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Calendar Effect in China's Stock Market

An empirical analysis on CSI 300 index

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Abstract: Various anomalies in financial markets have challenged the classical theory of rational man and efficient market hypothesis, which give birth to behavioral finance. This paper focuses on the discussion of calendar effect. Calendar effect is a phenomenon when abnormal return exists in particular time period.

This paper briefly describes the calendar effect and presents a review of literature on day-of-the-week effect. Then, with the introduction of stock index futures, we try to analyze day-of-the-week effect on CSI 300 index from an empirical point of view, which is an underlying asset of stock index futures. Using ARCH model, we concluded that from January 2005 to May 2011, the return of CSI 300 index exhibits "W" shape, and there is significant positive effect on Monday.

Keywords: Calendar effect; Day-of-the-week effect; ARCH model

I. AN INTRODUCTION TO BEHAVIORAL FINANCE

Classical finance starts from assumption of rational economic man and uses arbitrage-free equilibrium analysis to develop quite perfect financial theory. With continuous development of financial market and deepening financial practice, modern classic finance faces with many practical mysteries, such as calendar effect, equity premium puzzle, options volatility smile, closed-end fund puzzle, momentum and reversal effect et al, which are all called anomalies. Anomaly in security market is defined as the phenomenon that some assets or portfolios have abnormal return in particular time period, while traditional theory of efficient market hypothesis and capital asset pricing theory cannot reasonably explain.

To interpret this phenomenon, behavioral finance emerged as a new branch of modern finance theory. Behavioral finance focuses on psychological theory, particularly behavioral science, to observe entire financial market. From a new perspective to explain these anomalies, behavioral finance has become an important part in finance research. Behavioral finance does not totally reject the classical finance assumption, but has reasonable interpretation and amendment on tradition theory, mainly in the following two aspects:

First is the rational economic man hypothesis. Traditional financial theory considers that investors are risk-averse rational man. People have rational expectation on market, pursing maximal own utility with consideration of risk. But lots of psychological researches show that people's actual investment decisions deviate from path of rational man. Human behavior is not only selfish; decisions are often influenced by other non-material motivation. In the same time, environment and habitual thinking also have great effect on fully rational hypothesis. Therefore, behavioral finance proposes investors will make mistake and men are limited rational.

Second lies in that market is in equilibrium and effective. Traditional financial theory holds that once market deviates from equilibrium, arbitrage activities carried by rational investors will quickly bring market to equilibrium. But in the real world, there are all kinds of frictions, such as transaction cost and asymmetric information. Not every market participant can act rationally in accordance with the model theory, the market is not perfect. As the people themselves are not so rational, economic actives often have irrational side. For example, stock price change is not real reaction to firm's fundamental change. There is often over or under reaction impacted by investor sentiment.

II. CALENDAR EFFECT

Calendar effect is one of main anomalies in stock market. It refers to achieve abnormal return while doing transaction in particular time period. According to different time period, calendar effect can be divided into day-of–the-week effect, month-of-the-year effect, end-of-year effect, holiday effect. Integrated with empirical analysis of the paper, following part presents a review of literature discussed on day-of-the-week effect.

Day-of-the-week effect states that expected return is not the same for every weekday, on some days there are abnormal or excess return. Cross and French shows that average return is negative on Monday for S&P 500 Index. The result is the same as Gibbons shows in 1981. Berument and Kiymaz carried research on USA stock market further, they used the data from 1973 to 1997 to find that highest and lowest daily returns are observed on Wednesday and Monday; the highest and lowest stock volatility are observed on Friday and Wednesday[1].

For Japan and Australia stock market, Jaffe and Westerfield's study shows the lowest average return occurs on Tuesday. Choudhry does research on emerging Asian stock market and concludes significant negative Monday effect in

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[1] HakanBerument and Halil Kiymaz, "The day of the week effect on stock market volatility," Journal of Economics and Finance,Vol.25,summer 2001

Indonesia, Malaysia and Thailand; significant negative Tuesday effect in Korea, Taiwan and Thailand[2].

At the same time, researchers try to explain underlying reason of day-of-the-week effect. Some scholars believe time lag between trading and liquidation causes the effect, while others provide various interpretations regarding trading system and measurement error.

In China stock market, is there also evidence of day-of-the-week effect?

Jirui Xue and Lan Gu propose that significant weekend effect exists in China stock market. There is positive average return on Friday and increased volatility of return on Monday.

Yanfeng Guo and Yu Wei using ordinary least squares and generalized autoregressive conditional heteroskedasticity model to test calendar effect. The result shows intraday effect and day-of-the-week effect is significant for CSI 300 index, significant positive return on Monday.

Yong Shao explores a model based on fluctuation in short memory and finds Tuesday and Friday effect exist in early market, Monday and Thursday effect appears after 1997 financial crisis.

III. DATA

As China's stock index futures launched in April 2010, CSI 300 index as the underlying asset draws public attention. Previous studies show futures has the power to discover price before spot transaction, and in the long term, stock index futures has stable relations with the spot. At present, researches on calendar effect in securities market especially stock market have gradually carried out, but few are for stock index futures. Index futures research is concentrated in the United State, Europe, Japan, Hong Kong and Taiwan market. Empirical research targeting on China's first financial futures-CSI 300 stock index futures is few, so does research on operational characteristic of the underlying index. This partly dues to the late release of CSI 300 index and recent launch of stock index futures. However, as an important market anomaly, calendar effect represents regular market change, has significant importance for investors using futures to speculate, arbitrage or hedge.

CSI 300 index, also called Shanghai and Shenzhen 300 index, is the first index jointly released by Shanghai and Shenzhen Stock Exchange to reflect overall trend of A-share stock market. It makes public test run on January 4, 2005 and officially released on April 8, 2005.

In this paper, data sample range is daily data from January 5, 2005 to May 31, 2011; data source is from Great Wisdom software. There is only more than 6 year data for CSI 300 index, an insufficient data for test on January effect and seasonal effect. This paper use daily data to verify and analyze day-of-the-week effect.

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[2]Taufiq Choudhry, "Day of the week effect in emerging Asian stock markets: evidence from the GARCH model," Applied financial Economics,pp.235-242,2000

IV. ARCH MODEL AND EMPIRICAL RESULT

Traditional econometric approach requires residual term have zero mean and same variance. But for financial variables in reality, they exhibit fat tail and non-constant variance. When variance of a variable changes, significant change is shown concentrated in one period of time, with minor change seen in another period of time, which is called volatility clustering phenomenon. To describe and predict the phenomenon, Engle proposed autoregressive conditional heteroskedasticity model (ARCH) in 1982. Given information set for time $t-1$, $\phi_{t-1} = \{y_{t-1}, x_{t-1}, y_{t-2}, x_{t-2}, \ldots\ldots\}$, distribution of random error term ε_t is as follows:

$$\varepsilon_t \mid \phi_{t-1} \sim N(0, h_t)$$

$$h_t = a_0 + \sum_{i=1}^{q} a_i \varepsilon_{i-1}^2$$

Where, $a_0 > 0, a_i >= 0, i = 1, 2 \ldots\ldots, n$

ARCH model depicts some typical characteristics of time series data: (1) short term variance is a function of pre-term variance; (2) a large variance will affect following several term variance; (3) large variance tends to followed by large variance and small variance tend to followed by small variance.

With improvement and evolution, ARCH type models includes GARCH model, GARCH-M model other than traditional ARCH model. This paper adopts GARCH (1, 1) model to study day-of-the-week effect on CSI 300 index.

The model is as follows:

$$R_t = b_1 D_1 + b_2 D_2 + b_4 D_4 + b_5 D_5 + \varepsilon_t \tag{1}$$

$$\varepsilon_t \mid \phi_{t-1} \sim N(0, \sigma_t^2) \tag{2}$$

Equation (1) suggests that return of CSI 300 index is a linear function of dummy variables D_1, D2, D4, D5 and the error term is ε_t. Equation (2) indicates that ε_t follows normal distribution with zero mean and σ_t^2 variance given information set of time $t-1$.

R_t is daily CSI 300 index return, calculated as $R_t = \ln(P_t) - \ln(P_{t-1})$, where P_t is the closing price of index. D_1, D_2, D_4, D_5 are dummy variables represent returns occur on Monday, Tuesday, Thursday, Friday respectively. If it is Monday's return, then $D_1 = 1$, $D_2 = 0$, $D_4 = 0$, $D_5 = 0$; if it is Wednesday's return, then $D_1 = 0$, $D_2 = 0$, $D_4 = 0$, $D_5 = 0$. b_1, b_2, b_4, b_5 are coefficients represent average return for Monday, Tuesday, Thursday, Friday. If there is no day-of-the-week effect, the coefficient is not statistically significant. Otherwise, the futures gain of each trading day is significantly different, which shows day-of-the-week effect.

Using EViews3.1 here is the result:

TABLE I.   SUMMARY STATISTICS FOR DAILY INEDX RETURN

Independent variable	statistics			
	Coefficient	Std. Error	z-Statistic	Prob.
D1	0.002989	0.000812	3.680039	0.0002
D2	-0.000986	0.001078	-0.914206	0.3606
D4	-0.001708	0.000943	-1.81116	0.0701
D5	0.001781	0.000956	1.862513	0.0625

TABLE II.   VARIANCE EQUATION

	Coefficient	Std. Error	z-Statistic	Prob.
C	4.12E-06	1.04E-06	3.975043	0.0001
ARCH(1)	0.060966	0.008193	7.441181	0
GARCH(1)	0.930161	0.008787	105.8552	0
Mean dependent var	0.000718		S.D. dependent var	0.020335
Log likelihood	3999.838		Durbin-Watson stat	1.94207

V. INTERPRETATION

From the table above, return of CSI 300 index is positive on Monday and Friday, return on Tuesday and Thursday was negative. Meantime, in another model we use five dummy variables from Monday to Friday respectively, result shows that return of CSI 300 Index exhibits "W" shape, and significant positive return on Monday and Wednesday. The empirical research indicates that CSI 300 index has day-of-the-week effect, return is significantly positive on Monday. In the other words, there is a positive effect on earning on Monday.

Compared with previous study, previous study shows there is significant positive return on Friday from 1993 to 1999. But in this paper, Friday positive effect is not significant, there is significant positive return on Monday. Different index may lead to some difference; more is due to difference sample period selected.

Weekend effect is often explained by information disclosure practice. On Friday investors often forecast policy change in the weekend, thus tend to buy or sell equities, which leads to relatively large up or down movement at Friday's closing hour. Although we usually use "Black Friday" to describe the stock market, in the long run, return on Friday is positive. Compared with previous studies, weekend effect in China's stock market has gradually diminished, as return on Friday is no longer significantly positive. This phenomenon may be related to investors' arbitrage behavior.

The significance of calendar effect lies in two aspects. On the one hand, if calendar effect does exist, in stock market there are opportunities to obtain abnormal return, which indicates China's stock market is not weak form efficiency. On the other hand, studying the volatility pattern of return rate can serve investors to make important decision rule. At the same time, it should be noted that introduction of futures may alter the calendar effect pattern of stock market. According to Hiraki, Maberly and Taube's study in 1998, the pre-existing day-of–the-week effect may change after stock index futures begin to trade. As index futures provides information flow to spot price, further analysis is required some time later when stock index futures operates stably.

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