Turn-Of-The-Year Effect in Asia Pacific stock markets: New Evidence

Nhan HUYNH 1,*

1 Postgraduate Student, Department of Accounting, Economics and Finance, Swinburne Business School, Swinburne University of Technology, Melbourne, Australia.

*Corresponding Author: Unit 2, 38 Park Street, Hawthorn, VIC, 3122, Australia, Tel: +61 422 222 412, Email: huynhthanhnhan.buh@gmail.com

Abstract

This paper examines a well-known seasonal anomaly - the turn-of-the-year (TOY) effect in fifteen Asia Pacific stock indices by using an updated dataset and forward-looking methods. The analysis utilizes daily dataset that spans from January 2000 to December 2018. Applying the Ordinary Least Square (OLS) regression and EGARCH approach, the results of this paper suggest that the TOY effect becomes detectable again after the GFC in developed stock markets with tax year not ending in December. Oppositely, the magnitude of this anomaly has diminished in the emerging financial markets after the GFC, which is consistent with the EMH. The evidence of the leverage effect in the unconditional volatility is proposed that volatility in negative shocks is considerably higher than that of positive shocks across examined stock indices. This phenomenon is more conspicuous in mature stock indices compared to emerging indices. The positive connection between the leverage effect and stock market volatility is propositioned as diminishing magnitude of this effect during the stable market condition after the GFC. Our findings lend reinforcement to the conclusion that some Asia Pacific stock markets satisfy the weak form of the EMH.

Key words: Turn-of-the-year effect, Asia Pacific, stock return, seasonal anomaly.

JEL classifications: G11, G12, G14.
1. Introduction

In modern finance theory, one of the keystones is the Efficient Market Hypothesis (EMH). The strongest form of EMH indicates that stock prices fully reflect all relevant information in an impartial manner (Fama, 1970). In an efficient market, it is very difficult for investors to obtain abnormal returns consistently. However, stock market anomalies are one of the violations of the EMH. The presence of stock market anomalies indicates that investors can obtain abnormal profit from predictable patterns in stock returns (Hoang, Phan & Ta, 2020). Stock market calendar anomalies or seasonal anomalies represent the occasions that abnormal returns emerge from certain periods in a calendar year (Officer, 1975). The turn-of-the-year (TOY) effect or January effect exposes that stock return in the first month of the tax year is relatively higher than other months of the year (Rozeff & Kinney, 1976). In other words, this phenomenon indicates a systematic predictable pattern of stock returns. This pattern contradicts EMH that future stock price movements are unpredictable (Fama, 1970). Exclusively, this anomaly has been investigated by a large number of theoretical and empirical papers around the globe from the 1980s, which encourages investors to exploit the abnormal returns from the mispricing prospects. As a consequence, the existence of this anomaly on stock return is inconsistent with traditional asset pricing models as patterns of stock return could not be rationalised by the Efficient Market Hypothesis (Fama, 1970) and the Capital Asset Pricing Model (CAPM).

Wachtel (1942) is considered as the first scholar that acknowledged the evidence of the January effect. Another early example of this anomaly is Rozeff and Kinney (1976), whereby stock returns in January are higher than other months of the year. Subsequently, a large number of studies has been composed to support the presence of the TOY effect in consequence of its inconsistency with the EMH. The findings of this anomaly mostly concentrate in the developed stock markets, especially in the U.S market such as Tinic and West (1984), De Bondt and Thaler (1987), and Haugen and Jorion (1996). Similarly, this effect is also detected in other stock markets such as Australia (Brown, Keim, Kleidon & Marsh, 1983), Japan (Kato & Schallheim, 1985), Australia (Zhong, Limkriangkrai & Gray, 2014), and major industrialised markets (Gultekin & Gultekin, 1983).

Although there are numerous empirical evidence for the existence of the TOY effect, recent papers suggest that the significance of this anomaly has deteriorated over time. This anomaly is declining or disappearing in developed stock markets since the end of the 1980s (Gu, 2003) and the Japanese market (Li & Gong, 2015). The reasons for the deterioration are knowledge of investors, technology enhancement, cost efficiency, and improvement over time of stock market efficiency (Wong, Agarwal, & Wong, 2006). Further, Ariss, Rezvanian and Mehdian (2011) and Gu (2015) provide international evidence that the January effect has lost its momentum during their examined periods. Some papers provide evidence that the January effect no longer exists in the U.S market but it remains pervasive in emerging markets, as these markets are comparatively less efficient than developed markets (Wong et al., 2006).

This study is to examine the TOY effect in 15 Asia Pacific stock indices with the influences of the Global Financial Crisis (GFC) in 2007-2008 by comparing developed and emerging markets. This paper contributes to the current literature by providing updating evidence for the existence of TOY anomaly in Asia Pacific stock markets. Therefore, this study notes significant implications for fund managers and investors to take into consideration this anomaly to create a higher rate of abnormal profits. Another contribution is for researchers, this study sheds light on the current trend of seasonality effect in stock returns. This investigation advances our understanding of stock market anomalies and asset pricing theories.
The structure of this study is as follows. Section 2 provides the data descriptions and methodology for further analyses. The empirical analyses are reported in Section 3. Finally, the last section presents a brief conclusion.

2. Data and Methodology

To extend the blooming finance literature in seasonal anomaly, this paper examines the TOY effect in 15 stock market indices in the Asia Pacific, including 12 national and 4 regional indices. The detail of examined stock indices is reported in table 1.

Table 1: Selected Asia Pacific stock indices

| Category          | Region          | Country  | Stock exchanges                 | Code  | Tax-year end |
|-------------------|-----------------|----------|---------------------------------|-------|--------------|
| Developed Markets | East Asia       | Japan    | Tokyo Stock Exchange            | JPX   | December     |
|                   | Hong Kong       | Hong Kong| Hong Kong Stock Exchange        | HKEX  | March        |
| Oceania           | New Zealand     | New Zealand| New Zealand Stock Exchange     | NZX   | March        |
|                   | Australia       | Australia| Australian Securities Exchange  | ASX   | June         |
| Southeast Asia    | Singapore       | Singapore| Singapore Exchange              | SGX   | December     |
| Emerging Markets  | South Asia      | India    | National Stock Exchange of India| NSE   | December     |
|                   | Southeast Asia  | Malaysia | Bursa Malaysia                  | FKLCI | December     |
|                   | Philippines     | Philippines| Philippine Stock Exchange      | PSEi  | December     |
|                   | Thailand        | Thailand | Stock Exchange of Thailand      | SET   | December     |
| East Asia         | Taiwan          | Taiwan   | Taiwan Stock Exchange           | TWSE  | December     |
|                   | South Korea     | South Korea| Korea Exchange                 | KOSPI | December     |
| Regional Indices  | MSCI Pacific Small Cap Index | DMSmall | December                       |
|                   | MSCI Emerging Markets Asia Small Cap Index | EMSmall | December                       |
|                   | MSCI Asia Pacific Index | DMLarge | December                       |
|                   | MSCI Emerging Markets Asia Index | EMLarge | December                       |

Note: This table describes the categorised groups for 15 examined stock market indices according to the classifications of Morgan Stanley Capital International (MSCI). The selected countries are categorized into two groups developed markets and emerging markets. The regional indices are grouped by the market capitalization and economic development levels. The table also reports the stock exchanges, market indices, and the tax-year end for each selected market.

According to Morgan Stanley Capital International (MSCI), twelve countries are categorized into two groups of five developed markets and six emerging markets. The regional indices also include two large cap and two small cap indices, which are also categorised into two groups of emerging and developed markets. We employ the regional indices to comprehensively capture the presence of the TOY effect as these indices incorporate the stocks of large firms listed on the country's largest stock exchanges and reflect the overall investor sentiment of diverse states of the economy. The daily data is obtained from DataStream and MSCI database during the period January 2000 to December 2018. In the selected markets, there are three countries with tax year not ending in December including Australia with a June tax year-end, Hong Kong and New Zealand both with a March financial year-end. We consider the tax-year end period for the regional indices as of December.

The seasonal anomalies should be examined during different periods as anomalous returns may perform inversely depending on the stock market condition (Patel, 2016). Hence, we divide the sample into two sub-periods by considering the influences of the GFC 2007-2008. The prevalence of the TOY
effect is re-examined during two sub-periods, (1) Pre-crisis and crisis period from January 2000 to December 2008 and (2) the post-crisis period from January 2009 to December 2018.

To examine the TOY effect on value-weighted index returns, this study will construct two methods, including Ordinary Least Squares (OLS) regression and Exponential Generalized Autoregressive Conditional Heteroskedastic – EGARCH. The EGARCH model is firstly developed by Nelson (1990) and then extended by Nelson and Cao (1992) and McAleer and Hafner (2014). This model also captures a stylized fact of volatility clustering in financial time series as it can empirically capture the circumstance that negative shocks at time \( t - 1 \) have more significant impacts on the variance at time \( t \) than the positive shocks. The mean equation for the OLS and EGARCH is as follow for

\[
R_t = \alpha_1 + \beta_1 D_{FM} + \varepsilon_t
\]

Where, \( R_t \) is the monthly buy-and-hold returns of all stock market indices. The \( \alpha_1 \) represents the coefficient of the monthly returns except for the first month of the tax year. \( D_{FM} \) is the dummy variable for month i with the estimated coefficient \( \beta_1 \), which is the first month of the tax year. The dummy variable equal to 1 for returns of the first month of the tax year and 0 for the returns of the other eleven months. The error term of the regression model is taken by \( \varepsilon_t \). The variance equation of the EGARCH model is constructed as follow:

\[
\sigma_t^2 = \omega + \alpha_1 \ln(\sigma_{t-1}^2) + \delta \frac{\varepsilon_{t-1}^2}{\sigma_{t-1}} + \beta \frac{|\varepsilon_{t-1}|}{\sigma_{t-1}} + \theta * D_{FM}
\]

The intercept and error term are \( \omega \) and the \( \varepsilon_t \sim N(0, \sigma_t^2) \), respectively. \( D_{FM} \) is the dummy variable for month i with the estimated coefficient \( \beta_1 \), which is the first month of the tax year. The spill over effect or the association between preceding and current variance in absolute value is captured by the ARCH term (\( \alpha_1 \)). The asymmetry or leverage effect is captured by the leverage term (\( \delta \)). The leverage effect is identified if \( \delta \) is negative when the negative shocks are followed by higher volatility. This indicates that the negative shocks (bad news) have more impact on volatility than positive shocks (good news) of the same size (Chang & McAleer, 2017). The asymmetry is the leverage effect as the risks from growing leverage embrace the negative shocks (Tsay, 2005). The asymmetry is described when the impacts of positive and negative shocks on volatility at the same magnitude (McAleer & Hafner, 2014; Chang & McAleer, 2017; Caporin & Costola, 2019). The GARCH term (\( \beta \)) indicates the perseverance of the past volatility that can explain current volatility.

3. Results and Empirical Analysis

3.1 Descriptive Statistics

For five developed markets, the average returns in the first month of the tax year are significantly higher than other months in Australian, Hong Kong, Japan, and New Zealand markets. This disposition also presents in Taiwan, Thailand, Philippines, South Korea, and four regional stock indices. This inclination is also related to the TOY effect those in stock markets. For the other stock indices, the average return in January is negative and relatively lower than other months, which signifies the absence of the January anomaly. The results of the Unit root test (The Augmented Dickey-Fuller and Phillips-Perron Tests) suggest that data series are stationary (p-value <0.01), which means that variables follow a random
walk. Therefore, the data series are appropriate for further empirical time-series analyses in the succeeding section.

Table 2: Descriptive Statistics

| Stock index   | Mean | S.D | Dickey-Fuller test | Phillips-Perron test |
|---------------|------|-----|--------------------|----------------------|
|               | FM   | Other months | FM   | Other months | |
| Australia     | 0.014 | 0.007 | 0.038 | 0.036 | -5.03** | -12.79** |
| Hong Kong     | 0.028 | 0.005 | 0.052 | 0.060 | -5.77** | -13.54** |
| Japan         | -0.013 | 0.004 | 0.048 | 0.052 | -5.48** | -13.19** |
| New Zealand   | 0.028 | 0.007 | 0.039 | 0.054 | -4.48** | -14.03** |
| Singapore     | -0.001 | 0.006 | 0.069 | 0.059 | -5.26** | -13.45** |
| Malaysia      | 0.013 | 0.008 | 0.074 | 0.085 | -5.13** | -11.36** |
| Taiwan        | 0.028 | 0.002 | 0.087 | 0.073 | -5.70** | -14.23** |
| India         | 0.006 | 0.017 | 0.073 | 0.077 | -5.61** | -12.38** |
| Thailand      | 0.028 | 0.010 | 0.090 | 0.079 | -6.28** | -13.81** |
| Philippines   | 0.022 | -0.027 | 0.072 | 0.204 | -3.39** | -4.18** |
| South Korea   | 0.017 | -0.030 | 0.076 | 0.207 | -3.95** | -4.67** |

| Stock index   | Mean | S.D | Dickey-Fuller test | Phillips-Perron test |
|---------------|------|-----|--------------------|----------------------|
|               | FM   | Other months | FM   | Other months | |
| DMSmall       | 0.005 | 0.004 | 0.049 | 0.049 | -13.67** | -13.75** |
| EMSmall       | 0.006 | 0.004 | 0.069 | 0.068 | -11.80** | -12.02** |
| DMLarge       | 0.006 | 0.005 | 0.065 | 0.065 | -12.94** | -13.09** |
| EMLarge       | 0.002 | 0.001 | 0.046 | 0.046 | -13.09** | -13.18** |

Note: The FM is the average buy-and-hold return in the first month of the tax year, and the average return of other eleven months is Other months. The t-statistics indicate the results of the Unit root test (The Augmented Dickey-Fuller and Phillips-Perron Tests) for the monthly index returns. *, ** are statistically significant at 5%, and 1% level, respectively.

3.2 TOY effect in developed stock markets

Table 3 presents the results from OLS and EGARCH models for the TOY effect in developed markets. The results from the two models are relatively consistent with each other for all five markets for the full sample (Panel A). In particular, the April return coefficients in Hong Kong (t = 1.71) and New Zealand (t = 1.79) markets from OLS are statistically significant at the 10% level. However, the coefficients are statistically insignificant in EGARCH for these two markets, indicating an inclination of a weak TOY effect. For other market indices, returns in the first month of the tax year are not considerably greater than other monthly returns. Therefore, it is sufficient to conclude that the TOY effect is undetectable in the Australian, Japanese, and Singaporean market stock markets.

Separating the sample into two sub-periods by considering the impacts of the GFC 2007-2008, we re-examine the visibility of the TOY effect in five developed markets. For the pre-crisis and crisis period (2000 – 2008) in Panel B of Table 3 the TOY effect is invisible from both OLS and EGARCH models as return coefficients in the first month of the tax year are statistically insignificant. Interestingly, the TOY anomaly re-appears in some developed markets after the GFC as reported results in Panel C of Table 3. For the Australian market, the coefficients on the July return are considerably greater than other month coefficients in both employed models. Therefore, the conclusion of July effect in the Australian stock market can be drawn. The outcome in Hong Kong stock index is similar to what is obtained in the full sample analysis. The April return coefficient is only statistically insignificant in OLS model; therefore, an inclination of weak TOY effect becomes visible again after the GFC. Having the same tax
year period as Hong Kong market, the April effect is also present in the New Zealand market index. From the OLS and EGARCH regressions, the April return is considerably greater than the returns of other months at 10% significant level. This evidence lends support to the existent of the TOY effect in the New Zealand stock market after the GFC.

**Table 3**: Results for the TOY effect of five developed markets (2000-2018)

| Stock market | Australia | Hong Kong | Japan | New Zealand | Singapore |
|--------------|-----------|-----------|-------|-------------|-----------|
|              | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH |
| Mean equation |          |          |      |          |      |        |      |          |      |        |
| $\alpha_1$ (TOY) | 0.006** | 0.007*** | 0.004 | 0.006 | 0.003 | 0.002 | 0.006 | 0.009* | 0.006 | 0.009*** |
| $\beta_1$ (TOY) | 0.008 | 0.006 | 0.024* | 0.024 | -0.016 | -0.015 | 0.022* | 0.015 | -0.007 | 0.000 |
| Variance equation |        |          |      |          |      |        |      |          |      |        |
| $\omega$ | -1.137** | -0.799** | -8.815** | -0.542*** | -0.753*** |
| ARCH - $\alpha_1$ | 0.195* | 0.117 | 0.199 | 0.209*** | 0.239*** |
| Leverage - $\delta$ | -0.131* | -0.125** | 0.000 | -0.063 | -0.153* |
| GARCH - $\beta$ | 0.855*** | 0.878*** | -0.458 | 0.942*** | 0.905*** |
| $D_{FM}$ | 0.0093 | 0.0489 | -0.2305 | 0.2651 | -0.0305 |
| $R^2$ | 0.003 | 0.002 | 0.002 | 0.012 | 0.001 | 0.007 | 0.002 | 0.010 | 0.002 | 0.004 |

| Stock market | Australia | Hong Kong | Japan | New Zealand | Singapore |
|--------------|-----------|-----------|-------|-------------|-----------|
|              | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH |
| Mean equation |          |          |      |          |      |        |      |          |      |        |
| $\alpha_1$ (TOY) | 0.007* | 0.0123*** | 0.001 | 0.004 | -0.001 | 0.000 | 0.003 | 0.012*** | 0.003 | 0.013** |
| $\beta_1$ (TOY) | -0.016 | -0.013 | 0.015 | 0.009 | -0.019 | -0.024* | 0.023 | 0.014 | -0.008 | 0.006 |
| Variance equation |        |          |      |          |      |        |      |          |      |        |
| $\omega$ | -1.826*** | -2.601 | -2.514 | -0.544*** | -1.266*** |
| ARCH - $\alpha_1$ | 0.240 | -0.112 | 0.375 | -0.551*** | 0.070 |
| Leverage - $\delta$ | -0.309*** | -0.257* | 0.007 | -0.247*** | -0.336*** |
| GARCH - $\beta$ | 0.756*** | 0.512 | 0.623* | 0.084*** | 0.789*** |
| $D_{FM}$ | -0.378 | -0.783 | -0.743 | 0.199 | -0.066 |
| $R^2$ | 0.014 | 0.009 | 0.005 | 0.002 | 0.010 | 0.010 | 0.007 | 0.001 | 0.029 |

| Stock market | Australia | Hong Kong | Japan | New Zealand | Singapore |
|--------------|-----------|-----------|-------|-------------|-----------|
|              | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH |
| Mean equation |          |          |      |          |      |        |      |          |      |        |
| $\alpha_1$ (TOY) | 0.005 | 0.006** | 0.008 | 0.003 | 0.007 | 0.009* | 0.008** | 0.009*** | 0.009* | 0.003 |
| $\beta_1$ (TOY) | 0.029** | 0.029*** | 0.032* | 0.020 | -0.014 | -0.019 | 0.021* | 0.020* | -0.006 | -0.005 |
| Variance equation |        |          |      |          |      |        |      |          |      |        |
| $\omega$ | -0.122 | -0.074 | -11.61*** | -11.780*** | -0.282*** |
| ARCH - $\alpha_1$ | -0.184* | -0.143* | 0.382* | -0.188* | -0.206* |
| Leverage - $\delta$ | 0.024 | -0.122** | 0.203* | 0.071 | -0.108* |
| GARCH - $\beta$ | 0.963*** | 0.982*** | -0.940*** | -0.784*** | 0.946*** |
| $D_{FM}$ | 0.158 | 1.004*** | 0.108 | -0.511 | 1.165*** |
| $R^2$ | 0.054 | 0.053 | 0.026 | 0.011 | 0.006 | 0.004 | 0.027 | 0.027 | 0.001 | 0.014 |

Note: This table exhibits the results from the OLS regression and EGARCH model for the TOY effect in five developed markets in full sample (Panel A) and two sub-periods, January 2000 to December 2008 (Panel B) and January 2009 to December 2018 (Panel C). The $\beta_1$ represents the coefficient of return, while $\alpha_1$ is the coefficient of average returns of other months. The values denote the estimates of the coefficients for each monthly return. *, **, *** are statistically significant at 10%, 5%, and 1% level, respectively.
Using the EGARCH model, we also consider the asymmetry and leverage effect on the association between stock return shocks and previous shocks to volatility (Giovanis, 2009). As seen in Panel A of Table 3, the coefficient ($\delta$) in the EGARCH variance equation indicates the leverage effect is statistically significant for Australian, Hong Kong, and Singaporean stock indices. The New Zealand index denotes a negative sign, but is insignificant, while a positive coefficient ($\delta$) is reported for the Japanese index. These findings are still consistent when we regress on the first sub-period in Panel B. However, the leverage effect is also testified for the New Zealand index at 1% significant level. Further, the leverage effect evaporates in Australian, Japanese, and New Zealand markets when we consider the second sub-period.

### 3.3 TOY effect in emerging stock markets

Table 4 reports the results of the TOY effect on emerging market indices. Overall, our findings confirm the absence of the January effect in the six emerging stock markets during the examined period (Panel A), except the Taiwan stock market. Consistent with results in Table 2, the January return coefficients are statistically insignificant ($p$-value > 0.10) compared to other monthly returns in two applied models. For the Taiwan stock index, the January return coefficient from OLS is statistically significant at the 10% level. However, the coefficients are statistically insignificant in EGARCH, indicating a weak form of TOY anomaly.

Panel B in Table 4 reports the results for the period before and during the GFC (January 2000 to December 2008). The January anomaly is detectable in four out of six examined emerging markets, including Taiwan, Thailand, South Korea, and Philippines. From both models, the January return in Taiwan market is significantly higher than the returns of other months. This result supports the presence of the TOY effect in the Taiwan stock market before and during GFC. The January return coefficients in Thailand, South Korea, and the Philippines stock indices are statistically significant at 5% significance level for the EGARCH model only. Although the January returns in these three markets were not significantly higher than other months according to OLS model, the TOY coefficients ($\beta_1$) are both positive and greater than the regression model's intercept. In other words, the TOY anomaly is visible when considering the leverage effect (volatility clustering) in the EGARCH model. These results prove the existent of the TOY effect in Taiwan, Thailand, South Korean, and the Philippines, but not in Malaysian and Indian stock markets before and during the 2007-2009 financial turmoil. The results of the TOY anomaly in the second sub-period are reported in Panel C. The January return coefficients of OLS and EGARCH are reasonably consistent. The January returns are not ranked better in performance compared to other eleven months due to its statistically insignificant coefficients. Hence, the January effect is undetectable in all emerging stock indices during the period after the GFC.

Considering the asymmetry and leverage effect in emerging stock markets by using EGARCH model in Table 4, the leverage effect is captured in Malaysia, Taiwan, South Korea, and Philippines stock markets. The negative and insignificant coefficients ($\delta$) are also recorded for Indian and Thailand indices. Interestingly, the leverage effect is invisible in the Taiwan market and becomes significant in Indian market when we examine the first sub-period. After the GFC, the leverage effect is undetectable in all six examined emerging stock markets.
Table 4.: Results for the TOY effect of six emerging markets (2000-2018)

| Stock market | Malaysia | Taiwan | India | Thailand | South Korea | Philippines |
|--------------|----------|--------|-------|----------|-------------|-------------|
|              | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH |
| Mean equation |    |        |     |         |     |         |     |         |     |         |
| $\alpha_t$  | $0.009$ | $0.005^*$ | $0.002$ | $0.006$ | $0.012^{**}$ | $0.010^{**}$ | $0.009^*$ | $0.009^{**}$ | $-0.010$ | $0.006$ | $-0.013$ | $0.006$ |
| $\beta_t$ (TOY) | $0.004$ | $-0.008$ | $0.027^*$ | $0.004$ | $-0.006$ | $-0.002$ | $0.019$ | $0.018$ | $0.027$ | $0.009$ | $0.035$ | $0.012$ |

| Variance equation |    |        |     |         |     |         |     |         |     |         |     |         |
| $\omega$ | $-0.394^*$ | $-0.316^{**}$ | $-0.315^{**}$ | $-0.166^*$ | $-0.426^*$ | $-0.917^{**}$ |
| ARCH - $\alpha_t$ | $0.402$ | $0.180^{**}$ | $0.234^{***}$ | $0.208^{***}$ | $0.054$ | $0.054$ |
| Leverage - $\delta$ | $-0.090^{**}$ | $-0.100^{**}$ | $-0.002$ | $-0.032$ | $-0.283^{***}$ | $-0.443^{***}$ |
| GARCH - $\beta$ | $0.979^{***}$ | $0.965^{***}$ | $0.980^{***}$ | $0.991^{***}$ | $0.090^{**}$ | $0.802^{**}$ |
| $D_{FM}$ | $-0.450$ | $-0.409$ | $0.084$ | $-0.654^{**}$ | $-1.124^{***}$ | $-1.005^{***}$ |

| R-square | $0.001$ | $0.005$ | $0.012$ | $0.003$ | $0.001$ | $0.005$ | $0.002$ | $0.007$ | $0.004$ | $0.011$ |

Panel B: Before and during the Global Financial Crisis (2000-2008)

| Stock market | Malaysia | Taiwan | India | Thailand | South Korea | Philippines |
|--------------|----------|--------|-------|----------|-------------|-------------|
|              | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH |
| Mean equation |    |        |     |         |     |         |     |         |     |         |     |         |
| $\alpha_t$  | $0.001$ | $0.013^*$ | $-0.008$ | $-0.009$ | $0.011$ | $0.023^{**}$ | $0.003$ | $0.009$ | $-0.001$ | $0.005$ | $0.006$ | $0.006$ |
| $\beta_t$ (TOY) | $0.018$ | $-0.008$ | $0.068^{**}$ | $0.053^*$ | $0.002$ | $-0.008$ | $0.051$ | $0.074^{**}$ | $0.043$ | $0.058^{***}$ | $0.032$ | $0.043^{**}$ |

| Variance equation |    |        |     |         |     |         |     |         |     |         |     |         |
| $\omega$ | $-0.298^*$ | $-8.280^{***}$ | $-4.884^{***}$ | $-7.261^*$ | $-1.936^{***}$ | $-0.210^*$ |
| ARCH - $\alpha_t$ | $-0.415^{**}$ | $0.337$ | $-0.116$ | $0.348^{**}$ | $-0.513^*$ | $-0.261^{**}$ |
| Leverage - $\delta$ | $0.860^{***}$ | $-0.581^{***}$ | $-0.027$ | $-0.450$ | $0.547^{***}$ | $0.907^{***}$ |
| GARCH - $\beta$ | $0.979^{***}$ | $0.965^{***}$ | $0.980^{***}$ | $0.991^{***}$ | $0.090^{**}$ | $0.802^{**}$ |
| $D_{FM}$ | $-0.022$ | $0.053$ | $0.150$ | $0.594$ | $0.013$ | $-0.233$ |

| R-square | $0.002$ | $0.002$ | $0.051$ | $0.047$ | $0.002$ | $0.015$ | $0.023$ | $0.011$ | $0.02$ | $0.009$ | $0.009$ | $0.008$ |

Panel C: After the Global Financial Crisis (2009-2018)

| Stock market | Malaysia | Taiwan | India | Thailand | South Korea | Philippines |
|--------------|----------|--------|-------|----------|-------------|-------------|
|              | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH | OLS | EGARCH |
| Mean equation |    |        |     |         |     |         |     |         |     |         |     |         |
| $\alpha_t$  | $0.008^{**}$ | $0.006^{**}$ | $0.011^{**}$ | $0.007^*$ | $0.012^{**}$ | $0.005$ | $0.015^{**}$ | $0.014^{***}$ | $0.015^*$ | $0.012^{**}$ | $0.014^*$ | $0.014^{***}$ |
| $\beta_t$ (TOY) | $-0.008$ | $-0.009$ | $-0.011$ | $0.003$ | $-0.012$ | $0.007$ | $-0.010$ | $-0.012$ | $-0.010$ | $0.010$ | $-0.001$ | $-0.001$ |

| Variance equation |    |        |     |         |     |         |     |         |     |         |     |         |
| $\omega$ | $-0.156^{**}$ | $-0.084^{**}$ | $-0.208^{**}$ | $-11.28^{***}$ | $0.006^{***}$ | $-6.04$ |
| ARCH - $\alpha_t$ | $0.202^{***}$ | $-0.172^{***}$ | $-0.212^*$ | $0.285^{**}$ | $-0.132$ | $0.010$ |
| Leverage - $\delta$ | $-0.0123$ | $0.030$ | $-0.082$ | $-0.010$ | $0.013$ | $0.010$ |
| GARCH - $\beta$ | $0.959^{**}$ | $0.971^{***}$ | $0.951^{***}$ | $-0.807^{***}$ | $0.985^{***}$ | $0.010$ |
| $D_{FM}$ | $0.086$ | $0.172$ | $0.851^{**}$ | $0.428^{**}$ | $0.033$ | $0.000$ |

| R-square | $0.006$ | $0.003$ | $0.004$ | $0.007$ | $0.004$ | $0.013$ | $0.003$ | $0.003$ | $0.011$ | $0.001$ | $0.001$ |

Note: This table exhibits the results from the OLS regression and EGARCH model for the TOY effect in six emerging markets in full sample (Panel A) and two sub-periods, January 2000 to December 2008 (Panel B) and January 2009 to December 2018 (Panel C). The $\beta_t$ represents
the coefficient of return, while $\alpha_1$ is the coefficient of average returns of other months. The values denote the estimates of the coefficients for each monthly return. *, **, *** are statistically significant at 10%, 5%, and 1% level, respectively.

### 3.1 TOY effect in regional stock indices

Taking into account variations reflecting conditions across regions and market cap segments, the TOY effect is examined by using four regional market indices. The results of the full sample and two sub-periods are tabulated in Table 5. The results indicate that the January anomaly is unobservable in four regional indexes regardless of market capitalization and inspected periods. However, the January returns moderately decrease after the GFC as the intercept of two regression model increase while we can obtain more negative values of the slope. The leverage effect is captured in three indices except for the small cap index of developed markets. We also obtain comparable results when examining in sub-periods

Table 5: Results for the TOY effect of four regional indices (2000-2018)

| Stock market | DMSmall | EMSmall | DMLarge | EMLarge |
|--------------|---------|---------|---------|---------|
|              | OLS     | EGARCH  | OLS     | EGARCH  | OLS     | EGARCH  | OLS     | EGARCH  |
| $\alpha_1$   | 0.004   | 0.004   | 0.004   | 0.004   | 0.007*  | 0.002   | 0.003   |
| $\beta_1$ (TOY) | -0.002  | 0.005   | 0.013   | 0.011   | 0.012   | 0.005   | -0.010  | -0.002  |
| $\omega$     | -0.724  | -0.619**| -0.744**| -0.882* |
| ARCH - $\alpha_1$ | 0.233**| 0.270***| 0.275***| 0.203* |
| Leverage - $\delta$ | -0.059  | -0.098  | -0.103* | -0.093  |
| GARCH - $\beta$ | 0.905***| 0.926***| 0.908***| 0.885***|
| $D_{FM}$     | -0.450  | -0.409  | 0.084   | -0.654***|
| R-square     | 0.001   | 0.002   | 0.003   | 0.004   | 0.001   |

Panel B: Before and during the Global Financial Crisis (2000-2008)

| Stock market | DMSmall | EMSmall | DMLarge | EMLarge |
|--------------|---------|---------|---------|---------|
|              | OLS     | EGARCH  | OLS     | EGARCH  | OLS     | EGARCH  | OLS     | EGARCH  |
| $\alpha_1$   | 0.002   | 0.004   | -0.002  | 0.004   | -0.001  | 0.007*  | -0.001  | 0.003   |
| $\beta_1$ (TOY) | -0.001  | 0.005   | 0.034   | 0.011   | 0.033   | 0.005   | -0.014  | -0.002  |
| $\omega$     | -0.724  | -0.619**| -0.744**| -0.882* |
| ARCH - $\alpha_1$ | 0.233**| 0.270***| 0.275***| 0.203* |
| Leverage - $\delta$ | -0.059  | -0.098* | -0.103* | -0.093* |
| GARCH - $\beta$ | 0.905***| 0.926***| 0.908***| 0.885***|
| $D_{FM}$     | -0.542  | -0.116  | -0.082  | -0.096  |
| R-square     | 0.001   | 0.002   | 0.016   | 0.003   | 0.006   | 0.001   |

Panel C: After the Global Financial Crisis (2009-2018)

| Stock market | DMSmall | EMSmall | DMLarge | EMLarge |
|--------------|---------|---------|---------|---------|
|              | OLS     | EGARCH  | OLS     | EGARCH  | OLS     | EGARCH  | OLS     | EGARCH  |
| $\alpha_1$   | 0.006   | 0.004   | 0.009   | 0.004   | 0.005   | 0.005   | 0.005   | 0.001   |
| $\beta_1$ (TOY) | -0.003  | 0.009   | -0.007  | 0.007   | -0.007  | 0.005   | -0.006  | -0.002  |
| $\omega$     | -0.174  | -0.676* | -0.768  | -0.250* |
| ARCH - $\alpha_1$ | -0.161  | 0.222*  | 0.168   | -0.102  |
| Leverage - $\delta$ | -0.069  | -0.084  | -0.143* | -0.134* |
| GARCH - $\beta$ | 0.959***| 0.918***| 0.902***| 0.958***|
| Market categorization | Markets           | The first month of tax year | OLS   | EGARCH | OLS   | EGARCH | OLS   | EGARCH |
|------------------------|-------------------|-----------------------------|-------|--------|-------|--------|-------|--------|
|                       |                   |                             | Full sample (2000-2018) | Sub-sample (2000-2008) | Sub-sample (2009-2018) |
| Developed             | Australia         | July                         | No    | No     | Yes   | Yes    |       |        |
|                       | Hong Kong         | April                        | Yes   | No     | Yes   | No     |       |        |
|                       | Japan             | January                      | No    | No     | No    | No     |       |        |
|                       | New Zealand       | April                        | Yes   | No     | No    | No     |       |        |
|                       | Singapore         | January                      | No    | No     | No    | No     |       |        |
| Emerging              | India             | January                      | No    | No     | No    | No     |       |        |
|                       | Malaysia          | January                      | No    | No     | No    | No     |       |        |
|                       | Philippines       | January                      | No    | No     | Yes   | Yes    | No    | No     |
|                       | Thailand          | January                      | No    | No     | Yes   | Yes    | No    | No     |
|                       | Taiwan            | January                      | Yes   | No     | Yes   | Yes    | No    | No     |
|                       | South Korea       | January                      | No    | No     | Yes   | Yes    | No    | No     |
| Regional index        | Developed Large   | January                      | No    | No     | No    | No     |       |        |
|                       | Emerging Large    | January                      | No    | No     | No    | No     |       |        |
|                       | Developed Small   | January                      | No    | No     | No    | No     |       |        |
|                       | Emerging Small    | January                      | No    | No     | No    | No     |       |        |

As reported in Table 6 (Panel A), the evidence concerning the TOY anomaly (April effect) is only observable in the New Zealand and Hong Kong stock markets before the GFC by using the OLS model. The inconsistency between OLS and EGARCH regression could be explained by the assumption of...
constant volatility and errors minimization in estimating, and the stylized fact of volatility clustering of EGARCH model (Tsay, 2005; McAleer & Hafner, 2014). Studying two sub-periods, the TOY effect is undetectable before and during the GFC; however, it becomes visible again in three developed stock markets with tax year not ending in December after the GFC. This finding is consistent with generally consistent with Raj and Thurston (1994) and Hasan and Raj (2001) for the New Zealand market, who do not find any evidence for this anomaly by using data before the GFC. For the Australian market, this outcome is also consistent with prior findings of Gray and Tutticci (2007), who posit the presence of this anomaly before GFC. Strong evidence of the July effect in Australian market from both OLS and EGARCH models corroborates the finding of Zhong at el. (2014) related to the existence of this anomaly in the Australian market after the GFC. This study also cannot detect the January effect in the Singaporean stock market, which is consistent with Wong at el. (2006) who suggests seasonal anomaly is disappearing in the Singaporean stock market. Regarding the Japanese market index, our results support the absence of the January effect. This result corroborates the finding of Li and Gong (2015) related to the deteriorating movement of the January effect after the Japanese economic recession during the 1990s.

The empirical results of six emerging stock markets (except Taiwan) confirm the absence of the January effect during the full examined period. However, this anomaly is visible in the Philippines, Thailand, Taiwan, and South Korean markets before and during the GFC. This finding is inconsistent with Tangjitprom (2011) and Tong (1992) that this anomaly is not witnessed in both Thailand, South Korea, and Taiwan equity markets. The discrepancy can be rationalised by the variations in sample periods and methodology. The TOY effect becomes invisible in all emerging stock markets and four regional stock indices after the GFC. Our findings also reconcile with Raj and Kumari (2006) findings for the Indian market and Ali, Nassir, Hassan and Abidin (2009) and Ali Ahmed and Haque (2009) for the Malaysian market, who document the absence of January effect in these two markets.

The leverage effect denotes that the negative shocks (bad news) have more power on volatility than positive shocks (good news) at the same magnitude (Chang & McAleer, 2017; Nguyen & Nguyen, 2019), which are reported in Table 6 (Panel B). For developed markets, we depict evidence of leverage in the unconditional volatility in three out of five examined indices, including Australia, Hong Kong, and Singapore. When we regress on two sub-period, the leverage is reported in four indices (except Japan) before and during the GFC, while it is relatively faded away after this event. Evidence of leverage effect in emerging market indices also denotes the same condition. The number of stock indices that experienced leverage effect reduces from four to one after the GFC. We also observe convincing evidence for the disappearance of the leverage effect after the GFC in four examined regional stock indices. This finding reveals that the significance of the leverage effect in unconditional volatility has depreciated overtime after the global financial turmoil. This finding is strongly consistent with a prior finding of Campbell and Hentschel (1992) that suggests the positive association between the leverage effect and overall stock market volatility during the crisis. Also, the leverage effect is more prominent in the case of developed and large-cap stock indices. It corroborates the findings of Jayasuriya, Shambora and Rossiter (2009), Talpsepp and Rieger (2010), and Kayal and Maheswaran (2018) who posit the magnitude of leverage effect in unconditional volatility is more significant in mature markets compared to emerging markets.

4. Conclusion

Given the prospective effect of the TOY effect on the theories of modern finance and the inadequate research in this field, this study provides a comprehensive examination of the existence of the
TOY effect in fifteen stock market indices of the Asia Pacific region. Our findings indicate that the TOY effect becomes visible again in three developed stock markets with tax year not ending in December after the GFC. In contrast, this seasonal anomaly becomes invisible in emerging stock markets after the GFC, which is consistent with the EMH. Generally, our findings demonstrate that the magnitude of this anomaly has diminished in the emerging markets, but it remains prevalent in some developed markets in recent years. This finding also moderately tolerates the argument for the weakening of stock market anomalies over time, since investors progressively exploit this effect (Wong at el., 2006; Lu & Gao, 2016). The evaporation of this effect would lend encouragement to the supposition that some Asia Pacific stock markets satisfy the weak form of the EMH. It also has significant inferences for the trading behaviours of investors in the stock markets.

We also find evidence of the leverage effect in the unconditional volatility that volatility after negative shocks is significantly higher than that of positive shocks across examined stock indices. However, this effect is more conspicuous in mature stock indices than emerging indices. It is explicable as there is incidence large number of investors in developed stock markets compared to that of emerging markets. Our findings also propose the positive connection between the leverage effect and stock market volatility as the magnitude of this effect has weakened during the stable market condition after the GFC.

Our study notes significant implications for fund managers and investors to take into consideration this anomaly to create higher rates of abnormal profit. The presence of the leverage effect plays a critical role in financial risk controlling, hedging approaches, and options pricing. It also supports investors in their investment decision-making in the stock market. Another contribution is for researchers, this study sheds light on the current trend of seasonality effect in stock returns. This investigation advances our understanding of stock market anomalies and asset pricing theories.

Reference

Ali Ahmed, H., & Haque, Z. (2009). The Day of the Week, Turn of the Month and January Effect on Stock Market Volatility and Volume: Evidence from Bursa Malaysia. SSRN Electronic Journal. doi: 10.2139/ssrn.1460374

Ali, N., Nassir, A., Hassan, T., & Abidin, S. (2009). Does Bursa Malaysia Overreact?. International Research Journal of Finance and Economics, (34), 175-193.

Ariss, R., Rezvanian, R., & Mehdian, S. (2011). Calendar anomalies in the Gulf Cooperation Council stock markets. Emerging Markets Review, 12(3), 293-307. doi: 10.1016/j.ememar.2011.04.002

Brown, P., Keim, D., Kleidon, A., & Marsh, T. (1983). Stock return seasonalities and the tax-loss selling hypothesis. Journal of Financial Economics, 12(1), 105-127. doi: 10.1016/0304-405x(83)90030-2

Campbell, J., & Hentschel, L. (1992). No news is good news: An asymmetric model of changing volatility in stock returns. Journal of Financial Economics, 31(3), 281-318. doi: 10.1016/0304-405x(92)90037-x

Caporin, M., & Costola, M. (2019). Asymmetry and leverage in GARCH models: A News Impact Curve perspective. Applied Economics, 51(31), 3345-3364. doi: 10.1080/00036846.2019.1578853

Chang, C., & McAleer, M. (2017). The correct regularity condition and interpretation of asymmetry in EGARCH. Economics Letters, 161, 52-55. doi: 10.1016/j.econlet.2017.09.017

De Bondt, W., & Thaler, R. (1987). Further Evidence on Investor Overreaction and Stock Market Seasonality. The Journal of Finance, 42(3), 557-581. doi: 10.1111/j.1540-6261.1987.tb04569.x
Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), 383. doi: 10.2307/2325486

Giovanis, E., 2009. The Month-of-The-Year Effect: Evidence from GARCH Models in Fifty Five Stock Markets. *SSRN Electronic Journal*.

Gray, P. and Tutticci, I. (2007). Australian stock market anomalies. *Journal of Investment Strategy* 2 (2) 27-35.

Gu, A. (2003). The declining January effect: evidences from the U.S. equity markets. *International Journal of Finance*, 15(1), 2464-2475.

Gu, A. (2015). The June Phenomenon and the Changing Month of the Year Effect. *Accounting and Finance Research*, 4(3). doi: 10.5430/afr.v4n3p1

Gultekin, M., & Gultekin, N. (1983). Stock market seasonality. *Journal of Financial Economics*, 12(4), 469-481. doi: 10.1016/0304-405x(83)90044-2

Hasan, T., & Raj, M. (2001). An examination of the tax loss selling behavior in a de-regulated pacific financial market. *American Business Review*, 19(2), 100-105.

Haugen, R., & Jorion, P. (1996). The January Effect: Still There after All These Years. *Financial Analysts Journal*, 52(1), 27-31. doi: 10.2469/faj.v52.n1.1963

Hoang, L., Phan, T., & Ta, L. (2020). Nominal Price Anomaly in Emerging Markets: Risk or Mispricing?. *The Journal of Asian Finance, Economics and Business*, 7(9), 125-134. doi: 10.13106/jafeb.2020.vol7.no9.125

Jayasuriya, S., Shambora, W., & Rossiter, R. (2009). Asymmetric Volatility in Emerging and Mature Markets. *Journal of Emerging Market Finance*, 8(1), 25-43. doi: 10.1177/097265270900800102

Kato, K., & Schallheim, J. (1985). Seasonal and Size Anomalies in the Japanese Stock Market. *The Journal of Financial and Quantitative Analysis*, 20(2), 243. doi: 10.2307/2330958

Kayal P., Maheswaran S. (2018) Leverage Effect and Volatility Asymmetry. In: Mishra A., Arunachalam V., Patnaik D. (eds) Current Issues in the Economy and Finance of India. ICEF 2018 2018. Springer Proceedings in Business and Economics. Springer, Cham. doi: 10.1007/978-3-319-99555-7_9

Li, J., & Gong, J. (2015). Volatility Risk and January Effect: Evidence from Japan. *International Journal of Economics and Finance*, 7(6). doi: 10.5539/ijef.v7n6p25

Lu, X., & Gao, H. (2016). The day of the week effect in Chinese stock market. *The Journal of Asian Finance, Economics, and Business*, 3(3), 17-26. doi: 10.13106/jafeb.2016.vol3.no3.17

McAleer, M., & Hafner, C. (2014). A One Line Derivation of EGARCH. *Econometrics*, 2(2), 92-97. doi: 10.3390/econometrics2020092

Nelson, D. (1990). Stationarity and Persistence in the GARCH(1,1) Model. *Econometric Theory*, 6(3), 318-334. doi: 10.1017/s0266466600005296

Nelson, D., & Cao, C. (1992). Inequality Constraints in the Univariate GARCH Model. *Journal of Business & Economic Statistics*, 10(2), 229. doi: 10.2307/1391681

Nguyen, C. T., & Nguyen, M. H. (2019). Modeling stock price volatility: empirical evidence from the Ho Chi Minh city stock exchange in Vietnam. *The Journal of Asian Finance, Economics, and Business*, 6(3), 19-26. doi: 10.13106/jafeb.2019.vol6.no3.19
Officer, R. (1975). Seasonality in Australian capital markets. *Journal of Financial Economics, 2*(1), 29-51. doi: 10.1016/0304-405x(75)90022-7

Raj, M. and Thurston, D., 1994. January or April? Tests of the turn–of–the–year effect in the New Zealand stock market. *Applied Economics Letters, 1*(5), pp.81-83.

Raj, M., & Kumari, D. (2006). Day-of-the-week and other market anomalies in the Indian stock market. *International Journal of Emerging Markets, 1*(3), 235-246. doi: 10.1108/17468800610674462

Rozeff, M., & Kinney, W. (1976). Capital market seasonality: The case of stock returns. *Journal of Financial Economics, 3*(4), 379-402. doi: 10.1016/0304-405x(76)90028-3

Talpsepp, T., & Rieger, M. (2010). Explaining asymmetric volatility around the world. *Journal of Empirical Finance, 17*(5), 938-956. doi: 10.1016/j.jempfin.2010.08.005

Tangjitprom, N. (2011). The Calendar Anomalies of Stock Return in Thailand. *Journal of Modern Accounting and Auditing, 7*(6).

Tinic, S., & West, R. (1984). Risk and return. *Journal of Financial Economics, 13*(4), 561-574. doi: 10.1016/0304-405x(84)90016-3

Tong, W. (1992). An analysis of the January effect of united states, Taiwan and South Korean stock returns. *Asia Pacific Journal of Management, 9*(2), 189-207. doi: 10.1007/bf01732896

Tsay, R. (2005). Analysis of Financial Time Series (2nd ed.). New York: Wiley.

Wachtel, S. (1942). Certain Observations on Seasonal Movements in Stock Prices. *Journal of Business of The University of Chicago, 15*(2), 184. doi: 10.1086/232617

Wong, W., Agarwal, A., & Wong, N. (2006). The Disappearing Calendar Anomalies in the Singapore Stock Market. *Lahore Journal of Economics, 11*(2), 123-139. doi: 10.35536/lje.2006.v11.i2.a7

Zhong, A., Limkriangkrai, M., & Gray, P. (2014). Anomalies, risk adjustment and seasonality: Australian evidence. *International Review of Financial Analysis, 35*, 207-218. doi: 10.1016/j.irfa.2014.09.004