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Sentiment approach to negative expected return in the stock market

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ABSTRACT

A large number of researches have shown that the negative return of risky asset exists and has the profound significance whether for actual investment or theory studies. This paper investigates the effect of sentiment by establishing the sentiment asset pricing model, and explores the negative expected return when the parameters change in different situations. We provide the necessary and sufficient conditions for the negative expected return.

1. Introduction

The annual rate of return is assumed to be positive in the traditional financial theory, but the negative return of risky asset does exist in the reality financial market, and it has profound significance whether for actual investments or theory researches. For example, Ang et al. (2006, 2009) found a idiosyncratic volatility puzzle, and constructed a zero-investment portfolio that is long the most volatile portfolio and short the least volatile portfolio yields about −1% the following month. Bali et al. (2011) found a negative and significant relation between the maximum daily return over the past one month and expected stock returns, i.e., the expected return of stock is negative when the current biggest daily return of stock is higher. Eleswarapu and Thompson (2007) indicated that an unsustainably high price will cause price bubble, and the expected return premium is negative, which is different from the implicit assumption that the expected return premium is positive in traditional asset equilibrium price model (see, e.g., Breeden, 1979; Cox et al., 1985; Merton, 1971).

The different fluctuations of stock prices are caused by the investor cognitive biases and psychological factor of asset demand, but not fundamentals in the short term, so behavioral asset pricing model considering investor biases of psychology and behavior can better depict the fluctuations of asset prices compared to traditional asset pricing model based on rational expectations, even can more reasonably depict the characteristic of negative expected return. In the study of considering investor psychological factors, the asset pricing models based on the noise and biases are the most important and the most fruitful achievements. For example, the most famous study on the asset pricing model based on noise traders is DSSW model of De Long et al. (1990), which distinguished investors between sophisticated investors and noise traders, and explored the asset equilibrium price. And the asset pricing models based on biases mainly have the BSV model of Barberis et al. (1998), the DHS model of Daniel et al. (1998), the HS model of Hong and Stein (1999), the BHS model of Barberis et al. (2001).

However, compared to the latest researches based on investor sentiment in behavioral finance, both the researches based on noise and the researches based on biases are facing the following shortcomings. Firstly, the abstractions of biases and noise are unfathomable, so these models can't do the empirical analysis and inspection. However, the existing empirical researches on investor sentiment have resolved the measurement of sentiment and a consensus has emerged among educational circles that the sentiment is easy to measure no matter what proxy variables we use to represent sentiment. Secondly, the researches on noise and biases lack the support of the corresponding behavior experiments and neural experiments, but these experiments based on investor sentiment have rich experimental results and strong experimental evidences. Therefore, the asset pricing researches based on investor sentiment can get more useful conclusions.

Some asset pricing models have been developed to support the role of investor sentiment, such as Yang et al. (2012), Yang and Yan (2011), and Yang and Zhang (2013a, 2013b). Yang et al. (2012) presented a sentiment capital asset pricing model, and showed that investor sentiment is a nonlinear systematic factor for asset pricing. Yang and Zhang

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(2013a) presented a sentiment asset pricing model with consumption, and showed that the stock price has a wealth-weighted average structure and the investor's wealth proportion could amplify the sentiment shock on the asset price. Yang and Zhang (2013b) presented a dynamic asset pricing model with heterogeneous sentiment and found that the equilibrium stock price is the wealth-share-weighted average of the stock prices that would prevail in an economy with a sentiment investor only. Moreover, heterogeneous sentiments induce fluctuations in the wealth distribution, which increases the stock return volatility and induces mean reversion in stock returns.

Therefore, this paper explores the effect of investor sentiment on risky asset price by constructing and analyzing the sentiment asset pricing model and investigates when the expected return of risky asset will be negative by analyzing the different changes of the parameters in the sentiment asset pricing model. The analysis of the sentiment asset pricing model provides evidence for that asset's future price declines when the market sentiment is down, so the expected return of risky asset is negative.

The remainder of this paper is organized as follows. In Section 2, we construct and discuss the sentiment asset pricing model. Section 3 analyzes the expected negative returns by changing investor sentiment, the number of sentiment investors and the supply volume in the sentiment asset pricing model. Lastly, Section 4 presents our conclusion and future researches.

2. The sentiment model

Just like the noise trader model in De Long et al. (1990), this paper also adopts the over-lapping generation framework. However, in order to depict the relationship between the average level of investor sentiment in the overall market and the asset price or return, this paper will make some adjustments on its assumptions for describing the actual market more appropriately.

On the one hand, assume that there are two kinds of assets in the overall market: one is a risk-free asset, whose risk free rate is denoted as r_f and the supply volume is totally elastic with price 1, the other one is a risky asset (a stock), whose dividend is denoted as d and the supply volume is M. The symbol of P_t represents the price of risky asset in time t.

On the other hand, for the investors in the overall market, the noise trader model in De Long et al. (1990) assumed two kinds of agents, including sophisticated investors and noise traders. However, Barber et al. (2009) put forward that noise is a systematic factor for the asset price. In addition, either smart investors or noise traders, either institutional investor or individual investors, are all influenced by sentiment in the decision-making process of actual investment.

Therefore, this paper assumes that all investors are influenced by sentiment, and discusses the theoretical relationship between sentiment and the expected stock return. Suppose that the number of independent sentiment investors in two periods of the market is N, the initial sentiment is 0, and market sentiment level is S_t, which is pessimistic or optimistic. In short, assume that the investors' initial only decision-making is to determine the proportion of the risky asset, so that they can maximize their subjective expected utility. They will sell out the risky asset at price P_{t+1} and consume all the wealth at the end of the period. This kind of investor is influenced by sentiment, so the subjective expected risk of asset price is irrational. Assume that ρ_t represents the deviation of the wrong expected price at time t from the rational expected price ${}_tP_{t+1}$, and ρ_t are normally distributed as $\rho_t \sim N(\rho^*,\sigma_\rho^2)$, where both the expected value and the covariance σ_ρ^2 are two functions of the current sentiment. In fact, some financial conclusions of financial experiments, such as in De Bondt (1993), Hsee (1998), Shiller (2000), and Welch (2000), suggest that investor sentiment influences asset prices or return, while other financial experiments, such as Ganzach (2000), Shefrin (2001), Statman et al. (2008), and Kempf et al. (2012), indicated that investor sentiment influences both asset return and risk. So this paper has a lot of evidences to support the modified hypothesis for ρ^* and σ_ρ^2.

Assuming that $\rho^* = f(S_t)\cdot\overline{\rho}$, where $\overline{\rho}>0$ is the deviation caused by unit sentiment, $f(S_t)$ satisfies two cases, one is $f(S_t) > 0$ as $S_t > 0$, the other one is $f(S_t) < 0$ as $S_t < 0$. Hence, the average deviation of expected price is positive when the sentiment is high, and the average deviation of expected price is negative when the sentiment is low. In addition, assume that $\sigma_\rho^2 = g(S_t)\cdot{\sigma_{\overline{\rho}}}^2$ is a kind of risk measurement, ${\sigma_{\overline{\rho}}}^2$ is the deviation's fluctuation caused by unit sentiment, $g(S_t)$ also satisfies two cases, one is $0 < g(S_t) < 1$ as $S_t > 0$, the other one is $g(S_t) > 1$ as $S_t < 0$, so the fluctuations of expected price deviation become narrow when the sentiment is high; the fluctuations of expected price deviation will widen when the sentiment is low. Therefore, the sentiment investors have wrong ideas about the distribution of risky asset price, then maximize the expectation of the risk aversion function $U = -e^{-\gamma \cdot W}$, where W is the total wealth, $\gamma > 0$ is the constantly absolute risk aversion coefficient.

According to Yang and Yan (2011), we get the market-clearing price of risky asset as:

$$P_t = \frac{1}{1+r_f}\left({}_tP_{t+1} + d + \rho_t - \frac{M\gamma\sigma^2_{P_{t+1}}}{N}\right). \tag{1}$$

On the conditions that the unconditional distributions of P_{t+1} and S_{t+1} are consistent with the distribution of P_t and S_t, then the above rational expected price ${}_tP_{t+1}$ can be eliminated by recursive method, then the price of risky asset is (the proof is in Appendix A):

$$P_t = \frac{d}{r_f} + \frac{\rho_t - f(S_t)\overline{\rho}}{1+r_f} + \frac{f(S_t)\overline{\rho}}{r_f} - \frac{M\gamma\sigma^2_{P_{t+1}}}{Nr_f} \tag{2}$$

According to expression (1), there is the following relationship on $\sigma^2_{P_{t+1}}$:

$$\sigma^2_{P_{t+1}} = \frac{\sigma_\rho^2}{\left(1+r_f\right)^2} = \frac{g(S_t)\cdot{\sigma_{\overline{\rho}}}^2}{\left(1+r_f\right)^2}.$$

Finally, the risky asset price affected by sentiment at time t is:

$$P_t = \frac{d}{r_f} + \frac{\rho_t - f(S_t)\overline{\rho}}{1+r_f} + \frac{f(S_t)\overline{\rho}}{r_f} - \frac{M\cdot g(S_t)\gamma{\sigma_{\overline{\rho}}}^2}{N\cdot r_f\left(1+r_f\right)^2}. \tag{3}$$

In the sentiment asset price expression (3), the first one is the fundamental value of risky asset, it is not influenced by sentiment; the last three are the deviation from its fundamental value affected by sentiment; the sentiment asset price expression intends to its fundamental value when the investors' wrong expected price intends to 0.

The second one is the change of the risky asset price caused by the investor sentiment. The third one is the deviation degree of asset price to fundamental value, which represents that investor sentiment is not equal to 0 and the wrong expected price is either not equal to 0. The last one is the price pressure effect caused by investor perceived risk.

Moreover, this model can also get the following useful conclusions: besides the fundamental value of risky asset and the investor sentiment, its supply M and the number of its investors N are also important factors to influence asset price, so different supplies of risky asset or different numbers of its investors will lead to the difference of asset price. From expression (3), we can know that risky asset prices P_t and its supply M decrease monotonically, while risky asset prices P_t increase monotonically with the number of investors N. This conclusion can't be obtained from the model in De Long et al. (1990), where these two variables are standardized into 1. In fact, this phenomenon is consistent with the actual investment behavior, that is, investors