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Research and Application of Experimental Flipping Classroom on the Course Intermediate Macroeconomics: Taking the Financial Leverage Experiments as an Example

Hua-shan SU*, Wen-hui LV, Ji-hong DUAN and Shan-shan HUANG
School of Economics, Nanjing University of Finance and Economics, Nanjing, Jiangsu, China
*Corresponding author

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Abstract. As the theoretical basis and method foundation for a series of subsequent core courses, intermediate macroeconomics focuses on the cultivation of students' intuition and interest in economics. Under the traditional teaching mode, the teaching effect is not satisfactory because of the complexity and difficulty of the course. The combination of experiment and the "flipping classroom" teaching mode provides the direction for the teaching reform of this course. Discussing the application of experimental economics in intermediate macroeconomics "flipping classroom", is not only the deep thinking and practical exploration of the concrete methods and ways of the flipping classroom teaching, but also can improve the teaching effect of the intermediate macroeconomics. According to the characteristics of flipping classroom and the basic process of experimental economics teaching, the author designed the experiments. Taking financial leverage experiment as an example, this paper explores how to improve the teaching effect of intermediate macroeconomics by using experimental economics efficiently and reasonably in flipping classroom.

1. Introduction

The flipping classroom was first proposed by Baker. The idea is to align the classroom teaching content with extra-curricular learning content. Instead of simply explaining the theory in the classroom, it is mainly communicate and discuss with students to promote students' self-learning and deepen thinking, increase students' interest in learning, improve student's learning efficiency, and cultivate students' ability to use theory and knowledge. Specifically, teachers will use the basic knowledge of the curriculum in the form of video materials, and make full use of relevant sharing network platform to share video learning process with students, publish class discussion content and exercises in advance, etc. Classroom teaching is guided by teachers. Furthermore, it can make students develop active learning based on questions and practices, including question and answer, knowledge discovery and discussion, and case analysis, so that the classroom can be transformed into a place where teachers and students can interact and communicate. The goal is to enable students to gain more realistic learning through practice.

There are many schools in macroeconomics and the differences are large. The theoretic model is quite abstract and complex. As a result, many students have encountered a lot of difficulties in learning the course. In the teaching process, we learn from the rapid development of classroom teaching methods in recent years, use the experimental flip classroom model, and change the traditional teaching methods of intermediate macroeconomics to enhance students' interest in learning and learning. The experiment flipping classroom is one of the ways to realize the general flipping classroom. The uniqueness lies in that through the way of classroom on-site experiment, the students can combine the theory and practice closely.

With the help of computers, mobile phones, networks, and experimental software, experiment-based flipping classroom teaching is mainly based on experiments. Experiments, discussions, analysis, and thinking are carried out to enable students to understand relevant theories and apply them flexibly. It can realize the transition from simple surface learning to deeper research learning. Different strategies in the experimental game will make the experiment result different, and students will have more different results through the exchange of classes to stimulate students'

interest and curiosity, so that students can experience market rules in the experiment. In order to obtain an in-depth understanding of the individual's market operations, we must consider the real life and summarize how to use economic theory.

Some scholars have studied the application of virtual experiment flipping classrooms and found that experimental teaching could cultivate students' ability to solve practical problems [3].

Although scholars have different understandings of flipping the classroom, the teaching goals to be achieved are the same. They are all designed to enable students to learn knowledge better. According to the above conclusions based on the theoretical basis of financial leverage, and using experimental economics as the carrier, students participate in the experiment through the use of computers and networks in the classroom, this can help them to conduct experiments simultaneously and obtain more effective experimental results and data.

As a social science, the theory of macroeconomics comes from the real economy. Therefore, through classroom experiments, students can have an in-depth experience of the actual economic operation, so as to deepen their understanding of the connotation and application methods of the theories they have learned. In the Intermediate Macroeconomics course, we designed a series of classroom experiments by combining the main knowledge points of each part to complete the teaching of flipping the classroom. This course uses Dornbush *et al*. (2010) as the textbook. When teaching the theory of Chapter 18 "Financial Market and Asset Price", we used a financial leverage classroom experiment to enable students to participate in the experiment and understand the process of determining asset prices, and to understand the impact of financial leverage on asset prices and financial market risks. Next, taking this experiment as an example, this paper elaborates the operation mode and actual effects of the Intermediate Macroeconomic experiment flip classroom.

Financial leverage refers to the investor's use of less money to buy assets whose capital is insufficient to purchase when investing. This tool enlarges the investor's gains or losses at a fixed rate, and the risk increases significantly. Financial leverage has a great influence on capital markets and asset prices. Many scholars have studied and demonstrated the impact of financial leverage on the financial crisis, and also illustrate the impact of financial leverage on asset prices in the asset market. Asset prices in the capital market often exhibit bubbles and collapses. Asset bubbles refer to situation that the price of assets is higher than the basic value of assets, and asset collapse refers to situation that the price of assets falling below the basic value of assets.

The application of financial leverage has a greater impact on asset bubbles and asset price collapse. When many investors in the market use financial leverage, if the market is in good condition, there will be a larger bubble in the capital market. If the market conditions are poor, asset prices will show a downward trend and capital markets will collapse. The outbreak of the global financial crisis in 2008 caused serious damage to the world economy. The main cause of the crisis was the excessive degree of financial leverage. Through this classroom experiment, students will learn how financial leverage can lead to large fluctuations in asset prices, financial risks, and even a financial crisis.

2. The Development of Financial Leverage Experiments

Smith, Suchanek, and Williams summed up the research on market traders with homogeneous securities and conducted experiments on the basis of it [32]. The typical asset market asset price bubbles and collapse models were abbreviated as SSW experiment. They experimentally found a typical asset price bubble collapse model: the initial asset price is lower than the asset's base value, and then as the transaction proceeds, the asset's price begins to rise and exceeds the asset's basic value, showing a bubble phenomenon in the transaction. In the latter part of the period, the price of assets began to fall to the basic value of the assets and a crash occurred.

Miller, Porter and Smith believed that the asset market presented such a mode of bubble collapse [28,30,31]. The reason is that the degree of risk aversion decreased due to the increased familiarity of traders with the trading environment. Investors are rational and have speculative behavior in the course of trading. The study found that the growth of market trader's experience can eliminate the bubble. The SSW experiment initially emphasized that in the market they were designing, the

experimental participants were mixed together with inexperienced and two-experienced traders, and they found in the experiment that the bubble is smaller for the asset market participants with two experiences. Lei and Vesely found that when a trader had previously traded a similar asset, he could earn interest from the asset early in the asset transaction, which reduced the bubble [26].

Noussair *et al.* changed the setting that the asset base value was a monotone decreasing in the experiment, the basis of their assets in the experimental value was set to a constant, and then 8 groups of experiments were made, all the results still presented a typical phenomenon of asset price bubbles and crashes, only four of the experiments showed a smaller bubble [25]. Their research shows that asset base values are not immune to asset bubbles. Some scholars believe that the cash held by the trader can eliminate the bubble of the market if the accrued interest can cause the growth of asset base value. Bostian *et al*. assumed that the underlying value of the asset was constant in the experiment, compared with the interest rate of 10%, the 20% interest rate did not eliminate the bubble in the market, but the increase of interest rates increased the market bubble [10].

Corgnet *et al*. tested the influence of two kinds of public information "the price is too high" and “the price is too low” on asset markets [14]. It is found that the information “the price is too high” can reduce the formation of bubbles in the market with inexperienced trader. In the market with experienced experimenters, the information “the price is too low” can reduce the formation of bubbles in the market. And the result is only relevant to the content of the information, and has nothing to do with the authenticity and reliability of the information. Kirchler *et al*. designed four kinds of markets in their experiment: firstly, the basic value of assets remained unchanged, and the ratio of cash to assets increased; secondly, the basic value of assets remained unchanged, and the ratio of cash to assets decreased; thirdly, the basic value of the assets declined, and the ratio of cash to assets increased; fourthly, the basic value of assets declined, and the ratio of cash to assets decreased [24]. Through the comparison of the operations and results of these four markets, it was found that only if the basic value of assets declines, and the cash-to-asset ratio rises, bubbles appear in the market.

Domestic research on the bubble and collapse of the asset market is still relatively rare, and the papers using experimental methods to conduct research is even less. Feng *et al*. used the cointegration and VEC models to separate and extract China’s stock market bubbles and real estate bubbles [4]. They analyzed dynamic direct relationship between financial leverage and asset bubbles, and found that there was bi-directional leading relationship between financial leverage and the housing bubble, and there were significant differences in its positive effect and severity. The stock market bubble only had a one-way leading relationship, which had a positive impact on the stock market crash.

This paper explores the phenomenon of asset bubbles and collapses in the asset market through class financial leverage experiments. In this experiment, we also set different parameters to explore the factors that affect the asset market bubbles and collapses.

3. Teaching Objectives of Financial Leverage Experiment

3.1 Enable students to understand the formation of asset market bubbles and collapses

Focusing on the theoretical knowledge of financial leverage, as well as the research results of the bubble and collapse phenomenon of the asset market and its influencing factors, through reading relevant domestic and foreign literature and thinking about it, this experiments enable the students to deeply understand the problem of bubbles and collapses in the asset market, understand the formation process of the asset market price pattern, and analyze the reasons for the formation of this price model, that is, the factors that promote the formation of asset market bubbles and collapses.

3.2 Promote students to think about the impact of asset markets on economic fluctuations

In the financial crisis and economic crisis that occurred in history, the formation and collapse of asset price bubbles have more or less played a role in fueling the crisis. The development of

financial derivatives and the general application of financial leverage have made this asset market risk more prone and have exacerbated the possibility of financial crisis and economic recession. For example, the sharp fluctuations in the real estate market and financial markets in the United States were the direct causes of the subprime crisis in the United States in 2008.

3.3 Explore preventive measures for the financial market risks

On the basis of this experiment, through understanding the process of asset market bubble and collapse, we will further consider how to comprehensively adopt various macroeconomic policies and revise laws and regulations so as to effectively reduce the resulting financial risks, prevent the occurrence of financial crisis and economic recession, and maintain macroeconomic stability.

4. Teaching Design of Financial Lever Experiment Flipping Classroom

Before conducting an experiment to flip the classroom, we must first clarify the teaching content. For the experimental lesson, we should establish a reasonable experiment program, combine the characteristics of the major of students, and optimize the teaching program. Secondly, we'd better choose the computer which uses the network as the experimental medium to carry out experiments in the school laboratory, which will contribute to the adjustment of the whole experiment.

4.1 Teaching process of the experimental flipping classroom

The experiment flip classroom needs to be completed according to certain steps. In the preparation process of the experiment, the teacher should think about four main issues: one is the experimental theme; the second is the experimental idea; the third is the experimental theoretical basis and analysis method; the fourth is the experimental result. Through the answers to the above four questions, the teacher can organize and summarize the guidance of the experiment to find out the objectives and content of the experiment. In the preparatory work for the organization of experiments, it is necessary to have a complete understanding of the forms required for the experiment and the instruction of the experiment; there must be certain countermeasures in the grouping and other details. The experiment does not necessarily require the teacher to organize, it can also be are organized by students if they master the basics of "Intermediate Macroeconomics".

The experimental process mainly includes the following steps: the first step is grouping, the students are divided into several groups with equal number of individuals; the second step is to read the experiment instructions. After the experiment, the instructor read out the experimental instruction and answered the questions carefully for 7 minutes; the third step is the organization of the experiment, the students are divided into four groups, each group should do the experiments for three rounds, each round of experiment should not longer than 3 minutes, and the intervals between different rounds is 2 minutes; the fourth step is free discussion among the team members. After each group of experiments, there are 5 minutes of discussion and summary time; the fifth step is the experiment summary. When all the experiments are finished, the instructor will summarize the experiment. The time of summary is 3 minutes.

In the experiment, the instructor asked the students to answer the questions, and at the same time, the attention points of the experiment should be marked on the blackboard or PPT. In the experiment, students can compare the economic theories they have studied and consider whether the results obtained from the experiment are consistent with the existing theories.

4.2 Financial lever experiment design based on network experiment platform

The experiment was conducted in analog form and divided into two parts: experiment and Keynes guessing game.

Experimental section: the whole experiment has 10 rounds. Before the experiment started, the instructor set up the experimental data, including the trader's initial endowment, dividend payment, interest rate, and asset redemption value, to test whether the student understood the problem of the experiment. Experimental participants logged on to the online experiment software MobLab to start the experiment. The asset market is a bilateral continuous auction market. Each experimental

participant can act as either a buyer or a seller to conduct asset transactions and cannot communicate with each other. After the 10 rounds of experiments are completed, the program will automatically calculate the final income of the traders in the experiment and draw a model diagram of asset market asset prices. From the asset market transaction price chart, we can see the typical asset market bubbles and collapses phenomenon.

Keynes guessing game: in the experiment after the end of the asset market transaction, the Keynesian guessing game is performed by the students who originally participated in the experiment; when the game is over, the student's choice results given by the program are analyzed. The Nash equilibrium of Keynes guesses game is not the same as the actual result because people's cognitive limitations and the complexity of trust affect people's decision-making. Through discussions between students and teachers, students are made aware of the connection between Keynes's guessing game and the asset market, and recognize that speculation is one of the reasons why the asset market bubble will be caused.

4.3 Theoretical basis and analysis method of financial leverage experimental design

Smith *et al*. summarized and conducted experiments on the basis of previous research, and obtained the general asset price model of asset market [32]. Their experimental design was referred to as SSW experiment. In SSW's experimental design, a benchmark market was defined as a reference for subsequent research. Benchmark market has the following characteristics:

1. The market is a closed continuous bilateral auction market (CDA): bilateral auction is also called a double auction, refers to multiple sellers and buyers to participate in the auction. The most common bilateral auction is a CDA, which is auctioned for multiple identical items. The seller and the buyer may bid at any time for any number of items, biddings are sent to auction center, and the bidding auction center is responsible for matching buyers and sellers. After the successful match, the buyer and the seller shall conclude the transaction according to the average bidding price. The most typical bilateral auction market is the stock market.
2. The experimental participants can be either the buyer or the seller, and the trading time is 2 to 6 minutes, with a total of 15 rounds.
3. All players participated in the same type of market.
4. Assets traded on the benchmark market can be purchased without short selling or margin.
5. The form of a dividend payment is random, and its probability distribution is discrete and uniform. The expected value of assets is positive, and dividend payout is a positive relationship under the condition that the expected value of assets and the assets has no future value.
6. The asset base value is monotone decreasing, the value of assets is $V_t = (T-t+1)\,E[d]$, where V_t is the value of the asset in the tth round, T is the total number of rounds in the experiment, t is the tth round in the current experiment, d refers to dividends per unit of assets, $E[d]$ refers to the expected value of dividends per unit of assets.
7. In each round of experiments, the dividends per unit of assets are the same, and the dividends obtained after each round of experiments are immediately added to the cash account of the participants.
8. There is no transaction cost in the whole experiment. The cash held by the participants in the experiment will not bring interest, and there is no circuit breaker mechanism.
9. At the end of the experiment, the final remuneration of the participants was converted into real money based on the amount of cash at the end of the experiment, and then combined with the appearance fee. The participants' final cash position in the experiment was equal to the amount of cash they had just started, plus interest income and the income from the sale of assets, and then minus the expense of buying assets.

In the SSW experiment, an experiment was carried out in a well-designed benchmark market, with the typical non-experienced participants in the benchmark market under the asset price model (see Figure 1). From Figure 1, we can see the typical asset market price pattern: the ratio of the asset price in the initial market to the total cash value and asset value in the market is positively correlated. Asset prices start below the underlying value of assets, which are calculated based on

future expected dividends. Then, when the experiment was carried out to two or four rounds, the asset price began to rise and gradually exceeded the asset base value, forming a bubble. The asset bubble lasted until the end of the experiment. In the last 10 to 15 rounds of the experiment, the asset market bubble began to burst and collapse, and asset prices began to fall, falling to the basic value of the asset. In addition to the asset price presented by the bubble collapse to the model, it is found in the experiment that in the period before the market crashed, asset turnover is low, so it can be conclude that SSW market collapse is usually accompanied by a low volume.

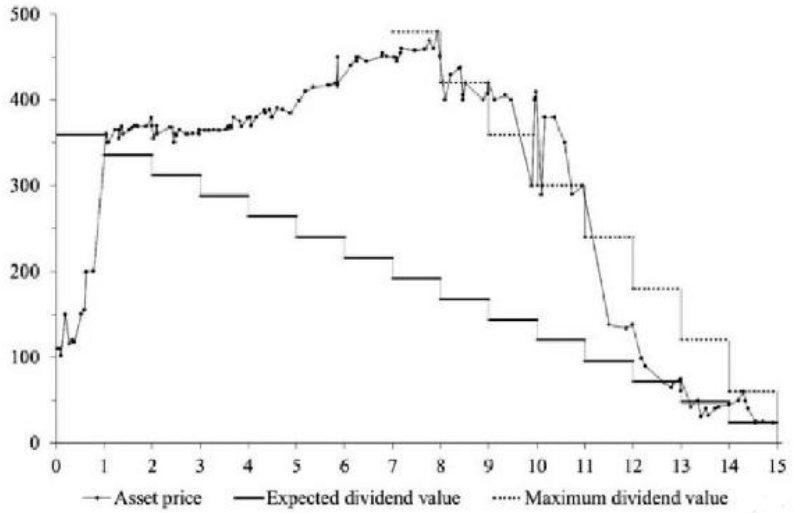

Figure 1. Bubbles and Crashes in the Experimental Asset Market

For the cause of the bubble collapse mode of asset prices, Miller, Porter and Smith argued that people were mostly risk aversion [28,30,31]. When people make the transactions for more and more times, they will become more and more familiar with the trading environment. As a result, they reduce the degree of risk aversion, which make asset price begins to rise. Market value of assets follow a monotone decreasing pattern, due to rising asset prices makes people infer that showed a trend of rising prices, leading to the market in asset prices higher, generate more bubbles, and the bubble will continue to expand, until people realize assets is far greater than the price of the asset value after the basis of the demand for the assets begin to decline, leading to the asset prices collapse. Traders were aware of the phenomenon of the mispricing at the end of the deal rather than at the time that asset prices began to exceed the value of foundation. One of the reason is that staff involved in the deal are rational, and their speculation is based on an asset price that are above the assets base value, so this kind of bubble is speculative.

Based on the SSW experimental design, this experiment mainly adopts discussion method. Through the basic experiment and contrast experiment, students can explore the formation of asset market bubbles and its influence factors. Students improve their ability to internalize knowledge by participating in experiments and fully discussing during the experiment.

5. Conclusion Analysis of Financial Leverage Experiment

This experiment is divided into two parts: the basic experiment and Keynes guessing game. The basic experiment consisted of 10 rounds of bilateral continuous auction transactions. The duration of each round of trading was 60 seconds, which led to a typical asset market bubble collapse model, namely in the first several rounds of the experiment, the market price is higher than the fundamental value of the assets and cause a bubble phenomenon, but in the final several rounds of the experiment, asset prices began to fall, even fall below the basic value of assets, and cause a collapse phenomenon. This typical asset market bubble collapse model is based on the value of no interest rate and no asset redemption. Through experiments, students learn about the process of asset market bubble collapse.

Keynes guessing games could explain the complexity of making decisions and in Keynes's

guessing game, the students were still doing the experiment. The Nash equilibrium of Keynes guessing game was different from the actual results, because the limitations of people's cognition and the complexity of trust affected people's decisions. Keynes speculated that games were closely related to asset markets, which explains that the speculative behavior of people become the factors that cause asset market bubbles. Namely some rational traders buy assets at high prices because they believe that they can be sold at a higher price to someone else in the future.

Through the financial leverage experiment, students have a deeper understanding of the causes of asset market bubbles. Experimental ways can make economic theory more image, which can help the students to internalize knowledge and combine economic theory and the actual economy together, causes the student to ponder the question they are interested in, strengthen their understanding about the economic theory, develop the students' ability of learning and scientific research.

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