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Department
of MANAGEMENT

Course of ADVANCED CORPORATE FINANCE

The Cause of the Turn-of-month Effect in the Chinese Security Market: An Empirical Study of the Liquidity Hypothesis

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Academic Year 2019/2020

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摘要

传统的金融学研究提出了有效市场假说，有效市场假说依据三个假设对资产价格进行了判断，认为市场中的资产价格已经反映了过去的信息，且信息的反馈及时、完全。但市场出现的市场异象对有效市场假说提出了挑战，也反映了有效市场假说的三个假设存在的缺陷。在各个市场异象中，日历效应表现形式多样，异象持续时间长久，进而获得了国内外学者的普遍关注。本文所研究的换月效应便是日历效应的一种表现形式。目前，国外学术界对换月效应的研究较为完整而且深入，而国内学者对换月效应的研究还停留在比较浅的层次上，仅仅有较多学者对中国股票市场换月效应的存在性进行了论证，而较少有学者进行深入的研究与挖掘。

本文首先梳理了国内外学者对换月效应的相关研究，进行了文献综述。其次，本文对换月效应对有效市场假说的挑战进行了阐述，具体叙述了有效市场假说的分类、假设和缺陷。接着，本文针对中国市场的独特性对换月效应进行了进一步的理论解释，从理论上说明了换月效应存在的合理性与流动性假说对换月效应的解释。本文接着进行了实证研究，本文选取了 2009 年 1 月 6 日至 2018 年 12 月 28 日的上证综指数据作为研究对象，采用 ARMA-GARCH 模型、引入虚拟变量、K-W 非参数检验等方式对样本数据进行分析。

本文的研究结果表明，中国股市在样本期间存在换月效应，且排除了月份效应的影响后，换月效应依然显著。在换月效应的成因研究方面，本文首次对中国市场换月效应流动性假说进行了验证。研究结果显示，一方面，货币政策的宽松和紧缩直接影响了换月期间的流动性，进而影响了换月效应的显著程度；另一方面，投资者信心直接影响投资意愿，即对新增流动性的投资行为，进而影响换月效应。在货币政策的宽松时期，换月期间流动性增大，换月效应表现更为显著；在货币政策紧缩时期，换月期间流动性缩小，换月效应表现相对较弱。当投资者信心高时，更愿意对新增流动性进行投资，从而造成更显著的换月效应；当投资者信心低时，相对不愿意对新增流动性进行投资，进而换月效应不那么显著。

关键词：有效市场假说，市场异象， ARMA-GARCH 模型，换月效应，流动性假说

ABSTRACT

Traditional financial research puts forward the efficient market hypothesis, which makes a judgment on asset prices evaluation based on its three assumptions, and holds that the asset prices in the market have already reflected all the information from history, and the feedback of the information is timely and complete. However, the market anomalies pose a challenge to the efficient market hypothesis and reflect the defects of the three assumptions of the efficient market hypothesis. In the various market anomalies, the calendar effect has a variety of forms, and this anomaly's duration is relatively long, and has won the general attention of scholars at home and abroad. The turn-of-month effect studied in this paper is a form of the calendar effect. At present, the research on the turn-of-month effect is more complete and in-depth in the international academia, while the research of the domestic scholars on the turn-of-month effect is still at a relatively shallow level, which means that many scholars have only demonstrated the existence of the demonstrated effect in the Chinese stock market, and fewer scholars have carried out in-depth research.

This paper firstly combs the relative research of the turn-of-month effect by scholars at home and abroad and makes the literature review. Secondly, this paper expounds the challenge of the turn-of-month effect to the effective market hypothesis, and describes the classification, assumptions and defects of the effective market hypothesis. Then, this paper makes a further theoretical explanation of the turn-of-month effect in view of the uniqueness of the Chinese stock market, and theoretically explains the rationality of the liquidity hypothesis for the turn-of-month effect. This paper then carries on the empirical research. This paper selects the Shanghai Composite Index data from January 6, 2009 to December 28, 2018 as the research object, using ARMA-GARCH model, the introduction of dummy variables, Kruskal-Wallis nonparametric test and other methods to analyze the sample data.

The results of this paper show that there is a turn-of-month effect in the Chinese stock market during the sample period, and after excluding the monthly effect, the turn-of-month effect is still significant. As for the study on the causes of the turn-of-month effect, this paper for the first time verified the liquidity hypothesis of the turn-of-month effect in the Chinese market. The results show that, on the one side, the monetary policy easing and stringency directly affect the liquidity during the turn-of-month period, which in turn affects the significant level of the turn-of-month effect; on the other side, the investors' confidence directly affects the willingness of investing the increased liquidity into the stock market during the turn-of-month period, which influences the significant level of the turn-of-month effect. During the period of monetary policy easing, the liquidity during the turn-of-month period will increase, and the turn-of-month effect will be more significant. While during the monetary policy stringency period, the liquidity during the turn-of-month period will

decrease, and the turn-of-month effect will be relatively less significant. When investors have higher confidence, they are more willing to invest the increased liquidity, which results in the more significant effect. While when investors have lower confidence, they will invest relatively less liquidity, thus the turn-of-month effect is not that significant.

Keywords: Efficient Market Hypothesis, Market Anomalies, ARMA-GARCH Model, Turn-of-month Effect, Liquidity Hypothesis

1. INTRODUCTION

According to the viewpoint of the weak efficient market hypothesis, all the historical transaction information in the market will be quickly and completely reflected on asset prices. Thus, future earnings cannot be predicted by past earnings models, and the return on assets will not change regularly. However, a large number of empirical studies have shown market anomalies in the security market. The market anomalies are phenomena that cannot be explained by the capital asset pricing model. The calendar effect is one of these market anomalies. The calendar effect refers to the correlation between the changing of the price and the trading time in the security market. Its manifestations include the week effect, the holiday effect, and the monthly effect.

The turn-of-month effect is one kind of the monthly effect. It refers to the phenomenon that the security market has abnormal returns at the turn of each calendar month and the abnormal returns cannot be explained by the capital asset pricing model. Since the introduction of the turn-of-month effect, many foreign scholars have paid attention on it, including the study of the effect existence, causes and arbitrage opportunities. Due to the late start of the Chinese stock market, there are few domestic studies on the turn-of-month effect. And the research is limited to the existence of the turn-of-month effect and the empirical study of the window dress hypothesis. On the basis of confirming that the turn-of-month effect exists in the Chinese stock market, this paper conducts an empirical study on its liquidity hypothesis.

The first part of this paper is the introduction; the second part is the literature review, which combs the international researches and the relevant domestic academic researches respectively; the third part gives a thorough introduction of the efficient market hypothesis, including the type, the assumptions, and the defects of the hypothesis; the fourth part explains the challenge of the turn-of-month effect to the efficient market hypothesis. This part specifies how the turn-of-month effect challenges the efficient market hypothesis and also describes the four explanations of the turn-of-month effect; the fifth part is the discussion of the turn-of-month effect in the Chinese stock market and expounds the theoretical explanation of the effect; the sixth part is the data used in the empirical research and this part also makes the preliminary statistical description of the data; the seventh part is the empirical study on the existence of the turn-of-month effect in the Chinese stock market; the eighth part is the empirical study on the liquidity hypothesis of the turn-of-month effect in the Chinese stock market; the last part is the conclusion of this paper.

This paper uses empirical analysis to prove the existence and the liquidity hypothesis of the turn-of-month effect. In this paper, the research sample is the daily return data of Shanghai Composite Index, and the study methods include dummy variable method, ARMA-GARCH model, K-W nonparametric test, equality tests by

classification and the control variable method.

This paper innovates the interpretation of the turn-of-month effect and expands the Chinese scholars' study on the causes of the turn-of-month effect. This paper is the first to prove the liquidity hypothesis of the turn-of-month effect in the Chinese market, and comprehensively proves the liquidity hypothesis from the perspective of monetary policy and investor confidence.

2. THE INTRODUCTION OF THE EFFICIENT MARKET HYPOTHESIS

The efficient market hypothesis (EMH) is a complete theoretical framework for researching efficient markets proposed by Fama in 1970. Efficient market means that the market is composed of a large number of rational investors who make judgments about the future market value of securities based on the information that can fully flow in the market, and compete with each other to maximize their own interests. The essence of the efficient market hypothesis is to study the speed and the distribution of the response of securities prices to all information in the market. The implied premise and conclusion by the theory can be summarized as: if the relevant information on the securities market is equal to each investor, and each investor can make timely and rational investment decisions based on the information he or she has, then any investor cannot obtain abnormal returns and the securities market is effective.

Specifically speaking, the efficient market hypothesis holds that markets can be considered effective if all the useful information is fully reflected in the prices of securities without any prejudice. In a fully effective capital market, there is no inherent connection in the changes in securities prices, and all irrelevant information will not attract investors' attention except for relevant information.

Furthermore, an efficient market means that the prices of various securities in the market can fully and timely present all relevant information available. There are various kinds of information in the securities market, including information about the company itself, industry development information, and macroeconomic information, etc. These kinds of information will affect the securities market to varying degrees, thereby causing the prices of stocks and bonds to respond accordingly. The efficient market hypothesis believes that in an efficient capital market, the price of securities should respond quickly to these kinds of information, and the responses should be adequate and appropriate. In other words, favorable information will immediately cause asset prices to rise, while unfavorable information will immediately cause asset prices to fall. Therefore, the asset price at any time has fully reflected all relevant information available at that time, and the security price is the best assessment of its intrinsic value at any time.

2.1. Three types of market efficiency

According to the efficient market hypothesis, the market is divided into the following three types according to the scope and degree of relevant information available: the weak efficient market, the semi-strong efficient market, and the strong efficient market.

The weak efficient market means that the current price of a security fully reflects the content implied by its historical transaction information (such as the transaction price and the transaction volume), and the changes in the price of a security present as a random walk. In other words, the current price of the securities is not related to the previous price changes, and also the current price of the securities has no effect on the future price change, that is, the individual prices in the time series are unrelated. If a weak-type efficient market exists, it is impossible to obtain a systemic excess profit by studying the historical data of securities and developing a technical analysis method for trading strategies. If the turn-of-month effect in the security market does exist, this market has not yet reached the condition of weak form effectiveness.

The range and extent of the kinds of relevant information that the semi-strong efficient markets conclude is more abundant than that in the weak efficient markets discussed earlier. The kinds of information in the semi-strong efficient market include not only the historical transactions of the securities, but also include other kinds of public information, such as the company's financial statements, the dividend distribution schemes, the profit forecasts, the major company decisions, the changes in market interest rates, the inflation rates, etc. . If the market is semi-strong, the current prices of the securities have adequately reflected all the available public information. Investors will not be able to obtain excess profits after buying and selling based on the newly released information. The semi-strong efficient markets do not mean that the investors can immediately accept and understand all the newly released public information. The reality is that generally only institutional investors or professional analysts can respond immediately to newly disclosed information. Institutional investors can obtain temporary excess profits through huge amount of research. However, the fierce competition in the securities market will cause prices adjustment rapidly and the excess profits will quickly disappear. In other words, the market is semi-efficient only when a large number of investors use the new disclosed information and intend to obtain excess profits. (Gultekin and Gultekin 1983)[24]

The information scope of the strong effective market is all relevant information, including public information and undisclosed inside information. Securities prices will respond to all relevant information, and investors cannot use inside information to obtain systematic excess profits. If the market is strong effective, inside information will also be reflected in the price of the securities. When an investor obtains inside information

and conducts related transactions based on the inside information, other investors will adopt relevant trading strategies based on the investment of the insider traders.

In general, the more efficient the market, the more reasonable the allocation of the capital resources. The different levels effectiveness of the stock market represents the different levels rationality of information distribution.

2.2. The assumptions of the efficient market hypothesis

The theory of the efficient market hypothesis consists of three gradual relaxing assumptions. For the first assumption, the efficient markets assume that all the investors are rational, so investors can make appropriate assessments of the fundamental value of the underlying assets. For the second assumption, even if some of the investors are irrational, because the transactions between investors are conducted randomly, the irrational behavior of the investors will finally offset each other, so the price of the securities will not be substantially affected. For the third assumption, in some cases, the behavior of irrational investors may not offset each other, because they may make the same mistakes, but because of the existence of the arbitragers in the market, their arbitrage behavior will finally eliminate the influences on the securities price.

Under the first assumption, all the investors are rational. The rational investors can correctly assess the fundamental value of assets. Fundamental value refers to the net present value of assets future cash flows after adjusting risks. When the investors can determine the fundamental value of various assets, they will immediately respond to various information affecting the fundamental value of assets. When the good news appears, they will raise the asset price through their trading behavior; when the bad news appears, they will lower the asset price also through their trading behavior. Therefore, the information will be reflected on the price of securities in time.

Under the second assumption, some investors are irrational. But the assumption supposes that even if there are irrational investors, the market may be still efficient. Because in the market there exists a large number of irrational investors, and the transactions of the irrational investors are random, thus the transactions between the irrational investors may offset each other. In this case, despite the very high volume of transactions by the irrational investors, the price of securities may still remain near the fundamental value.

Under the third assumption, the transactions of the irrational investors in the market are not random, meanwhile arbitrage behavior exists in the market. Arbitrage refers to the simultaneous purchase and sale of essentially the same securities at a favorable price in two different markets by an investor in order to gain

profits. If the price of a stock is higher than its fundamental value due to the trading by an irrational investor, the arbitrager will sell or short this overvalued stock, while buying securities that are essentially the same to hedge the risk. If the price of a stock is lower than its fundamental value due to the trading by an irrational investor, the arbitrager will buy or long this overvalued stock, and at the same time, sell securities that are essentially the same to hedge the risk. The arbitragers' profit-seeking behavior will return the deviating stock price to its fundamental value. Therefore, even if there are irrational investors in the market and the trading behavior of the irrational investors is interrelated, the arbitrage behavior will return the price of the securities to their fundamental value.

2.3. The defects of the efficient market hypothesis

As mentioned before, the efficient market hypothesis is based on three gradually relaxing assumptions. The first assumption is that all the investors are rational, so the rational investors can make appropriate assessments of the fundamental value of assets. The second hypothesis is that even if some investors are irrational, because the transactions of the irrational investors are carried out randomly, the trading behaviors of the irrational investors will finally offset each other, so that the price of securities will not be substantially affected. The third hypothesis is that the behavior of irrational investors will not offset each other, and the irrational investors' transactions are related, but there are arbitragers in the market. The behavior of the arbitragers will finally eliminate the influence of the irrational investors on the prices of securities. In fact, however, all these three assumptions of the efficient market hypothesis are flawed.

Since the 1980s, anomalies that contradicted efficient market theory have continuously emerged in financial markets, and modern financial theory has been constantly challenged by reality. Through experimental means, behavioral finance theory based on the study of human actual cognition and decision-making behavior analyzes the impact of human psychology, behavior, and emotion on human financial decision-making, financial product prices, and financial market development trends. The rational person and the complete arbitrage assumption of the efficient market hypothesis reflect that investors are bounded rationality, and arbitrageurs 'arbitrage behavior for irrational pricing is not complete.

The first rational person hypothesis of the efficient market hypothesis is quite flawed, because many investors' buying and selling decisions are always affected by unrelated information or noise. For example, a large number of investors in reality will be influenced by the opinions of some financial experts, but the opinions of these financial experts are mostly non-relevant information. Investors may also make a lot of irrational investment behaviors, such as no diversifying or frequently trading assets in their asset portfolio. In other

words, many investors in the market will not adopt passive trading strategies when lacking information as assumed by the efficient market hypothesis.

Investor rationality under the efficient market hypothesis has two meanings. The first meaning is that the investors' subjective probability of various unknown variables under uncertain conditions is rational, which is in line with Bayes' rule. Bayes' rule is particularly important for decision theory, because he assumes the dynamic characteristics of individual rationality under uncertain conditions, that is, the process of continuous adjustment and learning. However, human cognitive processes or information processing methods do not actually follow Bayes' rule. Experimental economists, especially some psychologists, pointed out that under the constraints of limited cognitive ability, people always try to adopt some strategies to simplify the cognitive process in the cognitive processes to reduce the cognitive burden, such as ignoring some information, excessively using certain information or accepting an imperfect choice, etc. This simplification strategy may be effective because it can make good use of limited cognitive resources to process almost endless information. But this strategy will also cause people's cognitive deviations and make people systematically make the same mistakes. The deviation of investors' perception of market information is the primary manifestation of investors' limited rationality. The second meaning of investor rationality is that investors' decisions based on subjective probability are rational, in line with the principles of expected utility theory. Psychological research has found that people do not abide by expected utility theory when making decisions, but instead systematically violate several axioms of expected utility theory, such as dominant axioms, transitive axioms, and constant axioms. Therefore, from the perspective of behavioral finance, the rational theory is untenable.

The second hypothesis of the efficient market hypothesis is that the irrational investors in the market will not affect assets prices because their random transactions will finally offset each other. However, according to the indication of behavioral finance and psychology studies, irrational people do not deviate from rationality by accident, but always deviate in the same way, such as the herd effect and the blind follow effect. For example, the irrational investors are susceptible to the rumors or the noises in the market, so the buying and selling behaviors of the irrational investors are strongly correlated, rather than completely random. That is, the irrational investors often buy and sell roughly the same stock at roughly the same time. Investor sentiment theory also indicates that a large number of irrational investors tend to have a large number of judgment errors or decision errors, and these decision errors have a strong correlation.

The third assumption of the efficient market hypothesis is that even if the trading behaviors of the irrational investors cannot offset each other, the arbitrage activities of the rational arbitragers in the market will eliminate the impact of the trading behaviors of irrational investors on assets prices. In other words, the establishment of the efficient market hypothesis depends on the effectiveness of the arbitrage mechanism. However,

according to behavioral finance research, arbitrage in reality is full of risks on the one hand and has limited effect on the other hand. The previous description of the arbitrage mechanism mentioned that when conducting arbitrage, arbitragers need to find alternative securities that are essentially the same as those affected by the irrational investors. That is, in order to avoid risks, the arbitragers must buy or short-sell overvalued securities while buying essentially the same alternative securities that do not deviate from the fundamental value. In most cases, however, it is often difficult to find suitable alternative securities for overvalued securities. Under this situation, the arbitragers can only sell or unload on securities that may be overvalued in their asset portfolios. But such arbitrage is not risk-free. In the absence of the alternative securities, if an arbitrager is risk averse, then the arbitrager will not participate in this kind of arbitrage. Therefore, considering the limited risk tolerance and the transaction costs of the arbitragers, and the greatly reduced arbitrage transaction volume, it is difficult for the arbitragers to maintain a large number of stock prices at their fundamental value level.

Another situation is that even if the perfect alternative securities can be found, there also exists another arbitrage risk, which is the unpredictability of the prices of the relevant securities when they are re-assigned in the future. Price deviations between the overvalued securities and the alternative securities may not be eliminated immediately but may persist for a considerable period of time. Even if the fundamental value of the two securities are essentially equal, the price of the overvalued securities may continue to rise, while those with lower prices may continue to fall. Although the price differences between the two will eventually be eliminated, the arbitragers will have to bear the temporary losses in such transactions. If the arbitragers can survive it, they will be able to gain profit finally, but the capital pressure and the budget constraints during this period will likely lead to the failure of the arbitrage.

All in all, even if the three assumptions of the efficient market hypothesis gradually relax, the efficient market hypothesis is flawed. The shortcomings of the efficient market hypothesis are the theoretical basis of various market anomalies. The existence of the turn-of-month effect also challenges the efficient market hypothesis.

3. LITERATURE REVIEW

The turn-of-month effect is a kind of the calendar effect, which belongs to the market anomalies in the securities market.

The international scholars' research on the calendar effect have started early. As early as 1931, Fields published a relative paper which pioneered the study of the calendar effect in the securities market(Fields 1931)[20]. The calendar effect came up with the challenge to the efficient market hypothesis purposed by the mainstream

finance studies. After Fields's research, more and more studies of this type of securities market anomalies have been conducted.

Most scholars' researches have focused on many mature securities markets in developed countries. Starting from the United States, scholars have gradually discovered that the stock markets in multiple countries or regions also have calendar effects. (Hansen, Lunde and Nason 2013)[25] conducted the research on multiple securities markets, including Denmark, France, Hong Kong, Italy, Japan, Sweden, the United Kingdom, and the United States. The author found that the calendar effect is particularly pronounced at the end of the year. (Tonchev and Kim 2004)[43] studied the calendar effect of three Eastern European countries including the Czech Republic, Slovakia, and Slovenia. The empirical research showed that different stock markets have different characteristics with regard to the calendar effect.

In the study of the monthly effect, the most extensive research fields by the international scholars are the research on the January effect and the research on the April effect. The January effect was first discovered by (Donald, B. and Keim 1983)[17]. The author found that in January, the returns of small enterprises were significantly higher than those of large enterprises, and nearly half of the scale effect appeared in January. (Fountas and Segredakis 2002)[22] studied the stock data of eighteen emerging markets from 1987 to 1995 and found that the January effect was significant in Chile, Greece, South Korea, Taiwan, and Turkey stock markets.

In the study of the January effect, many scholars abroad have tried to explain it. (Rozeff 1986)[39] used the tax reduction and exemption system to explain the January effect: investors sell their holding shares at the end of the previous year and use the losses to offset capital gains to obtain tax reduction, and then buy a large number of shares at the beginning of the new year. Thus, the January effect appears. (Jay, R. and Ritter 1988)[28] believed that the inefficient market is a kind of reallocation mechanism for portfolios. Institutional investors sell stocks that have underperformed in the past year at the end of the year, and financial statements will look better. That kind of window dressing behavior can put pressure on small-cap stocks, which means that the high returns in January are caused by investors buying stocks at the beginning of the year which can cause stock prices to rise. (Chan, Chen and Hsieh 1985)[15] explained from the perspective of risk and return. The author believed that the January effect arises because investors take greater risks in January, therefore investors should have correspondingly higher investment returns. Specifically, there are some neglected risk factors in January. If the risk of holding stocks in January is higher than any other month of the year, then the average return of January should be higher than other months. (Mills and Andrew Coutts 1995)[38] provided new ideas for studying the causes of the January effect. The author believed that the existence of the January effect is related to the liquidity restrictions from the regulatory authorities.

In the study of the holiday effect, (Chan-Wung et al. 1994)[16] not only analyzed the holiday effects of the US stock market, but also studied the stock markets of the United Kingdom and Japan. The author found that the three major stock markets in the United States all showed the holiday effect, and the similar holiday effect also exists in the British and Japanese stock markets.

In further research the international scholars have found that statistical methods can also affect the empirical results to a certain extent. (Giovanis 2009)[23] studied 55 stock indexes in 51 countries. The author conducted the in-depth research on the calendar effect, including the turn-of-month effect, the weekly effect, the monthly effect and the half-month effect. The research showed that only the turn-of-month effect exists in the 36 stock indexes, and the volatility has a stronger seasonality characteristic than the return, which is related to the weekly effect and the monthly effect. The author also found that the rest of the calendar effects have not been tested. This result is probably related to the statistical method used in the empirical test. The author tried to test the data again with the previous statistical methods and found the existence of the Monday effect and the January effect.

(Floros and Salvador 2014)[21] expanded the research on the calendar effect. The author studied the calendar effect under different economic cycles. Taking 2008 as an important time node, the author divided the period from 2004 to 2011 into two different economic cycles, and used the Markov transition model to study whether the calendar effect of stock index futures and the calendar effect of stocks existed in the Europe and the US stock market during the periods with severe market fluctuations. In the turbulent periods, the S & P 500 Spot Index and the British Futures Index have a negative Monday effect; in the stationary periods, the British Spot and Futures Index have a positive Thursday effect. During the stationary periods, the original positive monthly effect will turn into the monthly effect which is negative during the periods with severe market fluctuations.

3.1. International Study on the Turn-of-month Effect

Foreign scholars' studies on the turn-of-month effect are mainly concentrated in three aspects. The first aspect is to test the existence and the continuity of the turn-of-month effect in the security market. The second aspect is to study the causes of the turn-of-month effect. The third aspect is to explore the arbitrage opportunity caused by the turn-of-month effect.

3.1.1. Testing the existence and the continuity of the turn-of-month effect

(Ariel 1987)[1] was one of the earliest scholars to study the turn-of-month effect. Taking the stock index data from 1963 to 1981 as the research sample, the author compared the cumulative returns on the trading days of

the turn of each calendar month period and the cumulative returns on the other trading days. The result showed that the cumulative returns during the turn of month period is significantly positive, while the cumulative returns on the remaining trading days is not significantly different from 0. Later, (Lakonishok and Smidt 1988)[3] conducted a more in-depth study of the turn-of-month effect. The author conducted an empirical study of the Dow Jones Industrial Average for more than 90 years. The result showed that the average rate of return between the last trading day of the month and the first three trading days of the following month is significantly higher than the average rate of return on other trading days.

(Marquering, Nisser and Valla 2006)[9] believed that if the market anomalies are caused by data mining, these market anomalies will disappear quickly after being announced; on the other hand, as investors gradually understand market anomalies and the related market arbitrage behavior, these market anomalies will gradually weaken. The author made a dynamic analysis of some important market anomalies and found that most calendar effects gradually disappeared after being published, such as the weekend effect and the holiday effect, but the turn-of-month effect has always existed. (Mcconnell and Wei 2008)[36] conducted a further research on the continuity of the turn-of-month effect. The author selected the US stock market index data from 1897 to 2005 to conduct a comprehensive study of the turn-of-month effect. The study found that the turn-of-month effect in the US stock market has always existed during the study period, including the latest 20 years after the turn-of-month effect has been widely recognized. The author also obtained some relevant conclusions: the turn-of-month effect is not limited to the small-cap stocks and the low-priced stocks, but is a universal phenomenon; the turn-of-month effect is not related to other seasonal effects (the end-of-year effect and the end-of-quarter effect); the volatility of the rate of return during the turn of month period has not increased significantly, thus the excess rate of return is not a compensation for the excess risk; the turn-of-month effect is not caused by the increase in the risk-free interest rate during the turn of month period.

3.1.2. Studying the causes of the turn-of-month effect

(Ogden 1990)[4] proposed the liquidity hypothesis. The author believed that the standardized payments system in the United States generates a large amount of cash flow during the turn of month period, and the turn-of-month effect will occur when investors invest these large amounts of liquid funds into the stock market. Because the scale of cash flow generated during the turn of month period is affected by monetary policy, more liquid funds will be generated during the expanded monetary policy period, which will produce a more significant turn-of-month effect.

After the liquidity hypothesis was proposed, a large number of scholars conducted empirical research on the hypothesis from different perspectives, and the results showed that the liquidity hypothesis has a considerable

explanatory power for the turn-of-month effect. (Liano and Marchand 1992)[5] studied the relationship between the economic cycle and the turn-of-month effect and found that there was a close relationship between the turn-of-month effect on the OTC market stocks from 1973 to 1989 and the economic cycle. Specifically, during the economic expansion period the turn-of-month effect significantly exists in the over-the-counter market, but it is less obvious during the economic contraction period. (Zhao, Liano and III 2004)[7] studied the relationship between the US presidential election cycle and the turn-of-month effect. The author used the S&P500 index, the Dow Jones Industrial Average, and the Nasdaq constituent stock index from 1960 to 2001 as the research sample, and found that the turn-of-month effect is more significant in the second half of the presidency. The author believed that in order to fight for re-election, the government in the second half of the presidency will adopt a series of policies that are conducive to economic growth. Under the standardized payments system in the United States, these policies will generate more cash flow, which proves the rationality of the liquidity hypothesis from the side.

(Nikkinen, M and Ij 2007)[13] proposed the information release hypothesis. The author conducted an empirical study on the S&P500 index of the US stock market from 1995 to 2003 and found that the turn-of-month effect and the half-month effect have always existed. But the turn-of-month effect is no longer significant after considering the impact of programmatic macroeconomic information release in the United States and adding the relevant control variables into the empirical study, which means that the series of important macroeconomic information released at the beginning of each trading month is an important reason for the turn-of-month effect.

The window dress hypothesis is another explanation of the turn-of-month effect. The window dress hypothesis believes that the fund manager may significantly raise the price of their heavy holding stocks during the turn of month period to increase the fund net worth ranking or whitewash the statement. (Wiley and Zumpano 2008)[48] tested the window dress hypothesis empirically using REITs transaction data from 1980 to 2004. As the United States promulgated a decree on relaxing institutional investors' investment in REITs in 1993 (Omnibus Reconciliation Act), institutional investors have significantly increased the proportion of REITs investment in their asset portfolios. The author proved the window dress hypothesis through a significant change in the manifestation of the REITs turn-of-month effect around 1993. The author found that the REITs turn-of-month effect before 1993 was mainly reflected in the period from the last trading day of the previous month to the first four trading days of the next trading month. While after 1993, the REITs turn-of-month effect was reflected in the period from the last four trading days of the previous month to the first trading day of the next trading month. Meanwhile, the author believed that the window dressing behavior of institutional investors is an important factor of the turn-of-month effect, but not the only factor.

3.1.3. Exploring the arbitrage opportunity caused by the turn-of-month effect

(Hensel and Ziemba 1996)[27] conducted an empirical study on the feasibility of arbitrage using the turn-of-month effect. The author established a "switching investment strategies", that is, investing in stock portfolios during the turn of month period while investing in cash on other trading days. The author found that switching investment strategies are significantly better than simply buying and holding stock portfolios and have lower risk.

(Kunkel and Compton 1998)[31] conducted further research on market arbitrage opportunities. In order to avoid the impact of transaction costs and taxes as much as possible, the author established new switching investment strategies, that is, switching between pension accounts and money market asset accounts. The author found that the average annual return of the switched investment strategy is significantly higher than other asset portfolios.

3.2. Research on the Chinese stock market

The Chinese market started late on the calendar effect, but the research on various specific anomalies of the calendar effect has already covered relatively comprehensively. Chinese scholars' research on the regularity of the Chinese stock market has mainly focused on the scale effect, the weekend effect and the January effect.

As for the earlier research, (Song and Jin 1995)[41] did the statistical test of the small-company effect on the Shanghai stock market, which proved the existence of the small-company effect in the Shanghai stock market. (Wu 1996)[49] suggested on the research of the small-company effect in the Chinese stock market. The author suggested that the research should use a longer period of data in order to increase the reliability of the empirical study. The author also pointed out that the sample division should use the market value of the enterprises. (Wang and Zhou 2002)[47] made a good review of related research in several years and found through the research that the small-company effect is significant. Meanwhile, small companies have higher average returns in March and August, and their average returns are significantly higher than the market index, which means that without risk adjustment there exist the small-company March effect and the small-company August effect. After eliminating the volatility factors, there is no significant evidence that the small-company effect is concentrated in any certain month, that is, the monthly effect for small companies is not obvious during the sample data period, and the small-company effect is reflected in most months of the year.

In the study of the weekly effects, (Xu 1995)[51] used the GARCH model and found that during the period 1992 to 1994, the Shanghai and Shenzhen stock markets had the same weekly effects as developed countries.

Specifically, the stock return is significantly negative on Monday, which is the trough in a week. And the stock return reaches the peak on Friday. (Yan, Meng and Yang 2000)[54] conducted the study on the weekend effect of the Shanghai Stock Exchange. The study showed that the Shanghai stock market has a negative Tuesday effect, and the stock return on Friday reaches the peak of the week and on Monday the returns fluctuate the most. Furthermore, in 1996 the Chinese stock market introduced the daily limit system. The characteristics of the weekend effect before and after this time node showed significant differences, which proves that policies have a long-term impact on the stock market. (Xue and Gu 2000)[53] further studied the characteristics and the differences between the Shanghai and Shenzhen stock markets. The author found that the Shanghai Stock Index has the positive effect only on Monday, and the Shenzhen Stock Index shows the positive effect on both Monday and Friday. The two markets have the strongest volatility on Monday; the author also found that the monthly effect is related to the changes in the amount of capital in China, the national consumption habits and the macroeconomic trends. The monthly effect shows the seasonal characteristics and the August effect. (Feng 2003)[59] and (Zhou and Chen 2004)[58] both concluded that, unlike the stock markets in developed countries, the daily returns in the Chinese stock market have the largest variance on Monday, and show a significantly negative Tuesday effect and a significantly positive Friday effect. (Shi 2003)[40] conducted the study of the Shanghai stock market and found that there is a significant Friday effect in the Shanghai stock market. (Zhang 2005)[56] used the rolling sample test to process research data on the Shanghai Composite Index and Shenzhen Component Index from 1991 to 2004 to study the time-varying characteristics of the calendar effect. The author implied the empirical research of GARCH-GED (1, 1) and found that the Friday effect of Chinese stock market has gradually disappeared since 1998, and the Tuesday effect was only manifested in the early stages of the market, and the volatility on Monday is the largest during the week. (Sun 2018)[42] used the daily closing data of the CSI 300 index as the research sample and used the GARCH family model to conduct an empirical test of the calendar effect in the Chinese stock market. The test results showed that the Chinese stock market shows a negative Thursday effect from 2010 to 2016, and the Thursday effect is relatively significant.

The weekly effect is also affected by the economic cycle, because investors' expectations of the future are inconsistent under different economic cycles, and the changes in psychological factors can affect decision-making behavior. (Wang 2011)[46] divided the sample range into boom and recession. The results showed that the weekly effect of the domestic Shanghai A-share market during the economic boom has a significant positive Monday effect, but the weekly effect of the securities market during the recession does not show a significant positive Monday effect.

In the study of the monthly effect, the results of the domestic scholars vary greatly. (Xu and Zhang 2005)[52] selected the data from the opening day of the Shanghai and Shenzhen Stock Exchanges to May 31, 2004. The

author used the rolling sample test and the broadly GARCH model to verify the monthly effect. The results showed that the returns in the Chinese stock market are significantly positive in March and April, while in September and October they were significantly negative. (Li 2003)[33] studied the December effect, and the author argued that the December effect of the Chinese stock market can be explained by the withdrawal of funds from the year-end accounts and then the selling of stocks. (He and Xu 2006)[26] came to a different conclusion than previous studies. The author found that both the Shanghai and Shenzhen stock markets have significantly high yields in January and March, while in July and September there were significant negative yields. The author believed that this phenomenon is related to the selection of samples time range. (Fan and Dong 2007)[18] studied the positive March effect and the negative December effect. The author thought that the explanation for these two effects can be explained by the consumption habits. During the two important traditional festivals of New Year's Day and Spring Festival, the strong demand for liquidity of residents always brings about a peak in consumption, which is negatively correlated with the stock market yields, thus supporting the author's view. (Jiang, Lv and Zhang 2012)[30] further proved the effect of consumption habits on the monthly effect. The author studied from the perspective of consumer psychological accounts and believed that the year-end bonus issued lead to psychological bias among investors because the investors can differentiate the year-end bonus and their ordinary wage income and invest irrationally.

In the study of the holiday effect, foreign scholars have proved that the holiday effect is widespread in the developed country markets, and some of domestic scholars have studied whether there is the holiday effect in the Chinese stock market. (Li and Ouyang 2005)[32] based on the 1992-2004 Shenzhen Composite Index to verify the holiday effect in the Shenzhen stock market, including the Spring Festival, Labor Day, National Day. The author ruled out the potential weekly effect and found that before the holiday, the stock market showed the negative Monday effect and the positive Tuesday, Wednesday, and Friday effects at the 10% significant level. (Lu and Liu 2008)[34] focused on the holidays when the stock markets are closed for the statutory holidays. The author selected New Year's Day, Spring Festival, Labor Day, and National Day. Through the study, the author found that there is no holiday effect on National Day, and there is a positive holiday effect on New Year's Day, Spring Festival and Labor Day. Taking into account the particularity of the holidays, the author found that the holiday effect is still significant after controlling the weekly effect and the January effect. The author thought that investors are not completely rational, and there is a time lag in the processing of information. In addition, the post-holiday yield variance is different from the variance of other trading days, indicating that the high return after the festival is often accompanied by high risk. (Yi and Liu 2005)[55] carried out a more comprehensive verification of Chinese traditional and statutory festivals, and meanwhile ruled out the possibility that the abnormal rate of return may be due to the stock market closure. The author tested the

Shanghai Composite Index from 1996 to 2003 and found that there are abnormal returns before and after the traditional and statutory holidays in the Shanghai stock market and are not affected by the market closure, which also showed the correlation between the investors' sentiment and the stock market. (Xie 2018)[50] studied the Spring Festival effect of the Chinese stock market. The author examined the Shanghai Composite Index yield from 1996 to 2015 and found that the Chinese stock market tends to rise more and fall less before and after the festival. From the perspective of behavioral finance, the author believed that there are three reasons. First, before the Spring Festival many corporations pay bonus allowance, the additional income may flow into the stock market and push the stocks prices to rise. Second, the Chinese CPPCC and NPC sessions are near the Spring Festival, accordingly investors form policy expectations and enter the market ahead of schedule. Third, the Spring Festival since ancient times has been the Chinese traditional festival, the holiday atmosphere can affect the mood of investors, and thus helps promote the stock market.

In the study of the macro-index announcement effect, Chinese scholars have less research on this aspect. The macro-index announcement effect is an alternative calendar effect, which is not the impact of the index itself, but only refers to the market's reaction to the macro-index announcement schedule. (Zhang and Xu 2018)[57] researched on the effects of the inflation indicators publishing. The results showed that between 2001 and 2016, the Shanghai index shows a regular decline in the previous trading day before the National Bureau of Statistics published inflation data. This market anomaly comes from the information asymmetry of the Chinese securities market and the lack of financial products to hedge systemic risks. These problems have led to the risk-averse behavior by investors ahead of the macro data announcement.

In the study of the turn-of-the-month effect, (Feng 2003)[59] selected the daily data from Shanghai Composite Index and Shenzhen Component Index from 1992 to 1998 to conduct an empirical analysis. The result showed that there exists a significant turn-of-month effect in both stock markets. (Liu and Chen 2004)[8] proved the existence of the turn-of-month effect in the Shanghai stock market with the non-parametric multi-sample Kruskal Wallis test. Through the analysis of the development status of the Chinese fund industry, the author pointed out that the window dress effect caused by fund managers in order to improve the net worth ranking or in order to whitewash statements may be an important reason for the turn-of-month effect. (Xing and Zang 2006)[10] further pointed out that in order to avoid the overlapping of the futures contracts expiration date effect with the spot contracts month effect, turn-of-month effect, weekend effect and holiday effect, the last trading day of stock index futures is recommended to schedule in the third week of the expiration month. (Chen and Liu 2007)[11], (Ma 2007)[12], and (Gao 2009)[14] respectively selected different sample data and concluded through empirical studies that in the Shanghai Stock Market, the turn-of-month effect period is from the last trading day of the previous month to the first six trading days of the next trading month.

4. THE CHALLENGE OF THE TURN-OF-MONTH EFFECT ON THE EFFICIENT MARKET HYPOTHESIS

4.1. The proposing of the turn-of-month effect has challenged the efficient market hypothesis

(Ariel 1987)[1] was the first scholar who conducted a systematic research and the empirical test on the turn-of-month effect in the securities market. Ariel conducted an empirical study of the US stock index from 1963 to 1981. The study found that the positive rate of return only originated from the last trading day of each trading month to the first few trading days of the next trading month, while the daily rate of return on the other trading days is around zero. Shortly thereafter, (Lakonishok and Smidt 1988)[3]'s study of the 90-year Dow Jones Index also found the similar phenomenon. These studies are groundbreaking contributions to the study of the turn-of-month effect.

The existence of the turn-of-month effect is a severe challenge to the efficient market hypothesis. The appearance of the turn-of-month effect also indicates that the market is not efficient. As mentioned before, there are certain defects in the efficient market hypothesis theory, which explains that the market efficiency depends on the assumptions such as rational investors and the existence of the alternative securities. These conditions are difficult to meet in reality. In fact, investors tend to be irrational and it is difficult to find suitable substitutes for the large number of securities traded in the market. Therefore, the actual market has not operated as described by the efficient market hypothesis, so all kinds of market anomalies such as the turn-of-month effect can appear in the securities market.

4.2. Summary of various explanations of the turn-of-month effect

Market inefficiency is the essential cause of the anomalies in the securities market. However, different anomalies themselves have different characteristics, and different anomalies have diverse causes. As far as the turn-of-month effect is concerned, the explanations currently studied by scholars include the liquidity hypothesis, the window dress hypothesis, the information release hypothesis, and the data mining hypothesis.

4.2.1. The liquidity hypothesis

(Ogden 1990)[4] proposed the liquidity hypothesis. Ogden believed that the standardized payments system in the United States will generate a large amount of cash flow (including wages, dividends, and interest) during

the turn-of-month period. According to the Moody's research report, about 70% of the corporate bonds set the first trading day of the month or the last trading day of the month as the interest and principal payments dates. Similarly, about 90% of the municipal bonds also set the principal and interest payments dates as this period. The Standard & Poor's research report shows that approximately 45% of common shares and 65% of preferred shares pay dividends during the turn-of-month period. When investors invest a large amount of liquid funds into the stock market through various channels generated during the turn-of-month period, the market demand for stocks will increase accordingly, resulting in the turn-of-month effect. At the same time, because the size of the cash flow generated during the turn-of-month period is affected by monetary policy, specifically, during the easy period of the monetary policy, more residual liquidity will be generated, which will produce a more significant turn-of-month effect. While during the stringent period of the monetary policy, less residual liquidity will be generated, so the performance of the turn-of-month effect is relatively insignificant. The author used empirical tests on the existence of the turn-of-month effect and the applicability of the liquidity hypothesis by using the daily return data of the CRSP market value weighted index and the equal weight index from 1969 to 1986, and found that the turn-of-month effect is significant during the sample period and is consistent with the author’s expectations, that is, the turn-of-month effect during the easy monetary policy period is more significant, while the turn-of-month effect during the stringent monetary policy is less significant.

The liquidity hypothesis has received great attention from scholars since its introduction, and many scholars have conducted follow-up research on the liquidity hypothesis. Such as (Liano and Marchand 1992)[5], (Zhao, Liano and III 2004)[7], etc., scholars have carried out the empirical research on the liquidity hypothesis from different angles, and the results show that the liquidity hypothesis is indeed an important factor that produces the turn-of-month effect.

(Burnett, 2017)[2] provided an important supplement to Odgen's liquidity hypothesis from the perspective of behavioral finance. The author believed that it is not only the standardized payment system that affects the liquidity during the turn-of-month period, but also the investors willingness to invest in the increased liquidity. On the trading days that exhibits high liquidity, the turn-of-month effect is more significant only when investors' willingness to invest in the stock market is relatively high. The author supplemented the explanation of the investor confidence in the liquidity hypothesis.

Although many scholars have studied the liquidity hypothesis for the securities markets of different countries, the verification of the liquidity hypothesis has not yet appeared in the Chinese securities market.

4.2.2. The window dress hypothesis

The window dress hypothesis is related to the window dress effect. The window dress effect in the securities market refers to the phenomenon that the price of a stock rises significantly before the end of a certain trading day, especially before the end of the trading day at the end of the month. There exists the window dress effect in the securities markets of London, Norway, the United States, Australia, and Singapore. As for the Chinese Shanghai stock market, the window dress effect is more likely to occur on the last trading day of each month rather than other trading days.

The occurrence of the window dress effect is considered to be related to the fund managers, because the fund managers may want to raise the fund net worth ranking or other rankings before publicly disclosing their management performance. The fund managers may significantly raise the price of their heavy holding stocks. Because the fund's performance is generally calculated at the end of the month using the closing prices of their holdings, the closing prices of the fund heavy holding stocks are most likely to have the window effect at the end of the month, the end of the quarter and the end of the year.

The research results of (Jegadeesh and Titman 1993)[29] found that the stock returns have a certain degree of inertia in a short period of time. Therefore, the existence of the window dress effect may cause the relevant stocks to continue to obtain excess returns during the turn-of-month period, and thus become an important factor that produces the turn-of-month effect. Therefore, it is called the window dress hypothesis.

4.2.3. The information release hypothesis

(Nikkinen, M and Ij 2007)[13] proved that the programmatic macroeconomic information release mechanism in the United States has an important effect on the turn-of-month effect in the US stock market through the empirical study, and thus put forward the information release hypothesis of the turn-of-month effect. The basic opinion of the information release hypothesis is that a large amount of macroeconomic (macroeconomic data published by governments at all levels and the National Bureau of Statistics) and microeconomic information (quarterly reports and performance reports of listed companies, etc.) generated during the month change have caused the stock prices to rise.

The logic of the information release hypothesis is that a large amount of macro and micro economic information released during the turn-of-month period will surely cause the volatility of the relevant securities to rise, and the increase in the level of risk caused by the information release will inevitably require corresponding risk compensation, leading to a higher yield during the turn-of-month period, that is to say, the

higher yield during the turn-of-month period is actually a risk premium for the rising volatility.

4.2.4. The data mining hypothesis

Many scholars in academia do not acknowledge the existence of the calendar effects such as the turn-of-month effect. These scholars believe that the market anomalies such as the calendar effect are the result of data mining. Data mining refers to the use of the same data to discover and test a hypothetical individual or collective behavior. (Lakonishok and Smidt 1988)[3] believed that the discovery of the calendar effect is likely to be the result of data mining and sampling errors. After researching various market anomalies systematically, (Mehdian and Perry 2002)[37] pointed out that most market anomalies no longer exist as long as the sample period is changed.

5. DISCUSSION ON THE TURN-OF-MONTH EFFECT IN THE CHINESE STOCK MARKET

5.1. Discussion on the Liquidity Hypothesis

(Ogden 1990)[4] 's liquidity hypothesis states that the standardization of the US payment system has led to the turn-of-month effect of stock returns. Ogden's liquidity hypothesis is based on the fact that, for most economic entities, the conversion period of each calendar month is the typical payment date for wages, dividends, interest, and principal, so the end of each calendar month is investor's preference stay. When these entities have short-term investable funds, they prefer to invest in bonds that mature at the end of the month because shorter-term or longer-term bonds may need to be rolled out or sold before maturity to provide the necessary liquidity for the turn-of-month debt. Rolling out or selling before maturity will bring greater interest rate risk and transaction costs. As a result, increased demand for securities that mature at the end of the month has led to a rise in their prices compared with advanced-maturity securities. Meanwhile, the increase in price is related to monetary policy. Stringent monetary policy can limit overall liquidity and raise the expected liquidity cost of paying off turn-of-month debt.

The difference between the Chinese stock market and the US stock market is that China does not have a standardized payment system similar to the United States. Therefore, this paper believes that the theoretical premise of the liquidity hypothesis in the Chinese stock market is based on the following fact: In the Chinese A-share market, the net inflow of funds during the turn-of-month period is greater than that in other periods.

This paper selects the data of the net inflow of funds in the Chinese A-share market from January 4, 2012 to December 28, 2018. The period of the last trading day of the previous trading month to the first three trading days of the next trading month is selected as the turn-of-month period. The static statistical analysis shows that the average daily net inflow of funds in the market during the turn-of-month period is -9.505 billion yuan, while the average daily net inflow in the market during the non-turn-of-month period is -143.322 billion yuan, which means that more funds flows into the stock market during the turn-of-month period.

5.2. The Explanation on the Turn-of-month Effect

According to (Ferrel 1976)[19], investors will layer the liquidity of their portfolios, thus there are certain proportions of assets with different liquidity in investors' portfolios, such as cash, highly liquid securities (such as government bonds), and low liquid securities (such as stocks). In order to reduce transaction costs, investors will only increase stocks in their portfolios after their accumulated cash is sufficient enough and meets the low-liquidity investments. Generally speaking, cash is the most abundant during the turn-of-month period, as a result, the stock demand is the strongest during this period.

Meanwhile, according to (Burnett 2017)[2]'s supplement of investor confidence from the perspective of behavioral finance, investors will invest more increased liquidity into the stock market when the investor confidence is higher.

Therefore, in summary, in the months with overall greater liquidity income and higher investor confidence, investors will invest more funds into the stock market during the turn-of-month period, which will lead to an increase in stock returns. In the months with overall smaller liquidity income and lower investor confidence, the growth of stock returns during the turn-of-month period will not be realized. These arguments show that monetary policy determines the total liquidity profit during the month, which in turn affects stock demand, resulting in the changes in stock returns during the turn-of-month period; investor confidence determines the liquidity investment during the turn-of-month period, which in turn affects the aggregate demand in the stock market, leading to the different significant level of the turn-of-month effect. In a word, easy monetary policy and higher investor confidence will bring greater liquidity profits, leading to greater turn-of-month stock returns.

6. DATA

6.1. Selection of the Sample Data

This paper selects the daily closing price data of the Shanghai Stock Index as the research object. The data is from January 6, 2009 to December 28, 2018 and has a total of 2430 samples. The data comes from the Wind database. When calculating the turn-of-month effect, the data is divided into two parts: one is from the last trading day of the previous month to the first three trading days of the next month; the other part is the remaining trading days. The daily return of the index is expressed by the logarithmic return of the daily closing price. Assume p_t as the closing price of the index on the t-th day, then the logarithmic return of the index is defined as:

$$r_t = (lnp_t - lnp_{t-1}) \times 100\%$$

6.2. The Statistical Description of the Sample Data

Figure 3-1 shows the daily return series of the Shanghai Stock Index. It can be noticed that the fluctuation of the daily return of the Shanghai Stock Index shows time-varying and clustering characteristics. Ignoring such conditional heteroskedasticity effects (i.e., ARCH effects) in regression may lead to invalid parameter estimates.

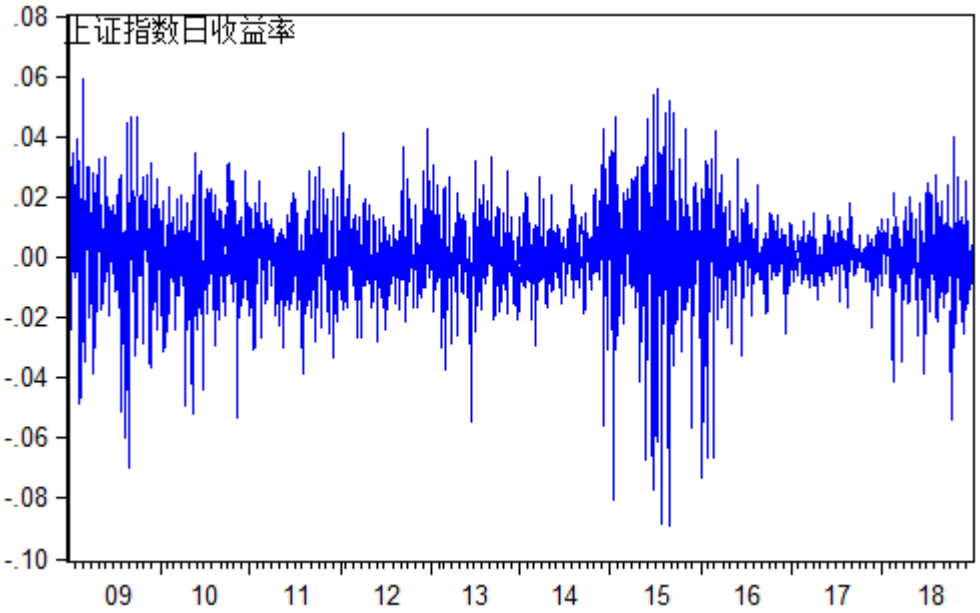

Figure 1: SSE Index Daily Return Series

The main statistical characteristics of the Shanghai Stock Index are shown in Figure 3-2. This paper finds that from 2009 to 2018, the daily average return of the Shanghai stock market is positive, and the daily return shows negative skewness and obvious peak. Meanwhile, the Jarque-Bera test significantly rejects the normal distribution assumption of the stock return. Experience indicates that the time-varying variance (i.e. ARCH effect) of financial returns can cause this situation and should be adjusted in the model.

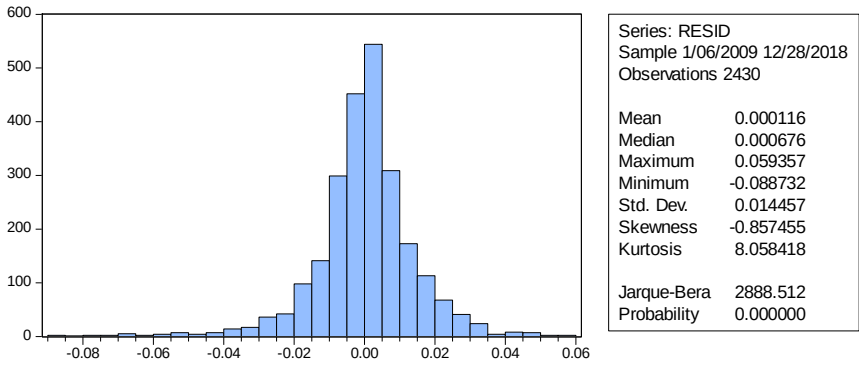

Figure 2: Descriptive statistics of daily returns of Shanghai Stock Index (2009/1/6-2018/12/28)

Note: Probability is the p-value of the Jarque-Bera test. A p-value close to 0 indicates that the null hypothesis is rejected, that is, the sequence does not obey the normal distribution.

6.3. Data Related to the Liquidity Hypothesis

According to the Chinese and international literatures assumptions about the turn-of-month interval, this paper assumes that the turn-of-month interval ranges from the last trading day of the previous trading month to the first three trading days of the next trading month, and is recorded as (-1, 3).

The liquidity hypothesis believes that the turn-of-month effect is affected by the degree of stringency of monetary policy because it is influenced by liquidity. According to (Lu, Xu and Xu 2019)[35], Chinese monetary policy transduction mechanism is affected by the money supply structure. The study shows that the growth rate of Chinese money supply and the trend of pledged repo rates have basically maintained a consistent equilibrium in different time periods. During the same period, the higher the pledged repo interest rates, the higher the growth rate of money supply, which means that the monetary policy is easier, otherwise it means that the monetary policy is more stringent. This paper uses the 7-day weighted average repo rate from January 6, 2009 to December 28, 2018 as the proxy variable for monetary policy. The data source is the Wind database.

At the same time, the level of investor confidence can also influence the liquidity hypothesis, which is finally reflected in the significance of the turn-of-month effect. This paper uses the "Investor Confidence Index-Buying in Index" to reflect the level of investor confidence. The data range is monthly data from January 2009 to December 2018. The data source is China Securities Investor Protection Fund Co., Ltd.

7. THE EMPIRICAL STUDY ON THE EXISTENCE OF THE TURN-OF-MONTH EFFECT IN CHINESE STOCK MARKET

7.1. Unit Root Test

The modeling of non-stationary time series may appear pseudo-regression, so unit root test should be performed before modeling. The unit root test is performed on the daily returns of Shanghai Stock Index from January 6, 2009 to December 28, 2018. The test results are shown in Table 1.

Table 1: ADF test for daily returns of Shanghai Stock Index

Variables	ADF Statistic	1% Critical Value	5% Critical Value	10% Critical Value
SSE Index Return	-47.9033	-3.4329	-2.8626	-2.5674

The ADF statistic of the daily return series of the Shanghai Stock Exchange Index are all smaller than their critical values. Therefore, the null hypothesis of the existence of the unit root is rejected at the significance level of 1%, 5%, and 10%. The daily return sequence of the Shanghai Stock Index is stationary.

7.2. Least Squares Regression Model

This paper performs a least squares regression on the entire sample interval (i.e., January 6, 2009 to December 28, 2018). The regression model is shown as Equation 1:

$$r_t = c + \emptyset TOM_t + \varepsilon_t \qquad (1)$$

The following table gives the parameter estimation results of the least square regression model. In the Shanghai stock market, $\emptyset$ is significantly positive at 1% significance level, which indicates that the turn-of-month effect is significant in the Shanghai stock market throughout the sample period. The R^2 of OLS regression is 0.005991, which indicates that the fluctuation of the market yield sequence is largely random. The fluctuation part that can be explained by the turn-of-month effect is exceedingly small, which means that the space for arbitrage using the turn-of-month effect may be extremely limited in the Shanghai stock market.

Table 2: Least Squares Estimation Results

$r_t = c + \emptyset TOM_t + \varepsilon_t$	
	Coefficient
c	$-0.0004[0.1789]$
TOM	$0.0028[0.0001]^{***}$
R2	0.0060
Residual LM test	

Lag=1	2.4953[0.1143]
Lag=4	2.3537[0.0518]
Lag=8	2.8423[0.0038]***
Lag=12	2.6674[0.0015]***

Note: *, **, *** indicate significant at the significance level of 10%, 5% and 1%, respectively.

The results of the diagnosis of OLS regression residuals are given in the table. The result show that when Lag = 8 and Lag = 12, the null hypothesis that there is no autocorrelation is very significantly rejected, indicating that there are autocorrelation problems and ARCH effects in the residuals. Thus, a more complex ARMA model is needed for the study. Because the regression results of the OLS model are not ideal, it can only provide some preliminary understanding of the turn-of-month effect in the Shanghai stock market.

7.3. The Construction of AMRA-GARCH Model

In order to test whether the stock returns will be significantly higher during the turn-of-month period than other trading days in the Chinese stock market, this paper sets up a dummy variable regression model as the following form:

$$r_t = c + \emptyset TOM_t + \varepsilon_t \qquad (1)$$

In this equation, r_t represents the logarithmic rate of return of the stock index on the t-th day, and TOM_t represents the dummy variable of the turn-of-month effect. If the estimated value of $\emptyset$ is statistically significantly positive, it means that the stock rate of return is significantly higher during the turn-of-month period than other trading days, which proves the existence of the turn-of-month effect.

$$TOM = \begin{cases} 1, & \text{Turn} - \text{of} - \text{month Period} \\ 0, & \text{Other trading days} \end{cases}$$

As for the setting of the turn-of-month period, there are two ways to set the period according to the Chinese literatures- one is from the last trading day of the previous trading month to the first six trading days of the next trading month; the other one is from the last trading day of the previous trading month to the first three trading days of the next trading month. The second way is the method adopted in many international studies. This paper uses the second method to define the turn-of-month period, which is denoted as (-1, 3).

Because the stock index return series has autocorrelation and conditional heteroscedasticity (expressed as time-varying and clustering of volatility), if the least square method is used to estimate formula 1 directly, it is probably to obtain invalid parameter estimators. Therefore, this paper uses the ARMA-GARCH model. At the same time, the risk factors of the financial markets do not obey the normal distribution and have heavy tails. Therefore, this paper uses the generalized error distribution (GED) to fit the conditional residuals of formula 1. The ARMA-GARCH model used in this paper is as follows:

$$r_t = c + \emptyset_1 TOM_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t \qquad (2)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=0}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=0}^{q} \beta_i \sigma_{t-j}^2 \qquad (3)$$

$$f(\varepsilon_t, \nu) = \frac{\nu \exp\left(-0.5 \left|\frac{\varepsilon_t}{\lambda}\right|^{\nu}\right)}{\lambda 2^{\frac{\nu+1}{\nu}} \Gamma(\frac{1}{\nu})} \qquad (4)$$

In the equations, $\lambda = \left(\frac{2^{-\frac{2}{\nu}}\Gamma\left(\frac{1}{\nu}\right)}{\Gamma\left(\frac{3}{\nu}\right)}\right)^{0.5}$. ν is the shape parameter of GED. When ν<2, GED is considered to have a fat tail distribution. Γ is a gamma function.

It is generally believed that GARCH (1,1) can well describe the characteristics of time-varying fluctuations in financial returns, and GARCH (1,1) model is generally used in empirical researches. Therefore, this paper takes the form of GARCH (1,1), and Equation 3 becomes:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \qquad (5)$$

Many Chinese studies on the calendar effect have found that the Chinese stock market has abnormal returns in January, March and April at the same time(Waggoner 2000)[44]. Additionally, some international studies have shown that the monthly effect mainly reflects in the first half of the trading month(Marquering, Nisser and Valla 2006)[9]. Therefore, the monthly effect will interfere with the study of the turn-of-month effect, that is, the excess return during the turn-of-month period may be partly due to the monthly effect. In order to eliminate the interference of the monthly effect, this paper adds several dummy variables of the monthly effect into the model. Equation 2 becomes:

$$r_t = c + \emptyset_1 TOM_t + \emptyset_2 TOM_t * Jan_t + \emptyset_3 TOM_t * Mar_t + \emptyset_4 TOM_t * Apr_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t \quad (6)$$

In the equation, Jan_t is the dummy variable for the January effect; Mar_t is the dummy variable for the March effect; and Apr_t is the dummy variable for the April effect.

$$Jan = \begin{cases} 1, & \text{January} \\ 0, & \text{Other trading days} \end{cases} \quad Mar = \begin{cases} 1, & \text{March} \\ 0, & \text{Other trading days} \end{cases} \quad Apr = \begin{cases} 1, & \text{April} \\ 0, & \text{Other trading days} \end{cases}$$

The test in this paper is divided into two parts. Part A uses the formula 2 which is commonly used by previous scholars; part B excludes the effect of the monthly effect and uses formula 6, which is:

Part A:

$$r_t = c + \emptyset_1 TOM_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

Part B:

$$r_t = c + \emptyset_1 TOM_t + \emptyset_2 TOM_t * Jan_t + \emptyset_3 TOM_t * Mar_t + \emptyset_4 TOM_t * Apr_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

7.4. The Empirical Study on the Existence of the Turn-of-month Effect with AMRA-GARCH Model

This paper uses the ARMA-GARCH model constructed in section 4.1 for estimation. Table 3 shows the estimation results of the ARMA-GARCH model for the entire sample period. As for the results, Part A is the model often used in the study of the turn-of-month effect at home and abroad, and Part B adds some dummy variables of the monthly effect on the basis of Part A to eliminate the influence of the monthly effect on the turn-of-month effect.

Table 3: Testing Results of the Turn-of-month Effect Existence in Shanghai Stock Market

Variable	Part A	Part B
c	-0.0004 [0.1880]	-0.0004[0.1881]
TOM	0.0027[0.0001]***	0.0029[0.0003] ***
*TOM * Jan*		-0.0003[0.8995]
*TOM * Mar*		-0.0019[0.4396]
*TOM * Apr*		3.47E-05[0.9883]
r_{t-1}	-0.2077[0.0000] ***	-0.2070[0.0000] ***
r_{t-7}	0.0410[0.0080] ***	0.0409[0.0082] **
r_{t-8}	0.5376[0.0000] ***	0.5375[0.0000] ***
r_{t-11}	-0.2666[0.0000] ***	-0.2665[0.0000] ***
r_{t-13}	0.0611[0.0000] ***	0.0613[0.0000] ***
r_{t-16}	-0.4870[0.0000] ***	-0.4876[0.0000] ***
ε_{t-1}	0.2254[0.0000] ***	0.2240[0.0000] ***
ε_{t-8}	-0.4944[0.0000] ***	-0.4944[0.0000] ***
ε_{t-11}	0.2524[0.0000] ***	0.2529[0.0000] ***
ε_{t-16}	0.5250[0.0000] ***	0.5258[0.0000] ***
ε_{t-23}	-0.0765[0.0000] ***	-0.0766[0.0000] ***
Residual LM test		
Lag=1	0.9870[0.3206]	0.9912[0.3195]
Lag=4	1.1320[0.3395]	1.1316[0.3397]
Lag=8	1.4246[0.1809]	1.4136[0.1855]
Lag=12	1.4604[0.1318]	1.4400[0.1403]
Variance eq		
α_0	6.87E-07[0.0018] ***	

ε_{t-1}^2	0.0505[0.0000] ***
σ_{t-1}^2	0.9447[0.0000] ***
Residual LM test	
Lag=1	2.2091[0.1373]
Lag=4	2.5971[0.0346] *
Lag=8	1.8437[0.0648]
Lag=12	1.5377[0.1035]

Note: The ARCH residual effect test in the model is the LM test, and Lag takes 1, 4, 8, and 12 respectively. The parameter of the generalized error distribution (GED) in the model is set as 1.5. The numbers in parentheses in the table are the p-values of the parameter t-test.

The results of the model estimation are generally ideal. From the LM test of the residuals, the ARMA model set in this paper can properly characterize the autocorrelation of the return sequence, and the GARCH model can roughly describe the characteristic of the time-varying fluctuation of the return series. Additionally, the coefficients of ε_{t-1}^2 and σ_{t-1}^2 in the GARCH model are larger than zero and less than one significantly, which indicates that historical information has a positive and slowing effect on future market fluctuations. Thereby SSE index returns fluctuations can show the grouping phenomenon (Wang 2013)[45].

From the regression results of Part A in Table 3, it can be seen that the daily rate of return of the Shanghai Stock Exchange Index is 0.002694% higher on average during the turn-of-month period than that in other trading days, and is significant at 1% significance level. This result shows that the Chinese stock market has a significant turn-of-month effect. This result is consistent with other domestic scholars' research results, such as (Feng 2003)[59], (Liu and Chen 2004)[8], (Xing and Zang 2006)[10], (Ma 2007)[12], (Chen and Liu 2007)[11], (Gao 2009)[14] et al.

The regression results of Part B in Table 3 show that when the January effect, the March effect and the April effect are controlled, the Shanghai stock market still exhibits a significant turn-of-month effect, that is, the daily rate of return of the Shanghai Stock Exchange Index is 0.002864% higher on average during the turn-of-month period than that in other trading days, and is significant at 1% significance level. In this paper, when researching the turn-of-month effect and the monthly effect at the same time, there is no significant monthly effect.

In summary, the daily return rate of the Shanghai Stock Exchange Index during the turn-of-month period is significantly higher than that in other trading days. After excluding the influence of the monthly effect, the same conclusion is obtained. Therefore, this paper concludes that the turn-of-month effect exists in the Chinese stock market during the sample period.

7.5. Kruskal-Wallis Nonparametric Test on the Existence of the Turn-of-month Effect

The model established in this paper has a disadvantage in the estimation, which is that the model depends on many theoretical assumptions in statistics and economics, but these assumptions are often difficult to be satisfied at the same time, so there may be deviations in research. For this disadvantage, this paper makes up for it by using nonparametric test. Nonparametric statistics do not require variable values to be in a specific distribution, nor do they depend on a specific theory. Thus, it makes up the disadvantage of above models.

Kruskal-Wallis nonparametric test can be used to test whether there are significant differences in the distribution of multiple populations. The statistic H^* of the K-W nonparametric test, which studies the turn-of-month effect in the Shanghai stock market, is calculated as follows:

$$H^* = \frac{2}{N(N+1)} \sum_{i=1}^{2} n_i [\bar{R}_i - \frac{N+1}{2}]^2 \qquad (7)$$

In this equation, N is the number of return rate samples; n_1 represents the number of return rate samples during the turn-of-month period, n_2 indicates the number of return rate samples on other trading days; $\bar{R}_1$ represents the average of return rate ranks during the turn-of-month period, $\bar{R}_2$ Represents the average of return rate ranks on other trading days. The original hypothesis is that the average rate of return during the turn-of-month period is the same as on other trading days. If the H^* statistic exceeds the critical value, the original hypothesis is rejected, proving that the rate of return during the turn-of-month period is significantly higher than other trading days.

Table 4 gives the descriptive statistics of the return rate in the Shanghai stock market. This descriptive statistic shows that, during the entire sample period, the average Shanghai Stock Exchange Index return rate was 0.2371% during the turn-of-month period, and -0.0439% on other trading days. In terms of return rate volatility, the turn-of-month period is basically the same as other trading days.

Table 4: Descriptive statistics of the return rate in the Shanghai stock market

	Observations	Average	Standard Deviation	Minimum	Maximum

Turn-of-month Period	480	0.0024	0.0144	-0.0711	0.0594
Other Trading Days	1950	-0.0004	0.0144	-0.0887	0.0560

Table 5 shows the Kruskal-Wallis nonparametric test results of turn-of-month effect in Shanghai stock market. The results show that, during the entire sample period, the return rate of the Shanghai Stock Index during the turn-of-month period is significantly higher than other trading days. In order to remove the influence of outliers, this paper removes the largest 20 observations and the smallest 20 observations in the yield series, and obtains sample part 1; further removes the largest 50 observations and the smallest 50 observations in the yield series , and obtains sample part 2. In addition, in order to avoid the impact of the monthly effect on the study of the turn-of-month effect, this article removes the observations in January, March and April, and obtains sample part 3. These three partial samples all get the same conclusion. Therefore, the Kruskal-Wallis nonparametric test also confirms the existence of the turn-of-month effect in the Chinese stock market.

Table 5: K-W Nonparametric Test Results of the Turn-of-month Effect in Shanghai Stock Market

	Full Sample	Sample Part 1	Sample Part 2	Sample Part 3
K-W nonparametric test results	14.543[0.000]***	12.646[0.000]***	10.572[0.001]***	13.663[0.000]***

8. THE EMPIRICAL STUDY ON THE LIQUIDITY HYPOTHESIS OF THE TURN-OF-MONTH EFFECT IN CHINESE STOCK MARKET

8.1. The Empirical Study on the Liquidity Hypothesis of the Turn-of-month Effect with AMRA-GARCH Model

To test the liquidity hypothesis of the turn-of-month effect, this paper still uses the ARMA-GARCH model established above, but only uses Part A for the liquidity hypothesis test.

Part A:

$$r_t = c + \emptyset_1 TOM_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

If, as mentioned above, the turn-of-month effect comes from investors' investment in liquid profits during the turn-of-month period, the income during the turn-of-month period should change directly with the expected liquid profits. Furthermore, expected liquid profits are related to the monetary policy. When the monetary policy is stringent, expected liquid profits are relatively low. Therefore, the stock return during the turn-of-month period is inversely proportional to the stringency of the monetary policy.

This part of the liquidity hypothesis test introduces an indicator of the monetary policy: the 7-day weighted average repo rate. According to (Ogden 1990)[4]'s research on the liquidity hypothesis of the turn-of-month effect in the US stock market, this paper introduces the variable *7d*TOM*, which is the product of the 7-day weighted average repo rate and the dummy variable for the turn-of-month effect. The higher the repo rate, the higher the growth rate of money supply, the easier the monetary policy, and the higher the return during the turn-of-month period. Thus, the coefficient of the variable *7d*TOM* should be positive.

$$r_t = c + \emptyset_1 7d * TOM + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t \qquad (8)$$

The variance equation is still $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$.

Table 6: Testing Results of the Turn-of-month Effect Liquidity Hypothesis – Money Policy Aspect

Variable	Part A
c	-0.0003[0.3253]
*7d*TOM*	0.0006[0.0014]***
r_{t-1}	-0.2017[0.0000]***
r_{t-7}	0.04030[0.0081]***
r_{t-8}	0.5631[0.0000]***
r_{t-11}	-0.2561[0.0000]***
r_{t-13}	0.0610[0.0000]***
r_{t-16}	-0.5007[0.0000]***

ε_{t-1}	0.2197[0.0000]***
ε_{t-8}	-0.5193[0.0000]***
ε_{t-11}	0.2410[0.0000]***
ε_{t-16}	0.5359[0.0000]***
ε_{t-23}	-0.0755[0.0000]***
Residual LM test	
Lag=1	1.1560[0.2824]
Lag=4	1.1497[0.3313]
Lag=8	1.4211[0.1823]
Lag=12	1.4252[0.1467]
Variance eq	
α_0	6.87E-07[0.0018]***
ε_{t-1}^2	0.0505[0.0000]***
σ_{t-1}^2	0.9447[0.0000]***
Residual LM test	
Lag=1	2.2091[0.1373]
Lag=4	2.5971[0.0346]*
Lag=8	1.8437[0.0648]
Lag=12	1.5377[0.1035]

The model estimation results are ideal. From the LM test of the residuals, the ARMA model can properly characterize the autocorrelation of the stock return series, and the GARCH model can roughly describe the characteristic of the fluctuations in the stock return series. The regression results in Table 6 show that the regression results are consistent with the predictions. The coefficient of the variable *7d*TOM* is positive and significant at 1% significance level. The results show that stock returns during the turn-of-month period are inversely proportional to the degree of stringency of the monetary policy, which proves the liquidity hypothesis

of the turn-of-month effect.

At the same time, the liquidity hypothesis is also affected by investor confidence. The higher the investors' confidence, the more willing to invest the increased liquidity in the stock market, resulting in a more significant turn-of-month effect. In other words, the significance of the turn-of-month effect is positively correlated with investor confidence.

This part of the liquidity hypothesis test introduces an indicator that expresses investor confidence: the investor confidence index-the buying in index. According to (Burnett 2017)[2] 's introduction of behavioral finance, the variable *Con*TOM* is added, which is the product of the investor confidence index-the buying in index and the dummy variable of the turn-of-month effect. According to the analysis of investor confidence above, the coefficient of this variable should be significantly positive.

$$r_t = c + \emptyset_1 TOM + \emptyset_2 Con * TOM + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t \qquad (9)$$

The variance equation is still $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$.

Table 7: Testing Results of the Turn-of-month Effect Liquidity Hypothesis – Investor Confidence Aspect

Variable	Part A
c	-0.0005[0.1905]
TOM	-0.0115[0.0078]**
*Con*TOM*	0.0003[0.0009]***
r_{t-1}	-0.2244[0.0000]***
r_{t-7}	0.0398[0.0144]*
r_{t-8}	0.4404[0.0000]***
r_{t-11}	-0.3349[0.0000]***
r_{t-13}	0.0628[0.0000]***
r_{t-16}	-0.4166[0.0000]***
ε_{t-1}	0.2415[0.0000]***

ε_{t-8}	-0.3989[0.0000]***
ε_{t-11}	0.3266[0.0000]***
ε_{t-16}	0.4634[0.0000]***
ε_{t-23}	-0.0762[0.0000]***
Residual LM test	
Lag=1	0.3102[0.5776]
Lag=4	0.7285[0.5724]
Lag=8	1.404[0.1897]
Lag=12	1.6635[0.0686]
Variance eq	
α_0	6.87E-07[0.0018]***
ε_{t-1}^2	0.0505[0.0000]***
σ_{t-1}^2	0.9447[0.0000]***
Residual LM test	
Lag=1	2.2091[0.1373]
Lag=4	2.5971[0.0346]*
Lag=8	1.8437[0.0648]
Lag=12	1.5377[0.1035]

The model estimation results are ideal. From the LM test of residuals, the ARMA model can characterize the autocorrelation of the return rate series well, and the GARCH model can basically describe the characteristics of the volatility. In table 7 the regression results are consistent with the prediction, and the coefficient of the variable *Con*TOM* is positive and significant at 1% significance level. The results show that stock returns during the turn-of-month period are positively correlated to investor confidence, which in turn proves the liquidity hypothesis of the turn-of-month effect.

8.2. The Equality Tests by Classification on the Liquidity Hypothesis of the Turn-of-month Effect

After performing the preliminary model estimation, according to (Ogden 1990)[4]'s research on the liquidity hypothesis of the turn-of-month effect in the US stock market, the sample data is divided into two sub-samples for further testing. The two sub-samples are divided into trading days with relatively easy monetary policy and trading days with relatively stringent monetary policy. The dividing principle is the 7-day weighted average repo rate, and those with a 7-day weighted average repo rate higher than 2.65[1] are classified as days with easy monetary policy while those with less than 2.65 are classified as days with stringent monetary policy. The easy sub-sample contains 1614 trading days data, and the stringent sub-sample contains 816 trading days data. According to the predictions, the rate of return during the turn-of-month period in the easy monetary policy sub-sample should be higher than that in the stringent sub-sample. This paper uses Eviews for equality tests by classification, the test results are shown in Table 8.

Table 8: Testing results of the Equality Tests by Classification – Money Policy Aspect

	Easy-money Months	Stringent-money Months
Turn-of-month Trading Days	0.0005[0.0005]***	0.0002[0.0010] ***
Obs.	335	145
Remaining Trading Days	0.0003[0.0008] ***	-0.0008[0.0004] ***
Obs.	1279	671

The test results show that, whether it is a month with relatively easy monetary policy or a month with relatively stringent monetary policy, the average daily rate of return during the turn-of-month period is higher than that in other trading days. For months with relatively easy monetary policy, the average daily rate of return during turn-of-month period is 0.000527 and is significant at 1% significance level. For months with relatively stringent monetary policy, the average daily rate of return during the turn-of-month period is 0.000221, which is smaller than months with relatively easy monetary policy. The test results are consistent with the predictions.

Further, divide the sample data according to the level of investor confidence. Based on the introduction of the Investor Confidence Index by China Securities Investor Protection Fund Co., Ltd., the investor confidence index of the Chinese securities market ranges from 0-100, with 50 being a neutral value. When the index is

[1] The specific division value has considered the mean, median of the 7-day weighted average repo rate, and the monetary policy announced by the People's Bank of China.

greater than 50, it indicates that the proportion of investors who hold optimistic and positive views is greater than the proportion that holds pessimistic and negative views, and the overall investor confidence tends to be optimistic. The higher the index value, the stronger the investor confidence. When the index is less than 50, it indicates that investor confidence is generally pessimistic. Therefore, this paper introduces a dummy variable indicating the investors' confidence level, which is assumed as *Con*. Data with a value greater than 50 is classified as higher investor confidence and is assumed as 1; data with a value less than 50 is classified as lower investor confidence and is assumed as 0.

$$Con = \begin{cases} 1, & \text{High investor confidence} \\ 0, & \text{Low investor confidence} \end{cases}$$

The high investor confidence sub-sample contains data for 1448 trading days, and the low investor confidence sub-sample contains data for 982 trading days. According to the prediction, the return rate of the high investor confidence sub-sample is higher than that of the low investor confidence sub-sample during the turn-of-month period. Use Eviews to perform equality tests by classification and obtain the test results as shown in Table 9.

Testing results of the Equality Tests by Classification – Investor Confidence Aspect

Table 9: Testing results of the Equality Tests by Classification – Investor Confidence Aspect

	High-confidence Months	Low-confidence Months
Turn-of-month Trading Days	0.0033[0.0009]***	0.0010[0.0009]***
Obs.	288	192
Remaining Trading Days	0.0005 [0.0004]***	-0.0019[0.0005]***
Obs.	1160	790

The test results show that whether it is a month with relatively high investor confidence or a month with relatively low investor confidence, the average daily rate of return during the turn-of-month period is higher than other trading days. For the months with higher investor confidence, the average daily rate of return during the turn-of-month period is 0.003305 and is significant at 1% significance level. For the month with relatively low investor confidence, the average daily rate of return during the turn-of-month period is 0.000970, which is less than the month with relatively high investor confidence. The test results are consistent with the prediction above.

8.3. Kruskal-Wallis Nonparametric Test on the Liquidity Hypothesis of the Turn-of-month Effect

Considering the shortcomings of the parameter test, when demonstrating the liquidity hypothesis of the turn-of-month effect, this paper adds Kruskal-Wallis nonparametric test for supplementary proof. Similar to the equality tests by classification, in this part the nonparametric test first groups all the samples. According to the grouping method mentioned in part 5.2., the sample data is divided into relatively easy monetary policy period and relatively stringent monetary policy period. The original hypothesis is still as follows: the average rate of return during the turn-of-month period is the same as on other trading days. The test statistic is the same with the formula 7:

$$H^* = \frac{2}{N(N+1)} \sum_{i=1}^{2} n_i [\bar{R}_i - \frac{N+1}{2}]^2 \qquad (10)$$

Table 10 gives the descriptive statistics of the Shanghai stock market returns during different periods of relatively easy and stringent monetary policy. The descriptive statistics show that, whether it is during an easy period or a stringent period, the average rate of return during the turn-of-month period is higher than other trading days. The standard deviation of the grouped sample data is not much different, and the volatility difference in stringent monetary policy period is relatively smaller.

Table 10: Descriptive statistics of the return rate in the Shanghai stock market during easy and stringent period

		Observations	Average	Standard Deviation	Minimum	Maximum
Easy	Turn-of-month Period	318	0.0005	0.0160	-0.0887	0.0560
	Other Trading Days	1195	0.0003	0.0151	-0.0711	0.0468
Stringent	Turn-of-month Period	162	0.0004	0.0115	-0.0537	0.0480
	Other Trading Days	755	-0.0006	0.0119	-0.0887	0.0594

Table 11 shows the test result of the Kruskal-Wallis nonparametric test for the full sample interval and the stringent monetary police interval. The results show that during stringent money police interval, the original hypothesis cannot be rejected, that is, the average rate of return during the turn-of-month period is not significantly different from other trading days. This result is consistent with the assumption in this article. Due to the relative stringency of monetary policy and the decrease in liquidity during the turn-of-month period, there is no more liquidity flowing into the stock market, thus the turn-of-month effect is not obvious or even disappears. The same conclusions are obtained from the sample part 1 and sample part 2 with the extreme observations removed, and from the sample part 3 with the monthly effect removed.

Table 11: K-W Nonparametric Test Results of the Turn-of-month Effect during the Stringent Period

	Full Sample	Sample Part 1	Sample Part 2	Sample Part 3
Full Sample Period	14.543[0.000]***	12.646[0.000]***	10.572[0.001]***	13.663[0.000]***
Stringent	1.811[0.178]	1.636[0.201]	1.188[0.276]	0.675[0.411]

Note: Sample Part 1 removed the 20 sample data with the smallest logarithmic return rate, Sample Part 2 removed the 20 sample data with the largest logarithmic return rate removed, and Sample Part 3 removed the sample data with the removal of January, March and April .

Further dividing the sample data into high confidence interval and low confidence interval, the original hypothesis is still: the average rate of return during the turn-of-month period is the same as that of other trading days. Table 12 gives the descriptive statistics of the Shanghai stock market returns in different periods when investor confidence is relatively high and investor confidence is relatively low. This descriptive statistic shows that whether the investor's confidence is relatively high or relatively low, the average rate of return is higher than other trading days during the month change. Both the mean and standard deviation during the high confidence period are higher than during the low confidence period.

Table 12: Descriptive statistics of the return rate in the Shanghai stock market during high and low confidence period

		Observations	Average	Standard Deviation	Minimum	Maximum
High confidence	Turn-of-month Period	289	0.0033	0.0153	-0.0698	0.0594
	Other Trading Days	1161	0.0005	0.0146	-0.0887	0.0560
Low confidence	Turn-of-month Period	193	0.0010	0.0129	-0.0711	0.0538
	Other Trading Days	791	-0.0019	0.0140	-0.0887	0.0520

Table 13 displays the Kruskal-Wallis nonparametric test results for the high confidence sample interval and the low confidence interval. The results show that during the period of relatively low investor confidence, the sample part 2 with the extreme data removed and the sample part 3 with the monthly effect removed cannot reject the null hypothesis. The full sample can reject the null hypothesis at the 2.5% significance level and the sample part 1 with some extreme data removed can reject the null hypothesis at the 5% significance level. The high confidence interval of full samples, sample part 1, sample part 2, and sample part 3 all reject the null hypothesis at the 1% significance level. That is to say, the turn-of-month effect is significantly present in the high-confidence months, while in the low-confidence months the turn-of-month effect has low significant level

or even disappears. This result is the same as the prediction in this paper above. When investors have high confidence, they are more willing to invest increased liquidity into the stock market, thereby increasing the demand for stocks, which results in the turn-of-month effect.

Table 13: K-W Nonparametric Test Results of the Turn-of-month Effect during the High and Low Confidence Period

	Full Sample	Sample Part 1	Sample Part 2	Sample Part 3
High confidence period	9.413[0.002]***	0.9832[0.002]***	8.823[0.003]***	11.029[0.001]***
Low confidence period	5.159[0.023]**	4.423[0.039]*	2.874[0.090]	3.404[0.065]

9. CONCLUSION

This paper supplements the gap in the research on the liquidity hypothesis of the turn-of-month effect in the Chinese market. Focused on the uniqueness of the Chinese stock market, this paper theoretically discusses the explanation basis of the liquidity hypothesis in the Chinese market. Specifically, the theoretical basis of the liquidity hypothesis in the US stock market is that the US has a standard payments system. The standardization of this payments system brings more liquidity during the turn-of-month period, so the end of each calendar month is the investors' preference habitat. However, there is no obvious standard payments system in the Chinese market, but through the study of the Chinese stock market data, this paper finds that more funds flow into the stock market during the turn-of-month period. Therefore, in essence, the Chinese market has the same theoretical basis for the liquidity hypothesis, which provides the theoretical premise for the liquidity hypothesis explanation of the turn-of-month effect.

Then this article summarizes and categorizes the explanation theories of the turn-of-month effect in the Chinese stock market and provides the theoretical explanations and supplements to the liquidity hypothesis. After Odgen proposed the liquidity hypothesis based on monetary policy, Burnett supplements the liquidity hypothesis from the perspective of behavioral finance. And this paper combines the two studies to prove the liquidity hypothesis of the turn-of-month effect in Chinese stock market from the aspects of both monetary policy and investor confidence. Specifically, the liquidity hypothesis o believes that the turn-of-month effect results from the additional liquidity generated during the turn-of-month period entering the stock market, thereby increasing stocks demand and prices, which in turn produces the turn-of-month effect. The significance of the turn-of-month effect is affected by two aspects. On the one hand, monetary policy will affect the liquidity

scale during the turn-of-month period, and the liquidity will be higher under the easy monetary policy; on the other hand, investor confidence will affect how much of the liquidity will flow into the stock market during the turn-of-month period. When investor confidence is high, investors are more willing to invest the increased liquidity in the stock market, which leads to a more significant turn-of-month effect.

In terms of empirical research, this paper takes the Shanghai Index Return as the research object and conducts some empirical tests on the existence and the liquidity hypothesis of the turn-of-month effect. After accomplishing the ARMA-GARCH model, equality tests by classification, K-W non-parametric test and other tests, this paper believes that the turn-of-month effect exists in the Shanghai stock market from January 6, 2009 to December 28, 2018. And after controlling the monthly effect, the existence of the turn-of-month effect is still significant. Secondly, this paper believes that the liquidity hypothesis has a certain explanatory power for the turn-of-month effect in the Chinese stock market. After excluding the effects of extreme values and the monthly effects, the liquidity hypothesis still has explanatory power. The liquidity hypothesis explains the turn-of-month effect as follow: the return on the stocks during the turn-of-month period is inversely proportional to the degree of monetary policy stringency and is positively correlated to the investor confidence. The conclusion of this paper also provides support for the impact of monetary policy on stocks and proves the liquidity hypothesis in the Chinese market from the perspective of behavioral finance.

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ACKNOWLEGEMENTS

The life of being a graduate student will soon come to an end, and I will finally finish my long school life. The short period of postgraduate has taught me a lot and made me grow up quickly. The past year has been a difficult and fulfilling year. I have experienced the ups and downs of my study and my internship, but I have gained a strong heart afterward. I am deeply grateful for all the pain I have been through during this year, and I can bravely move on to my next life stage now.

The writing time of this paper coincides with the spread period of 2019-nCoV. Both China and Italy have experienced the attack of 2019-nCoV. All the medical workers and volunteers are angels who protect people. Thanks to their selfless dedication, I can do not worry about safety issues and continue my study.

I am very grateful to my supervisor Raffaele Oriani from Luiss University. My supervisor urged me to carry out my research of the thesis so early, and he is closely connected with students in every step from topic selection to primary project. Before I left Italy, my supervisor and I have already discussed on my thesis many times face-to-face. During the writing period of this thesis, my supervisor and I are far away from each other in two countries. Despite the distance and the different time zone, my supervisor is always very patient with my inquiry and always answers my questions in time, which motivates me deeply to carry out the research of the thesis. My supervisor's advice is direct and to the point, which helped me a lot in the further research.

I am also really grateful to my supervisor Luo Yan from Fudan University. My supervisor also helped me to improve and modify the structure and the model in my paper even during the vacation. My supervisor very practically pointed out many initial problems of the model and gave many suggestions for further research and the writing of the paper. I am grateful to my supervisor for giving me guidance at the expense of her rest time. My supervisor’s earnestness also inspired me to work hard to complete this paper.

I am grateful to Fudan University and Luiss University for giving me so many opportunities to study, to receive the best quality education in both countries, and to broaden my horizon and my life experience.

Finally, I would like to thank my family and my friends for their tolerance, comfort and love for me, no matter how my emotions may fluctuate, no matter how naive and vulnerable I may be to them. To have my family and my friends standing behind me is my greatest blessing. Writing here, this paper is about to end, and it is also for my student life to draw to an end. The road ahead is long, but I will not fear all the suffering, and go ahead bravely.

SUMMERY

According to the viewpoint of the weak efficient market hypothesis, all the historical transaction information in the market will be quickly and completely reflected on asset prices. Thus, future earnings cannot be predicted by past earnings models, and the return on assets will not change regularly. However, a large number of empirical studies have shown market anomalies in the security market. The market anomalies are phenomena that cannot be explained by the capital asset pricing model. The calendar effect is one of these market anomalies. The calendar effect refers to the correlation between the changing of the price and the trading time in the security market. Its manifestations include the week effect, the holiday effect, and the monthly effect.

The turn-of-month effect is one kind of the monthly effect. It refers to the phenomenon that the security market has abnormal returns at the turn of each calendar month and the abnormal returns cannot be explained by the capital asset pricing model. Since the introduction of the turn-of-month effect, many foreign scholars have paid attention on it, including the study of the effect existence, causes and arbitrage opportunities. Due to the late start of the Chinese stock market, there are few domestic studies on the turn-of-month effect. And the research is limited to the existence of the turn-of-month effect and the empirical study of the window dress hypothesis. On the basis of confirming that the turn-of-month effect exists in the Chinese stock market, this paper conducts an empirical study on its liquidity hypothesis.

The first part of this paper is the introduction; the second part is the literature review, which combs the international researches and the relevant domestic academic researches respectively; the third part gives a thorough introduction of the efficient market hypothesis, including the type, the assumptions, and the defects of the hypothesis; the fourth part explains the challenge of the turn-of-month effect to the efficient market hypothesis. This part specifies how the turn-of-month effect challenges the efficient market hypothesis and also describes the four explanations of the turn-of-month effect; the fifth part is the discussion of the turn-of-month effect in the Chinese stock market and expounds the theoretical explanation of the effect; the sixth part is the data used in the empirical research and this part also makes the preliminary statistical description of the data; the seventh part is the empirical study on the existence of the turn-of-month effect in the Chinese stock market; the eighth part is the empirical study on the liquidity hypothesis of the turn-of-month effect in the Chinese stock market; the last part is the conclusion of this paper.

This paper uses empirical analysis to prove the existence and the liquidity hypothesis of the turn-of-month effect. In this paper, the research sample is the daily return data of Shanghai Composite Index, and the study methods include dummy variable method, ARMA-GARCH model, K-W nonparametric test, equality tests by

classification and the control variable method.

This paper innovates the interpretation of the turn-of-month effect and expands the Chinese scholars' study on the causes of the turn-of-month effect. This paper is the first to prove the liquidity hypothesis of the turn-of-month effect in the Chinese market, and comprehensively proves the liquidity hypothesis from the perspective of monetary policy and investor confidence.

The efficient market hypothesis (EMH). The efficient market hypothesis (EMH) is a complete theoretical framework for researching efficient markets proposed by Fama in 1970. Efficient market means that the market is composed of a large number of rational investors who make judgments about the future market value of securities based on the information that can fully flow in the market, and compete with each other to maximize their own interests. The essence of the efficient market hypothesis is to study the speed and the distribution of the response of securities prices to all information in the market. The implied premise and conclusion by the theory can be summarized as: if the relevant information on the securities market is equal to each investor, and each investor can make timely and rational investment decisions based on the information he or she has, then any investor cannot obtain abnormal returns and the securities market is effective.

Specifically speaking, the efficient market hypothesis holds that markets can be considered effective if all the useful information is fully reflected in the prices of securities without any prejudice. In a fully effective capital market, there is no inherent connection in the changes in securities prices, and all irrelevant information will not attract investors' attention except for relevant information.

Furthermore, an efficient market means that the prices of various securities in the market can fully and timely present all relevant information available. There are various kinds of information in the securities market, including information about the company itself, industry development information, and macroeconomic information, etc. These kinds of information will affect the securities market to varying degrees, thereby causing the prices of stocks and bonds to respond accordingly. The efficient market hypothesis believes that in an efficient capital market, the price of securities should respond quickly to these kinds of information, and the responses should be adequate and appropriate. In other words, favorable information will immediately cause asset prices to rise, while unfavorable information will immediately cause asset prices to fall. Therefore, the asset price at any time has fully reflected all relevant information available at that time, and the security price is the best assessment of its intrinsic value at any time.

According to the efficient market hypothesis, the market is divided into the following three types according to the scope and degree of relevant information available: the weak efficient market, the semi-strong efficient market, and the strong efficient market. In general, the more efficient the market, the more reasonable the

allocation of the capital resources. The different levels effectiveness of the stock market represents the different levels rationality of information distribution.

The weak efficient market means that the current price of a security fully reflects the content implied by its historical transaction information, and the changes in the price of a security present as a random walk. In other words, the current price of the securities is not related to the previous price changes, and also the current price of the securities has no effect on the future price change, that is, the individual prices in the time series are unrelated. If a weak-type efficient market exists, it is impossible to obtain a systemic excess profit by studying the historical data of securities and developing a technical analysis method for trading strategies.

The range and extent of the kinds of relevant information that the semi-strong efficient markets conclude is more abundant than that in the weak efficient markets discussed earlier. The kinds of information in the semi-strong efficient market include not only the historical transactions of the securities, but also include other kinds of public information, such as the company's financial statements, the dividend distribution schemes, the profit forecasts, the major company decisions, the changes in market interest rates, the inflation rates, etc. . If the market is semi-strong, the current prices of the securities have adequately reflected all the available public information. Investors will not be able to obtain excess profits after buying and selling based on the newly released information.

The information scope of the strong effective market is all relevant information, including public information and undisclosed inside information. Securities prices will respond to all relevant information, and investors cannot use inside information to obtain systematic excess profits. If the market is strong effective, inside information will also be reflected in the price of the securities. When an investor obtains inside information and conducts related transactions based on the inside information, other investors will adopt relevant trading strategies based on the investment of the insider traders.

The efficient market hypothesis is based on three gradually relaxing assumptions. The first assumption is that all the investors are rational, so the rational investors can make appropriate assessments of the fundamental value of assets. The second hypothesis is that even if some investors are irrational, because the transactions of the irrational investors are carried out randomly, the trading behaviors of the irrational investors will finally offset each other, so that the price of securities will not be substantially affected. The third hypothesis is that the behavior of irrational investors will not offset each other, and the irrational investors' transactions are related, but there are arbitragers in the market. The behavior of the arbitragers will finally eliminate the influence of the irrational investors on the prices of securities. In fact, however, all these three assumptions of the efficient market hypothesis are flawed.

The first rational person hypothesis of the efficient market hypothesis is quite flawed, because many investors' buying and selling decisions are always affected by unrelated information or noise. Meanwhile, from the perspective of behavioral finance, the rational theory is untenable. The second hypothesis of the efficient market hypothesis is that the irrational investors in the market will not affect assets prices because their random transactions will finally offset each other. However, according to the indication of behavioral finance and psychology studies, irrational people do not deviate from rationality by accident, but always deviate in the same way, so the buying and selling behaviors of the irrational investors are strongly correlated. The third assumption of the efficient market hypothesis believes that the arbitrage activities of the rational arbitragers in the market will eliminate the impact of the trading behaviors of irrational investors on assets prices. However, according to behavioral finance research, arbitrage in reality is full of risks on the one hand and has limited effect on the other hand.

The existence of the turn-of-month effect is a severe challenge to the efficient market hypothesis. The appearance of the turn-of-month effect also indicates that the market is not efficient. As mentioned before, there are certain defects in the efficient market hypothesis theory, which explains that the market efficiency depends on the assumptions such as rational investors and the existence of the alternative securities. These conditions are difficult to meet in reality. In fact, investors tend to be irrational and it is difficult to find suitable substitutes for the large number of securities traded in the market. Therefore, the actual market has not operated as described by the efficient market hypothesis, so all kinds of market anomalies such as the turn-of-month effect can appear in the securities market.

Explanations of the turn-of-month effect. Market inefficiency is the essential cause of the anomalies in the securities market. However, different anomalies themselves have different characteristics, and different anomalies have diverse causes. As far as the turn-of-month effect is concerned, the explanations currently studied by scholars include the liquidity hypothesis, the window dress hypothesis, the information release hypothesis, and the data mining hypothesis.

The liquidity hypothesis believes that the standardized payments system in the United States will generate a large amount of cash flow during the turn-of-month period. When investors invest a large amount of liquid funds into the stock market through various channels generated during the turn-of-month period, the market demand for stocks will increase accordingly, resulting in the turn-of-month effect. At the same time, the size of the cash flow generated during the turn-of-month period is affected by monetary policy.

The window dress effect is considered to be related to the fund managers, because the fund managers may want to raise the fund net worth ranking or other rankings before publicly disclosing their management

performance. The fund managers may significantly raise the price of their heavy holding stocks. Because the fund's performance is generally calculated at the end of the month using the closing prices of their holdings, the closing prices of the fund heavy holding stocks are most likely to have the window effect at the end of the month, the end of the quarter and the end of the year.

The information release hypothesis is that a large amount of macro and micro economic information released during the turn-of-month period will surely cause the volatility of the relevant securities to rise, and the increase in the level of risk caused by the information release will inevitably require corresponding risk compensation, leading to a higher yield during the turn-of-month period, that is to say, the higher yield during the turn-of-month period is actually a risk premium for the rising volatility.

Many scholars in academia do not acknowledge the existence of the calendar effects such as the turn-of-month effect. These scholars believe that the market anomalies such as the calendar effect are the result of data mining.

The turn-of-month effect in the Chinese stock market. China does not have a standardized payment system like the United States. Therefore, this paper believes that the theoretical premise of the liquidity hypothesis in the Chinese stock market is based on the following fact: In the Chinese A-share market, the net inflow of funds during the turn-of-month period is greater than that in other periods.

Investors will layer the liquidity of their portfolios, thus there are certain proportions of assets with different liquidity in investors' portfolios, such as cash, highly liquid securities (such as government bonds), and low liquid securities (such as stocks). In order to reduce transaction costs, investors will only increase stocks in their portfolios after their accumulated cash is sufficient enough and meets the low-liquidity investments. Generally speaking, cash is the most abundant during the turn-of-month period, as a result, the stock demand is the strongest during this period. Meanwhile, investors will invest more increased liquidity into the stock market when the investor confidence is higher.

Therefore, in summary, in the months with overall greater liquidity income and higher investor confidence, investors will invest more funds into the stock market during the turn-of-month period, which will lead to an increase in stock returns. In the months with overall smaller liquidity income and lower investor confidence, the growth of stock returns during the turn-of-month period will not be realized. These arguments show that monetary policy determines the total liquidity profit during the month, which in turn affects stock demand, resulting in the changes in stock returns during the turn-of-month period; investor confidence determines the liquidity investment during the turn-of-month period, which in turn affects the aggregate demand in the stock market, leading to the different significant level of the turn-of-month effect. In a word, easy monetary policy and higher investor confidence will bring greater liquidity profits, leading to greater turn-of-month stock

returns.

Data. This paper selects the daily closing price data of the Shanghai Stock Index as the research object. The data is from January 6, 2009 to December 28, 2018 and has a total of 2430 samples. The data comes from the Wind database. When calculating the turn-of-month effect, the data is divided into two parts: one is from the last trading day of the previous month to the first three trading days of the next month; the other part is the remaining trading days. The daily return of the index is expressed by the logarithmic return of the daily closing price. Assume p_t as the closing price of the index on the t-th day, then the logarithmic return of the index is defined as:

$$r_t = (lnp_t - lnp_{t-1}) \times 100\%$$

This paper assumes that the turn-of-month interval ranges from the last trading day of the previous trading month to the first three trading days of the next trading month, and is recorded as (-1, 3). This paper uses the 7-day weighted average repo rate from January 6, 2009 to December 28, 2018 as the proxy variable for monetary policy. The data source is the Wind database. This paper uses the "Investor Confidence Index-Buying in Index" to reflect the level of investor confidence. The data range is monthly data from January 2009 to December 2018. The data source is China Securities Investor Protection Fund Co., Ltd.

The empirical study on the existence of the turn-of-month effect in Chinese stock market. First, the unit root test shows that the daily return sequence of the Shanghai Stock Index is stationary. Then, the OLS regression indicates that the fluctuation of the market yield sequence is largely random. The fluctuation part that can be explained by the turn-of-month effect is exceedingly small, which means that the space for arbitrage using the turn-of-month effect may be extremely limited in the Shanghai stock market. Because the regression results of the OLS model are not ideal, it can only provide some preliminary understanding of the turn-of-month effect in the Shanghai stock market.

This paper uses the ARMA-GARCH model. At the same time, the risk factors of the financial markets do not obey the normal distribution and have heavy tails. Therefore, this paper uses the generalized error distribution (GED) to fit the conditional residuals. The ARMA-GARCH(1,1) model used in this paper is as follows:

$$r_t = c + \emptyset_1 TOM_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

$$f(\varepsilon_t, \nu) = \frac{\nu \exp\left(-0.5\left|\frac{\varepsilon_t}{\lambda}\right|^{\nu}\right)}{\lambda 2^{\frac{\nu+1}{\nu}}\Gamma(\frac{1}{\nu})}$$

In the equations, $\lambda = \left(\frac{2^{-\frac{2}{\nu}}\Gamma\left(\frac{1}{\nu}\right)}{\Gamma\left(\frac{3}{\nu}\right)}\right)^{0.5}$. ν is the shape parameter of GED. When ν<2, GED is considered to have a fat tail distribution. Γ is a gamma function.

What is more, in order to eliminate the interference of the monthly effect, this paper adds several dummy variables of the monthly effect into the model.

$$r_t = c + \emptyset_1 TOM_t + \emptyset_2 TOM_t * Jan_t + \emptyset_3 TOM_t * Mar_t + \emptyset_4 TOM_t * Apr_t + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

From the regression results, the daily rate of return of the Shanghai Stock Exchange Index is 0.002694% higher on average during the turn-of-month period than that in other trading days, and is significant at 1% significance level. This result shows that the Chinese stock market has a significant turn-of-month effect. Additionally, when the January effect, the March effect and the April effect are controlled, the Shanghai stock market still exhibits a significant turn-of-month effect, that is, the daily rate of return of the Shanghai Stock Exchange Index is 0.002864% higher on average during the turn-of-month period than that in other trading days, and is significant at 1% significance level.

In summary, the daily return rate of the Shanghai Stock Exchange Index during the turn-of-month period is significantly higher than that in other trading days. After excluding the influence of the monthly effect, the same conclusion is obtained. Therefore, this paper concludes that the turn-of-month effect exists in the Chinese stock market during the sample period.

This paper also uses Kruskal-Wallis nonparametric test to test whether there are significant differences in the distribution of multiple populations. The statistic H^* of the K-W nonparametric test, which studies the turn-of-month effect in the Shanghai stock market, is calculated as follows:

$$H^* = \frac{2}{N(N+1)} \sum_{i=1}^{2} n_i [\bar{R}_i - \frac{N+1}{2}]^2$$

The Kruskal-Wallis nonparametric test also confirms the existence of the turn-of-month effect in the Chinese stock market.

The empirical study on the liquidity hypothesis of the turn-of-month effect in Chinese stock market. This part of the liquidity hypothesis test introduces an indicator of the monetary policy: the 7-day weighted average

repo rate. This paper introduces the variable *7d*TOM*, which is the product of the 7-day weighted average repo rate and the dummy variable for the turn-of-month effect. The higher the repo rate, the higher the growth rate of money supply, the easier the monetary policy, and the higher the return during the turn-of-month period. Thus, the coefficient of the variable *7d*TOM* should be positive.

$$r_t = c + \emptyset_1 7d * TOM + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

The coefficient of the variable *7d*TOM* is positive and significant at 1% significance level. The results show that stock returns during the turn-of-month period are inversely proportional to the degree of stringency of the monetary policy, which proves the liquidity hypothesis of the turn-of-month effect.

At the same time, the liquidity hypothesis is also affected by investor confidence. The higher the investors' confidence, the more willing to invest the increased liquidity in the stock market, resulting in a more significant turn-of-month effect. In other words, the significance of the turn-of-month effect is positively correlated with investor confidence. This part introduces an indicator that expresses investor confidence: the investor confidence index-the buying in index. The variable *Con*TOM* is added, which is the product of the investor confidence index-the buying in index and the dummy variable of the turn-of-month effect. According to the analysis of investor confidence above, the coefficient of this variable should be significantly positive.

$$r_t = c + \emptyset_1 TOM + \emptyset_2 Con * TOM + \sum_{i=1}^{n} \theta_i r_{t-i} + \sum_{j=1}^{m} \varphi_j \varepsilon_{t-j} + \varepsilon_t$$

The results show that stock returns during the turn-of-month period are positively correlated to investor confidence, which in turn proves the liquidity hypothesis of the turn-of-month effect.

After performing the preliminary model estimation, this paper did the equality tests by classification. The sample data is divided into two sub-samples for further testing. The two sub-samples are divided into trading days with relatively easy monetary policy and trading days with relatively stringent monetary policy. The dividing principle is the 7-day weighted average repo rate, and those with a 7-day weighted average repo rate higher than 2.65[2] are classified as days with easy monetary policy while those with less than 2.65 are classified as days with stringent monetary policy. The test results show that, whether it is a month with relatively easy monetary policy or a month with relatively stringent monetary policy, the average daily rate of return during the turn-of-month period is higher than that in other trading days.

[2] The specific division value has considered the mean, median of the 7-day weighted average repo rate, and the monetary policy announced by the People's Bank of China.

Further, divide the sample data according to the level of investor confidence. Based on the introduction of the Investor Confidence Index by China Securities Investor Protection Fund Co., Ltd., the investor confidence index of the Chinese securities market ranges from 0-100, with 50 being a neutral value. When the index is greater than 50, it indicates that the proportion of investors who hold optimistic and positive views is greater than the proportion that holds pessimistic and negative views, and the overall investor confidence tends to be optimistic. The higher the index value, the stronger the investor confidence. The test results show that whether it is a month with relatively high investor confidence or a month with relatively low investor confidence, the average daily rate of return during the turn-of-month period is higher than other trading days.

Afterwards this paper did the Kruskal-Wallis nonparametric test and according to the result for the month with relatively low investor confidence, the average daily rate of return during the turn-of-month period is 0.000970, which is less than the month with relatively high investor confidence. The test results are consistent with the prediction above.

Conclusion. This paper supplements the gap in the research on the liquidity hypothesis of the turn-of-month effect in the Chinese market. Focused on the uniqueness of the Chinese stock market, this paper theoretically discusses the explanation basis of the liquidity hypothesis in the Chinese market. Specifically, the theoretical basis of the liquidity hypothesis in the US stock market is that the US has a standard payments system. The standardization of this payments system brings more liquidity during the turn-of-month period, so the end of each calendar month is the investors' preference habitat. However, there is no obvious standard payments system in the Chinese market, but through the study of the Chinese stock market data, this paper finds that more funds flow into the stock market during the turn-of-month period. Therefore, in essence, the Chinese market has the same theoretical basis for the liquidity hypothesis, which provides the theoretical premise for the liquidity hypothesis explanation of the turn-of-month effect.

Then this article summarizes and categorizes the explanation theories of the turn-of-month effect in the Chinese stock market and provides the theoretical explanations and supplements to the liquidity hypothesis. After Odgen proposed the liquidity hypothesis based on monetary policy, Burnett supplements the liquidity hypothesis from the perspective of behavioral finance. And this paper combines the two studies to prove the liquidity hypothesis of the turn-of-month effect in Chinese stock market from the aspects of both monetary policy and investor confidence. Specifically, the liquidity hypothesis o believes that the turn-of-month effect results from the additional liquidity generated during the turn-of-month period entering the stock market, thereby increasing stocks demand and prices, which in turn produces the turn-of-month effect. The significance of the turn-of-month effect is affected by two aspects. On the one hand, monetary policy will affect the liquidity scale during the turn-of-month period, and the liquidity will be higher under the easy monetary policy; on the

other hand, investor confidence will affect how much of the liquidity will flow into the stock market during the turn-of-month period. When investor confidence is high, investors are more willing to invest the increased liquidity in the stock market, which leads to a more significant turn-of-month effect.

In terms of empirical research, this paper takes the Shanghai Index Return as the research object and conducts some empirical tests on the existence and the liquidity hypothesis of the turn-of-month effect. After accomplishing the ARMA-GARCH model, equality tests by classification, K-W non-parametric test and other tests, this paper believes that the turn-of-month effect exists in the Shanghai stock market from January 6, 2009 to December 28, 2018. And after controlling the monthly effect, the existence of the turn-of-month effect is still significant. Secondly, this paper believes that the liquidity hypothesis has a certain explanatory power for the turn-of-month effect in the Chinese stock market. After excluding the effects of extreme values and the monthly effects, the liquidity hypothesis still has explanatory power. The liquidity hypothesis explains the turn-of-month effect as follow: the return on the stocks during the turn-of-month period is inversely proportional to the degree of monetary policy stringency and is positively correlated to the investor confidence. The conclusion of this paper also provides support for the impact of monetary policy on stocks and proves the liquidity hypothesis in the Chinese market from the perspective of behavioral finance.