Physica A 389 (2010) 91–99

Contents lists available at ScienceDirect

Physica A

journal homepage: www.elsevier.com/locate/physa

Weather effects on the returns and volatility of the Shanghai stock market

Sang Hoon Kang [a], Zhuhua Jiang [b], Yeonjeong Lee [b], Seong-Min Yoon [b,*]

[a] *Division of Business Administration, Gyeongsang National University, Jinju, 660–701, South Korea*

[b] *Department of Economics, Pusan National University, Busan 609–735, South Korea*

ARTICLE INFO

Article history:
Received 21 February 2009
Received in revised form 22 July 2009
Available online 10 September 2009

PACS:
89.65.Gh

Keywords:
MA-MSD method
Anomaly
Investment sentiment
Financial market openness
Efficient market hypothesis

ABSTRACT

This study investigates the weather effects on returns as well as volatility in the Shanghai stock market. In order to analyze the influence of the opening of B-share market to domestic investors, it is assumed that domestic investors are more sensitive to the Shanghai local weather than foreign investors. In doing so, extreme weather condition dummies are generated by using the 21-day and 31-day moving average and its standard deviation. Empirical analysis provides two key results regarding weather effects. First, the weather effect exists in the A-share returns, but does not exist in the B-share returns over the whole period. In addition, the post-opening period shows the strong weather effect on B-share returns only, indicating that the market openness to domestic investors results in the weather effect. Second, the weather effect has a strong influence on the volatility of both A- and B-share returns. Similar to the case of returns, the weather effect on volatility is explained by the openness of B-share market.

1. Introduction

This study investigates the weather effects on investors' mood and sentiment in the stock markets. It is well known that weather conditions affect an individual's emotional state or mood, which holds back people from making rational or optimal decisions [1–4]. Supposing that the existence of weather effects affect the investor's decisions making, various weather conditions may influence the movement of stock returns and volatility.

To date, market liberalization and globalization increase the proportion of foreign investors in the local stock markets, which leads to weak weather effects in the markets. For example, the financial globalization results in a series of interdependencies which make contagion inevitable during a country's financial crisis. With the development of the electronic-trading system and communication technology, the arbitrageurs can develop international portfolio strategies using program trading.

In light of the efficient market hypothesis (EMH) that share prices are justified by firms' fundamental values, there is no weather effect on their returns and volatility. However, the behavioral finance theory has argued that, to some extent, stock market anomalies can be the result of relevant weather factors [5–17]. As a result, the existence of a weather effect has raised some questions as to the validity of the EMH.

The Shanghai stock market provides a unique source for examining weather effects. The Shanghai Stock Exchange (SHSE) divides its stock market into a domestic board (A-share) and a foreign board (B-share). Most of the ownership of A-share

* Corresponding address: Department of Economics, Pusan National University, Jangjeon2-Dong, Geumjeong-Gu, Busan, 609-735, South Korea. Tel.: +82 51 510 2557; fax: +82 51 581 3143.

E-mail address: smyoon@pusan.ac.kr (S.-M. Yoon).

0378-4371/$ – see front matter
doi:10.1016/j.physa.2009.09.010

is restricted to residents of domestic investors,[1] while that of B-share is restricted to foreign investors. However, starting from 19th February, 2001, Chinese domestic investors are allowed to trade B-shares. The investment decisions of domestic investors may be affected by Shanghai weather factors, therefore the weather effect can exist in the Shanghai stock market. Thus, this distinctive market structure allows us to test the existence of weather effect on stock returns and volatility.

This paper primarily examines whether there is a relationship between the stock market and three specific weather variables such as the temperature, humidity, and sunshine duration, using the Shanghai A- and B-share indexes. In particular, following 19th February, 2001, we consider that the addition of domestic investors in the B-share market creates the extent of weather effect. In order to analyze the openness of the B-share market to domestic investors, we divide the B-share index into two sub-periods and compare the impact of weather effect on its returns and volatility.

The paper is organized as follows: Section 2 discusses previous research regarding the weather effect on stock markets. Section 3 provides the statistical characteristics of the stock returns and weather data, and discusses the weather dummy variables and methodology. Section 4 examines the relationship between weather and stock returns and volatility, and compares the results for the two sub-periods. Section 5 of this paper summarizes the most relevant conclusions.

2. Literature review

Psychologists have been long interested in the influence of sunshine on individual's behaviors [1–4]. They asserted that the degree of sunshine influences an individual's mood or sentiment, and can generate a predisposition to engage in particular behaviors — i.e., a mild sunshine positively influences the consumer's behaviors, and encourage people to take an interview.

With regard to this perspective, research into the weather effect has focused on the influence of cloud cover (or lack of sunshine) on stock returns. Initially, Saunders [5] reported that cloud cover was negatively correlated with the daily returns of New York stock indexes. Hirshleifer and Shumway [6] supported the sunshine effect of Saunders with an analysis of index returns for 26 international stock exchanges. Kamstra, Kramer and Levi [7] investigated the daylight saving effect and found that stock returns, following sleep disruptions on daylight saving weekends, are negative. Kamstra, Kramer and Levi [8] also discussed the seasonal affective disorder (SAD) effect where seasonal variation in returns is linked to depression caused by the reduced length of day. The SAD effect is also supported by Garrett, Kamstra and Kramer [9].

Recent studies have considered multiple weather conditions. Keef and Roush [10,11] examined the weather effect on the returns of New Zealand financial securities using three local weather factors: cloud cover, temperature and wind. Dowling and Lucey [12,13] also investigated the weather effect on stock returns using multiple weather proxy variables. Keef and Roush [14] and Cao and Wei [15] found a negative correlation between temperature and returns in the Australian stock market. Chang et al. [16] reported that temperature and cloud cover had a negative effect on returns in the Taiwan stock market. Yoon and Kang [17] investigated the influence of the weather effect on the Korean stock returns using temperature, humidity and cloud cover.

However, other researchers have stated that there is no weather effect or that the effect is negligible and can be ignored. For example, Trombley [18] re-examined Saunders' work [5] and found no sunshine effect on the New York stock market, and Jacobsen and Marquering [19] found little evidence on the SAD effect. Similar empirical results were reported by Krämer and Runde [20] for the German DAX stock index, by Pardo and Valor [21] for the Madrid stock index, and by Tufan and Hamarat [22] for the Istanbul stock exchange.

Several empirical studies on the weather effect on the Chinese market have been conducted. Yi and Wang [23] examined empirically the impact of some weather variable and seasonal affective disorder (SAD)[2] on returns of Shanghai composite stock index, and evidenced the weather effect (humidity and wind) in the dynamics of Shanghai composite stock index. Han [24,25] examined the relationship between the weather effect and the daily returns of Shanghai and Shenzhen stock markets, and found that sunshine is closely correlated to market returns. Han and Wang [26] investigated the role of SAD in the Chinese stock market returns. They found that stock returns in Shanghai stock exchange are significantly related to the length of daylight through the fall and winter. In the case of emerging stock markets, market efficiency is an important aspect [27–31]. The above findings can be interpreted as casting doubt on the validity of the EMH in the Chinese stock market, because application of weather effect to trading strategies is only profitable to dealers with low transaction expense.

In this paper, we improve the above studies in two points of view. First, we define weather variable using a new method proposed by Yoon and Kang [17]. They assume that extreme weather conditions may result in more significant effects on stock returns than would normal weather conditions, and generate dummy variables for each weather factor, depending on extremely above-average and extremely below-average weather conditions. These dummy variables can provide additional insight into the weather effects which can occur in the Chinese stock market. Second, we introduce interaction effects

1 From July, 2003 foreign investors have begun to trade A-shares restrictively as QFII (Qualified Foreign Institutional Investor).

2 Seasonal Affective Disorder (SAD), also known as winter depression or winter blues, is a mood disorder in which people who have normal mental health throughout most of the year experience depressive symptoms in the winter or, less frequently, in the summer, repeatedly, year after year (http://en.wikipedia.org). This terminology is usually used in the field of medicine and pathophysiology. The US National Library of Medicine notes that "some people experience a serious mood change when the seasons change. They may sleep too much, have little energy, and crave sweets and starchy foods. They may also feel depressed. Though symptoms can be severe, they usually clear up (http://www.nlm.nih.gov)."