

The application and understanding of feedback model

Xin Hu

central south university of forestry and technology, Changsha 410000, China

Abstract. Before feedback model was widely used, there were many authoritative theories and tools to study and quantify the financial world, including efficient market theory. However, some excessive fluctuations of the stock cannot be explained by the efficient market model, or even deviate from the efficient market theory. This phenomenon attracted the attention of behavioral finance experts led by Shiller, and worked out the formula of feedback model, trying to explain the abnormal volatility. Many psychologists and economists have made outstanding contributions to the study of feedback model, but there are few applications of this model. This paper conducts application and case analysis of feedback model, including economic decline affected by COVID-19, running on foreign currency in the Ukrainian-Russian conflict, and the application of feedback model in prosperous economies. Through the analysis of the above three situations, the feedback model is re-understood, hoping to provide help to the future research on the feedback model.

Keyword: Feedback model, Cases, efficient market model.

1. Introduction

The efficient market theory seemed to dominate financial market for a long time. Many people even think that the theory was beyond doubt during this period. Since its creation, much research on the financial world has been based on it. However, the anomalies, such as excess volatility of the stock, are beyond the range predicted by the efficient market model, which makes a group of scholars to put forward some rational doubts on the market efficiency theory and also expressed their own opinions on such anomalies. For example, Marsh and Merton(1986) pointed out that dividends do not need to follow trends precisely because they are influenced by many factors, such as the issuance of shares and buybacks. John Campbell and Shiller(1988) found evidence of excess volatility by reconstructing time series models and declining the attention on other time series assumptions. After many studies based on efficient market theory, there was still no theory that could effectively connect the fluctuation and subsequent fundamentals of the stock market. Therefore, scholars gradually shifted their research focus to the behavior and psychology related to the financial market, which created conditions for the rise of behavioral finance. The development of feedback model well reflects the process of behavioral finance.

In the past, the quantitative and empirical analysis of feedback model was more. Derivation based on mathematical model lacks qualitative application and objective case analysis. From a new perspective, this paper strengthens the application analysis of the feedback model, and provides some meaningful enlightenment for further thinking and understanding of the feedback model. Secondly, feedback model has a very wide range of applications in actual economic development, but there are not many studies in this area. This paper will start with three different economic conditions and qualitatively analyze the application of feedback model in real economy.

2. The significance of feedback model

Feedback models is not an emerging concept. Although it does not often appear in our textbooks, it has penetrated into people's lives for a long time. The first financial bubble recorded in human history (Tulipmania in Holland in the 17th century) can be explained by feedback model. Feedback model, also known as price-to-price feedback model, refers to people's expectation of an item (including the stock price) is higher or lower than its current trend through word of mouth and mass communication, resulting in the price (or stock price) of the item soaring or plummeting. But such extremes were unsustainable and eventually led to the bursting of the bubble. People who participated

in the bursting of the bubble were not all so-called "experts". Most of them were psychologically convinced that the price would move in the direction they thought it would. The psychological and behavioral factors that cause feedback have been found to be supported by experimental evidence, no matter from lab experiments or natural experiments. These experiments all reflect the same conclusion: human interaction is the most fundamental cause of speculative bubbles, which is also the core conclusion of the feedback model. Ponzi scheme, as the most convincing natural experiment of the real version of speculative bubble, demonstrates the practical significance of research of feedback model with irreparable loss.

Then, what is the practical significance of studying feedback model? Multiple financial models are based on the assumption that investors are rational. For example, CAPM(Capital Asset Pricing Model) clearly indicates that this research is modeled on the basis that investors are rational and carry out diversified investment strictly in accordance with the rules of Markowitz Model by William F. Sharpe(1964). In addition, the efficient market hypothesis is also based on the assumption that investors will react promptly and correctly to information. But in the vast majority of cases, the assumption that investors are rational is not true. Investors will change their investment decisions due to a variety of subjective factors, and such deviation from rational decisions is systematic and cannot be eliminated by statistical averages. Feedback model, an important model in behavioral finance, studies how people's psychology and behavior affect speculative bubbles. In most models, the stock market is regarded as an objective existence, but in the feedback model, investors' psychology and behavior are directly related to the fluctuations of the stock market and explain why certain excess volatility occur. People may envy others' success in investment, and blindly follow the trend without knowing the essence of making profit, resulting in the price of the stock market being falsely higher than its real price, and then forming a price bubble. This cannot be explained only by market efficiency theory, which is also the most important significance of the existence of feedback model. However, Shiller (1990) points out that investors make decisions not only based on yesterday's price movements, but also on prices months and years ago. Therefore, in the feedback model, it may not be enough to only consider the current psychological state of people. In addition, There may also be a reference to the impact of previous share-price movements. One of the defects of feedback model is also a common defects of behavioral finance. Although it explains that the fluctuation of stock price is largely related to the psychology and behavior of investors, it does not provide advice for investors to avoid making decisions that are not conducive to investment.

3. The application of Feedback model

The global spread of COVID-19 has had a huge impact on the lives of people around the world. As of June 30, 2022, there were 544 million infected people and 6.33 million deaths worldwide according to the World Health Organization. Many companies have had to reduce the number of people on production lines or even stop production to reduce the risk of infection because COVID-19 is so devastating to humans. As a result, the unemployment rate has soared. According to U.S Bureau of Labour Statistics, the unemployment rate in the United States reached 14.7% in April 2020, the highest level in history. In the first few months, tens of millions of people lost their jobs. Although the country and the government took timely measures, the problem of people's income could not be solved in a short time. Compared to normal days, people are in urgent need of other sources of income when their income is reduced or even no regular income due to the impact of the epidemic. As a consequence, irrational speculative behaviors are more likely to occur in this situation. If there is a second Charles Ponzi, the first batch of successful investors who have huge returns in a few months, there will be a second group, a third group or more of cash-hungry investors blindly sucked into a premeditated deception through interpersonal communication. The classic dialogue described by Charles MacKay (1996) may already be reappearing in unknown corners of the 21st century.

Another situation that makes the feedback model strongly apply for is a run on foreign currency during the Russia-Ukraine conflict. The conflict has affected the economy of both sides, especially

the devaluation of the ruble, which has been widely concerned. After the conflict between Russia and Ukraine, foreign investors sold the bonds of the Russian Federation in large quantities. Meanwhile, Russian enterprises also exchanged foreign currencies in large quantities, and the phenomenon of running on foreign currencies in various places was even more obvious. Whether investors were selling bonds or companies or individuals were cashing in on foreign currencies, these activities were driven by fears that the devaluation of the rouble would reduce the real value of liquid assets. In the early stages of the conflict, some people realized the possibility of a devaluation of the ruble, which created expectations of a devaluation of the ruble, prompting people to sell bonds and go to banks to exchange foreign currency. And then it led to a devaluation of the ruble, which made others harden their expectations of a devaluation of the rouble. Secondly, they would consider that the bank's foreign currency storage is limited. If they do not go to exchange in time, they may be helpless to see the real value of their deposits decrease. This psychology has exacerbated the phenomenon of more people exchanging foreign currency and selling bonds, further weakening the ruble. This resulted vicious circle that can also be explained by feedback models. How did Russia break the vicious circle in the feedback model in response to the continued depreciation of the ruble? First of all, Russia has taken effective measures to restrain the increase of foreign exchange demand and promote the increase of rouble demand. For example, the benchmark interest rate of Russia has been raised to 20%; Restricting the exchange of foreign currency; Forcing large businesses to convert most of their foreign currency into rubles; The suspension of sales of Russian securities by foreign investors and so on. Russia launched the "ruble settlement order" effectively reduced the international market on the ruble short will so that people's confidence in the ruble gradually restored. These measures are necessary. Imagine that if the rouble continues to depreciate without control, Russia's inflation will greatly increase, and so will the cost of export goods. Although the unreasonable depreciation of the ruble will not last long, the Russian economy will suffer a heavy blow and irreparable damage when the devaluation stops naturally. This also shows that, under the feedback model, if the government or other relevant institutions do not intervene, the feedback will eventually stop, but the cost will be unbearable for the government and the people.

Moreover, feedback models can be applied more strongly in prosperous economies than in normal ones. For example, during the bull market from 1990 to 2000, the S&P rose from 665.46 in October 1990 to 2567.91 in August 2000, an increase of about 400%, the strongest bull market to date. Thanks to the end of the Cold War and the advent of the Internet, a strong economy and stable inflation have boosted confidence in the future. In this period, after people felt the benefits brought by the Internet, they put a lot of money into the Internet. It is understandable that the positive development environment and the visible benefits brought by the Internet are indeed worth spending more money on the Internet, but excessive investment will lead to the increase of the price bubble. People's expectation to the development of the Internet is up. Therefore, to the Internet stock, investors will produce an up expectations. This leads to more money into the Internet stocks. Excessive investment makes stock prices rise, which in turn acts on people's expectations for Internet stocks, thus falling into a cycle leading to high stock prices. The boom is not real prosperity, but what former Federal Reserve Chairman Alan Greenspan calls "irrational exuberance." The Nasdaq index, the symbol of the "new economy," has lost 34.2% of its value in a month, which fully proves the view above(from 5048.62 in March 2000 to 3321.29 in April). Another important factor is that the development of the Internet has made a qualitative leap in information transmission. Without the advent of modern communication tools, the "interactions between people" that are the essential cause of speculative bubbles would not be able to transfer information and function as efficiently as they do now.

4. Conclusion and implication

In general, the feedback model can be used to explain both the economic depression and the economic prosperity. Also, with the development of information technology, the influence of feedback model will be more profound. In these cases, they have one thing in common: investors'

Ijp7ImRpdnMiOnRydWUsInNwbGl0cyI6dHJ1ZX0sInNpZ0RldiI6e319LCJjdXN0b21SYW5nZSI6bnVsbCwic3ltYm9scyI6W3sic3ltYm9sIjoiXklYSUMiLCJzeW1ib2xPYmplY3QiOnsic3ltYm9sIjoiXklYSUMiLCJxdW90ZVR5cGUiOiJJTkRFWCIImV4Y2hhbmdlVGltZVpvcjUuIjBbWVyaWNhL05ld19Zb3JrIn0sInBlcmllvZGljaXR5IjoxLCJpbmRlcnZhbCI6IndlZWsiLCJ0aW1lVW5pdCI6bnVsbCwic2V0U3Bhbil6bnVsbH1dLCJzdHVkaWVzIjp7IuKAjHZvbCB1bmRy4oCMljp7InR5cGUiOiJ2b2wgdW5kciIsImlucHV0cyI6eyJpZCI6IuKAjHZvbCB1bmRy4oCMliwiZGlzcGxheSI6IuKAjHZvbCB1bmRy4oCMIn0sIm9ldHBldHMiOnsiVXAgVm9sdW1lIjoiIzAwYjA2MSIsIkRvd24gVm9sdW1lIjoiI2ZmMzMzYSJ9LCJwYW5lbCI6ImNoYXJ0IiwicGFyYW1ldGVycyI6eyJ3aWR0aEZhY3Rvcil6MC40NSwiY2hhcnROYW1lIjoiY2hhcnQiLCJwYW5lbE5hbWUiOiJjaGFydCJ9fX0sInJhbmdlIjpudWxsQ.

- [11] Alan Greenspan. "The Challenge of Central Banking in a Democratic Society." Francis Boyer Lecture AEI Annual Dinner (1996).
- [12] Shiller, R. J. "From Efficient Markets Theory to Behavioral Finance." The Journal of Economic Perspectives (2003).