

# Innovative Approaches in Social, Human and Administrative Sciences

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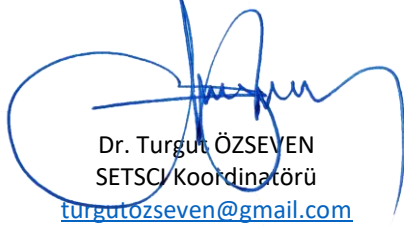
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# **Innovative Approaches in Social, Human and Administrative Sciences**

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## **Extrapolation Error and Investing Behavior**

Rıza Doruk Ercan<sup>1</sup>, F. Özlen HİÇ<sup>2</sup>

### 1. INTRODUCTION

Behavioral Finance studies on two topics regarding finance markets. First one is that investor's psychology can be a barrier to act rationally. The other one is that investor's arbitrage abilities might be limited for the overpricing situation (Bayar and Kılıç, 2014:185). In accordance with both topics, financial crisis shall be examined within the scope of behavioral sciences including behavioral finance, behavioral economics and neuroeconomics.

Financial crises occur periodically due to various reasons. However, speculative bubbles would be defined as the main reason. A bubble is that the price of an asset rises to a level that is higher than it would be in the absence of the rationality. Furthermore, a rational observer's forecasting might not be a high short-term ROA (return on the asset) for this price level. For instance, in many discussions on 2008 recession the common idea was that a bubble occurred in real estate industry. After 2006, real estate prices had been increased unsustainably and reached to high levels. Whether a bubble is too swollen it would burst. In this case this price bubble burst and triggered widespread defaults on subprime mortgage. It lowered the value of banks' subprime-linked holdings. Then banking system was highly effected beyond the foresights of the qualitative risk management. At this point the financial crisis is considered to be applied by behavioral economics and behavioral finance. Because these applied sciences are as new disciplines with the aim of examining the bubble formation by the improved responses to risk changes. These multidisciplinary fields consisting of psychology and economics. It aims to analyze investment decisions and investors' behaviors. In this thesis financial bubbles are taken into the consideration by using behavioral analysis.

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Financial crisis is caused the questioning the adequacy of the current economic approaches. Because the current economic approaches try to figure out the reasons of the crisis by rational expectations, maximization of utility function and information shocks. These approaches are not defined as adequate to predict the financial crisis or explain the reasons. The current approaches are inadequate because the human behavior can not be predictable. Behavioral finance focuses on this point. It is based on the irrationality of human nature. The investors are human so while making decisions they would not act rationally. It means that the investor would not consider on the profit maximization, he can act with the effects of emotions. For example, even if the selling the stock is the rational option, investor might will to keep and retain it. Or even if it is not a rational option, it can be invested in the same stock as other investors show great interes. Explaining the situations like these with traditional theories would not be adequate.

Financial markets include both information and noise. Therefore, they are in complex forms. Information affects fundamental values. Noise is the opposite of information and means inaccuracy in ideas and data. Shortcuts, rules of thumb, or heuristics to process market signals are developed by risk managers in financial institutions. Behavioral finance investigates how risk managers gather, interpret, and process information and noise. Particularly, the process features perception and also cognitive bias. Therefore, models can be built by influenced behavior and it can shape decisions. It means that the biases can change the decisions.

Behavioral finance offers a new way of looking at the processes taking place in capital markets. By referring to psychology and examining on the imperfections of human mind, it makes clear to see the mistakes of both individual and professional investors (Szyszka, 2010: 121).

Two emotions guide people when investing (Shefrin & Statman, 2000). These are fear and greed. The fear is about losing the existing standards of living. Therefore, they have a tendency to keep a portion of savings in very safe securities like treasury bonds. This type of securities are designed to preserve the real value of money in time. Greed is about the desire of jumping to a higher standard of living. This motivates investors to accept unnecessary risk with the hope of gaining high profits. Very safe and high risk instruments can be included in a portfolio without considering on the correlation between two. It is related with narrow framing consisting of analyzing problems in an isolated manner (Kahneman & Lovallo, 1993; Kahneman & Tversky, 1984; Read, Loewenstein, & Rabin, 1999).

In people's mind, there is a mental accounting. This is created as separated account for the various types of expenses and incomes. For instance, the money won in lottery is more easier to spend than hard-earned savings. As rationally, one dollar equals one dollar regardless of how easy or hard to be earned (Szyszka, 2010: 121).



Besides greed, underestimated risk is another noteworthy point regarding the behavioral and physiological bias. Forgetting risk is often seen in the midst of the chase after higher and higher rates of return. An overconfidence occurs and it is a causative situation for underestimating risk (Szyszka, 2010).

## 2. BACKGROUND AND LITERATURE REVIEW

There are four general appearances of overconfidence: above-average effect, calibration effect, illusion of control, and unrealistic optimism (Barber & Odean, 2000; Glaser & Weber, 2007; Odean, 1998). First, people tend to overestimate their knowledge and skills while considering an opinion or making assessments about their surrounding reality. In various surveys, 60% to 90% of respondents stated that their driving abilities were above-average. Moreover their sense of humor greater than others or that their chances of passing away because of a specific disease were lower than average. (Barberis & Thaler, 2003; Svenson, 1981; Weinstein, 1980). Therefore, it can be assumed that people generally believe that they are better than the average person in a given field. It is called as above-average effect. A significant number of people overestimate their predispositions. Because whether we split all humanity in accordance with the talents specified above, the above average talented ratio would not be over 50 per cent. (Keren, 1991; Lichtenstein, Fischhoff, & Phillips, 1982; Yates, 1990).

Overconfidence is also appeared as calibration effect. When asked to people for an information or to make estimates on something that are not exact. However these estimates are pointed that people very often indicate overconfidence in parallel with their level of knowledge. According to the research of Alpert and Raiffa (1982), responses with a high certainty turn out to be correct approximately 60% of cases. People who are asked to make a prediction on the long-run changes in specific values would indicate more confidence than the predictions in the short term (De Bondt, 1998). Another factor regarding the self-confidence is the gender. Usually, men have more confidence in comparison with women (Deaux & Emswiller, 1974).

The illusion of control is manifested by overconfidence. People believe that the random incidents might be affected by their actions. For example, according to Langer (1975), higher values are given by the lottery players on the tickets which were filled by their selections instead of a machine (Szyka, 2010).

In addition to the illusion of control, overconfidence also causes optimism and wishful thinking. Errors in planning are might be related with excessive optimism. The studies of Buehler, Griffin and Ross (2002) are about the improper estimation of the time that needs to be completed as planned assignments. The trouble has both plans would show effects on large-scale public investment. Furthermore, previous mistakes would not be a teaching factor for people. Although they aware of the wishful thinking and optimism of previous

forecasts, they still prefer to believe that their predictions will accurate for the next time. (Szyka, 2010)

Self-attribution bias support overconfidence. It includes successes and mistakes. Even random successes are attributed by people to themselves. On the other hand failures are not related with themselves (Taylor & Brown, 1988). This self-attribution is a proof of lack of objectivity. This lack would cause the continuous over-confidence and a barrier for self-improvement. The beliefs are analyzed slowly and it is sign of confirmation-bias that is tendency to search information to confirm their previous beliefs or hypothesis. Also they prevent from encountering the facts have conteradiction with their adopted opinion or they can mix witt that opinion(Lord, Lepper, & Ross, 1979; Wason, 1966).

The true cause-effect relationship between two variables people concentrate on the simultaneously observed cases. A given strategy which did not bring an outcome in parallel with the expectation shall not be selected by the people. This selective approach creates an illusion of availability. It means that connecting with incorrect convictions or even implement them, showing overconfidence at the same time (Einhorn & Hogarth, 1978).

During the last bull market period, extrapolation error was committed by the people. It shall be defined as an important factor. The prices had been increasing for a long time therefore the expectation is continuation of the trend. The types of investment are claimed as never bringing losses. The issue for property market was the same. The increase in the prices had a continuous increase over decades. A drop in the price was not expected. An economic boom occurred in the commodity market as a sequel. The aruement of many analysts was like demand in the Asian economies. Also there was an underestimation of risk. It was nourished by the people's propensity to treat the things seems like impossible would not occur. Hence, the concept that an unfortunate coincidence was not accepted. It was looked very unlikely. Similarly, people ignored the risk of failure of positive developments that were assessed as highly probable and treated almost as a certainty. The fact showed that the coincidence of such almost impossible cases not only came true but also proved to have an enormous impact on the entire economy in the World. Fischhoff et al. (1977) argued that people have high tendency to ignore the possibility of occurrence of unlikely developments and, simultaneously, to treat highly possible scenarios as certain. Kahneman and Tversky (1979) theoretically clarified that in their prospect theory. With respect to the prospect theory, two function affects the total assessment of utility of a specific decision-making scenario . These functions are the S-shaped value function and the weighting function and these are subjective for each decision maker. Kahneman and Tversky pointed that one of the properties of the weighing function is its discontinuity for the probability values close to zero and close to one. Figure 1 shows that the function assigns the value of zero to very low probability arguments, and the probability arguments close to one are assigned the value of one. This clearly demonstrates the investors'

tendency to treat unlikely events as impossible and highly likely ones as absolutely certain.(Szyka, 2011).

“Another theory of overvaluation argues that bubbles arise because investors extrapolate past outcomes like returns, earnings growth, or default rates. Also the outputs of these assessments are too far into the future (Lakonishok, Shleifer, Vishny, 1994; Barberis, Shleifer, Vishny, 1998; Greenwood and Hanson, 2010). This assumption is usually motivated by Kahneman and Tversky’s (1974) representativeness heuristic. According to this heuristic, people expect even small samples of data to reflect the properties of the parent population. As a result, they draw overly strong deductions from these small samples, and this can lead to over extrapolation. The accompanying article by Barberis and Shleifer (2003) presents a model of bubble formation based on over-extrapolation of past returns, itself motivated by representativeness.

An extrapolation error occurs when people attach too much weight to past trends. The observed data in a short period of time is used for the following period by extending. Without considering on the extraordinary events(as assuming them as outliers) would cause many vital defects on the sales based on the long term forecasts. So it shall be remembered by analysts. Keeping a forecast with the assumption of a similar pace of growth may not have healthy results. The representativeness heuristic has a relevance with extrapolation error’s psychological grounds. Specially, its variation referred to as the short-series bias consisting in early results and generalizing samples from a limited amount of observations (Gilovich, Vallone, & Tversky, 1985).

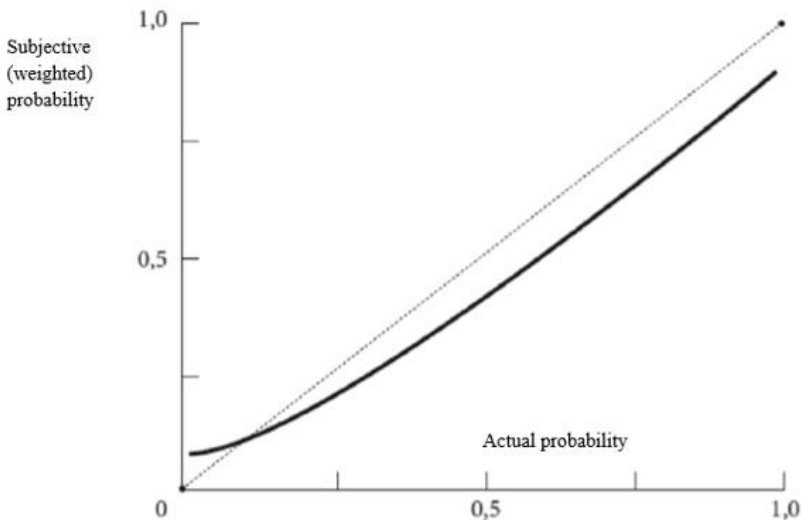


Figure 1. The Probability weighting function Source: Szyka,2011

### 3. METHODOLOGY

When people attach too much weight to past trends, an extrapolation error occurs. Especially those were occurred during a relatively short period of time and in inadequately extending them onto subsequent future periods. The observed behavior of the real estate market is a belief-based model and it is one of all these models as useful for understanding the mindset of extrapolation error. “The model is arguing that bubbles occur due to the people over-extrapolate the past when making forecasts. Also U.S. stock market in the 1920s and the 1990s, the Japanese real estate and stock markets in the late 1980s, South Sea bubble of 1720 and the tulip mania of the 1630s can be another examples. All of these are the pictures of a high propensity on the part of some market participants to extrapolate past price increases too far into the future” (Barberis, 2011). By considering on these issues, the answer that is required to see is the decisions of the people’s by the past trends. An empirical study of behaviors of the people on what they expect for a trend without perfect knowledge on the next movement of the variable. Hence, the purpose of this research is to investigate, from people’s own forecasts in accordance with the past trends to see the existence of extrapolation error.

$$H_0; \theta_0 \in \Theta_0 \quad H_A; \theta_0 \in \Theta_A$$

$H_0$  is for the null hypothesis and  $H_A$  is for the alternative hypothesis. The union of null and alternative hypothesis defines a hypothesis  $H \in \Theta = \Theta_0 \cup \Theta_A$  called the maintained hypothesis.

$H_0$  = There is a relationship between the forecasts and past trends.

$H_A$  = There is not a relationship between the forecasts and past trends.

This is a qualitative study based on a forecast simulation that was implemented on the people who live in Turkey. Simulation data would be independent from the answers of the participants. Qualitative methods are used as they can reveal information, uncover dimensions such as irrationality, thoughts and motivations and provide insight during the forecasts. In the simulation, the main goal to observe is the forecast behavior of the participant. Therefore, a budget to conduct or other market conditions are not shared with the participants. The only need from them was to make forecasts for an asset for the next period by indicating the past trends.

The study consisted of 100 people randomly living in Turkey from different financial literacy levels by random selection. It was appropriate to seek random selection of participant for this study, by sharing the simulation via online channels including Facebook Messenger, E-Mails Services and Whatsapp Messenger.

In the simulation, participants were asked to make a forecast regarding the value of three assets named as X, Y and Z that are independent each other for the following period

that is not given. The X was figuring bubble asset that was increasing and the expectation was from the participants to make a forecast as an increase in accordance with the previous change in the value. In addition, Y was a stable asset and Z was a decreasing asset. In the simulation, the participants did not manage a budget or were not investing anything. The only expectation from the participants was to make a guess or forecast for the following period that was unknown. Due to this, the causality regarding the stress, budget or the market conditions would be ineffective. Therefore, participants tried to make a forecast regarding the previous changes but their choice that was ‘There is insufficient data to make a forecast’ was always active. This simulation observed their forecasting or guessing behavior.

The measurement was based on the phenomena on extrapolation error. The expectation was that the previous changes in a variable would affect the forecast behavior and the participants whop asked to make a forecast would not expect an unexpected change in the data for the following period.

#### 4. FINDINGS

In accordance with the expectations, the null and alternative hypothesis are submitted below. Initially, the changes in X are given in the table 1.

H0 = There is a relationship between the forecasts and past trends.

HA = There is not a relationship between the forecasts and past trends.

In the following table the changes and the forecast behaviors are shared. In order to test the hypothesis, the regression model was applied.

Table 1. The Changes of Asset X and the Forecasts for the Following Period

Period	Change	Decrease	Increase	Insufficient Information to Make a Forecast	Stable
2	4,5	4	69	25	2
3	1,5	5	63	16	16
4	-0,3	76	5	16	3
5	2,3	7	71	16	6
6	1	7	65	15	13
7	-10	65	16	16	3

In accordance with the results of the participants’ forecasts as ‘increase’ are correlated with the changes in the value of X. Particularly, the most participants made a forecast on increase while it has an upward trend. While the changes were 4,5 and 2,3 increase, the increase expectation for the following period was over 65%. Also the P value is over 0,05 so the null hypothesis can not be denied.

Table 2. Regression Between Increase Answers and the Changes of X

<i>Regression Between Increase and Changes of X</i>	
Multiple R (Correlation)	0,34948
R Square	0,122137
Adjustable R Frame	-0,09733
Standard error	30,9221
Observation	6

Table 3. Coefficients, Standard Error, t-stat and p-value Between Increase Answers and the Changes of X

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	72,98095	35,57801	2,051294	0,109529

The changes of X and the answers on decrease have a high correlation while it was going down. It would be parallel with the Keynes' essay:

“We are suffering just now from a bad attack of economic pessimism. It is common to hear people say that the epoch of enormous economic progress which characterized the nineteenth century is over; that the rapid improvement in the standard of life is now going to slow down—at any rate in Great Britain; that a decline in prosperity is more likely than an improvement in the decade which lies ahead of us.

I believe that this is a wildly mistaken interpretation of what is happening to us. We are suffering, not from the rheumatics of old age, but from the growing-pains of over-rapid changes, from the painfulness of readjustment between one economic period and another. The increase of technical efficiency has been taking place faster than we can deal with the problem of labour absorption; the improvement in the standard of life has been a little too quick; the banking and monetary system of the world has been preventing the rate of interest from falling as fast as equilibrium requires.”(Keynes, 1930)

Table 4. Regression Between Decrease Answers and the Changes of X

<i>Regression Between Decrease and Changes of X</i>	
Multiple R (Correlation)	0,699455
R Square	0,489237
Adjustable R Frame	0,361546
Standard error	26,8773
Observation	6

Table 5. Coefficients, Standard Error, t-stat and p-value Between Decrease Answers and the Changes of X

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	26,56047	10,97971	2,41905	0,072838

As seen in the Table 4 and 5 changes of X and Decrease Forecasts have a high correlation and the P value is higher than 0,05; the null hypothesis cannot be denied.

There was an option that was figuring not giving a decision on making a forecast. Whether a participant feels that there was not enough information to make a forecast; “Insufficient Information to make a forecast” was able to be chosen. It is assumed that it would be chosen by the participants in the initial questions due to insufficient data. Therefore the null hypothesis and the alternative ones are submitted below.

H0 = There is a relationship between not giving a decision and the previous data

HA = There is not a relationship between not giving a decision and the previous data

Table 6. Regression Between Decrease Answers and the Changes of Y

<i>Regression Between Decrease and Changes of Y</i>	
Multiple R (Correlation)	0,679276
R Square	0,461415
Adjustable R Frame	0,326769
Standard error	1,535027
Observation	6

Table 7. Coefficients, Standard Error, t-stat and p-value Between the Periods and Insufficient Choice

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	10,33178	3,212025434	3,216592	0,032385

The P value is lower than 0,05; hence the null hypothesis is denied.

In accordance with the expectations, the null and alternative hypothesis are submitted below. Initially, the changes in Y are given in the table 8.

H0 = There is a relationship between the forecasts and past trends.

HA = There is not a relationship between the forecasts and past trends.

In the following table the changes and the forecast behaviors are shared. In order to test the hypothesis, the regression model was applied.

Table 8. The Changes of Asset Y and the Forecasts for the Following Period

Period	Change	Decrease	Increase	Insufficient Information to Make a Forecast	Stable
2	0	2	14	18	66
3	0	8	10	16	66
4	0	13	8	15	64
5	0	6	15	14	65
6	0	10	5	12	73
7	0	7	5	13	75

In accordance with the results of the participants' forecasts as 'stable' are correlated with the changes in the value of Y. Particularly, the most participants made a forecast on stability while it had a stability trend. Also the P value is over 0,05 so the null hypothesis can not be denied.

Table 9. Regression Between Increase Answers and the Changes of Y

<i>Regression Between Increase and Changes of Y</i>	
Multiple R (Correlation)	0,148854
R Square	0,022157
Adjustable R Frame	-0,2223
Standard error	5,110435
Observation	6

Table 10. Coefficients, Standard Error, t-stat and p-value Between Increase Answers and the Changes of Y

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	68,16667	2,086326	32,67306	5,23E-06

The changes of Y and the answers on stability have a high correlation while it was stable.



Table 11. Regression Between Stable Answers and the Previous Period Data

<i>Regression Between Decrease and Changes of Y</i>	
Multiple R (Correlation)	0,774769
R Square	0,600267
Adjustable R Frame	0,500334
Standard error	3,267444
Observation	6

Table 12. Coefficients, Standard Error, t-stat and p-value Stable Answers and the Previous Data

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	59,55238	3,759421	15,84084	9,28E-05

As seen in the Table 11 and 12 changes of Y and Decrease Forecasts have a high correlation and the P value is higher than 0,05; the null hypothesis cannot be denied.

There was an option that was figuring not giving a decision on making a forecast. Whether a participant feels that there was not enough information to make a forecast; “Insufficient Information to make a forecast” was able to be chosen. It is assumed that it would be chosen by the participants in the initial questions due to insufficient data. Therefore the null hypothesis and the alternative ones are submitted below.

H0 = There is a relationship between not giving a decision and the previous data

HA = There is not a relationship between not giving a decision and the previous data

Table 13. Regression Between Stable Answers and the Insufficient Choice

<i>Regression Between Decrease and Changes of Y</i>	
Multiple R (Correlation)	0,940256
R Square	0,884082
Adjustable R Frame	0,855102
Standard error	0,822308
Observation	6

Table 14. Coefficients, Standard Error, t-stat and p-value Between the Periods and Insufficient Choice

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	19,55238	0,946122	20,66581	3,24E-05

The P value is higher than 0,05; hence the null hypothesis cannot be denied.

In accordance with the expectations, the null and alternative hypothesis are submitted below. Initially, the changes in Z are given in the table 1.

H0 = There is a relationship between the forecasts and past trends.

HA = There is not a relationship between the forecasts and past trends.

In the following table (Table 15) the changes and the forecast behaviors are shared. In order to test the hypothesis, the regression model was applied.

Table 15. The Changes of Asset Z and the Forecasts for the Following Period

Period	Change	Decrease	Increase	Insufficient Information to Make a Forecast	Stable
2	-1	74	4	18	4
3	-1,1	80	4	14	2
4	-1	68	7	14	11
5	-2	78	5	9	8
6	-1	82	5	9	4
7	-3	82	4	9	5

In accordance with the results of the participants' forecasts as 'increase' are correlated with the changes in the value of Y. Particularly, the most participants made a forecast on increase while it has an downward trend. While the changes were 4,5 and 2,3 increase, the increase expectation for the following period was over 65%. Also the P value is over 0,05 so the null hypothesis cannot be denied.

Table 16. Regression Between Increase Answers and the Changes of Y

<i>Regression Between Decrease and Changes of Y</i>	
Multiple R (Correlation)	0,699455
R Square	0,489237
Adjustable R Frame	0,361546
Standard error	26,8773
Observation	6

Table 17. Coefficients, Standard Error, t-stat and p-value Between Increase Answers and the Changes of Y

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intersection	26,56047	10,97971	2,41905	0,072838

The study shows that there is a relationship between the changes in the values and the forecasts for the following period. People have a high tendency to expect the continuous in the time series. They do not have an expectation on a change in the time series. It is parallel with the previous extrapolation error tests.

## 5. DISCUSSION AND CONCLUSION

The human factor was always in the heart of all concepts of Economics and Finance. While financial innovations can be useful in preventing psychological factors from leading people depraved, the paper suggests that the same psychological factors might be always in the heart. This may be particularly true for all financial innovations that are complex. This complexity would cause to miss some vital points.

The vital point might focus on the behaviors. Because behavioral approach would figure out the issues regarding the economic models. Extrapolation error is relevant with the people's investing behavior. This behavior sounds like an output of a complex decision making process but it is an output of a basic model.

Especially in the financial crisis, bubbles were the triggers. These triggers were directly related with the human behaviors. The investing behavior is based on a the simple model that is looking at the former data. Because the decision making is made without perfect knowledge that was assumed in many economics schools and thoughts. In parallel with the literature reading and the researches, one of the factors in the investing behaviors is extrapolation error. The tendency is on over-extrapolate the past when making forecasts and bubbles occur due to this behavior.

Consequently, the empirical studies and other points figure out that many people have a tendency to follow up the continuous in the timeline series. In other words expectation of the people is not an outlier or a difference between the previous data. Human can be defined as the atom of the community. As an expectation from an atom, the all subatomic particles would be in a rational order. It might have a logic for the Chemistry or Physics. However, whether the atom is human, the outputs might be complex. Therefore rationality shall not be expected. Irrational behaviors are always observed and it will continue regarding the nature of the human. Like atoms in a material, irrational people behavior drives the macro economy.

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