impinge on their freedom to choose’ (Thaler, Benartzi 2004, s.185).

Both time, information plays a key role. Research shows that ‘voters with relatively unlimited time behave differently than voters who decide under time pressure... [however] the amount of information and time devoted to decision making does not influence the probability of making a “correct” vote (neither in a positive nor in negative way).’ (Tóth & Chytilík 2018, pp. 82-83.).

Decisions are influenced not only by the time horizon of obtaining information, but the ownership also does matter. Options chosen by people differ if the decision is made on their own property or on others’ (Kolnhofer-Derecskei 2017).

Considering acquiring the information, we can measure the distances not only in time but also in personal-connection distances. In Milgram’s experiment, when people were asked to send a file to an unknown stranger, it turned out that completed chains varied from two to 10 intermediate acquaintances with the median at five. The distance between two randomly selected persons was also only an average five persons no matter where they happened to live in the United States (Milgram 1967). In 1967, that was the distance between two persons and so were all the documents and information. In these experiments, fixed paths are always longer than the shortest possible. The ability to obtain information has become increasingly simple and has accelerated over time. Relationships are simplified so that the threads between individuals do not break for geographic reasons. Since people are able to maintain more and more relationships, distances decrease and we can approach the three-person distance nowadays (Barabási 2002).

Methodology

Primary research was carried out using a questionnaire to reveal how people felt about their decisions over time. This was measured by two questions. The main difference between them was the length of time that elapsed from the decision making to the evaluation. The exact period of time was not mentioned because the terms ‘short’ and ‘long’ can only be interpreted based on knowing the content of the decision, which can vary on a very wide scale. The following two questions were posed:

- Q1: Right after making your decision, how heavily convinced are you that you have made the most appropriate decision?
- Q2: After a longer period of time, how heavily convinced are you that you have made the most appropriate decision?

Respondents were asked to use percentage values from 0 to 100 to express how certain they were. How self-confident they were can be evaluated from the data.

These questions were a part of a bigger research; the whole questionnaire was published on the internet and using the snowball method, the Hungarian business decision makers were targeted. Because of the snowball method, the results have to be handled with reservation, that is, no kind of representativeness can be assumed about the sample. It has to be added that based on the literature, it is not typical in such a research either. The aim is always to proof the existence of different phenomena. However, in this research, it can be supposed that spreading the questionnaire among members of the relevant target group, raise the reliability of the survey. The big sample size supports the conclusions.

Descriptive statistical methods, such as calculating frequencies, relative frequencies, mean, median, mode, skewness, kurtosis, measuring the strength of relationship between variables (crosstab analysis) and so on, were applied to present and describe the characteristics about the sample. Inferential methods were used to compare means or medians; several (nonparametrical) tests were carried out to confirm the conclusions.

Results

In 443 cases, it was possible to compare the attitudes in the short and in the long term. 205 out of them are males and 238 females. Right after making the decision, respondents have a mean 81.36%, which indicates a high self-confidence. The value is almost the same, 80.88%, if the question refers to a longer period of time. Standard deviations calculated from the data of sample (sample standard deviations) show even less difference. In the first case, it is 14.70 and in the latter, it is 14.71. The Pearson’s correlation coefficient is of medium strength with the value of 0.5856. In both cases, the range is 100. Interestingly, in 144 cases (32.51%), the certainty has risen over time. In 168 cases (37.92%), it has decreased, and in 131 cases (29.57%), it has not changed.

Values grouped by gender are displayed in Table 1.

Table 1. Statistical characteristics (Source: author’s compilation)

Statistics	Male		Female	
	Right after	After a longer period	Right after	After a longer period
Number of elements	205	205	238	238
Mean	82.5073	81.4927	80.3739	80.3529
Median	85.0000	80.0000	80.0000	85.0000
Mode	90.00	80.00	80.00	90.00

Std. deviation	13.56380	13.71689	15.57962	15.52599
Skewness	-1.181	-1.374	-1.925	-1.569
Std. error of skewness	.170	.170	.158	.158
Kurtosis	1.807	3.845	5.732	3.990
Std. error of kurtosis	.338	.338	.314	.314
Range	75.00	90.00	99.00	99.00
Minimum	25.00	10.00	1.00	1.00
Maximum	100.00	100.00	100.00	100.00

To explain whether males and females differ when thinking about these questions, it would be necessary to know the decisions that later turned out to be false (e.g. on. ratio scale) and to take into account the cognitive biases, and hindsight bias in the long run. That cannot be carried out based on the data gained. However, it can be examined whether the means (very close to each other) that refer to the certainty in decision making right after, and after a long period of time, significantly differ from each other. T-test can be applied to it; however, it requires the data to be derived from a normally distributed population and (sometimes) not to have different variances in the populations.

In the case of data normally distributed, mean, median and mode have the same value. Should the kurtosis or skewness be higher or lower than +1 or -1, the distributions given differ from the normal ones. Values of skewness and kurtosis or the quotient of their standard errors must not exceed ± 2.58 ; in a stricter case ± 1.96 (Sajtos, Mitev 2007).

Statistics somewhat differ from expected values; the kurtosis and the skewness are also outside the borders mentioned above. Histograms and normal density functions displayed on them also help (see Figures 2–5).

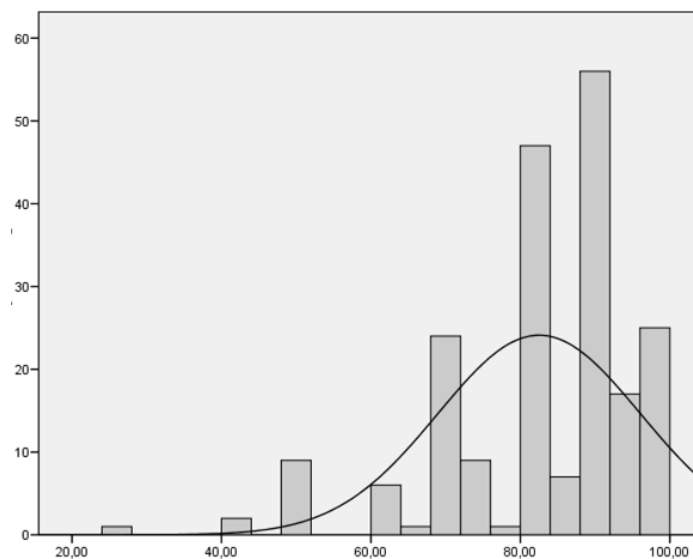


Fig. 2. Certainty right after making the decision. Subsample: males (Source: author's compilation)

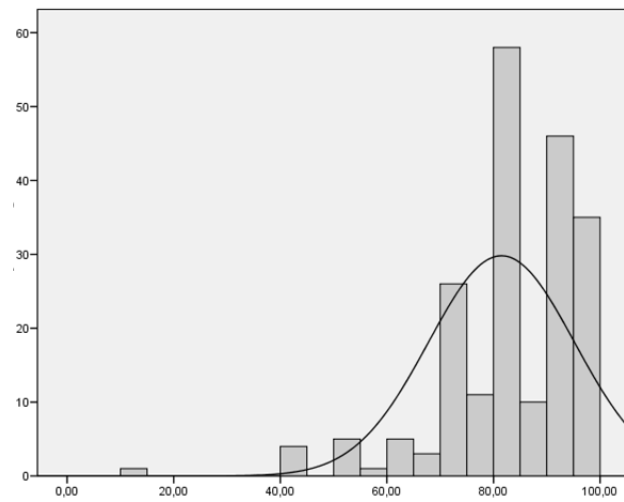


Fig. 3. Certainty after a longer period of time. Subsample: males (Source: author's compilation)

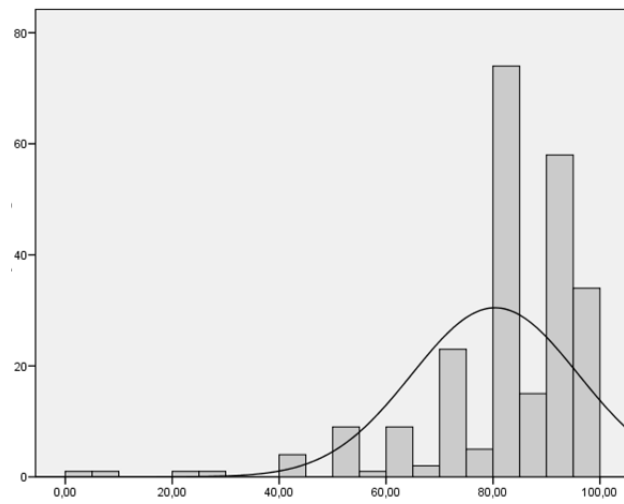


Fig. 4. Certainty right after making the decision. Subsample: females (Source: author's compilation)

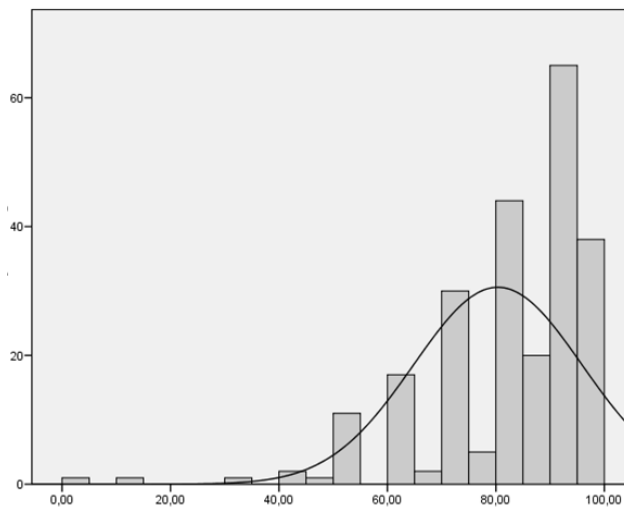


Fig. 5. Certainty after a longer period of time. Subsample: females (Source: author's compilation)

Figures 2–5 show remarkable difference from normal distributions, so Shapiro-Wilk and Kolmogorov-Smirnov with Lilliefors Significance Correction tests were applied (see Table 2).

Table 2. Tests for normal distributions (Source: author's compilation)

Certainty in making the best decision	Gender	Kolmogorov-Smirnov Lilliefors Significance Correction			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Right after	Male	0.183	205	0.000	0.894	205	0.000
	Female	0.251	238	0.000	0.828	238	0.000
After a longer period	Male	0.184	205	0.000	0.888	205	0.000
	Female	0.193	238	0.000	0.867	238	0.000

Significance levels below 0.05 indicate that in all four cases, the null hypotheses have to be rejected; samples cannot be derived from normally distributed populations. It follows that the two samples' t-test cannot be applied, so testing the variances has no sense (e.g., F-test or Levene-test).

The Mann-Whitney U and Wilcoxon W tests are nonparametric tests that do not require the assumption of normal distributions and can be applied, when variables can be ordered on ordinal scale. The hypothesis now refers to the medians instead of the means.

H₀: The certainty is equal between subsamples (males and females).

H₁: There is a significant difference.

Table 3. Rank test table (Source: author's compilation)

Certainty	Gender	N	Mean Rank	Sum of Ranks
Right after	Male	205	230.47	47246.50
	Female	238	214.70	51099.50
	Total	443		
After a longer period	Male	205	223.27	45770.00
	Female	238	220.91	52576.00
	Total	443		

Based on the results displayed in Table 3, it seems that males have higher self-confidence. To establish whether this is really the case, significance tests have to be carried out (see Table 4). The consequences can be interpreted in two ways.

Table 4. Test statistics of Mann-Whitney U and Wilcoxon W tests grouped by gender (Source: author's compilation)

Test statistics	Right after	After a longer period
Mann-Whitney U	22658.500	24135.000
Wilcoxon W	51099.500	52576.000
Z	-1.318	-0.197
Asymp. Sig. (2-tailed)	0.188	0.844

Having the number of elements higher than 30 in the sample, U-statistics can be transferred into Z-statistics, which can then be corrected by the number of occurrences of related ranks. In the first case, $z_U = -1.318 > z_{0.05/2} = -1.96$, so H_0 hypothesis cannot be questioned: at 5% level of significance right after the decision making, there is no difference in self-confidence between men and women.

In the second case, the level of significance turned out to be 0.844, which is > 0.05 , so again, there is no evidence for rejecting the null hypothesis: after a longer period of time, there is no difference in self-confidence between men and women.

Based on calculations between a nominal or ordinal (advancement in rank) and a ratio scaled value (certainty), H indicates 0.1804 right after the decision has been made, and 0.1850 after a longer period. The advancement in rank explains the variance of certainty in 3.25% in the first case, and in 3.42% in the second. Having such low values, there is no sense in carrying out hypothesis tests for these. Practically, in both cases, self-confidence is independent of position, so we cannot conclude, for example, that higher rank would mean higher confidence.

Investigating the relationship between the highest educational level and self-confidence, H indicates 0.0491 right after decision making and 0.0118 after a longer period. The educational level explains 0.24% in the first and 0.01% in the second case, from the variance of certainty. Here, if one might be allowed to point out, the variables are even more independent than in the previous case.

Conclusions

Based on the literature, it is quite clear that the current decisions are not equally influenced by the time differences between future results. But decisions have been investigated in connection with future events so far, and not yet in connection with the past. This research was about therefore just to evaluate the past events.

Regarding making business decisions, people tend to have very high self-confidence (81.31%), that is, they are convinced that they are able to select the best (optimal) alternative. Surprisingly, over time, this level of self-confidence does not decrease (significantly). Analyses shows that this holds true regardless of gender.

Differences – neither in position (i.e., the rank), nor in educational level – have an effect on the level of certainty. These are unexpected results because one could have assumed that (i) the farther one goes up the corporate ladder, the more certainty can be observed about one's decisions and (ii) the higher qualification one has, the more certain one can be.

References

- Barabási, A-L. (2002). *Linked: The New Science of Networks*. Perseus Books Group
- EUROSTAT [Accessed 20.04.2018] Available from Internet: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=National_accounts_and_GDP
- Kaufmann, A. (1968). *The Science of Decision-Making: An Introduction to Praxeology*. New York, McGraw-Hill
- Kahneman, Daniel & Tversky, Amos (1979): *Prospect Theory: An Analysis of Decision under Risk*. *Econometrica*, Vol 47, No 2. pp. 263-292.
- Kolnhofer-Derecskei, A. (2017). How would you decide on behalf of your friend? *Management, Enterprise and Benchmarking (MEB) "Global challenges, local answers"*, Budapest, Hungary, pp. 195-204.
- Loewenstein, G. & Prelec, D. (1992). Anomalies in Intertemporal Choice: Evidence and an Interpretation. *Quarterly Journal of Economics*. Vol. 107, Issue 2
- Milgram, S. (1967). The Small-World Problem. *Psychology Today*, vol. 1, no. 1, pp. 61-67.
- Nobelprize.org – The Official Web Site of the Nobel Prize. [Accessed 20.04.2018] Available from Internet: https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/
- Read, D. & Roelofsma, P. H. M. P. (2003). Subadditive versus Hyperbolic Discounting: A Comparison of Choice and Matching. *Organizational Behavior and Human Decision Processes*. Vol. 91, Issue 2

Ricardo, D. (1817). *On the Principles of Political Economy and Taxation*. London, John Murray, Albemarle-Street. [Accessed 07.11.2018] Available from Internet: https://books.google.hu/books?id=cUBKAAAAYAAJ&pg=PR1&hl=hu&source=gbs_selected_pages&cad=2#v=onepage&q&f=false

Samuelson, P. (1937). A Note on Measurement of Utility. *Review of Economic Studies*, vol. 4, issue 2, pp. 155–161.

Sajtos L. & Mitev A. (2007). *SPSS kutatási és adatelemzési kézikönyv*. Alinea Kiadó, Budapest

Simon, H. A. (1969). *The Sciences of the Artificial*. MIT Press, Cambridge, Mass, 1st edition.

Smith, A. (2007). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Edited by S. M. Soares. MetaLibri Digital Library, 29th May 2007

Sopher, B. & Sheth, A. (2006). A Deeper Look at Hyperbolic Discounting. *Theory and Decision*. Vol. 60, Number 2-3, Springer

Thaler, R. H. (2016). *Misbehaving: The Making of Behavioral Economics*. W. W. Norton & Company; 1st edition

Thaler, R. H. & Benartzi, S. (2004). Save More Tomorrow™: Using Behavioral Economics to Increase Employee Saving. *Journal of Political Economy* 112, no. S1

Tóth, M. & Chytilék, R. (2018). Fast, frugal and correct? An experimental study on the influence of time scarcity and quantity of information on the voter decision making process. *Public Choice*. Vol. 177, issue 1-2, pp. 67-86.