The Study of Month-of-the-Year Effect for Gaming Stocks

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Abstract. The study focused on the stocks of major six gambling enterprises in Macao and tested the period of samples by using GARCH (1,1) model, compared the monthly situations with Hong Kong stock market and United States stock market for discussing the existence of “Month-of-the-Year Effect” in those stocks. The empirical result showed that “Month-of-the-Year Effect” existed in the stock of Galaxy (00027, GXYEF), Melco (00200, MLCO) and Sands (01928, LVS). The “Month-of-the-Year Effect” existed only in the stock of Wynn (WYNN) and MGM (MGM) at United States stock market. However, the “Month-of-the-Year Effect” didn’t exist in the stock of SJM (00880, SJMHF).

1. Introduction

In the past, the research about the “Month-of-the-Year Effect” in China mostly focused on the major domestic stock markets or the major stock indices. It was rarely focused on the individual stock or the sectors of industry. Therefore, the research object for this study focuses on the six gaming stocks. This study observes their performance of each month in the Hong Kong stock market and the US stock market to determine the existence of “Month-of-the-Year Effect”.

2. Literature Review

The Month-of-the-Year Effect means the regular fluctuation of the average rate of return in a certain month. It was also called the “Monthly Effect”. Ariel (1987)[1] found that after excluding the data of January, the “Month Effect” still existed in the stock market. The effect existed not only in January. Jaffe & Westerfield (1989)[2] found that the Australia stock market was the only stock market which has a positive significance of “Month Effect”.

To discuss the existence of “Month-of-the-Year Effect” in the six gaming stocks, this study analyzed the six gaming stocks by using the CES Gaming Top 10 Index and NASDAQ US Benchmark Gambling Index as the reference indicators of industry and discussed this effect with GARCH (1,1) Model for studying the existence of “Month-of-the-Year Effect” in the six gaming stocks.

3. Research Methods

3.1. Data

In this study, the data of Hong Kong stock market retrieved from Yahoo! Hong Kong Finance (https://hk.finance.yahoo.com), and the data of the US stock market retrieved from Investing.com (https://www.investing.com). In addition, the data of CES Gaming Top 10 Index retrieved from the Bloomberg database. The sample period of the study is 3 June 2011 to 19 November 2018.
3.2. The Selection of Research Model

This study uses the closing price of the six gaming stocks after the dividend and the split adjustment of the stocks as the basis to calculate the average daily rate of return. The formula was shown as below:

\[ R_t = \frac{(P_t - P_{t-1})}{P_{t-1}} \]  \hspace{1cm} (1)

\( R_t \) refer to the daily average rate of return; \( P_t \) refer to the daily closing price of trading day \( t \); \( P_{t-1} \) refer to the daily closing price of trading day \( t-1 \). According to Jiang, Xei & Zhang (2008)[3] and Yang (2017)[4] were suggested that the GARCH (1,1) model was more suitable to solve problems for the residual super Kurtosis. The formula was shown as below:

\[
\begin{align*}
R_t &= \sum_{i=1}^{12} b_i D_{it} + e_t \\
h_t &= \alpha_0 + \sum_{i=1}^{p} \alpha_i e_{t-i} + \sum_{j=1}^{q} \beta_j h_{t-j} 
\end{align*}
\]  \hspace{1cm} (2)

\( R_t \) was the daily rate of return; \( b_i \) was the coefficient of the daily rate of return at the month of \( i \); \( D_{it} \) was the dummy variables of the daily average rate of return at the day of \( t \) in the month of \( i \), (\( i=1,2,3,4,\ldots,12 \)). If the daily rate of return for the day \( t \) which \( i \) was January, then \( D_{1t}=1 \), otherwise \( D_{1t}=0 \), so on and so forth. The residual mean equation was followed \( e_t \sim N(0, h_t) \), and the variance equation should be satisfied with the condition of \( \alpha_0>0, \alpha_i\geq0, \beta_j\geq0, \sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j < 1 \).

4. Empirical Analysis

This study used the Augmented Dickey-Fuller Unit Root to test the smooth of each time series. Next, this study used Ljung-Box Q statistic to test the autocorrelation. Subsequently, this study used ARCH-LM to test the existence of heteroscedastic in the residual of each time series. And then, GARCH(1,1) model with dummy variables was used to test the existence of “Month-of-the-Year Effect” in each time series.

4.1. Unit Root Test

In Hong Kong stock market, the ADF test for each time series were significant, the interception and time trend were not significant, it meant they were stationary time series without interception and time trend. In addition, the ADF test for each time series were significant in the US stock market, the interception and time trend were not significant, it meant they were stationary time series without interception and time trend.

4.2. Autocorrelation Test of Residuals

The empirical result shown that the residuals of mean equations for the stock of Galaxy (00027), SJM (00880), Wynn (01128), Sand (01928) and CES Gaming Top 10 Index in Hong Kong stock market had a significant autocorrelation. Secondly, the autocorrelation of the residual in mean equation for the stock of Melco (00200) after lag 2 had a significant autocorrelation. The residual of the mean equation for the stock of MGM (02282) after lag 1 also had a significant autocorrelation.

In addition, the residuals of mean equations for the stocks of Galaxy (GXYEF) and SJM (SJMHLF) in the US stock market had a significant autocorrelation. The residual of the mean equation for the stock of Melco (MLCO) after lag of 1 had a significant autocorrelation. The residuals of the mean equation for the stock of Wynn (WYNN), Sands (LVS) and NASDAQ US Benchmark Gambling index after the third lag
of 3 had a significant autocorrelation. The residual of mean equation for the stock of MGM (MGM) after lag of 5 and 17 had a significant autocorrection.

### 4.3. Heteroscedastic Test of Residuals

The stocks of Galaxy (00027), Melco (00200), Sands (01928) and MGM (02282) in Hong Kong stock market after lag of 3 had a significant ARCH effect. The stock of SJM (00880) and of Wynn (01128) after lag of 2 had a significant ARCH effect. The CES Gaming Top 10 Index after lag of 1 had a significant ARCH effect. In the US stock Market, the stock of Galaxy (GXYEF) and SJM (SJMHF) after lag of 1 had a significant ARCH effect. The stock of Wynn (WYNN) after lag of 2 had a significant ARCH effect. The stock of Melco (MLCO) after lag of 3 had a significant ARCH effect. The stock of MGM (MGM) after lag of 4 had a significant ARCH effect. The stock of Sands (LVS) and of NASDAQ US Benchmark Gambling index after lag of 5 had a significant ARCH effect.

### 4.4. The result for the Month-of-the-Year Effect

| Code   | Galaxy | Melco | SJM    | Wynn  | Sands | MGM   | CESGaming Top 10 Index |
|--------|--------|-------|--------|-------|-------|-------|------------------------|
| Month  | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient |
| JAN    | 0.004491** (0.025) | 0.002942 (0.1745) | 0.002185 (0.2101) | 0.001655 (0.3803) | 0.003975** (0.0142) | 0.001754 (0.3369) | 0.002725 (0.0783) |
| FEB    | 0.000696 (0.7167) | 0.001097 (0.6231) | 0.000256 (0.8791) | 0.00082 (0.714) | 0.000489 (0.7752) | 0.001 (0.6456) | 0.000241 (0.8808) |
| MAR    | 0.002613 (0.2031) | 0.002213 (0.3094) | -0.000908 (0.61) | 0.002577 (0.223) | 0.002508 (0.1528) | -0.00166 (0.4681) | 0.001175 (0.4697) |
| APR    | 0.000823 (0.6813) | 0.002985 (0.1939) | 0.002595 (0.1564) | 0.002907 (0.1803) | 0.002508 (0.1528) | -0.00166 (0.4681) | 0.001175 (0.4697) |
| MAY    | 0.000501 (0.8102) | 0.000161 (0.9455) | 0.0000712 (0.7113) | 0.0000504 (0.9826) | 0.000621 (0.7607) | 0.000787 (0.7167) | 0.000282 (0.8685) |
| JUN    | -0.00177 (0.3006) | -0.003342 (0.885) | -0.000678 (0.6717) | -0.001051 (0.535) | -0.000923 (0.52) | -0.001753 (0.2832) | -0.00234 (0.0734) |
| JUL    | 0.003854** (0.041) | 0.002192 (0.2541) | 0.001389 (0.4317) | 0.001822 (0.3123) | 0.003032** (0.0548) | 0.002605 (0.1415) | 0.002509** (0.0924) |
| AUG    | 0.0000511 (0.9773) | -0.0000224 (0.9914) | -0.000721 (0.6438) | -0.001829 (0.3116) | -0.00107 (0.5577) | -0.000215 (0.9147) | -0.000795 (0.6169) |
| SEP    | 0.001872 (0.3277) | 0.000191 (0.9303) | -0.00019 (0.9094) | 0.002636 (0.1896) | 0.002096 (0.1953) | 0.000748 (0.7184) | 0.001469 (0.3365) |
| OCT    | 0.002932 (0.156) | 0.00394 (0.0658) | 0.000162 (0.9357) | 0.002546 (0.2449) | 0.00154 (0.4101) | 0.002078 (0.3087) | 0.002256 (0.1658) |
| NOV    | 0.003221 (0.1651) | 0.001579 (0.502) | -0.000265 (0.8893) | 0.001406 (0.5345) | 0.002801 (0.1799) | 0.00238 (0.3209) | 0.001932 (0.305) |
| DEC    | 0.001106 (0.6061) | 0.000816 (0.6976) | 0.000133 (0.9361) | -0.001026 (0.6452) | -0.000569 (0.7723) | 0.000304 (0.8832) | -0.0000467 (0.9781) |
| Durbin-Watson | 1.86398 | 1.946554 | 1.852588 | 1.877123 | 1.890526 | 1.941718 | 1.801428 |

Note 1: *it is 10% level  **it is 5% level  ***it is 1% level.
Note 2: The value in brackets is the p-value of coefficient.
In Table 1, under the 5% significant level, the stock of Galaxy (00027) had a positive and significant “January effect” and “July effect”. Secondly, “January effect” existed in the stock of Sands (01928). Under the 10% significant level, the stock of Melco (00200) had a weak “June effect” and “October effect”. The stock of Sands (01928) had a weak “July effect”. Therefore, this study believed that the “Month-of-the-Year Effect” existed in the three gaming stocks mentioned above in Hong Kong stock market. However, the “Month-of-the-Year Effect” didn’t exist in the stock of SJM (00880), Wynn (01128), and MGM (02282). It inferred that there was no “Month-of-the-Year Effect” in these three gaming stocks in Hong Kong stock market.

Table 2. The Result of Month-of-the-Year Effect for Gaming Stocks.

| Code   | Galaxy | Melco | SJM | Wynn | Sands | MGM | NASDAQUS Benchmark Gambling |
|--------|--------|-------|-----|------|-------|-----|-----------------------------|
|        | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient |
| JAN    | 0.0051* (0.0167) | 0.003438 (0.0825) | 0.002212 (0.3711) | 0.00402* (0.0039) | 0.002852* (0.0039) | 0.002195 (0.1667) | 0.002513* (0.03) |
| FEB    | 0.000463 (0.8443) | -0.000192 (0.9295) | 0.001036 (0.7413) | 0.000481 (0.8254) | 0.001823 (0.3504) | 0.0000459 (0.9755) | 0.000883* (0.5466) |
| MAR    | 0.000206 (0.3548) | 0.002936 (0.177) | -0.002325 (0.4576) | 0.00301 (0.1405) | 0.002109 (0.2207) | 0.002096 (0.1336) | 0.001743 (0.1924) |
| APR    | 0.000707 (0.7553) | 0.002575 (0.2202) | 0.002819 (0.3506) | 0.001695 (0.2237) | -0.000628 (0.614) | 0.000815 (0.6063) | -0.000159 (0.9887) |
| MAY    | 0.000656 (0.7472) | -0.00119 (0.5846) | 0.00236 (0.3363) | 0.0000337 (0.9875) | 0.000377 (0.8383) | 0.000348 (0.8628) | 0.000543 (0.7164) |
| JUN    | -0.002161 (0.2383) | -0.001017 (0.5279) | -0.002657 (0.2816) | -0.001784 (0.22) | -0.000271 (0.8221) | -0.00107 (0.4332) | -0.000609 (0.5458) |
| JUL    | 0.0003475 (0.1137) | -0.000337 (0.8703) | 0.002044 (0.4856) | 0.000529 (0.7397) | -0.0000793 (0.9584) | 0.002082 (0.2438) | 0.000758 (0.5526) |
| AUG    | -0.000202 (0.9136) | 0.000275 (0.8918) | -0.001979 (0.4112) | 0.000334 (0.8449) | -0.001143 (0.4305) | -0.001059 (0.4901) | -0.000703 (0.5478) |
| SEP    | 0.002493 (0.2483) | 0.002879 (0.1894) | -0.002627 (0.3086) | 0.002828* (0.607) | -0.001936 (0.1763) | 0.001383 (0.4036) | 0.001535 (0.2176) |
| OCT    | 0.003531* (0.0736) | 0.0031* (0.0732) | 0.003118 (0.255) | 0.002364* (0.0607) | 0.001535 (0.2339) | 0.000692 (0.9606) | 0.000832 (0.4572) |
| NOV    | 0.003451 (0.1811) | 0.001421 (0.482) | 0.000023 (0.9517) | 0.000725 (0.9662) | 0.001752 (0.2362) | 0.00141 (0.4594) | 0.001689 (0.2028) |
| DEC    | 0.001427 (0.5282) | 0.001276 (0.5652) | -0.001562 (0.5395) | 0.000764 (0.6921) | -0.000315 (0.8236) | 0.002422* (0.0747) | -0.000391 (0.969) |
| Durbin-Watson | 2.106143 | 1.928847 | 2.254188 | 1.928588 | 1.947784 | 1.956498 | 1.942703 |

Note 1: *it is 10% level, **it is 5% level, ***it is 1% level.
Note 2: The value in brackets is the p-value of coefficient.

In Table 2, under the 1% significant level, the daily average rate of return for Wynn (WYNN) in January was the highest for whole year, the rate of return was significant and positive, it meant that the stock had a very significant “January effect”. Secondly, under the 5% significant level, the daily average
rate of return for the stocks of Galaxy (GXYEF) and Sands (LVS) in January both reached the highest of the whole year, the rate of return of both stocks were significant and positive, it meant that “January effect” existed in all of the mentioned stocks. Besides, under the 10% significant level, the daily average rate of return for the stock of Melco (MLCO) in January was the highest for the whole year, it was significantly and positive, it meant that the stock had a weak of “January effect”. Except for January, the daily average rate of return for the stock of Galaxy (GXYEF) and of Melco (MLCO) in October were slightly higher than the other months, it meant that these two gaming stocks had a weak of “October effect”. The stock of Wynn (WYNN) had a weak of “Month-of-the-Year Effect” in September and October. The daily average rate of return of MGM (MGM) in December reached the highest in the whole year, it was significantly and positive, it meant that the stock had a weak “December effect”. Except SJM (SJMHF), the “Month-of-the-Year-Effect” existed in the other gaming stocks in the US stock market.

Table 3. The Result for Comparing the Month-of-the-Year Effect between HK Stock Market and US Stock Market.

| Company of gambling | Trading Market | Code | JAN Coefficient | JAN P-value | JUN Coefficient | JUN P-value | JUL Coefficient | JUL P-value | SEP Coefficient | SEP P-value | OCT Coefficient | OCT P-value | DEC Coefficient | DEC P-value |
|---------------------|----------------|------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|
| Galaxy              | HK Stock Market| 00027| 0.004491**      | (0.025)     | -0.00177        | (0.3006)    | 0.003854*       | (0.041)    | 0.001872        | (0.3277)    | 0.002932        | (0.156)     | 0.001106        | (0.6061)    |
|                     | US Stock Market| GXYEF| 0.0051**        | (0.0167)    | -0.002161       | (0.2383)    | 0.003475        | (0.1137)   | 0.002493        | (0.2483)    | 0.003531        | (0.0736)    | 0.001427        | (0.5282)    |
| Melco               | HK Stock Market| 00200| 0.002942        | (0.1745)    | -0.003432*      | (0.085)     | -0.0000337      | (0.8703)   | 0.002879        | (0.1894)    | 0.0031          | (0.0732)    | 0.000127        | (0.5652)    |
|                     | US Stock Market| MLCO| 0.003438        | (0.0825)    | -0.001017       | (0.5279)    | -0.000337       | (0.8703)   | 0.002879        | (0.1894)    | 0.0031          | (0.0732)    | 0.000127        | (0.5652)    |
| SJM                 | HK Stock Market| 00880| 0.002185        | (0.2101)    | -0.000678       | (0.6717)    | 0.001389        | (0.4317)   | -0.00019        | (0.9094)    | 0.000162        | (0.9357)    | 0.000133        | (0.9361)    |
|                     | US Stock Market| SJMHF| 0.002212        | (0.3711)    | -0.002657       | (0.2816)    | 0.002044        | (0.4856)   | -0.002627       | (0.3086)    | 0.003118        | (0.255)     | -0.001562       | (0.5395)    |
| Wynn                | HK Stock Market| 01128| 0.001655        | (0.3803)    | -0.001051       | (0.535)     | 0.001822        | (0.3123)   | 0.002636        | (0.1896)    | 0.0002546       | (0.2449)    | 0.0001026       | (0.6452)    |
|                     | US Stock Market| WYNN| 0.00402***      | (0.0039)    | -0.001784       | (0.22)      | 0.000529        | (0.7397)   | 0.002828*       | (0.0668)    | 0.002364*       | (0.0607)    | 0.000764        | (0.6921)    |
| Sands               | HK Stock Market| 01928| 0.003975**      | (0.0142)    | -0.000923       | (0.52)      | 0.003032*       | (0.0548)   | 0.002096        | (0.1953)    | 0.00154         | (0.4101)    | -0.000569       | (0.7723)    |
|                     | US Stock Market| LVS | 0.002852        | (0.0318)    | -0.000271       | (0.8221)    | -0.0000793      | (0.9584)   | 0.000196        | (0.1763)    | 0.001535        | (0.2339)    | -0.000315       | (0.8236)    |
| MGM                 | HK Stock Market| 02282| 0.001754        | (0.3369)    | -0.001753       | (0.2832)    | 0.002605        | (0.1415)   | 0.000748        | (0.7184)    | 0.0002078       | (0.3087)    | 0.000304        | (0.8832)    |
|                     | US Stock Market| MGM | 0.002195        | (0.1667)    | -0.00107        | (0.4332)    | 0.002082        | (0.2438)   | 0.001383        | (0.4036)    | 0.0000692       | (0.9606)    | 0.002422*       | (0.0747)    |

Note 1: *it is 10% level, **it is 5% level, ***it is 1% level.
Note 2: The value in brackets is the p-value of coefficient.

Due to the performance of “Month-of-the-Year Effect” for the six gaming stocks were inconsistent in Hong Kong stock market and the US stock market. This study compared the situation of the six gaming
stocks with two trading markets and tried to ensure the “Month-of-the-Year Effect” didn’t exist in the six gaming stocks.

In Table 3, a significant “Month-of-the-Year Effect” existed in the stock of Galaxy (00027, GXYEF), Melco (00200, MLCO) and Sands (01928, LVS) in the two trading markets. The coefficient in each month for the stock of SJM (00880, SJMHF) in the two trading markets were not significant, it meant that the “Month-of-the-Year Effect” didn’t exist in the stock during the sample period. For the stock of Wynn (WYNN) and MGM (MGM), the “Month-of-the-Year Effect” only existed in the US stock market.

4.5. The Reason for the Month-of-the-Year Effect

The study revealed the main reasons caused the “Month-of-the-Year Effect” is the location of the two trading markets. Rozeff & Kinney (1976)[5] mentioned that “location” was one of the reasons affecting the existence of the “Month-of-the-Year Effect”. Secondly, Ariel (1987)[1] mentioned that the interception of the sample period affects the existence of the “Month-of-the-Year Effect”. Besides, according to Rozeff & Kinney (1976)[5], it also proved that the differences in the tax system is also one of the main reasons to affect the “Month-of-the-Year Effect”. Finally, there were various financial assets in different trading markets. The differences of their liquidity were one of the main reasons affecting the “Month-of-the-Year Effect”, which a conclusion has been mentioned in Chen & He (2004)[6].

5. Conclusion

This study analyzes the existence of “Month-of-the-Year Effect” in the stocks of six gambling enterprises in Macao by using the GARCH (1,1) model. The results shown that the stocks of Galaxy (00027, GXYEF) and Sands (01928, LVS) have a significant and positive “January effect” in both of the Hong Kong stock market and the US stock market during the sample period. On the other hand, there is a weak of “October effect” in the stock of Melco (00200, MLCO), the result shown that the above three gaming stocks have a “Month-of-the-Year Effect”. In addition, the “Month-of-the-Year Effect” only exists in the stocks of Wynn (WYNN) and MGM (MGM) in the US stock market. There is no “Month-of-the-Year Effect” in the stock of SJM (00880, SJMHF) in neither Hong Kong stock market nor the US stock market.

This study believes that “Monthly Effect” performs differently to the two trading markets. The main reason is the different locations of the two trading markets. Secondly, there is a difference between the Hong Kong tax system and the US tax system. Besides, the intercept sample period has also affected the existence of the "Month-of-the-Year Effect”. Finally, the difference in liquidity of financial assets traded in two different trading markets were also affected the existence of the “Month-of-the-Year Effect”.

Another stock abnormal phenomena and the interaction which may exist in the stock market is not considered in this study. At the same time, it is proposed that the investors should consider the other existing factors which caused stock abnormal phenomena except the “Month-of-the-Year Effect” when they make any investment decision.

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