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RESEARCH PAPER

Adaptation Level of the Reference Point and Investigating the Symmetrical Effect of Influential Variables

Asgar Noorbakhsh*

Department of Financial Management, Faculty of Management and Accounting, Farabi Campus of University of Tehran, Qom, Iran.

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Abstract

This study aims to examine the adaptation level of the reference point, the dynamic level of this point, and the intensity of investors' reaction to gains and losses based on prospect theory. The basis of the study is the adaptation of the reference point based on the received stimuli and considering the disposition effect. In this regard, a sample of 103,937 firm-year observations of the firms listed on the Tehran Stock Exchange (TSE) during the years 2008 to 2020 and an integrated panel data approach was used to examine the research hypotheses. The results show that, because investors act on the stimuli they receive to correct their reference point, the reference point cannot be fixed. Five variables (stimuli) – gain (loss) amount, gain (loss) duration, simultaneous effect of amount and duration of gain (loss), positive (negative) EPS adjustment, and positive (negative) coverage percentage of EPS – have a significant effect on trading volume and reference point adaptation level, and they can be mentioned as adaptation determinant factors of the reference point. The results show that the intensity of investors' reaction to gains and losses is not the same. In most studies, the reference point is assumed to be fixed and static. The reference point does not appear to be static and varies according to the conditions and stimuli received. In this research, the researchers intend to identify the factors affecting the reference point, to provide a dynamic model that can explain how investors' reference point is adapted.

Keywords:
Prospect Theory;
Reference Point;
Disposition Effect;
Adaptation Level;
Value Function.

Introduction

Kahneman and Tversky [1] published an article in the Journal of Econometrica entitled "Prospect Theory: An Analysis of Decision under Risk", which criticized the theory of Expected Utility as a decision-making model under uncertain and risky situations and proposed an alternative model called Prospect Theory. According to prospect Theory, the decision-making process takes place in two stages: Editing and Evaluation. Under prospect theory, investors evaluate outcomes not according to final wealth levels but according to their perception of gains and losses relative to a reference point (Fig. 1); investors are risk averse for gains and risk seeking for losses; investors are more sensitive to losses than to gains of the same magnitude; and investors use transformed rather than objective probabilities to calculate expectations (probability weighting).

* Corresponding author: (A.Noorbakhsh)
Email: anoorbakhsh@ut.ac.ir

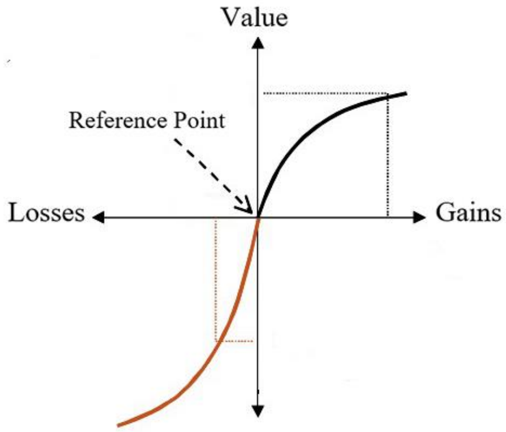

Fig 1. Example of a hypothetical value function.

One of the fundamental issues of prospect Theory is how to determine the reference point. Kahneman and Tversky [1] believe that the reference point can reflect the current situation as well as the level of expectations, in which case determining the actual location of the reference point will be somewhat ambiguous (Baucells et al. [2]). In financial decisions, there is no consensus on the price that determines the reference point. Some researchers believe that the initial purchase price in the investment can be a reference point (Weber and Camerer [3]; Odean [4]). In contrast, research by Gneezy [5] shows that the highest historical share price can be defined as a reference point. On the other hand, Köszegi and Rabin [6] and Yogo [7] believe that the reference point indicates the expected value of the individual from the future consequences. Also, the results of the research of Baucells, et al [2] show that, instead of testing past prices as a reference point, other alternatives such as purchase price, historical maximum price (historical peak point) and weighted average of purchase price can be used. But what forms the basis of the present study is that none of the above can be considered as a reference point because investors act on the stimulus or stimuli they receive to correct their reference point. These stimuli can include price changes, time, expectations, and even the simultaneous effect of these variables on each other.

So far, many studies have been conducted to determine the reference point. Some of these studies have emphasized that the reference point of investors is fixed and does not change over time. The basis of the present study is the adaptation of the reference point based on the received stimuli and considering the disposition effect.

Literature Review

Prospect theory assumes that investors evaluate the consequences relative to the reference point. If the consequences are above (below) this point, it indicates a gain (loss) (Kahneman and Tversky [1]). In addition, investors experience loss aversion, according to which investors are risk averse above the reference point and risk seeking below that point.

Determining the appropriate reference point is a key issue. Kahneman and Tversky [1] argue that the reference point should reflect the current situation or expectations or the level of inclination. For this reason, the location of the reference point may be unclear. In financial decisions, there is no consensus on what price guarantees a reference point: The initial purchase price (Odean [4]; Weber and Camerer [3]), the historical maximum price (Gneezy [5]), and the expected value of future outcomes (Köszegi and Rabin [6]; Yogo [7]) are among those cited by researchers as reference points.

This argument becomes complicated when we assume that the reference point may be dynamic. Reference point adaptation means a change in the reference point or an update of the reference point that indicates that the loss or gain changes up or down. Therefore, subsequent prices are evaluated relative to the modified reference point. Adaptation is a process in which the effect of a constant or repetitive stimulus decreases over time. All definitions imply that the reference point is not fixed and is affected by past or future outcomes and stimuli. Arkes et al. [8] show that adaptation of the reference point exists, and people adapt to gains faster than to losses of the same magnitude. Adaptation level theory suggests that the perceived magnitude of a stimulus depends on its relation to an adapted level that is determined by preceding stimuli (Arkes et al. [8]; Chen and Rao [9]). According to Helson's formula [10], the adaptation level (AL) is the average of past stimuli levels, while Xt represents the current stimulus level, and t represents time (Eq. 1):

$$AL = \frac{1}{t}\sum_{t=0}^{t} X_t \tag{1}$$

Sarris [11] argued that extreme stimuli do not affect the adaptation level as much as Helson [10] suggested. Parducci [12] suggested that the judgment of a stimulus is influenced by the rank of that stimulus within a group of stimuli. In addition, the Helson equation does not distinguish between the time at which a loss occurs. For example, it does not differentiate how a more distant loss experienced two years ago and how a more recent loss experienced two days ago may affect the adaptation level differently. To account for this temporal component, Hardie, Johnson, and Fader [13] propose the following formula to model the adaptation level (Eq. 2):

$$AL_t = \alpha X_{t-1} + (1-\alpha)AL_{t-1} \tag{2}$$

where α is between 0 and 1 ($0 \leq \alpha \leq 1$). Although the parameter α now allows recent stimuli to receive more weight than past stimuli, it still does not allow for a full separation of time and stimuli. The Helson equation implies that the adapted reference point is determined as a recursive average of all preceding stimuli.

Therefore, in the area of losses, we expect the adapted reference point to have a positive relationship with the sum of all previous losses (i.e., the total amount of losses) and to have a negative relationship with the number of past time points. As the stock price drops more, the size of the total price change becomes more negative and the adapted reference point is expected to be lower as well. We do not expect that the adaptation process follows the precise dynamics of the Helson equation, but we do expect a significant relationship between the total sum of past stimuli and the elapsed time to the final adapted reference point. The effect of total loss and time on adaptation can be shown as follows (Eq. 3):

$$AL_t = p_t - R_t = \alpha + \beta_1 . t + \beta_2 . TL_t + \beta t_{t_{int}} \tag{3}$$

where *AL* denotes the adapted reference point, *t is* the time in a losing position, and TL_t the size of the total loss. Because the accumulation of losses occurs over time, there needs to be a correction between the time spent in the loss situation and the total size of the loss. For this reason, the simultaneous effect between the two also needs to be examined.

Therefore, in order to better understand how investors make decisions under risk (based on prospect theory) and also to understand how to adapt an investor reference point with respect to information received such as price changes, time effects, losses and their simultaneous effects and investors' expectations, the following basic questions need to be answered: 1) Does considering the disposition effect, the amount of gain (loss), the duration of gain (loss), and the simultaneous effect of the amount and duration of gain (loss) affect the volume of transactions? 2) Is there a significant relationship between the trading volume and shareholders' expectations based on the disposition effect? 3) Do investors react symmetrically in the face of gains and losses of equal intensity?

As mentioned earlier, the basis of the study is the adaptation of the reference point based on the received stimuli and considering the disposition effect. The reference point cannot be fixed, because investors act to correct their reference point based on the stimuli they receive. These stimuli can include price changes, time, expectations, and even the simultaneous effect of these variables on each other.

Citing studies by Lee et al. [14], Köszegi and Rabin [6], Yogo [7] and Hoffman et al. [15], to express the adaptation level of the reference point, five variables (stimuli) – gain (loss) amount, gain (loss) duration, simultaneous effect of amount and duration of gain (loss), positive (negative) EPS adjustment, and positive (negative) coverage percentage of EPS – have been used and the general hypothesis was expressed as follows:

Hypothesis 1: Considering the disposition effect, there is a significant relationship between trading volume and the adaptation level of the reference point.

Adapting the reference point means changing the reference point or updating the reference point based on the investor's gain or loss level. Also, according to the disposition effect, investors sell shares in a gain position sooner and hold shares in a loss position for a long time (Shefrin and Statman [16]). If the trading volume increases with the new adaptation, it indicates that a new reference point has been adapted. Therefore, according to the research, the variables (stimuli) of gain (loss) amount, gain (loss) duration and their simultaneous effect on the adaptation of the reference point will be tested. Therefore, the first sub-hypothesis is expressed as follows:

Sub-hypothesis 1.1: Considering the disposition effect, gain (loss) amount, gain (loss) duration, and simultaneous effect of amount and duration of gain (loss) affect the trading volume.

$$\begin{cases} H_0: \beta_i = 0 \quad \forall i;\ i = 2, \ldots, 10 \\ H_1: Otherwise \end{cases}$$

According to research on the determinants of the reference point, investors' expectations have been mentioned as one of the determinants of the reference point (Köszegi and Rabin [6]; Yogo, [7]; and Hoffman *et al.* [15]). In this section, the expected EPS and the amount of its realization and adjustments have been used as a factor to determine the future expectations of shareholders. Therefore, the role of EPS, related adjustments and the percentage of EPS coverage in determining the new reference point will be tested as follows:

Hypothesis 2: Considering the disposition effect, there is a significant relationship between trading volume and shareholder expectations.

Sub-hypothesis 2.1: There is a significant relationship between trading volume and positive (negative) adjustment of EPS.

Sub-hypothesis 2.2: There is a significant relationship between trading volume and positive (negative) percentage of EPS coverage.

Another hypothesis relates to the intensity of reference point adaptation. Citing research by Arks [8] and Chen and Rao [9], this hypothesis arises as a result of the question of whether investors react equally to gains and losses with the same intensity. On the other hand, it is thought that, if the first stimulus indicates a loss and the next stimulus indicates a gain, the reference point correction will be faster. Therefore, it is hypothesized that:

Hypothesis 3: Adaptation of the reference point is significantly larger following a gain than following a loss (asymmetry in reference point adaptation).

Sub-hypothesis 3.1: There is a significant relationship between trading volume and the level of adaptation of the reference point towards gain (loss).

Sub-hypothesis 3.2: There is a significant relationship between trading volume and gain stimulus following losses.

Data and Methodology

The dependent variables

To extract the required data related to the dependent variable of hypotheses 1 and 3.1, stock trading volume data (VOL_{it}) in the research period has been used. Also, citing the research of Huddart *et al*., [17,18] in order to avoid a high correlation between data (due to the use of daily transactions) or accumulation error (due to the use of monthly transactions), the average weekly trading volume is used as the dependent variable (Eq. 4):

$$VOL_{it} = \frac{\sum_{i=1}^{n} NSW_{it}}{NSOW_{it}} \tag{4}$$

where (VOL_{it}) is the average daily number of firm *i* shares traded as a percentage of firm shares outstanding in week *t*, NSW_{it} is the number of shares traded by firm i in week t, and $NSoW_{it}$ is the number of firm i shares outstanding in week t.
To extract the required data related to the dependent variable of Hypothesis 2, stock trading volume data (VOL_{it}) in the research period has been used as follows (Eq. 5):

$$VOL_{it} = \frac{VOL_{i+26}}{VOL_{i-26}} \tag{5}$$

where (VOL_{it}) is the average daily number of firm *i* shares traded as a percentage of firm shares outstanding in week *t*, and VOL_{i+26} and VOL_{i-26} represent the number of shares traded by firm i in 26 working days after and prior to gain adjustment, respectively.

The independent variables

Gain (loss) amount: Since there must be a basis for calculating the gain of firm i in week *t* ($GAIN_{it}$) or the loss of firm i in week t ($LOSS_{it}$) to calculate the amount of gain or loss accordingly, the reference point has been used as the basis for measuring gain or loss. Numerous studies and research have been carried out to determine the reference point; some of the most authoritative research being that conducted by Huddart *et al*., [17,18]. According to this research, stock trading volume increases as the price exceeds the maximum price of the previous year. Therefore, it can be said that the maximum price in the last year is the reference point for investors. As a result, the gain (loss) of investors will be determined based on the maximum price in the past year (which follows the rolling benchmark period). The gain ($GAIN_{it}$) or loss ($LOSS_{it}$) of firm i in week t will be equal to the difference between the average weekly stock price of firm i in week t ($AVE.W.PRICE$) and the maximum stock price of firm i in the past year ($PRIORMAX$):

$$AVE.W.PRICE - PRIORMAX > \circ \Rightarrow GAIN_{it}$$
$$AVE.W.PRICE - PRIORMAX < \circ \Rightarrow LOSS_{it}$$

The above formulas indicate the existence of gain or loss but do not indicate the amount of gain or loss. On the other hand, it is not possible to access the gain or loss account of investors to determine the amount of gain or loss. Therefore, gain (AG) or loss (AL) intervals have been used to determine the amount of gain or loss, as shown in Table 1:

Table 1. Gain (AG) or Loss (AL) intervals.

No.	Gain or loss intervals (%)	No.	Gain or loss intervals (%)
1	$0 \leq AG < 5$	6	$-5 \leq AL < 0$
2	$5 \leq AG < 10$	7	$-10 \leq AL < -5$
3	$10 \leq AG < 15$	8	$-15 \leq AL < -10$
4	$15 \leq AG < 20$	9	$-20 \leq AL < -15$
5	$AG \geq 20$	10	$AL < -20$

The amount of gain or loss can be in one of the above intervals and, using it, its impact and significance on trading volume can be tested. As a dummy variable, if the amount of the gain or the loss is in the desired range, it will be assigned '1'; otherwise, it will be assigned 'zero'.

Gain (loss) duration: The longer the loss period, the lower the reference point adaptation (Lee *et al*. [14]). Gain (loss) duration has also been used in this study as another variable affecting the trading volume, which ultimately affects the determination of the reference point. To determine the duration of gain (loss), time intervals have been used and the duration of loss or gain has been determined according to the reference point. Therefore, based on the reasons in the previous hypothesis, we again use the maximum price in the last year as a reference point for investors. For this purpose, 10 time intervals for gain (TG) and loss (TL) have been determined, as shown in Table 2:

Table 2. Ten time intervals for gain (TG) and loss (TL).

No.	Gain or loss duration (Week)	No.	Gain or loss duration (Week)
1	TG=1	6	TL=1
2	TG=2	7	TL =2
3	TG=3 to 4	8	TL =3 to 4
4	TG=5 to 8	9	TL =5 to 8
5	TG > 8	10	TL > 8

The duration of gain or loss of each shareholder can be in one of the above intervals and, using it, its impact and significance on the volume of trading can be tested. As a dummy variable, if the duration of the gain or the loss is in the desired range, it will be assigned '1'; otherwise, it will be assigned 'zero'.

Simultaneous effect of amount and duration of gain (loss): There is strong evidence that, the greater the amount of loss and the longer the duration of the loss, the lower the reference point correction and the greater the level of adaptation (Lee *et al*. [14]). Therefore, in this study, the simultaneous effect of the amount and duration of gain (loss) ($AG.TG_{it}$ and $AL.TL_{it}$) on trading volume (VOL_{it}) was also tested.

Positive (negative) EPS adjustment: To examine the effect of gain adjustment on trading volume, we consider the projected annual gain and express it quarterly. Therefore, positive (PAEPS) and negative (NAEPS) EPS adjustments have been used, as shown in Table 3:

Table 3. Positive (PAEPS) and negative (NAEPS) EPS adjustments.

No.	Positive (negative) EPS adjustment (%)	No.	Positive (negative) EPS adjustment (%)
1	$NAEPS < -45$	5	$0 \leq PAEPS < 15$
2	$-45 \leq NAEPS < -30$	6	$15 \leq PAEPS < 30$
3	$-30 \leq NAEPS < -15$	7	$30 \leq PAEPS < 45$
4	$-15 \leq NAEPS < 0$	8	$PAEPS \geq 45$

As a dummy variable, if the amount of the gain adjustment is in the desired range, it will be assigned '1'; otherwise, it will be assigned 'zero'.

Positive (negative) coverage percentage of EPS: To examine the effect of a positive or negative percentage of gain coverage on trading volume, a positive or negative difference between the actual percentage and the expected percentage is calculated quarterly. Therefore, positive (PCEPS) and negative (NCEPS) EPS coverage have been used, as shown in Table 4:

Table 4. Positive (PCEPS) and negative (NCEPS) EPS coverage.

No.	Positive (negative) EPS coverage (%)	No.	Positive (negative) EPS coverage (%)
1	NCEPS < -45	5	0 ≤ PCEPS < 15
2	-45 ≤ NCEPS < -30	6	15 ≤ PCEPS < 30
3	-30 ≤ NCEPS < -15	7	30 ≤ PCEPS < 45
4	-15 ≤ NCEPS < 0	8	PCEPS ≥ 45

As a dummy variable, if the amount of the gain coverage is in the desired range, it will be assigned '1'; otherwise, it will be assigned 'zero'. The following equation is also used to calculate the expected quarterly EPS (Eq. 5):

$$Seasonal\ Expected\ EPS = \left(\frac{Annually\ Predicted\ EPS}{4}\right) \times t \tag{6}$$

where, t is seasonality.

Method

The scope of the research will be from the beginning of 2008 to the end of March 19, 2020, for 12 years. However, since the rolling window method has been used in data collection, so the data for 2007 has also been used. The statistical population of the research is the Tehran Stock Exchange (TSE). The number of samples used for hypotheses 1 and 3 comprises 280 companies (654 weeks in total). Therefore, the sample of 103,937 firm-week observations in the period of the research has been used in the required analysis. The number of samples used for Hypothesis 2 comprises 320 companies and the total observations in the period of research as a firm-week is equal to 12,798 pieces of data that have been used in the required analysis.

Chow test is a test to determine whether Common Effect (CE) or Fixed Effect (FE) is the most appropriate model to use in estimating panel data.

To select the appropriate model and method of regression for the panel data, all statistical tests such as the test for poolability, Chow test, Hausman test, and tests for cross-sectional dependence were performed. Also, all calculations were performed using R 2.12.2 software and the plm package.

Results

Regression model test for Hypothesis 1: To examine the relationship between trading volume and gain (loss) amount, gain (loss) duration, and simultaneous effect of amount and duration of gain (loss), Eqs. 7, 8, and 9 were used:

$$VOL_{it} = \beta_0 + \sum_{k=2}^{10} \beta_k A_{kit} + \varepsilon_{it} \quad ; \quad i = 1,2,\dots,280, \qquad t = 1,\dots,654 \tag{7}$$

$$VOL_{it} = \beta_0 + \sum_{k=2}^{10} \beta_k T_{kit} + \varepsilon_{it} \quad ; \quad i = 1,2,\dots,280, \qquad t = 1,\dots,654 \tag{8}$$

$$VOL_{it} = \beta_0 + \sum_{k=2}^{50} \beta_k S_{kit} + \varepsilon_{it} \quad ; \quad i = 1,2,\dots,280, \qquad t = 1,\dots,654 \tag{9}$$

where Eq. 7 is to express the relationship between trading volume and gain (loss) amount, Eq. 8 is to express the relationship between trading volume and gain (loss) duration, and Eq. 9 is to express the simultaneous effect. The results of fitting Eq. 7 are shown in Table 5.

Table 5. Results of fitting the Hypothesis 1 (Eq. 7) relationship between trading volume and gain (loss) amount.

Variable	Coefficients	Coefficient estimation	standard deviation	t-value	p-value
A_1	B0	0.273	0.011	28.50	<0.001 ***
A_2	B2	0.232	0.182	12.05	<0.001 ***
A_3	B3	0.313	0.033	9.87	<0.001 ***
A_4	B4	0.317	0.082	3.79	<0.001 ***
A_5	B5	0.490	0.047	10.98	<0.001 ***
A_6	B6	-0.064	0.013	-6.84	<0.001 ***
A_7	B7	-0.078	0.013	-8.11	<0.001 ***
A_8	B8	-0.081	0.013	-8.52	<0.001 ***
A_9	B9	-0.098	0.013	-9.95	<0.001 ***
A_{10}	B10	-0.093	0.011	-13.41	<0.001 ***
R^2	0.133636		F-Value	116.665	
Adjusted R^2	0.133635		F probability	<0.001 ***	
*** Indicates statistical significance at a 0.1% level, ** Indicates statistical significance at a 1% level, *Indicates statistical significance at a 5% level.					

Considering the results in Table 5, all virtual variables in the model are significant. According to the estimation of coefficients, the higher the gain is, the higher the trading volume will be. On the other hand, the higher the loss is, the lower the trading volume will be. Among these variables, according to the estimation of their coefficients, A10 has the most negative impact and A5 has the most positive effect on trading volume. That is, when the loss amount is more than 20% (AL < -20), the largest decrease in trading volume is observed, and when the gain amount is more than 20% (AG ≥ 20), the largest increase in trading volume is observed. Fig. 2 shows the effect of gain or loss on trading volume. Also, the results of fitting Eq. 8 are shown in Table 6.

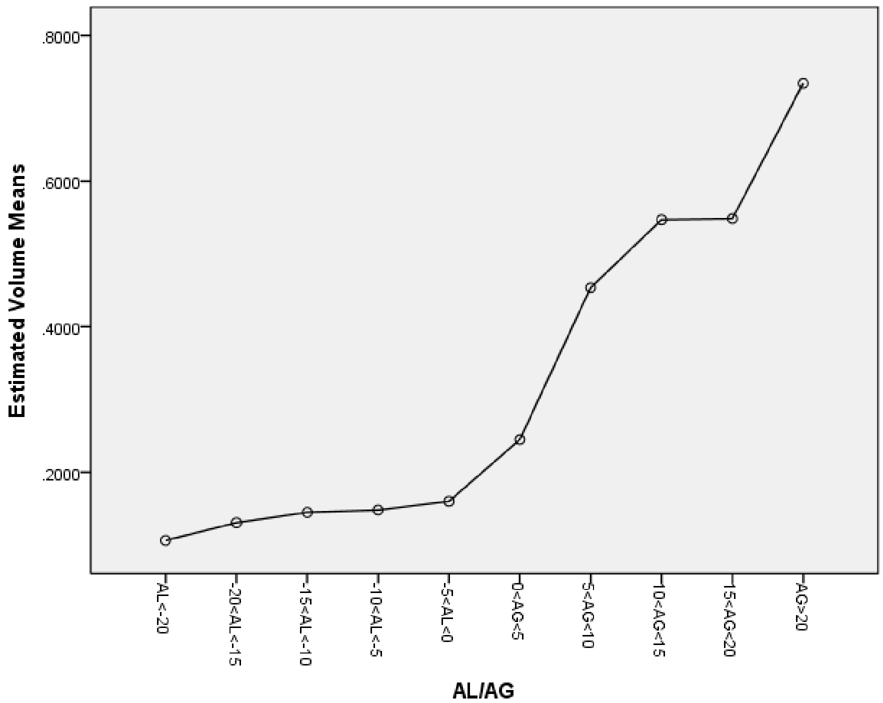

Fig 2. Impact of Gain or Loss (AL/AG) amount on Trading Volume (VOL)

Table 6: Results of fitting the Hypothesis 1 (Equation 8)- relationship between trading volume and gain (loss) duration.

Variable	Coefficients	Coefficient estimation	standard deviation	t-value	p-value
T_1	B0	0.445	0.015	35.083	<0.001 ***
T_2	B2	-0.03	0.023	-2.542	<0.001 ***
T_3	B3	-0.062	0.024	-4.011	<0.001 ***
T_4	B4	-0.149	0.028	-6.836	<0.001 ***
T_5	B5	-0.302	0.032	-10.943	<0.001 ***
T_6	B6	-0.131	0.02	-9.092	<0.001 ***
T_7	B7	-0.18	0.021	-11.423	<0.001 ***
T_8	B8	-0.208	0.019	-14.866	<0.001 ***
T_9	B9	-0.205	0.017	-16.065	<0.001 ***
T_{10}	B10	-0.259	0.015	-23.438	<0.001 ***
R^2	0.113550		F-Value	116.960	
Adjusted R^2	0.113549		F probability	<0.001 ***	
*** Indicates statistical significance at a 0.1% level, ** Indicates statistical significance at a 1% level, *Indicates statistical significance at a 5% level.					

According to the results of Table 6, all virtual variables in the model are significant. Given that the T1 coefficient estimate is a positive number, we conclude that, when the gain period is 1 week (TG = 1), the trading volume increases. After that, the longer the gain period, the more the trading volume decreases. Also, according to the estimation of T6, T7, T8, T9 and T10 coefficients, it is observed that, the longer the loss period, the more the trading volume decreases. Among these variables, T5 and T10 have the most negative impact on trading volume. That is, when the gain period is more than two months (TG>2) or when the loss period is more than two months (TL>2), we see the largest decrease in trading volume. Fig. 3 shows the effect of gain (loss) duration on trading volume. Also, the results of fitting Eq. 9 are shown in Table 7.

The adjusted R^2 of the model also indicates that about 15.2% of the changes related to the volume of trading are explained by the variables (amount and duration of gain and loss) in the model. Considering that the probability value (P-value) of the F statistic is less than 0.05, the overall significance of the model is confirmed.

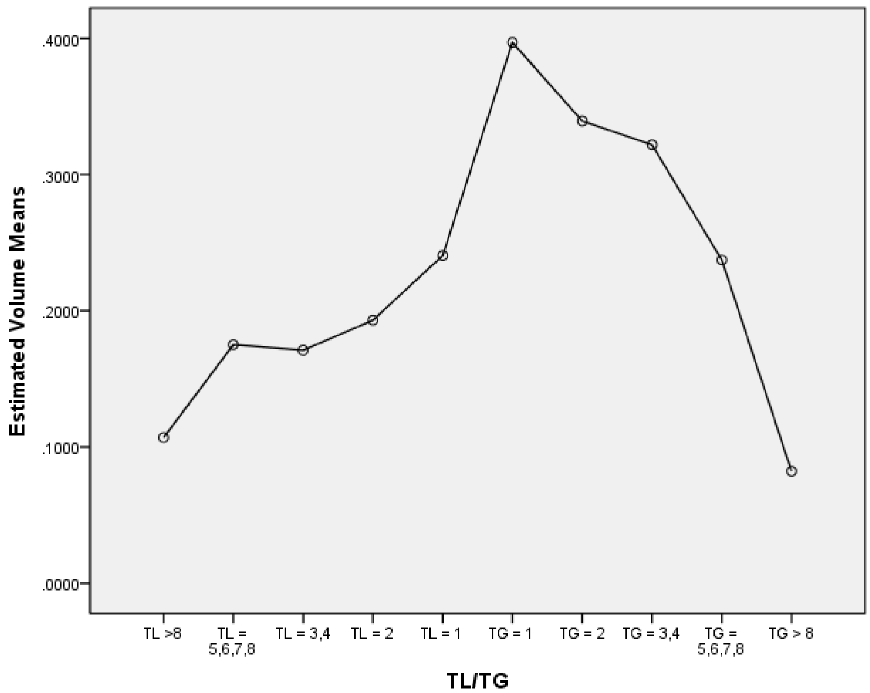

Fig 3. Impact of Gain or Loss (AL/AG) duration on Trading Volume (VOL)

Table 7: Results of fitting the Hypothesis 1 (Eq. 9)- relationship between trading volume and simultaneous effect of amount and duration of gain (loss).

Duration / %	1	2	3-4	5, 6, 7 and 8	>8	1	2	3-4	5, 6, 7 and 8	>8
0≤AG<5	0.253 (***)	0.139 (***)	0.107 (***)	0.018	-0.098 (**)	--	--	--	--	--
5≤AG<10	0.380 (***)	0.400 (***)	0.345 (***)	0.304 (***)	0.095	--	--	--	--	--
10≤AG<15	0.527 (***)	0.371 (***)	0.419 (***)	0.579 (***)	0.167	--	--	--	--	--
15≤AG<20	0.483 (***)	0.573 (**)	0.396 (*)	0.293	0.174	--	--	--	--	--
AG≥5	0.556 (***)	1.083 (***)	0.937 (***)	0.375 (**)	0.177	--	--	--	--	--
-5≤AL<0	--	--	--	--	--	-0.123 (***)	-0.059 (*)	-0.013	-0.066 (**)	-0.038 (*)
-10≤AL<-5	--	--	--	--	--	-0.173 (***)	-0.095 (***)	-0.063 (**)	-0.047 (*)	0.008
-15≤AL<-10	--	--	--	--	--	-0.230 (***)	-0.121 (***)	-0.062 (*)	-0.042 (*)	0.021 (*)
-20≤AL<-15	--	--	--	--	--	-0.019 (***)	-0.173 (**)	-0.084 (**)	-0.134 (***)	-0.009
AL<-20	--	--	--	--	--	-0.114	-0.127 (**)	-0.121 (***)	-0.055 (***)	-0.132 (***)
R^2		0.15235				F-Value		29.2381		
Adjusted R^2		0.15229				F probability		<0.001 ***		

***Indicates statistical significance at a 0.1% level, ** Indicates statistical significance at a 1% level, *Indicates statistical significance at a 5% level.

Regression model test for Hypothesis 2: To examine the relationship between trading volume and EPS adjustment and coverage percentage of EPS, Eq. 10 and 11 were used:

$$VOL_{it} = \beta_0 + \sum_{k=1}^{8} \beta_k AEPS_{kit} + \varepsilon_{it} \quad ; \quad i = 1,2,\dots,301, \quad t = 1,\dots,48 \tag{10}$$

$$VOL_{it} = \beta_0 + \sum_{k=1}^{8} \beta_k CEPS_{kit} + \varepsilon_{it} \quad ; \quad i = 1,2,\dots,301, \quad t = 1,\dots,48 \tag{11}$$

where Eq. 10 is to express the relationship between trading volume and EPS adjustment and Eq. 11 is to express the relationship between trading volume and coverage percentage of EPS. The results of fitting Eq. 10 are shown in Table 8.

The adjusted R^2 of the model also indicates that about 2.8% of the changes related to the volume of trading are explained by the variable (positive (negative) EPS adjustment) in the model. Considering that the probability value (P-value) of the F statistic is less than 0.05, the overall significance of the model is confirmed. The results of fitting Eq. 11 are shown in Table 9.

Table 8: Results of fitting the Hypothesis 2 (Eq. 10)- relationship between trading volume and EPS adjustment.

Variable	Coefficients	Coefficient estimation	Standard deviation	t-value	p-value
intercept	B0	0.086	0.019	4.618	0.000 ***
$AEPS_1$	B1	0.221	0.062	3.592	0.000 ***
$AEPS_2$	B2	-0.014	0.093	-0.147	0.884
$AEPS_3$	B3	0.082	0.072	1.137	0.255
$AEPS_4$	B4	-0.089	0.048	-1.865	0.062*
$AEPS_5$	B5	-0.056	0.039	-1.439	0.150
$AEPS_6$	B6	0.033	0.056	0.594	0.553
$AEPS_7$	B7	0.088	0.087	1.020	0.308
$AEPS_8$	B8	0.197	0.062	3.165	0.002**
R^2	0.02866		F-Value	4.206	
Adjusted R^2	0.02864		F probability	<0.000 ***	
*** Indicates statistical significance at a 0.1% level, ** Indicates statistical significance at a 1% level, *Indicates statistical significance at a 5% level.					

Table 9: Results of fitting the Hypothesis 2 (Eq. 11)- relationship between trading volume and coverage percentage of EPS.

Variable	Coefficients	Coefficient estimation	Standard deviation	t-value	p-value
intercept	B0	0.268	0.076	3.629	0.000***
$CEPS_1$	B1	0.029	0.093	0.314	0.754
$CEPS_2$	B2	-0.114	0.093	-1.224	0.221
$CEPS_3$	B3	-0.192	0.081	-2.375	0.018*
$CEPS_4$	B4	-0.218	0.076	-2.881	0.004**
$CEPS_5$	B5	-0.225	0.076	-2.947	0.003**
$CEPS_6$	B6	-0.139	0.087	-1.590	0.112
$CEPS_7$	B7	-0.085	0.115	-0.738	0.460
$CEPS_8$	B8	-0.122	0.096	-01.275	0.202
R^2	0.024929		F-Value	3.406	
Adjusted R^2	0.024908		F probability	<0.0006 ***	
*** Indicates statistical significance at a 0.1% level, ** Indicates statistical significance at a 1% level, *Indicates statistical significance at a 5% level.					

The adjusted R^2 of the model also indicates that about 2.49% of the changes related to the volume of trading are explained by the variable (positive (negative) coverage percentage of EPS) in the model. Considering that the probability value (P-value) of the F statistic is less than 0.05, the overall significance of the model is confirmed.

Analysis of data related to Hypothesis 3: As mentioned before, to examine the asymmetry in reference point adaptation, two sub-hypotheses were expressed as follows:

Sub-hypothesis 3.1: Adaptation in the reference point is significantly larger following a gain than following a loss (asymmetry in reference point adaptation).

Sub-hypothesis 3.1: There is a significant relationship between trading volume and the level of adaptation of the reference point towards gain (loss).

To test Hypothesis 3.1, a Comparison of Two Population Means has been used. The results of the Kolmogorov-Smirnov test show that the distribution of observations is not normal. Therefore, the Mann–Whitney U test has been used for the Comparison of Two Population Means. The Mann–Whitney U test is a nonparametric test of the null hypothesis that, for randomly selected values X and Y from two populations, the probability of X being greater than Y is equal to the probability of Y being greater than X. The results of the test are shown in Table X. It should be noted that the variables µ1 to µ10 are related to the average gain and loss of the defined 10 intervals (including five gain intervals from µ1 to µ5 and five loss intervals from µ6 to µ10) that were previously included.

Table 10: The Mann–Whitney U test results for Hypothesis 3.1.

Null Hypothesis	Test statistics	p-value	Estimating differences	95% confidence interval for differences	
				Upper-bound	Lower-bound
$H_0: \mu_1 = \mu_6$	17609353	<0.001**	0.010	0.012	0.008
$H_0: \mu_2 = \mu_7$	8124953	<0.001**	0.143	0.155	0.132
$H_0: \mu_3 = \mu_8$	2569612	<0.001**	0.246	0.276	0.218
$H_0: \mu_4 = \mu_9$	368132	<0.001**	0.223	0.312	0.159
$H_0: \mu_5 = \mu_{10}$	9441650	<0.001**	0.257	0.328	0.214

Given the very small p-value values in Table 10, we conclude that all of the above null hypotheses are rejected. That is, the volume of trading in symmetrical gain and loss periods is not the same. Given that the estimation of mean differences is positive for all tests of hypotheses, we conclude that, when traders are in gain, the volume of trades is greater than when they are in symmetric loss.

An interesting point in the estimation of mean differences column in Table 10 is that, the higher the gain and the loss are, the greater the difference is. That is, the higher the gain and the loss are, the more the traders' behavior differs in the gain and the loss. In other words, the higher the gain and loss are, the higher the trading volume is in the gain position than the trading volume in the loss position.

According to Hypothesis 3.2, there is a significant relationship between trading volume and the level of adaptation of the reference point towards gain (loss). It is claimed here that, if the first stimulus indicates a loss and the next stimulus indicates a gain, the reference point adaptation will be faster. To test Hypothesis 3.2, a two-week scenario was considered for two different cases, as follows:

The first case: Traders were in loss for the first week and in gain for the second week.

The second case: Traders were in gain in both the first and second weeks.

A summary of the descriptive statistics for these two cases is given in Table 11:

Table 11: Descriptive statistics for the first scenario presented in Hypothesis 3.2.

	Number of observations	Average percentage change	Standard deviation	Median
The first case	398	806.60	7906.754	34.17
The second case	1340	1584	35335.31	-0.60

To see if this percentage change in trading volume is the same for both cases, a Comparison of Two Population Means has been used. The results of the Kolmogorov-Smirnov test show that the distribution of observations is not normal. Therefore, The Mann–Whitney U test has been used for the Comparison of Two Population Means. The results of these tests are shown in Table 12:

Table 12: Mann–Whitney U test results for the first scenario proposed in Hypothesis 3.2.

Test statistics	p-value	Estimating differences	95% confidence interval for differences	
			Upper-bound	Upper-bound
319420	<0.001**	34.182	45.508	23.144

According to the Table 12, the null hypothesis is rejected. That is, the behavior of traders in these two cases is different**.** Given that the difference estimate is positive, we conclude that in the first case, the increase in trading volume is greater than in the second case. That is, when traders are at a loss one week and at a gain the next, the increase in trading volume is greater than when they are at a gain for two consecutive weeks.

To further test this hypothesis, a second scenario was considered with the other two cases, as follows:

The first case: Traders were in gain for the first week and at a loss for the second week.

The second case: Traders were losing in both the first and second weeks.

A summary of descriptive statistics for these two cases is given in Table 13:

Table 13: Descriptive statistics for the second scenario presented in Hypothesis 3.2.

	Number of observations	Average percentage change	Standard deviation	Median
The first case	1121	10.43	577.45	-50.51
The second case	2054	1540	33632.47	-25.10

The results of the Mann-Whitney test for the second scenario are shown in Table 14:

Table 14: Mann–Whitney U test results for the second scenario proposed in Hypothesis 3.2.

Test statistics	p-value	Estimating differences	95% confidence interval for differences	
			Upper-bound	Upper-bound
839306	<0.001**	-24.781	-20.825	-28.824

According to the results of Table XIV, the null hypothesis is rejected. That is, the behavior of traders in these two cases is different. Given that the estimate of the difference is negative, we conclude that in the second case, the increase in trading volume is greater than in the first case. That is, when traders are at a loss for two consecutive weeks, the increase in trading volume is greater than when they are at a gain one week and at a loss the next.

It is important to mention here that in some relationships such as Tables 8 and 9, a small percentage of the relationships between variables are covered, and for this reason the interpretation of the findings should be done with caution for these items.

Conclusion

As mentioned earlier, the basis of the study is the adaptation of the reference point based on the received stimuli and considering the disposition effect. The results show that, because investors act on the stimuli they receive to correct their reference point, the reference point cannot be fixed. Reference point adaptation means a change in the reference point or an update of the reference point that indicates that the loss or gain changes up or down. Therefore, subsequent prices are evaluated relative to the modified reference point. Adaptation is a process in which the effect of a constant or repetitive stimulus decreases over time. All definitions imply that the reference point is not fixed and is affected by past or future outcomes and stimuli. Arkes *et al*. [8] show that adaptation of the reference point exists and people adapt to gains faster than to losses of the same magnitude.

According to research results, the five variables (stimuli) – gain (loss) amount, gain (loss) duration, simultaneous effect of amount and duration of gain (loss), positive (negative) EPS adjustment, and positive (negative) coverage percentage of EPS – have a significant effect on trading volume and reference point adaptation level and they can be described as adaptation determinant factors of the reference point.

Although the degree of explanation of the reference point adaptation level by these variables is not equal and has intensity and weakness, respectively, the simultaneous effect of amount and duration of gain (loss), the amount of gain (loss), duration of gain (loss), positive (negative) EPS adjustment, and the positive (negative) coverage percentage of EPS have the greatest impact on trading volume.

Also, the results indicate that reference point adaptation was not asymmetric and adaptation following a gain was significantly greater than following a loss. Meanwhile, the results show that there is a significant relation between volume and gain stimuli after loss. So, when traders lose one week and gain the next week, the increase in volume is greater than for two weeks in gains.

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