Investors' Irrational Behaviors, Stock-Price Fluctuation and Enterprise Inefficient Investment

Huang Yi^{1,*}, Yang Xiugang²

¹26-1/2-4-502, Shizhong District, Shandong Yingcai University, Ji'nan, China

²110/1-4 Prachachuen Road, Tungsonghong, Laksi, China-Asean International College of Dhurakji Pundit University, Bangkok, Thailand.

*hy2924669@163.com

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ABSTRACT

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Based on Chinese A-share companies as research samples, the effect of investors' irrational behaviors on enterprise inefficient investment was studied in this paper. Results show that investors' overconfidence and their sentiments are positively correlated with enterprise inefficient investment, and stock price fluctuation play a mediation role between the two. By further investigation, it can be found that the effects of investors' overconfidence on stock price fluctuation and on enterprise inefficient investment are of certain persistence and share the same direction. However, the effects of investor's sentiment on stock price fluctuation at the current stage and later stages are of intervals and feature direction variation. The worsening and relieving effect of stock price fluctuation on over-investment is particularly significant on lagged first-order.

1. Introduction

Investors' irrational behaviors not only leads to stock mispricing, but also the impact on enterprise resource allocation efficiency. Since China capital market is immaturely developed and Chinese social culture brings a series of cognitive biases, Chinese investors' irrational behaviors are even more significant. This paper demonstrates that the stock price fluctuation plays a medium role between China investors' irrational behaviors and enterprise inefficient investment, and the effects of investors' overconfidence and sentiments on stock price fluctuation at current stage and later stages have different orientations, which provides reference for improving capital market and investment efficient management.

2. Research Hypothesis

2.1 Investors' Irrational Behaviors and Un-Efficient Investment

Currently, investors' irrational behaviors are thought to cause negative influence to enterprise investment efficiency. Some scholars believe that investors' irrational motions affect enterprise investment efficiency via "equity financing channel", which means when the investors are in high spirits, the cost of equity financing is low, making enterprises in financing restriction conduct great amount of external financing, for instance may invest in project whose NPV<0, thus resulting in over-investment [i]; some scholars believe when the investors' irrational motions are changed, managers will cater to the investors' sentiment and arrange investment project for them, which means the investment behavior change with investors' sentiments. No matter what the reason is, we believe that, for any reason, the impact of investor irrational behavior on corporate investment is linked by stock-price. Therefore, stock price fluctuation plays a mediation role between investors' irrational behaviors and enterprise inefficient investment, i.e. investors' irrational behaviors guide management's investment behavior via stock price change. When investors' irrational behaviors cause stock price rise, the management will increase external financing to expand investment scale, thus forming over-investment; when stock price drops, to repurchase stock and maintain stock price, the management may give up some investment projects with NPV>0, thus forming under-investment. And we believe investors' irrational behaviors cause bigger influence to lagged enterprise inefficient investment. Hypotheses are proposed as follows:

Hypothesis 1: Investors' irrational behaviors are significantly positively related to inefficient investment, and stock price fluctuation plays a mediation role between the two.

Hypothesis 1-1: Investors' irrational behaviors has more obvious influence on over-investment of lagged first period than the current period.

Hypothesis 1-2: Investors' irrational behaviors have more obvious influence on under-investment of lagged first-order than the current period.

2.2 Investors' Irrational Behaviors and Stock-price Volatility

Investors' sentiment is a type of systematic bias for future cash flow and investment risk expectation. Investors' over-confidence means the investors have too much confidence in their own ability, and over-estimate the factors such as luck and opportunities. Therefore, investors' sentiment is a comprehensive evaluation of capital future value, which varies with the capital value and other objective factors. Over-confidence is a personality trait of investors are naturally optimistic, which is more stable, less likely to quickly change, and exert persistent influence on the market. Many scholars presented examples in US and French stock markets to show investors' sentiment indeed significantly affect stock price (Corredor, 2013 [ii]; Stambaugh, 2012 [iii]; et al.) ; Yi Zhigao (2010) [iv], Liu Zhenbiao (2016) [v], Ba Shusong (2016) [vi] et al. Believed the investors' sentiment in China stock market also affected the stock price; Thorley & Vorkink (2006) pointed out that investors' over-confidence would cause stock-price fluctuation around its actual value; He Chengying et al (2014) [vii] believed that investors' over-confidence was nonpersistent. However, no scholars have ever studies whether the effects of the two investors' irrational behaviors (overconfidence and sentiment) on stock price are the same ones. Since the over-confidence is a kind of personality trait of a person who regularly has stable sentiment, it exerts persistent influence to stock price; in contrast, the influence of investors' sentiment on stock price varies with market expectation. Hypotheses are proposed as follows:

Hypothesis 2: Investors' over-confidence and sentiment are significantly positively correlated with stock-price fluctuation.

Hypothesis 2-1: The influence of investors' sentiment on stock price is

nonpersistent.

Hypothesis 2-2: The influence of investors' overconfidence on stock price is persistent.

3. Research Design

3.1 Samples

In this paper, Chinese A-share companies from 2009 to 2015 were selected as research objects. After screening the data, finally 8809 research samples were obtained.

3.2 Variable Definition

We employ the turnover rate to measure **investor overconfidence** (Ioc) i.e., the rate between annual turnover and the number of circulation stocks at the beginning of the year.

Investor sentiment (Isent) is measured by the momentum effect.

$$Isent_{i,t} = \frac{1}{12} \sum_{j=1}^{12} R_{i,t-1,j}$$

Where $Isent_{i,t}$ is the investors' sentiment of i enterprise in t year, $R_{i,t-1,j}$ is the monthly stock yield, i.e., the monthly stock yield of i enterprise in j industry in t-1 year.

Stock-price volatility (Pv) : first calculates daily stock price variation, and then calculate the standard deviation of monthly stock price variation. Finally calculate the standard deviation of monthly standard deviation from January to December.

Un-efficient Investment (Uf) is measured as deviations from expected investment using a model that predicts investment as a function of growth opportunities, leverage, the level of cash, firm age, firm size, return on assets and prior firm investment level[viii].

$$I_{new,t} = \alpha + \beta_1 Growth_{t-1} + \beta_2 Lev_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Stock Return_{t-1} + \beta_7 I_{new,t-1} + \sum Year + \sum Industry + \varepsilon$$

Where α is a constant, β is variation coefficient, ε is residual term; $Growth_{t-1}$ is the growth of investment opportunities measured by the main business income growth rate of year t-1; Lev_{t-1} is the asset liability rate at the end of year t-1; $Cash_{t-1}$ is monetary capital stock (cash and cash equivalents divided by total assets at the end of year t-1); Age_{t-1} is years from listing to investment spending; $Size_{t-1}$ is natural log of total assets at the end of year t-1; $StockReturn_{t-1}$ is stock returns from year t-1 to year t; $I_{new,t-1}$ is new investment of year t-1. Year and industry are dummy variables.

The model regression residual refers to the inefficient part of actual additional investment spending, namely the proxy variables of un-efficient investment(Uf), positive residuals is over-investment and negative residuals is under-investment.

4. Empirical Research

4.1 Models

Model (1) verifies the influence of investors' irrational behaviors to inefficient investment; model (2) verifies the influence of investors' irrational behaviors to stock price fluctuation; model (3) and (4) verify the mediating effect of stock price fluctuation.

$$UF_{i,t} = X + X_1 Isent_{i,t} + X_2 Ioc_{i,t} + X_n Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$UF_{i,t} = X + X_1 Isent_{i,t} + X_n Controls_{i,t} + \varepsilon_{i,t} \quad (1-1)$$

$$UF_{i,t} = X + X_1 Ioc_{i,t} + X_n Controls_{i,t} + \varepsilon_{i,t} \quad (1-2)$$

$$PV_{i,t} = \delta + \delta_1 Isent_{i,t} + \delta_2 Ioc_{i,t} + \delta_n Controls_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$PV_{i,t} = \delta + \delta_1 Isent_{i,t} + \delta_n Controls_{i,t} + \varepsilon_{i,t} \quad (2-1)$$

$$PV_{i,t} = \delta + \delta_1 Ioc_{i,t} + \delta_n Controls_{i,t} + \varepsilon_{i,t} \quad (2-2).$$

$$UF_{i,t} = \eta + \eta_1 Isent_{i,t} + \eta_2 PV_{i,t} + \eta_n Controls_{i,t} + \varepsilon_{i,t} \quad (3).$$

$$UF_{i,t} = \eta + \eta_1 Ioc_{i,t} + \eta_2 PV_{i,t} + \eta_n Controls_{i,t} + \varepsilon_{i,t} \quad (4).$$

4.2 Descriptive Statistics

As showed in Table 1, inefficient investment mean value is 0.4518. The standard deviation is 1.1019. The number of over-investment samples is 3380, which accounts for 38.37% of full samples; the number of under-investment samples is 5428, accounting for 61.63%. This indicates that the under-investment degree is larger than the over-investment degree, which is highly consistent with the research results of Zhang Gong Fu et al. (2009) and Huang Yi et al. (2016) [ix].

Variable ^{a)}	Mean ^{a)}	Std Dev ^{a)}	Minimum ^{a)}	Maximum ^{a)}	Observations ^{a)}	VIF ^{a)}	1/VIF ^{a)}
pv ^{a)}	0.3725 ^{a)}	0.5065 ^{a)}	0.0049 ^{a)}	9.0947 ^{a)}	8809 ^{a)}	1.15 ^{a)}	0.8724 ^{a)}
uf ^{a)}	0.4518 ^{a)}	1.1019 ^{a)}	0.0000 ^{a)}	16.4380 ^{a)}	8809 ^{a)}	1.15 ^{a)}	0.8706 ^{a)}
over-uf ^{a)}	0.5443 ^{a)}	1.0557 ^{a)}	0.0000 ^{a)}	10.3086 ^{a)}	3380 ^{a)}	1.08 ^{a)}	0.7041 ^{a)}
under-uf ^{a)}	-0.3943 ^{a)}	1.1261 ^{a)}	-16.4380 ^{a)}	-0.0001 ^{a)}	5428 ^{a)}	1.63 ^{a)}	0.9204 ^{a)}
ioc ^{a)}	3.8617 ^{a)}	2.6858 ^{a)}	0.2803 ^{a)}	125.0108 ^{a)}	8809 ^{a)}	1.37 ^{a)}	0.7313 ^{a)}
isent ^{a)}	2.6805 ^{a)}	4.5120 ^{a)}	-8.6761 ^{a)}	64.3821 ^{a)}	8809 ^{a)}	1.40 ^{a)}	0.7164 ^{a)}
size ^{a)}	22.1086 ^{a)}	1.3873 ^{a)}	14.9416 ^{a)}	28.5087 ^{a)}	8809 ^{a)}	1.36 ^{a)}	0.7378 ^{a)}
lev ^{a)}	50.7675 ^{a)}	20.2512 ^{a)}	0.7080 ^{a)}	99.8124 ^{a)}	8809 ^{a)}	1.42 ^{a)}	0.7046 ^{a)}
growth ^{a)}	16.8079 ^{a)}	113.2210 ^{a)}	-100.0000 ^{a)}	5835.6730 ^{a)}	8809 ^{a)}	1.01 ^{a)}	0.9858 ^{a)}
cf ^{a)}	0.0451 ^{a)}	0.0947 ^{a)}	-1.0324 ^{a)}	0.9319 ^{a)}	8809 ^{a)}	1.17 ^{a)}	0.8539 ^{a)}
roa ^{a)}	3.6376 ^{a)}	6.5799 ^{a)}	-99.8602 ^{a)}	92.8513 ^{a)}	8809 ^{a)}	1.34 ^{a)}	0.7478 ^{a)}
q ^{a)}	2.5842 ^{a)}	6.8708 ^{a)}	0.3374 ^{a)}	495.7741 ^{a)}	8809 ^{a)}	1.09 ^{a)}	0.9215 ^{a)}

4.3 Results

Before regression analysis, all variables were submitted to 1% Winsorization treatment, and the multicollinearities of all variables were inspected. Results showed that the VIF values of all variables were under 2, and the 1/VIF values were all over 0.1, indicating that there is no autocorrelation among the variables.

Hausman inspection result shows that $\chi^2(7) = 668.36$, $P < 0.05$, so the original hypothesis is rejected. As a result, regression analysis was conducted based on a fixed effect model and GLS-based estimation was conducted, with results shown in Table 2. According to the results of model 1 and 2, both investors' over-confidence and sentiment are positively correlated with inefficient investment and stock price fluctuation, which verifies the hypothesis 1 and 2.

Model ^{a)}	1 ^{a)}	2 ^{a)}	1-1 ^{a)}	1-2 ^{a)}	2-1 ^{a)}	2-2 ^{a)}	3 ^{a)}	4 ^{a)}
Variables ^{a)}	uf ^{a)}	pv ^{a)}	uf ^{a)}	uf ^{a)}	pv ^{a)}	pv ^{a)}	uf ^{a)}	uf ^{a)}
isent ^{a)}	0.290*** (33.07) ^{a)}	0.017*** (2.20) ^{a)}	0.261*** (32.60) ^{a)}		0.135*** (11.59) ^{a)}		0.249*** (34.04) ^{a)}	
ioc ^{a)}	0.094*** (9.37) ^{a)}	0.181*** (19.26) ^{a)}		0.094*** (9.42) ^{a)}		0.234*** (17.06) ^{a)}	0.075*** (7.76) ^{a)}	
pv ^{a)}							0.131*** (10.42) ^{a)}	0.100*** (7.24) ^{a)}
size ^{a)}	0.058*** (2.87) ^{a)}	0.675*** (37.36) ^{a)}	0.075*** (3.72) ^{a)}	0.037* (1.70) ^{a)}	1.021*** (33.27) ^{a)}	0.989*** (32.43) ^{a)}	-0.018 ^{a)} (-0.81) ^{a)}	-0.031 ^{a)} (0.02) ^{a)}
lev ^{a)}	0.010 ^{a)} (0.66) ^{a)}	-0.100*** (-7.58) ^{a)}	0.000 ^{a)} (0.02) ^{a)}	-0.017 ^{a)} (-1.07) ^{a)}	-0.170*** (-7.59) ^{a)}	-0.146*** (-6.57) ^{a)}	0.016 ^{a)} (1.06) ^{a)}	-0.007 ^{a)} (-0.44) ^{a)}
growth ^{a)}	0.103*** (3.50) ^{a)}	0.040 ^{a)} (1.52) ^{a)}	0.095*** (3.20) ^{a)}	0.177*** (5.63) ^{a)}	0.041 ^{a)} (0.91) ^{a)}	0.046 ^{a)} (1.03) ^{a)}	0.091*** (3.11) ^{a)}	0.173*** (5.53) ^{a)}
cf ^{a)}	-0.037*** (-3.70) ^{a)}	-0.015 ^{a)} (-1.62) ^{a)}	-0.037*** (-3.66) ^{a)}	-0.079*** (-7.42) ^{a)}	-0.015 ^{a)} (-0.97) ^{a)}	-0.008 ^{a)} (-0.54) ^{a)}	-0.035*** (-3.50) ^{a)}	-0.078*** (-7.33) ^{a)}
roa ^{a)}	0.134*** (9.67) ^{a)}	-0.066*** (-5.27) ^{a)}	0.123*** (8.83) ^{a)}	0.117*** (7.88) ^{a)}	-0.123*** (-5.81) ^{a)}	-0.096*** (-4.58) ^{a)}	0.134*** (9.69) ^{a)}	0.123*** (8.33) ^{a)}
q ^{a)}	0.511*** (8.04) ^{a)}	1.898*** (33.19) ^{a)}	0.598*** (9.45) ^{a)}	0.222*** (3.48) ^{a)}	3.141*** (32.53) ^{a)}	3.082*** (34.04) ^{a)}	0.329*** (4.83) ^{a)}	0.415*** (6.02) ^{a)}
constant ^{a)}	0.324*** (49.93) ^{a)}	0.028*** (4.73) ^{a)}	0.326*** (49.91) ^{a)}	0.293*** (42.60) ^{a)}	0.169*** (16.99) ^{a)}	0.171*** (17.52) ^{a)}	0.322*** (49.57) ^{a)}	0.290*** (42.24) ^{a)}
F-value ^{a)}	179.52 ^{a)}	505.97 ^{a)}	190.39 ^{a)}	42.63 ^{a)}	398.47 ^{a)}	428.70 ^{a)}	182.58 ^{a)}	44.11 ^{a)}
R-sq ^{a)}	0.162 ^{a)}	0.352 ^{a)}	0.152 ^{a)}	0.139 ^{a)}	0.273 ^{a)}	0.287 ^{a)}	0.164 ^{a)}	0.145 ^{a)}

Note: T-statistics are in parentheses, ***p<0.01, **p<0.05, *p<0.1^{a)}

According to the results of model 1-1, 2-1, and 3, it can be seen that investors' sentiment is significantly positively correlated with inefficient investment (wherein the coefficient of 0.261), and also significantly positively correlated with stock-price fluctuation (wherein the coefficient of 0.135). In model 3, the investors' sentiment coefficient (0.249) and stock-price fluctuation coefficient (0.131) are significantly positively correlation with each other at 1% level, and the investors' sentiment coefficient in model 3 is smaller than that in model 1-1 (0.249<0.261). This indicates the stock-price fluctuation plays a mediation role between inefficient investment and investors' sentiment. According to the results of model 1-2, 2-2, and 4, it can be seen that investors' over-confidence is significantly positively correlated with enterprise inefficient investment (0.075), and also significantly positively correlated with stock-price fluctuation (0.234) at 1% level. In model 4, the investors' over-confidence coefficient (0.094) and stock-price fluctuation coefficient (0.1) are

significantly positively correlation at 1% level, and the investors' over-confidence coefficient in model 4 is smaller than that in model 2-2 (0.075<0.094). This indicates the stock-price fluctuation also plays a mediation role between inefficient investment and investors' over-confidence. So the mediating effect in hypothesis 1 is verified.

To verify the hypothesis 1-1, 1-2, 2-1 and 2-2, the data during lagged period 1 to lagged period 3 in model 1 and 2 were selected for regression analysis and the results are shown in Table 3. It can be seen that the regression coefficients of two independent variables in the first column is both positive and significant under 1% level. This indicates that investors' irrational behaviors has positive influence to the lagged over-investment behavior, and such influence is far smaller than the that at current period (wherein the coefficient is smaller than the coefficient of model 1 in Tab-3, i.e., 0.068<0.290).

Table 3 The Regression Results 2nd

Model ¹	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
Variables ²	over-uf_1 ³	under-uf_1 ³	pv_1 ³	pv_2 ³	pv_3 ³	pv_1 ³	pv_2 ³	pv_3 ³
isent ⁴	0.068*** ⁵	-0.088*** ⁵	-0.156*** ⁵	0.074*** ⁵	-0.151*** ⁵	⁶	⁶	⁶
⁷	(7.52) ⁸	(-10.20) ⁸	(-18.99) ⁸	(8.61) ⁸	(-17.81) ⁸	⁹	⁹	⁹
ioc ⁴	0.151*** ⁵	-0.131*** ⁵	⁶	⁶	⁶	0.160*** ⁵	0.063*** ⁵	0.080*** ⁵
⁷	(14.14) ⁸	(-12.68) ⁸	⁹	⁹	⁹	(16.20) ⁸	(6.14) ⁸	(7.77) ⁸
size ⁴	-0.040* ⁵	0.104*** ⁵	-0.380*** ⁵	-0.203*** ⁵	-0.271*** ⁵	-0.386*** ⁵	-0.238*** ⁵	-0.285*** ⁵
⁷	(-1.89) ⁸	(5.38) ⁸	(-17.47) ⁸	(-8.98) ⁸	(-12.13) ⁸	(-17.61) ⁸	(-10.44) ⁸	(-12.49) ⁸
lev ⁴	-0.002 ⁵	-0.002 ⁵	0.048*** ⁵	0.029* ⁵	0.056*** ⁵	0.067*** ⁵	0.030* ⁵	0.043*** ⁵
⁷	(-0.15) ⁸	(-0.16) ⁸	(3.02) ⁸	(1.73) ⁸	(3.40) ⁸	(4.20) ⁸	(1.83) ⁸	(2.57) ⁸
growth ⁴	-0.082*** ⁵	0.112*** ⁵	-0.045 ⁵	0.276*** ⁵	0.107*** ⁵	-0.068** ⁵	0.323*** ⁵	0.149*** ⁵
⁷	(-2.62) ⁸	(3.97) ⁸	(-1.39) ⁸	(8.31) ⁸	(3.26) ⁸	(-2.11) ⁸	(9.70) ⁸	(4.46) ⁸
cf ⁴	0.019* ⁵	-0.023** ⁵	0.008 ⁵	-0.022* ⁵	-0.017 ⁵	0.025** ⁵	-0.041*** ⁵	-0.039*** ⁵
⁷	(1.84) ⁸	(-2.47) ⁸	(0.76) ⁸	(-1.91) ⁸	(-1.50) ⁸	(2.32) ⁸	(-3.65) ⁸	(-3.49) ⁸
roa ⁴	-0.020 ⁵	-0.012 ⁵	0.062*** ⁵	0.027* ⁵	0.071*** ⁵	0.079*** ⁵	0.035** ⁵	0.063*** ⁵
⁷	(-1.29) ⁸	(-0.96) ⁸	(4.10) ⁸	(1.71) ⁸	(4.60) ⁸	(5.21) ⁸	(2.25) ⁸	(4.02) ⁸
q ⁴	-0.426*** ⁵	0.570*** ⁵	-0.463*** ⁵	0.518*** ⁵	-0.404*** ⁵	-0.240*** ⁵	0.053 ⁵	-0.813*** ⁵
⁷	(-5.79) ⁸	(9.98) ⁸	(-6.77) ⁸	(7.28) ⁸	(-5.73) ⁸	(-3.69) ⁸	(0.78) ⁸	(-11.98) ⁸
Cons ⁴	0.204*** ⁵	-0.159*** ⁵	-0.107*** ⁵	-0.043*** ⁵	-0.100*** ⁵	-0.095*** ⁵	-0.060*** ⁵	-0.117*** ⁵
⁷	(24.99) ⁸	(-22.69) ⁸	(-15.10) ⁸	(-5.86) ⁸	(-13.81) ⁸	(-13.56) ⁸	(-8.22) ⁸	(-16.06) ⁸
F ⁴	35.31 ⁵	47.03 ⁵	101.06 ⁵	46.14 ⁵	108.81 ⁵	86.41 ⁵	40.78 ⁵	70.01 ⁵
Obs ⁴	5,428 ⁵	3,380 ⁵	8,808 ⁵	8,807 ⁵	8,806 ⁵	8,808 ⁵	8,807 ⁵	8,806 ⁵
R-sq ⁴	0.08 ⁵	0.114 ⁵	0.087 ⁵	0.042 ⁵	0.093 ⁵	0.075 ⁵	0.037 ⁵	0.062 ⁵

Note: T-statistics are in parentheses, ***p<0.01, **p<0.05, *p<0.1⁺

However, the influence of investors' over-confidence on lagged over-investment is even more significant (0.151>0.098), so the hypothesis 1-1 is partially verified; The regression coefficients of two independent variables in the second column are both negative and significant at 1% level. This indicates that investors' irrational sentiment has positive influence to lagged under-investment (as the data of under-investment is negative), and such influence is lower than that during current period. In contrast, the influence of investors' over-confidence on lagged under-investment is even more significant. Column 3-8 presents the influence during lagged period 1 to lagged period 3; column 3-5 shows that the coefficients of lagged influence on investors' sentiment are significant at 1% level, however the influence orientations alternate with positive and negative; column 6-8 shows that the coefficients of lagged influence of

investors' over-confidence are significant at 1% level, which verifies the hypothesis 2-1 and 2-2.

5. Conclusion

This paper investigated the mediating role of stock-price fluctuation between investors' irrational behaviors (investors' over-confidence and investors' sentiment) and inefficient investment, and concluded that the effects of two irrational behaviors on enterprise investment efficiency were different. This results are just opposite to the opinion proposed by He Chengying et al. (2014) that the influence of investors' over-confidence is nonpersistent. We believe that investors' over-confidence and investors' sentiment are two different irrational manifestations. Investors' over-confidence is a type of personality trait, which features individual variation and generality, less likely to change, has persistent and stable influence on market and resource allocation. In contrast, investors' sentiment is based on the judgment of the market, which varies with market expectation and has non persistent influence.

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