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Investigation of Monday Effect in the American and Chinese Stock Markets

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ABSTRACT

This paper investigates the presence of the Monday effect in the American and Chinese stock markets. The data uses the Russell 1000 index from the American stock market, as well as the Gem composite index from the Chinese stock market in the period 2012 to 2021. Moreover, this paper chooses the GARCH model and the ARMA-GARCH model to investigate the Monday effect in two different stock markets. As a result, there is no evidence to find the presence of the Monday effect in the two stock markets. Nonetheless, there is still the existence of the calendar effect in the two stock markets. We ensure the credibility of results by checking for the potential bias of COVID-19 pandemic, by omitting the last two years from the data and also changing the estimation method to OLS. Results remain parallel to our main empirical findings.

Keywords
Stock Markets
Monday Effect
Calender Effect
ARCH-GARCH

JEL Classification
G1, C58
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1. Introduction

The existence of the calendar effect in the stock markets, especially the Monday effect in the earlier American stock market, has been known as a common phenomenon. This is mainly due to the fact that, not every investor is rational as opposed to the assumptions of the Efficient Market Hypothesis that is proposed by Fama (1970). Thus, the financial anomalies, in the form of calendar effect might arise. Moreover, the calendar effects cover the Monday effect which means the returns on Monday are significantly different than returns on other days.

The calendar effect in the American effect was first founds in the study of Fields (1931). After that, Jaffe and Westerfield (1985), Mehdian and Perry (2001) find the calendar effect in the American stock market, including the Monday effect. Cai et al. (2006) get a result that there is the Monday effect in the Chinese stock markets. Beyond that, the calendar effect does not only exist in the American stock market and the Chinese stock market, but the calendar effect also appears in other countries. For example, Edwards et al. (2003) find the calendar effect in the Netherlands. However, with the time goes by, Xiao (2016) discovers that there is no existence of the Monday effect in the American stock market. Perez (2018) get a conclusion that there is no Monday effect in the Chinese stock market.

Compared with the stock market from all over the world, the American stock exchange develops better, even if it is not the first stock exchange of the world (the first stock exchange was in the Amsterdam). Moreover, the Chinese economy includes the financial market developed rapidly recently, it is meaningful to investigate whether there is the presence of the Monday effect in the two stock markets. In the context of the development of stock markets in different countries, this paper documents the Monday effect on the daily closing returns via using the American Russell 1000 index and the Chinese Gem composite index for January 1st, 2012 through December 31st, 2021. As for the models, according to characteristics of the data of the returns, the optimal models are the OLS model, the ARMA model and the GARCH model with dummy variables to research the calendar effect that Chawla and Shastri (2023) select the OLS, GARCH(1,1) regression to research the calendar effect.

The rest of the paper is structured as follows. Section two presents the literature review and hypotheses development. Section three presents the data and methodology while the next section presents empirical findings. The last section of this paper presents the conclusion.

2. Literature Review and Hypothesis Development

In the previous research, researchers investigate the calendar effect in the American stock market at the beginning. The first calendar effect is found by Fields (1931). Then, Merrill (1966) and Cross (1973) find the negative Monday effect by using the Dow Jones Industries index and the S&P 500 index respectively from 1953 to 1970. Moreover, French (1980) selects the S&P 500 index to research the calendar effect in the period of 1953 to 1977, there is the same result as earlier studies, the presence of the negative Monday effect. Gibbons and Hess (1981) get the negative Monday effect through using the Dow Jones Industries index. However, others such as Mehdian and Perry (2001) expands the sample. They select five different indices to investigate the calendar effect, these are the Dow Jones composite index, the New York Stock Exchange index, the S&P 500 index, the NASDAQ index, and the Russell 2000 index. Consequently, the positive Monday effect exists in the NASDAQ index, and the Russell 2000 index, even if the negative Monday effects in the Dow Jones composite index, the New York Stock Exchange index, the S&P 500 index, the results that there is the presence of the Monday effects in the American stock market are the same with earlier studies in other indices.

Compared with the American stock market, even if the Chinese stock market is not as prosperous as the American one, there also exists the Monday effect. Cai et al. (2006)' verdict from empirical analysis is that there is the negative Monday effect in the Chinese stock market. Meanwhile, they advise to avoid investing stocks on the Friday of the third and fourth weeks and delay purchase until the end of the following Monday for every investor in the Chinese stock market. Zhang et al. (2017) draw a conclusion that there is the presence of the Monday effect in the case of Chinese stock market generally.

Nonetheless, the Monday effect does not exist in the American stock market, the calendar effect including the Monday effect also exists in all countries. Indeed, there are more types of the calendar effects except the Monday effect, even in the American and Chinese stock markets. Jaffe and Westerfield (1985) covers indices from four countries, the United Kingdom, Japan, Canada, and Australia. However, the results are diverse, they find the negative Tuesday effect in the Japan and Australia. The researchers does not only find the negative Tuesday effect in these two countries, but Solnik and Bousquet (1990) also discover the same results in the Paris stock exchange. Meanwhile, they examine the negative Monday effect in the United Kingdom. Beyond

that, Agrawal and Tandon (1994) investigate the calendar effect of eighteen countries. As a result, there is the presence of the negative Monday effects in more than 50% of countries. Nevertheless, eight countries exist the negative Tuesday effect on the stock market. Besides, Brooks and Persand (2001) find the positive Monday effect and the negative Tuesday effect in the Thailand and Malaysia stock market, and there are no significant calendar effect in the South Korea and the Philippines. In China, Kling and Gao (2005) find the positive Friday effect. Basher and Sadorsky (2006) still discover the positive Friday effect in Taiwan. The negative Monday and Tuesday effect is found in the Australian stock market by Worthington (2010). Lu and Gao (2016) find the negative Tuesday effect in the Chinese stock market. Dicle and Levendis (2014) find the evidence that the day of the week effect still exists in most countries in 33 countries, including the American and the Chinese stock markets. Du Toit et al. (2018) find the day of the week effect (the positive Monday effect and the negative Friday effect) exist in the South African stock market. Novotná and Zeng (2017) focus on the Chinese stock markets, as a result, there exists the day of the week effect, but not just the Monday effect. Winkelried and Iberico (2018) examine the existence of the negative Monday effect in the Latin American stock markets. Nevertheless, Xiao (2016) use the data in the period of 2000 to 2015 to discover the absence of the Monday effect in the American stock market. Perez (2018) still find no Monday effect in the Chinese stock market.

As for methods to investigate the calendar effect including the Monday effect, there are researchers who insert the dummy variables to examine the calendar effect, such as Agrawal and Tandon (1994), Arsad and Andrew Coutts (1997), Kato and Schallheim (1985), Mustafa (2008) and Lu and Gao (2016). Moreover, the OLS regression is selected by Addinpujoartanto (2019). Furthermore, Holden et al. (2005) and Du Toit et al. (2018) used the GARCH model to research the calendar effect, Zhang et al. (2017) also use the GARCH model to examine the day of the week effects through 35 countries. Baker et al. (2008) select the ARCH model to investigate the calendar effect. Liu (1986) and Rounaghi and Zadeh (2016) use the ARMA model to research the calendar effect. Gharaibeh (2017) select the OLS, GARCH(1,1) regression to examine the calendar effect. Truong and Friday (2021) also use the same models.

In a word, a part of researchers finds the calendar effect including the Monday effect is disappearing with the development of the stock market. However, others still discover the presence of the calendar effect including the Monday effect in different stock markets. This paper uses the

Russell 1000 index and the Gem composite index to investigate the presence of the Monday effect in the American and Chinese stock market further.

Hypothesis: *Monday effect disappears in the American market and the Chinese stock markets with the development of the stock markets.*

3. Data and Methodology

This paper uses the closing daily price of the Russell 1000 index in the American stock market and the Gem composite index in the Chinese stock market in the period January 1st, 2012, to December 31st 2021. The Russell 1000 index covers the 1000 stocks with high value from Russell 3000 index, occupying approximately 92% market value of Russell 3000 index. The Gem composite index includes 100 stocks, which contain higher value, more liquidity stocks from Chinese Gem index. The data is all from the Wind database. this paper deletes the whole week without Monday. Thus, the numbers of observations of the Russell 1000 index and the Gem composite index are 2326 and 2315 respectively.

The visualization of the data (the Russell 1000 index and the Gem composite index) is reported in figure 1 and table 1. Figure 1 shows that all the data in two indices fluctuate around zero, it can be initially adjusted that the data are stationary. And the most violent fluctuation in the Russell 1000 index is between 2015 to 2017. The most violent fluctuation in the Gem composite index in the period 2020 to 2021, is perhaps influenced by the COVID virus. In table 2, both the maximum means are on Tuesday, it possible to denote the positive Tuesday effect. The distributions of the maximum in the Russell 1000 index and the Gem composite index are on Tuesday and Monday respectively. The returns on Monday of the Russell 1000 index are minimum, and the returns on Thursday of the Gem composite index are minimum. Compared to the maximums and the minimums, this displays the contrary distribution.

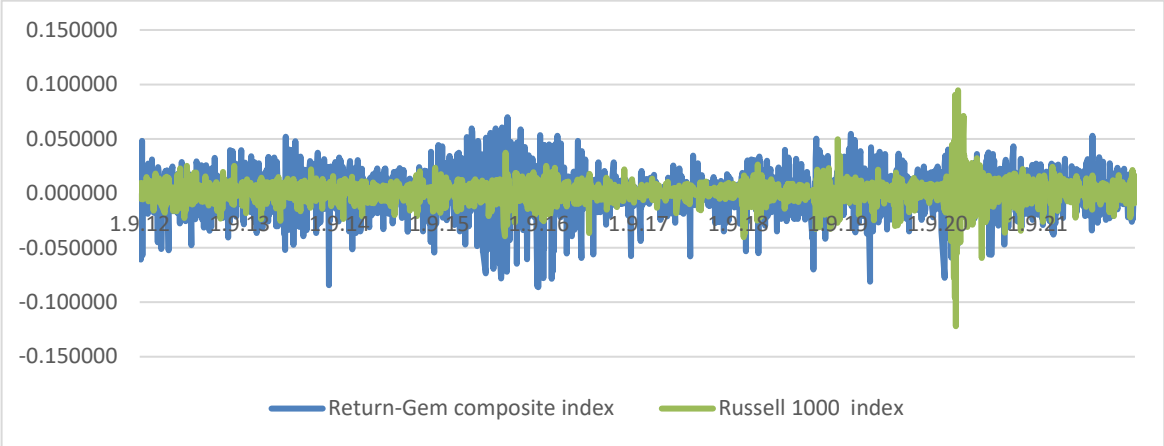

Figure 1 The Line & Symbol Chart of the Daily Returns of the Russell 1000 Index and the Gem Composite Index

Table 1

Description Statistics of the Daily Returns of the Russell 1000 Index and the Gem Composite Index

Russell 1000	Return	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	0.0005775	0.0000578	0.0009874	0.0005674	0.0005236	0.000761
Median	0.0007288	0.0005391	0.0005367	0.0006225	0.0013067	0.0008922
Maximum	0.0946305	0.0710443	0.0946305	0.0496626	0.0617224	0.0904138
Minimum	-0.1219918	-0.1219918	-0.032520	-0.0556806	-0.0956516	-0.041950
Sd	0.0105158	0.0117905	0.0100088	0.0100525	0.0106052	0.0100033
Observation	2326	474	469	467	460	456
Gem composite	Return	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	0.000798	0.0020381	0.002298	0.0006639	-0.00135	0.00023
Median	0.0011859	0.0041948	0.003272	0.0003617	-0.00093	-7E-05
Maximum	0.0699539	0.0563275	0.059761	0.0699539	0.053587	0.06049
Minimum	-0.086188	-0.085067	-0.07777	-0.064496	-0.08619	-0.0621
Sd	0.0192242	0.0238955	0.018222	0.0175088	0.017954	0.01741
Observation	2315	475	472	467	456	445

The data used to analyze the Monday effect in this paper is in time series. Therefore, it is important to check the stationary of data. The result will be invalid without stationarity. Firstly, the paper uses Augmented Dickey-Fuller test (ADF) method to test the presence of the unit root. The null hypothesis of the ADF test states that there is presence of the unit root, with the alternative hypothesis of no unit root in the data.

The results of Table 2 suggest that there is no unit root, because the P-values in the Russell 1000 index and the Gem composite index are zero, which means the null hypothesis (there is the unit root) needs to be rejected at the 1%, 5% and 10% significance levels, the returns in these two indices are stationary.

Table 2

The ADF Test of the Daily Return of the Russell 1000 Index & the Gem Composite İndex

Index	**test critical values**			**t-statistic**	**P-value**
	1% level	**5% level**	**10% level**		
Russell 1000	-2.56596	-1.94096	-1.616608	-15.2382	0.0000
Gem composite	-2.56596	-1.94096	-1.616608	-45.6884	0.0000

Secondly, the autocorrelation will be tested, there will be some disadvantages if autocorrelation exists. It will lead to the invalid result, overestimated goodness of fit, and high t-statistics. Moreover, the method that is used to check autocorrelation is the Ljung-box test. The formula is as follow:

$$\mathrm{Q(m)} = \mathrm{n(n+2)} + \sum_{i=i}^{m} \frac{\hat{p}_i}{n-i} \qquad (1)$$

Where n is observation, m is a selected random number, $\hat{p}_i$ is the autocorrelation coefficient of i-order lags. Under the condition that the original hypothesis holds, q (m) obeys the chi-square distribution with degree of freedom M.

Table 3 shows the autocorrelation test result with 23 lags, because there are 23 trading days at most during a month. There are two different situations in the two indices. For the Russell 1000 index, all the P-values are zero, and the null hypothesis (there is no autocorrelation) should be rejected that there is the presence of autocorrelation. But for the Gem composite index, the P-values are all higher than 0.01, therefore, there is no autocorrelation at the 1% significance level.

Table 3

The Ljung-Box Test of the Daily Return of the Russell 1000 Index & the Gem Composite Index

Lags	Russell 1000		Gem composite	
	Q-Stat	Prob	Q-Stat	Prob
1	60.312	0.0000	5.905	0.015
2	82.245	0.0000	7.0774	0.029
3	82.504	0.0000	7.2453	0.064
4	97.849	0.0000	7.3592	0.118
5	100.53	0.0000	8.3584	0.138
6	138.38	0.0000	8.4074	0.21
7	210.65	0.0000	10.383	0.168
8	261.36	0.0000	13.744	0.089
9	313.33	0.0000	13.774	0.131
10	316.09	0.0000	15.072	0.129
11	317.38	0.0000	17.892	0.084
12	322.48	0.0000	17.959	0.117
13	355.29	0.0000	18.01	0.157
14	370.42	0.0000	20.571	0.113
15	389.91	0.0000	25.543	0.043
16	406.71	0.0000	25.825	0.057
17	406.9	0.0000	27.086	0.057
18	410.55	0.0000	27.277	0.074
19	410.57	0.0000	27.303	0.098
20	418.3	0.0000	27.312	0.127
21	426.87	0.0000	27.433	0.157
22	436.82	0.0000	30.379	0.11
23	437.36	0.0000	30.393	0.138

After ensuring that the data is stationarity this paper uses returns of the daily closing price, the equation is below:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (2)$$

Where R_t is the current return, P_t is the current closing price, P_{t-1} is the closing price from the last trading day.

The dummy variable can just take values of 0 and 1, where the zero-value represents the absence of the item, and the one-value symbolizes the presence of the item. For investigating the Monday effect, the dummy variable is used to insert into models and denote the different trading days in the stock market. It is the same method as Mustafa (2008) and Lu and Gao (2016). In this

paper, d_2 denotes the presence or absence of the Tuesday, d_3 denotes the presence or absence of the Wednesday, and so on.

The Monday effect is that the returns on Monday are different from returns on other trading days. Thus, this paper uses the OLS regression that Arsad and Andrew Coutts (1997) and Addinpujoartanto (2019)still use this regression. And it specifies the OLS equation as below:

$$r_t = \mathrm{c} + \alpha_2 d_2 + \alpha_3 d_3 + \alpha_4 d_4 + \alpha_5 d_5 + \varepsilon_t \quad (3)$$

Where c is the intercept term that is the mean of the daily returns on Monday. d_i is the dummy variable which can be 2,3,4,5, these represent Tuesday, Wednesday, Thursday, and Friday respectively. When a trading day is on Tuesday, $d_2 = 1$, other dummy variables are zero, and so on.

Nonetheless, there are some assumptions of the OLS model, such as homoscedasticity. Not all data satisfy whole assumptions. When the assumptions are violated, Yuan and Gupta (2014) used the ARMA-GARCH model to continue their research. This paper also chooses the GARCH model (if the presence of the ARCH effect) or the ARMA-GARCH model (if the presence of autocorrelation and the ARCH effect) to investigate the calendar effect. the ARMA(p,q)-GARCH(1,1) is specified as below:

$$r_t = \mathrm{c} + arma(p,q) + \sum_{i=n}^{n} \alpha_i d_i + a_t \quad (4)$$

$$\sigma_t^2 = \gamma_1 + \beta_1 a_{t-1}^2 + \beta_2 \sigma_{t-1}^2 \quad (5)$$

Where p and q are the orders in the ARMA (p,q) model. a_t is the constant term. For testing the Monday effect, c is the intercept term that is the mean of the daily returns on Monday, the α_i and d_i can be 2,3,4,5 which are the same as equation (2). For equation (4), σ_t^2 is the conditional variance. γ_1 is the constant term, β_{i} is the coefficient.

4. Empirical Findings and Results

4.1. ARCH Effect Test

On the one hand, due to the returns of the Russell 1000 index, ARMA model should be considered in the mean equation. Therefore, the paper uses the ARCH test of the mean equation with ARMA (2,2), the P-value is zero that the null hypothesis (i.e. there is no ARCH effect) should be rejected, which means that there is the presence of the ARCH effect. On the other hand, it is

noticeable that the ARCH effect also exists in the Gem composite index. Because the P-values after testing the equation are zero, it is the same as the result of the Russell 1000 index.

Table 4

The ARCH Test Results of the Daily Return of the Russell 1000 Index & the Gem Composite Index

	Russell 1000	**Gem composite**
F-statistic	667.8644	815.1937
P-value	0.0000	0.0000

Due to the returns of the Gem composite index are stationary with no autocorrelation, data do not violate the assumptions of the OLS model. But the mean equations of the Russell 1000 index and the Gem composite index have the ARCH effect, therefore, the paper selects the GARCH(1,1) to examine the Monday effect in the Chinese stock market. Nonetheless, even if the mean equations of the Russell 1000 index show no unit root, there is still the existence of autocorrelation. Thus, the paper uses the ARMA(2,2)-GARCH(1,1) to research the Monday effect in the American stock market.

Previous studies find the calendar effect including the Monday effect from all over the world, such as Cross (1973), Mehdian and Perry (2001) and Worthington (2010) and so on. With the development of the stock market, there are researchers who find the calendar effect including the Monday effect disappeared in recent years, such as Perez (2018). In this paper, the results in table 5 show the same consequence that there is no Monday effect in the Russell 1000 index and the Gem composite index, because not all the divergence of the returns between the Monday and other trading days are significant. Nevertheless, even if there is no Monday effect, there is the presence of the calendar effect in the two stock markets. It is obvious that the differences of returns between Monday and Wednesday, Thursday, Friday are significant at the 10% significance level in the Chinese stock market. It denotes that there is the presence of anomaly in the Chinese stock market at the 10% significance level. Perhaps there is the existence of the Wednesday effect, Thursday effect or Friday effect. there is still the significant difference of returns between Monday and Friday at the 5% significance level in the American stock market, it is only possible to exist the Friday effect in the American stock market.

Table 5

The ARMA(2,2)-GARCH (1,1) Result of the Russell 1000 Index& GARCH (1,1) Result of the Gem Composite Index

	Russell 1000	**Gem composite**
Mean equation		
C	0.000497*	0.001621***
	(0.000277)*	(0.000612)***
TU	0.000192	0.000430
	(0.000453)	(0.000987)
W	0.000120	-0.001833*
	(0.000421)	(0.001045)*
TH	0.000275	-0.002679***
	(0.000423)	(0.001006)***
F	0.000962**	-0.001769*
	(0.000424)**	(0.001051)*
AR(1)	0.106958	
	(0.196727)	
AR(2)	0.759550***	
	(0.178816)***	
MA(1)	-0.160487	
	(0.204533)	
MA(2)	-0.771987***	
	(0.195114)***	
Variance equation		
C	0.000004***	0.00000554***
	(0.0000005)***	(8.81E-07)***
RESID(-1)^2	0.192190***	0.054294***
	(0.015310)***	(0.006283)***
GARCH(-1)	0.762582***	0.928885***
	(0.016085)***	(0.006985)***
Goodness of fit statistics		
AIC	-6.822724	-5.237871
ARCH-LM		
WGT_RESID^2(-1)	0.006120	-0.011697
	(0.020756)	(0.020797)

Notes: *, **, and *** denote the rejection of the null hypothesis at 10%, 5 and at 1% significance level. Values in parentheses are standard errors. Values above parentheses are coefficients.

Compared with two stock markets, the calendar effects are more likely to present in the Chinese stock market. It is possible that the Chinese speculators cause this situation as Kling and Gao (2005)' researcher, there are some Chinese speculators who often embezzled public money for private investment, and it was necessary to give money back before the weekends. Moreover, as is known to all, the American stock market was built in 1790, but the Chinese stock market was built in 1990. Thus, it is an enormous divergence in the development of the two stock markets.

After running the models, it is necessary to test the ARCH effect one more time via using the LM-ARCH test. From table 5, there is no significant coefficient that the null hypothesis (there is no ARCH test) should not be rejected at the 1%, 5% and 10% significance levels. And the result is that the ARCH effects in the two indices are eliminated.

5. Robustness Check

In order to ensure that the empirical results are credible, it is necessary to make the robustness tests. The wold economy highly influence from COVID-19 pandemic, especially China Xiong et al. (2020) find the damaging impact of the pandemic to Chinese firms. Therefore, in order to eliminate the potential bias, in the robustness analysis, the paper reestimate the model by eliminating the data periods after 2020, just the data in the period of 2012 to 2019 remaining. The observation is 1853 of the Russell 1000 index, the observation is also 1853 of the Gem composite index. For test robustness, the paper selects the OLS regression to test this, the results are as follow:

Table 6

The OLS Results of Daily Returns the Russell 1000, Gem Composite Index from 2012 to 2019

	Russell 1000	**Gem composite index**
Mean equation		
C	0.000117	0.001592
	(0.000417)	(0.001009)
TU	9.07E-05	0.000618
	(0.000591)	(0.00143)
W	0.000300	-0.000805
	(0.000593)	(0.001435)
TH	0.000712	-0.003422**
	(0.000596)	(0.001444)**

F	0.000679	-0.001079
	(0.000599)	(0.001451)
Goodness of fit statistics		
AIC	-6.790422	-5.013292

Notes. *, **, and *** denote the rejection of the null hypothesis at 10%, 5 and at 1% significance level. Values in parentheses are standard errors. Values above parentheses are coefficients.

It is obvious that there is no significant result in the Russell 1000 index at 1%, 5% and 10% significant level. Which means the null hypothesis (There is no Monday effect) should not be reject. There is no existence of the Monday effect in the Russell 1000 index. The result is the same with result through using data in the Russell1000 index from 2012 to 2021. Moreover, as for the consequence of the Gem composite index, the returns on Tuesday, Wednesday, Friday have no difference with returns on Monday, because all the P-value on these three days are more than 10%, it means that the null hypotheses should not be rejected. Even if the abnormal divergence between the returns on Thursday and the return on Monday, the consequence draw a conclusion that there is no Monday effect in the Chinese stock market (it is the same with the data used for the year 2012 through 2021. Because just the returns on one day are significant different from returns on Monday, it is no Monday effect. Nonetheless, due to this anomaly, it shows that the calendar effect still exists in the Chinese stock market. In summary, whether the sample selected from 2012 to 2021 or in the period of 2012 to 2019 or the change in estimation method from GARCH to OLS method did not matter and the result are still parallel, which states there is no Monday effect in the American and the Chinese stock markets. Thus, the results in this paper are robust.

6. Conclusion

The purpose of this paper is to test the presence of the Monday effect in the American and Chinese stock markets between 2012 and 2021 using the ARMA(2,2)-GARCH(1,1) model and the GARCH(1,1) model respectively. As a result, there is no Monday effect in the two stock markets which is similar with the findings of Xiao (2016) and Perez (2018) who find no Monday effect in the American and Chinese stock markets. Nonetheless, there is the presence of the calendar effect in the American and the Chinese stock markets, which means that the significant difference between returns on Monday and returns on Friday in the Russell 1000 index and the abnormal divergence from returns on Monday and returns on Wednesday, Thursday and Friday. One of he reasons why there is more likely to find the calendar effects in the Chinese stock market compared

to the American stock markets is that the presence of speculators in China are more than that in the United States, and the other one is that the development in America is more rapid than the development in China. The results remain robust with the alternative settings including changing estimation method to OLS regressions and omitting the potential bias from COVID-19 periods by limiting the estimation periods to 2012-2019 instead of 2021.

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