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INFLUENCE OF PSYCHOLOGICAL EXPECTATION CORRECTION ON THE RETURN RATE OF TRANSNATIONAL INVESTMENT

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Abstract

Drawing on behavioral finance theory, this paper explores the mutual influence between investor sentiment and the return rate of transitional investment. Since the investor sentiment can be measured by the transaction amount of the transnational investment market, the author derived the psychological expectation by the fluctuation theorem, rather than investor survey. On this basis, a model was established to disclose the interaction between investor's psychological expectation correction and the return rate of transnational investment return. The results show that investor's psychological expectation has a significant causal relationship with the return rate of transnational investment; any change to one of the two factors will induce a variation in the other factor. The research results enrich the theoretical system of behavioral finance, reveal the psychological features of investors, and provide guidance for market regulation of transnational investment.

Key words: *Transnational Investment Market, Return Rate, Investor Sentiment, Psychological Expectation Correction.*

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INTRODUCTION

The transnational investment market is highly volatile, the environment is unstable, and investors' speculative behavior is quite common (Mintz & Smart, 2004). It's of positive significance to study the influence of investor's psychological sentiment on the transnational investment market from the policy and the individual perspective (Wang, Pan, & Luo, 2015). The psychological sentiment of investors is an important branch of behavioral finance and it is a bridge for the behavioral finance to study the transnational investment market returns (Walton, 2016). At present, it's a consensus of domestic and foreign scholars that the investor's psychological sentiment can influence the transnational investment market (Smies-Lok, 1984). Therefore, the analysis of the influence of investor's psychological sentiment on the transnational investment market is a very persuasive perspective, and has a profound significance for the study of investor's psychological sentiment (Pablo, Onieva, José et al., 2013).

Domestic and foreign scholars have conducted a lot of research and analysis on the influence of investor's psychological sentiment on transnational investment market returns (Bellak, Leibrecht, & Damijan, 2007). However, their research methods and perspectives are slightly different and their conclusions are different as well. The reasons for this can be summarized as follows: first, the variables selected for the construction of the indicators are different; single indicator or multiple indicators were chosen (Barrett & Feldman, 2009); second, the indicator construction methods are different (Garnefski, Koopman, & Kraaij et al., 2009); third, the analysis subjects and the markets are different, and there are

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large differences in the investor's psychological sentiment in mature markets and emerging markets (Xu, Hu, & Fan, 2009; Bourne & Maxwell, 2010). Wherein, how to measure investors' psychological sentiment more accurately is one of the main reasons that troubles the people (Bal & Smit, 2012; Maclay & Hannah, 2013). Accurately extracting the investor's psychological sentiment from the indicators is the key to solving this problem (Dorn & Shang, 2012; Tang & Tan, 2015; Choi & Donggul, 2018).

Therefore, this paper attempts to systematically explore the relationship between investor's psychological sentiment and transnational investment returns in this context. The results of the study show that, only under the premise that the investor's psychological sentiment has been fully recognized, can it provide support for the new asset price formation system. Therefore, the conclusion of this study can provide a new breakthrough point for the research on the formation of the asset price.

ANALYSIS OF INVESTOR'S PSYCHOLOGICAL SENTIMENT

Measurement of sentiment indicator

Assume in the *T-1-th* period, there are *N* investor transactions, each investor can use his/her own experience to process the obtained information, understand the market situation, and formulate the investment decisions of the next period according to his/her own risk preferences.

Assume in the *T-th* period, the total amount of the N transactions is $TV(t)$, which represents the planned investment decision made by the investor; then the difference value between the total amount of the transactions in period $T$and the total amount of the transactions in period $T-1$ represents the change in the planned investment decision implemented by the investor in the $T-1$-th period.

Therefore, the change in planned investment decision is the change of investor's psychological sentiment, which is recorded in the form of formula (1):

$$IS = \frac{TV(T)-TV(T-1)}{TV(T-1)} \quad (1)$$

In the formula, IS represents the change in investor's psychological sentiment, $TV(T)$ and $TV(T-1)$ represent the transaction amount of current period and previous period, respectively.

Taking the investor's transaction amount as the investor's psychological sentiment indicator has two advantages compared with the investor's psychological sentiment indicator obtained by the survey:

(1) The investor's psychological sentiment indicator obtained by the survey is constrained by the characteristics of the survey itself, the coverage rate is low and the number of subjects is limited, which cannot guarantee the authenticity. However, the investor's psychological sentiment indicator based on the transaction amount is the statistics of investors in the entire market, and it can guarantee the accuracy of the indicator;

(2) The investor's psychological sentiment obtained through the survey is the expectations and decision-making plans within a period of time, it can hardly reflect the true situation of investors' psychological sentiment during this period. In addition, the survey generally does not focus on the everyday data, but focuses on a longer period of time, while the investor's psychological sentiment with the transaction amount as the indicator is indeed the everyday data.

Digital characteristics and stationarity test of investors' psychological sentiment

The statistical results of the investor's psychological sentiment time series are shown in Table 1.

Table 1 shows that the skewness of the time series of the investor's psychological sentiment is 3.6732, which shows obvious peak characteristics.

The stationarity test is not only important for the time series of investors' psychological sentiment and returns, but also for the stability of any time series, it's because the stability of the series has a great impact on its behavior and properties.

A strict stationary process means that for any given $t_1, t_2, t_3, \cdots t_T \in Z, T = 1,2,\cdots$, there is:

$$Fx_{t1}, x_{t2}, \ldots, x_{tr}, (x_{t2}, \ldots, x_{tr}) = Fx_{t1+k}, x_{t2+k}, \ldots, x_{tr+k}, (x_{t2}, \ldots, x_{tr}) \quad (2)$$

Wherein, Frepresents the joint distribution function of a set of random variables, which can also be represented as a series $\{y_t\}$.

Table 1. **Data characteristics of investor's psychological sentiment**

Variable	Sample Mean	Median	Skewness	Peak value	Statistic of Jarque-Bera
IS	0.0502	-0.0203	3.6732	26.0174	35426

When the value distribution of the time series does not change with time, it means that this function is strictly stable in the past, present and future.

The widely-used ADF test was adopted, and the test results are shown in Table 2.

Table 2. **ADF test of two series of IS and R**

Variable	Statistic	Confidence
IS	-41.89	0.000
R	-37.02	0.000

As can be seen from the test results, both series clearly rejected the original hypothesis. Therefore, both do not have root of unity, and both have significant stability.

Autoregressive quantitative analysis of investors' psychological sentiment

Further, the autoregressive moving average model (ARMA) was used to conduct one-dimensional time series analysis on the investor's psychological sentiment, the model expression is shown in formula (3).

$$IS_t = \alpha t + \sum_{j=1}^{P} r_j IS_{t-j} + \sum_{i=1}^{q} \beta_i \varepsilon_t + \varepsilon_t \quad (3)$$

$$E(\varepsilon_t | \Omega_t) = 0 \quad (4)$$

$$VAR(\varepsilon_t) = \sigma^2 \quad (5)$$

Where, ε is subject to the zero mean white noise process.

The steps of the ARMA model are systematically estimated as follows:

Step 1: Determine the order of the model. Apply the autocorrelation method to plot the time chart of the investor's psychological sentiment and the autocorrelation function of the investor's psychological sentiment, so as to determine the most appropriate order.

The autocorrelation and partial autocorrelation test results of the investor's psychological sentiment time series are shown in Table 3.

Step 2: Use the least squares method to estimate the parameters of the model.

Step3: Model test.

Therefore, after three steps, the ARMA model expression of investor's psychological sentiment (IS) is:

$$IS_t = \alpha t + \sum_{j=1}^{3} r_j IS_{t-j} + \sum_{i=1}^{4} \beta_i \varepsilon_t + \varepsilon_t \quad (6)$$

For the investor's psychological sentiment ARMA model, the Akaike Information Criterion (AIC) and the Schwarz's Bayesian Information Criterion (SBIC) are shown in Tables 4 and 5.

Table 3. **Autocorrelation and partial autocorrelation test results of the investor's psychological sentiment time series**

Order	AC	PAC	Q-stat	Pro Significance
1	-0.111	-0.111	18.231	0.0000
2	-0.055	-0.068	22.704	0.0000
3	-0.008	-0.022	22.812	0.0000
4	-0.05	-0.059	26.622	0.0000
5	-0.005	-0.021	26.676	0.0000
6	-0.056	-0.068	31.355	0.0000
7	-0.022	-0.042	34.096	0.0000
8	-0.019	-0.041	32.661	0.0000
9	-0.006	-0.024	32.727	0.0000
10	-0.012	-0.004	32.954	0.0000

Table 4. **AIC of the ARMA model of the investor's psychological sentiment**

P / q	0	1	2	3	4
0	0.7994	0.7862	0.7832	7717.012	0.7801
1	0.7884	0.7755	0.7764	7658.012	0.7777
2	0.7853	0.7771	0.7783	0.7784	0.779
3	0.7867	0.7792	0.7789	0.779	0.7575
4	0.7841	0.7792	0.7801	0.7801	––

Table 5. **SBIC of the ARMA model of the investor's psychological sentiment**

p / q	0	1	2	3	4
1	0.7957	0.7865	0.7911	0.7962	0.7996
2	0.7963	0.7918	0.78472	0.8004	0.8047
3	0.8014	0.7975	0.8009	0.8047	0.7868
4	0.8025	0.8012	0.8058	0.8095	––

From Table 4 and Table 5, according to the AIC and SBIC of the investor's psychological sentiment series, when p=3 and q=4, the AIC reaches the minimum, which is significantly smaller than other information standard values; when p=1 and q=1, the SBIC reaches the minimum; but when p=3 and q=4, the SBIC has no significant difference.

INTERACTIVE RELATIONSHIP BETWEEN INVESTOR'S PSYCHOLOGICAL SENTIMENT AND TRANSNATIONAL INVESTMENT MARKET RETURNS

The lag order of the VAR model

The VAR model was constructed with each endogenous variable in the system as a function of the lagged value of all endogenous variables in the system. In the information criterion method, the lag order of the variable model is determined by AIC and SBIC.

The lag orders of VAR model of 1-9 orders are shown in Table 6.

Table 6. **Lag orders of VAR model of 1-9 orders**

Order	Value of SIC	Value of SBIC
1	-4.7942	-4.77221
2	-4.80333	-4.76666
3	-4.82439	-4.77302
4	-4.82889	-4885794
5	-4.82941	-4.74858
6	-4.82618	-4.73061
7	-4.83044	-4.7201
8	-4.83813	-4836007
9	-4.83407	-4.69415

It can be seen from Table 3 that the lag order obtained from numerical prediction is significantly larger, which is also the characteristic of the AIC value prediction; when the AIC value gradually returns to the third order which is suitable for the model order, after the third order, the SBIC value is gradually increased with the increase of the lag order. Therefore, this paper chooses the third-order lagged VAR model as the research object.

Information impact of market returns on investor's psychological sentiment

When studying the influence of investment return rate on the investor's psychological sentiment, the change of investor's psychological sentiment should be taken into consideration. When the conditional variance is constant, the adjustment model that changes with the investor's psychological sentiment is shown as formulas (7)-(8).

$$IS_t = C_0 + Br_t + \sum_{j=1}^{3} r_j IS_{t-j} + \sum_{i=1}^{4} \beta_i \varepsilon_t + \varepsilon_t \quad (7)$$

$$ln(\sigma_t{}^2) = C_1 + \beta\, ln(\sigma_{t-1}{}^2) + \gamma \frac{\sigma_{t-1}}{\sqrt{\sigma_{t-1}{}^2}} + \alpha\left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}{}^2}} - \sqrt{\frac{2}{\pi}}\right] \quad (8)$$

Further, the conditional variance equation in the $EGARCH$ model is expressed as:

$$ln(\sigma_t{}^2) = C_3 + \beta\, ln(\sigma_{t-1}{}^2) + \gamma \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}{}^2}} + \alpha \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}{}^2}} \quad (9)$$

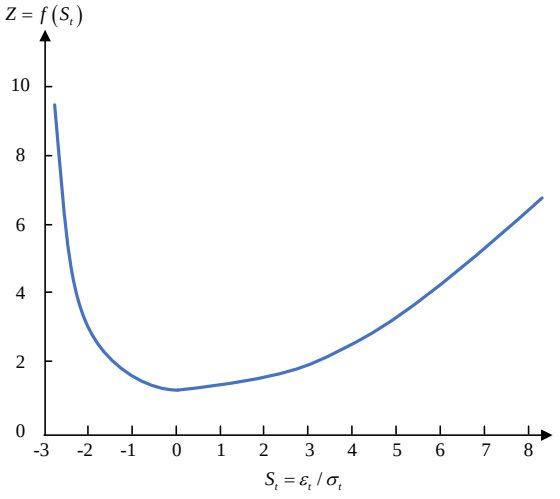
Assume:

$$Z = f(S_t) = \gamma S_t + \alpha |S_t| \quad (10)$$

where in, $\boldsymbol{S_t = \varepsilon_t/\sigma_t}$.

Apply above model to plot the information impact map of the investment returns on investor's psychological sentiment, so as to show whether the investor's psychological sentiment has an asymmetric impact on investment returns. The results are shown in Figure 1.

Figure 1. **Information impact of investment returns on investors' psychological sentiment**



As shown in Figure 1, when $S_t = \varepsilon_t/\sigma_t \leq 0$, the curve is steep, and the changes in each unit of S_t would bring about huge changes to $Z =$

$f(S_t)$; however, when $S_t = \varepsilon_t/\sigma_t \geq 0$, the curve is relatively flat, and the change in $Z = f(S_t)$ brought about by the change in each unit of S_t decreases dramatically, the curve has vividly showed the asymmetric influence of investment returns on the investor's psychological sentiment.

The influence of investor's psychological sentiment fluctuation on investment returns

Theoretically, the investor's psychological sentiment should be consistent with the market expectation. If the market expectation is good and optimistic, the investor's psychological sentiment will rise, leading to an increase in the enthusiasm for market participation. Conversely, if investors are pessimistic about future market prospects, their sentiment and enthusiasm for market participation will decline.

Therefore, the expression of the GARCH-M model that reflects the influence of investor's psychological sentiment on the investment returns is:

$$r_t = C_4 + b^* IS_t + \delta {\sigma_{t-1}}^2 + \varepsilon_t \quad (11)$$

$${\sigma_t}^2 = C_5 + \alpha_1 {\varepsilon_{t-1}}^2 + \alpha_2 {\sigma_{t-1}}^2 \quad (12)$$

Use the data provided by the $CSMAR$ research database to estimate, the estimated results are shown in Table 7.

Table 7. **Estimation results of the GARCH-M model that reflects the influence of investor's psychological sentiment on market returns**

Coefficient	Improved GARCH-M Model	Simple Model of GARCH-M
C_4	-0.00229	-0.00084
b_0	008453	0.005968
b_1	0.014177	—
b_2	0.003304	—
b_3	0.004839	—
δ	8.893113	6.213025
α_1	0.152264	0.155283
α_2	0.802133	0.823946
C_5	0.000132	0.00013
R^2	0.176981	0.025232

The statistical estimation results in Table 7 are significant. For fitness value R^2 after adjustment, in the adjusted GARCH-M model, it has a better fitness than that in the simple GARCH-M model. In both models, the risk premium δ is significant and has a greater influence on the investment returns. In other words, when the investor's psychological sentiment changes, the investor can get more extra returns.

CONCLUSIONS

Based on the investor's psychological sentiment, one of the factors of investor's psychological behavior, this paper studied the influence of investor's psychological sentiment on transnational investment returns, and drew the following conclusions:

(1) The investor's psychological sentiment has a significant influence of the investment returns, and positive psychological sentiment can bring greater returns;

(2) The influence of investment returns on investor's psychological sentiment is asymmetric. The negative influence of investment returns on investor's psychological sentiment is greater. That is to say, the investor's psychological sentiment fluctuation caused by the negative expected returns is greater than that caused by the positive expected returns;

(3) Due to the continuity of the investor's psychological sentiment, the transnational investment return rate is significantly positively correlated with the investor's psychological sentiment. The specific manifestation is not only the "price pressure effect" that can be formed in the whole market, but also the risk rewards obtained due to systemic risks.

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