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ANOMALIES IN ASIA PACIFIC STOCK MARKETS: A RE-EXAMINATION OF THE TURN-OF-THE-YEAR EFFECT

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ABSTRACT

This paper examines the turn-of-the-year (TOY) effect in fifteen Asia Pacific stock indices by using an updated dataset. The analysis utilizes the daily datasets spanning from 2000 to 2018. Applying the Ordinary Least Square (OLS) and the Exponential Generalized Autoregressive Conditional Heteroskedastic (EGARCH) approach, the results of this paper suggest that the TOY effect becomes detectable again after the Global Financial Crisis (GFC) in developed markets with the tax year not ending in December. Furthermore, the magnitude of this anomaly diminishes in emerging markets after the GFC, which is consistent with the Efficient Market Hypothesis (EMH). The evidence of the leverage effect in the market volatility shows in negative shocks that it is considerably higher than that of positive shocks for all markets. This phenomenon is more evident in mature markets compared to emerging markets. The positive connection between the leverage effect and stock market volatility is seen with diminishing magnitude during the stable market condition after the GFC.

Contribution/ Originality: This study provides further evidence on the presence of the TOY effect in Asia Pacific equity markets with mixed findings in prior studies. With an updated dataset and method, the new evidence sheds further light on the anomaly in stock returns and proposes several implications for investment strategies.

1. INTRODUCTION

One of the keystones in modern finance theory is the Efficient Market Hypothesis (EMH), which states 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 gives opportune investors can obtain profit abnormal from those obtained from predictable stock patterns (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, shows that stock returns in the first month of the tax year is relatively higher than the rest of the year (Rozeff & Kinney Jr, 1976). In other words, this phenomenon indicates a systematic predictable pattern of stock returns, which contradicts EMH's theory that future stock price movements are unpredictable (Fama, 1970). Such 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 stocks. As a consequence, the existence of this anomaly in stock returns is inconsistent with traditional asset pricing models as patterns of stock return cannot be rationalized by the Efficient Market Hypothesis (Fama,

1970) and the Capital Asset Pricing Model (CAPM). Wachtel (1942) is considered the first scholar that acknowledged the evidence of the January effect. Another early example of this anomaly is Rozeff and Kinney Jr (1976), whereby stock returns in January were higher than in other months of the year. Subsequently, a large number of studies have 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 Bandt and Thaler (1987), and Haugen and Jorion (1996). This phenomenon is also detected in stock markets such as Australia (Brown, Keim, Kleidon, & Marsh, 1983), Japan (Kato & Schallheim, 1985), Australia (Zhong, Limkriangkrai, & Gray, 2014), and major industrialized markets (Gultekin & Gultekin, 1983).

Although there is numerous empirical evidence for the existence of the TOY effect, recent papers suggest that the significance of this anomaly has been deteriorating in developed stock markets since the end of the 1980s (Gu, 2003) and the Japanese market (Li & Gong, 2015). The reasons for such deterioration are knowledge of investors, technology enhancement, cost efficiency, and improvement over time of stock market efficiency (Huynh, 2020). Further, Ariss, Rezvanian, and Mehdian (2011) and Gu (2015) provide some 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 remains pervasive in emerging markets. This is possibly because such markets are comparatively less efficient than developed markets (Wong, Agarwal, & Wong, 2006).

This study is to examine the TOY effect in fifteen Asia Pacific stock indices with the influences of the Global Financial Crisis (GFC) in 2007-2008 by comparing developed and emerging markets. The markets, both developed and emerging, in the Asia Pacific region have significantly grown over the last decades as the loosening of barriers for capital flows across markets (Huynh, Dao, & Nguyen, 2021; Tran, Huynh, & Huynh, 2022). This paper contributes to the current literature by providing updated evidence for the existence of TOY anomalies in Asia Pacific stock markets, noting significant implications for fund managers and investors to take into consideration to increase the rate of abnormal profits. Another contribution is to shed light on the current trend of seasonality effects in stock returns and to advance 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, and the last section presents a brief conclusion.

2. DATA AND METHODOLOGY

To extend the finance literature on seasonal anomalies, this paper examines the TOY effect on fifteen stock market indices in the Asia Pacific, including twelve national and four regional indices. The detail of the examined stock indices is reported in Table 1.

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 categorized into two groups of emerging and developed markets. We employ the regional indices to capture the comprehensive 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 the economy. The daily data was obtained from DataStream and the MSCI database during the period from January 2000 to December 2018. In the selected markets, there are three countries with the 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, 2015). Hence, we divided 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.

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 Stock Exchange	HKEX	March
	Oceania	New Zealand	New Zealand Stock Exchange	NZX	March
		Australia	Australian Securities Exchange	ASX	June
	Southeast Asia	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	Philippine Stock Exchange	PSEi	December
		Thailand	Stock Exchange of Thailand	SET	December
	East Asia	Taiwan	Taiwan Stock Exchange	TWSE	December
		South Korea	Korea Exchange	KOSPI	December
Regional Indices					
Small Cap		MSCI Pacific Small Cap Index		DMSma	December
		MSCI Emerging Markets Asia Small Cap Index		EMSmal	December
Large cap		MSCI Asia Pacific Index		DMLarg	December
		MSCI Emerging Markets Asia Index		EMLarg	December

Note: This table describes the categorized 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.

To examine the TOY effect on value-weighted index returns, this study will conduct two methods: Ordinary Least Squares (OLS) regression and Exponential Generalized Autoregressive Conditional Heteroskedastic (EGARCH). The EGARCH model was first developed by Nelson (1990) and then extended by Nelson and Cao (1992) and McAleer and Hafner (2014). This model 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 follows:

$$R_t = \alpha_1 + \beta_1 D_{FM} + \varepsilon_t \quad (1)$$

R_t is the monthly buy-and-hold returns of all stock market indices, α_1 represents the coefficient of the monthly returns except for the first month of the tax year, and D_{FM} is the dummy variable for month i with the estimated coefficient β_1, which is the first month of the tax year. The dummy variable is equal to 1 for returns of the first month of the tax year and equal to 0 for the returns of the other eleven months. ε_t. The variance equation of the EGARCH model is as follows:

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

The intercept and error terms are $\boldsymbol{\omega}$ and $\varepsilon_t \sim N(0, \sigma_t^2)$, respectively. D_{FM} is the dummy variable for month i with the estimated coefficient β_1, which is the first month of the tax year. The spill-over effect or the association between preceding and current variance in the absolute value is captured by the ARCH term (α_1). The asymmetry or leverage effect is denoted by the leverage term (δ) and is identified if δ is negative when the negative shock is followed by higher volatility. This indicates that the negative shock impacts volatility more than positive shocks 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 positive and negative shocks impact volatility at the same magnitude (Caporin & Costola, 2019; Chang & McAleer, 2017; McAleer & Hafner, 2014). The GARCH term (β) indicates the perseverance of the past volatility used to explain current volatility.

Table 2. Descriptive statistics.

Panel A: Data for National Indices						
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**
Hongkong	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**
Panel B: Data for Regional Indices						
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 shown under 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. * and ** are statistically significant at 5% and 1%, respectively.

3. RESULTS AND EMPIRICAL ANALYSIS

3.1. Descriptive Statistics

For five developed markets, the average returns in the first month of the tax year were significantly higher than in other months in Australia, Hong Kong, Japan, and New Zealand markets, and furthermore was also presented in Taiwan, Thailand, Philippines, South Korea, and four regional stock indices. This inclination also relates to the TOY effect in those stock markets. For the other stock indices, the average return in January was shown to be negative and relatively lower than in 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 the data series is stationary ($p <$ 0.01), which means that variables follow a random walk. Therefore, the data series is appropriate for further empirical time-series analyses in the succeeding section.

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 shown in 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. On the other hand, the coefficients were shown as statistically insignificant in EGARCH for these two markets, indicating a weak TOY effect. For other market indices, returns in the first month of the tax year did not show as considerably greater than returns in the other months, therefore, it is

acceptable to conclude that the TOY effect is undetectable in the Australian, Japanese, and Singaporean market stock markets.

The sample was separated into two sub-periods to examine the impacts of the GFC 2007-2008, and the visibility of the TOY effect in five developed markets was re-examined. 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 the return coefficients in the first month of the tax years were statistically insignificant. Interestingly, though, the TOY anomaly re-appears in some developed markets after the GFC as shown in Panel C of Table 3. In the Australian market, returns in July are considerably greater than in other months. The outcome in the 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 the Hong Kong market, the April effect is also present in the New Zealand market and is considerably greater than the returns of other months with a 10% significance level. This evidence lends support to the existence of the TOY effect in the New Zealand stock market after the GFC.

Using the EGARCH model, we also consider the asymmetry and leverage effect on the association between stock return shocks and historic shocks to volatility (Giovanis, 2009). As seen in Panel A of Table 3, the coefficient (δ) 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 (δ) is reported for the Japanese index. These findings are still consistent when we refer to the first sub-period in Panel B, however, the leverage effect is also testified for the New Zealand index at a 1% significance level. Furthermore, the leverage effect is no longer shown 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. Our findings confirm an overall absence of the January effect in the six emerging stock markets (Panel A) except Taiwan. Consistent with the results in Table 2, the January return coefficients are statistically insignificant (p-value < 0.10) compared to other monthly returns in the 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 TOY anomaly.

Table 4 shows the results for the period before and during the GFC (January 2000 to December 2008) in panel B. In it, the January anomaly is detectable in four out of the six emerging markets, these being Taiwan, Thailand, South Korea, and the Philippines. From both models, the presence of the TOY effect in the Taiwan stock market before and during GFC is evidenced, as the January return is significantly higher than that of the other months. The January return coefficients in Thailand, South Korea, and the Philippines stock indices are statistically significant at a 5% significance level for the EGARCH model only. Although the January returns in these three markets were not significantly higher than the other months according to OLS model, the TOY coefficients ($\boldsymbol{\beta_1}$) 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, which proves the existent of the TOY effect in Taiwan, Thailand, South Korea, 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 the other eleven months due to their statistically insignificant coefficients, hence, the January effect is undetectable in all emerging stock indices during the period after the GFC.

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

Panel A: Full sample (2000 - 2018)										
Stock market	**Australia**		**Hong Kong**		**Japan**		**New Zealand**		**Singapore**	
	OLS	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**
Mean equation										
α_1	0.006**	0.007***	0.004	0.006	0.003	0.002	0.006	0.009*	0.006	0.009***
β_1 *(TOY)*	0.008	0.006	0.024*	0.024	-0.016	-0.015	0.022*	0.015	-0.007	0.000
Variance equation										
ω		-1.137**		-0.799**		-8.815**		-0.542***		-0.753***
ARCH - α_1		0.195*		0.117		0.199		0.209***		0.239***
Leverage - δ		-0.131*		-0.125**		0.000		-0.063		-0.153**
GARCH - β		0.855***		0.878***		-0.458		0.942***		0.905***
D_{FM}		0.0093		0.0489		-0.2305		0.2651		-0.0305
R-square	0.003	0.002	0.002	0.012	0.001	0.007	0.002	0.010	0.002	0.004
Panel B: Before and during the Global Financial Crisis (2000-2008)										
Stock market	Australia		Hong Kong		Japan		New Zealand		Singapore	
	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH
Mean equation										
α_1	0.007*	0.0123***	0.001	0.004	-0.001	0.000	0.003	0.012***	0.003	0.013**
β_1 *(TOY)*	-0.016	-0.013	0.015	0.009	-0.019	-0.024*	0.023	0.014	-0.008	0.006
Variance equation										
ω		-1.826***		-2.601		-2.514		-0.544***		-1.266***
ARCH - α_1		0.240		-0.112		0.375		-0.551***		0.070
Leverage - δ		-0.309***		-0.257*		0.007		-0.247***		-0.336***
GARCH - β		0.756***		0.512		0.623*		0.084***		0.789***
D_{FM}		-0.378		-0.783		-0.743		0.199		-0.066
R-square	0.014	0.009	0.005	0.002	0.010	0.010	0.010	0.007	0.001	0.029
Panel C: After the Global Financial Crisis (2009-2018)										
Stock market	Australia		Hong Kong		Japan		New Zealand		Singapore	
	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH
Mean equation										

α_1	0.005	0.006**	0.008	0.003	0.007	0.009*	0.008**	0.009***	0.009*	0.003
β_1 (TOY)	0.029**	0.029***	0.032*	0.020	-0.014	-0.019	0.021*	0.020*	-0.006	-0.005
Variance equation										
ω		-0.122		-0.074		-11.61***		-11.780***		-0.282***
ARCH - α_1		-0.184*		-0.143*		0.382*		-0.188*		-0.206*
Leverage - δ		0.024		-0.122**		0.203*		0.071		-0.108*
GARCH - β		0.963***		0.982***		-0.940***		-0.784***		0.946***
D_{FM}		0.158		1.004**		0.108		-0.511		1.165***
R-square	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 β_1 represents the coefficient of return and α_1 is the coefficient of average returns of other months. The values denote the estimates of the coefficients for each monthly return. *, ** and *** are statistically significant at 10%, 5%, and 1% level, respectively.

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 (δ) 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.

3.4. TOY Effect in Regional Stock Indices

The TOY effect is examined by using four regional market indices, taking into account variations reflecting conditions across regions and market cap segments. The results shown in Table 5 indicate no January anomaly 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 models increases as more negative values occur. The leverage effect is captured in three indices except for the small-cap index of developed markets. We also obtain comparable results when examining the sub-periods.

3.5. Summary of the Results

Table 6 shows in panel A that the TOY anomaly is only observable in the New Zealand and Hong Kong markets (With the first tax month being April) 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 (McAleer & Hafner, 2014; Tsay, 2005). Studying two sub-periods, the TOY effect is undetectable before and during the GFC, however, it does show again in three developed stock markets with the tax year not ending in December after the GFC. This finding is 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 before the GFC, and for the Australian market, this outcome is also consistent with the findings of Gray and Tutticci (2007), who posit the presence of this anomaly pre-GFC. Strong evidence of the July effect in the Australian market from both OLS and EGARCH models corroborates the findings of Zhong et al. (2014) relating to the existence of this anomaly in the Australian market after the GFC. This study did not detect the January effect in the Singaporean stock market, however, which is consistent with Wong et al. (2006) who suggest seasonal anomaly is disappearing in the Singaporean stock market. Regarding the Japanese market index, our results corroborate with the findings of Li and Gong (2015) relating to the deteriorating movement of the January effect after the Japanese economic recession during the 1990s.

The empirical results of the six emerging stock markets (excluding Taiwan) confirm the absence of the January effect during the examined period. However, this anomaly is visible in the Philippines, Thailand, Taiwan, and South Korean markets before and during the GFC, which is inconsistent with the findings in Tangjitprom (2011) and Tong (1992). The discrepancy can be rationalized by the variations in sample periods and methodology, as 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 the January effect in both examples.

Table 4. Results for the TOY effect of six emerging markets (2000-2018).

Panel A: Full sample (2000 - 2018)												
Stock market	**Malaysia**		**Taiwan**		**India**		**Thailand**		**South Korea**		**Philippines**	
	OLS	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**
Mean equation												
α_1	0.009	0.005*	0.002	0.006	0.012**	0.010**	0.009*	0.009**	-0.010	0.006	-0.013	0.006
β_1 (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												
ω		-0.394*		-0.316**		-0.315**		-0.166*		-0.426*		-0.917**
ARCH - α_1		0.402		0.180**		0.234***		0.208***		0.054		0.054
Leverage - δ		-0.090**		-0.100**		-0.002		-0.032		-0.283***		-0.443***
GARCH - β		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	0.001	0.005	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	OLS	EGARCH
Mean equation												
α_1	0.001	0.013*	-0.008	-0.009	0.011	0.023**	0.003	0.009	-0.001	0.005	0.006	0.006
β_1 (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												
ω		-0.298*		-8.280***		-4.884***		-7.261*		-1.936***		-0.210*
ARCH - α_1		-0.415**		0.337		-0.116		0.348**		-0.513*		-0.261**
Leverage - δ		0.860***		-0.581**		-0.027		-0.450		0.547***		0.907***
GARCH - β		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	OLS	EGARCH
Mean equation												
α_1	0.008**	0.006**	0.011**	0.007*	0.012**	0.005	0.015**	0.014***	0.015*	0.012**	0.014*	0.014***
β_1 (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												
ω		-0.156**		-0.084**		-0.208**		-11.28***		0.006***		-6.04
ARCH - α_1		-0.202***		-0.172***		-0.212*		0.285**		-0.132		0.010
Leverage - δ		-0.0123		0.030		-0.082		-0.010		0.013		0.010
GARCH - β		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	0.003	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 β_1 represents the coefficient of return, while α_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.

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

Panel A: Full sample (2000 - 2018)								
Stock market	**DM Small**		**EM Small**		**DM Large**		**EM Large**	
	OLS	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**
α_1	0.004	0.004	0.004	0.004	0.004	0.007*	0.002	0.003
β_1 (TOY)	-0.002	0.005	0.013	0.011	0.012	0.005	-0.010	-0.002
ω		-0.724		-0.619**		-0.744**		-0.882*
ARCH - α_1		0.233**		0.270***		0.275***		0.203*
Leverage - δ		-0.059		-0.098		-0.103*		-0.093
GARCH - β		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	0.003	0.003	0.003	0.004	0.001
Panel B: Before and during the Global Financial Crisis (2000-2008								
Stock market	DM Small		EM Small		DM Large		EM Large	
	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH	OLS	EGARCH
α_1	0.002	0.004	-0.002	0.004	-0.001	0.007*	-0.001	0.003
β_1 (TOY)	-0.001	0.005	0.034	0.011	0.033	0.005	-0.014	-0.002
ω		-0.724		-0.619**		-0.744**		-0.882*
ARCH - α_1		0.233**		0.270***		0.275***		0.203
Leverage - δ		-0.059		-0.098*		-0.103*		-0.093*
GARCH - β		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	0.016	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
α_1	0.006	0.004	0.009	0.004	0.008	0.005	0.005	0.001
β_1 (TOY)	-0.003	0.009	-0.007	0.007	-0.007	0.005	-0.006	-0.002
ω		-0.174		-0.676*		-0.768		-0.250*
ARCH - α_1		-0.161		0.222*		0.168		-0.102
Leverage - δ		-0.069		-0.084		-0.143*		-0.134*
GARCH - β		0.959***		0.918***		0.902***		0.958***
D_{FM}		0.077		0.170		0.381		0.598
R-square	0.001	0.005	0.001	0.007	0.001	0.004	0.002	0.004

Note: This table exhibits the results from the OLS regression and EGARCH model for the TOY effect in four regional indices 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 $\boldsymbol{\beta_1}$ represents the coefficient of return, while $\boldsymbol{\alpha_1}$ is the coefficient of average returns of other months. The top values denote the estimates of the coefficients for each monthly return. *, **, *** are statistically significant at 10%, 5%, and 1% level, respectively.

The leverage effect denotes that the negative shocks have more power on volatility than positive shocks at the same magnitude (Chang & McAleer, 2017; Nguyen & Nguyen, 2019), which are reported in Table 6 (Panel B). For the developed markets, we see evidence of leverage in the unconditional volatility in three out of the five examined indices, including Australia, Hong Kong, and Singapore. When we regress on two sub-period, the leverage is reported in four indices (excluding Japan) before and during the GFC, though this is noticeable after the event. Evidence of a leverage effect in emerging market indices also denotes the same condition. The number of stock indices that experienced a leverage effect reduced 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 since the GFC and is strongly consistent with Campbell and Hentschel

(1992) who found a positive association between the leverage effect and overall stock market volatility during the crisis. This leverage effect is more prominent in developed and large-cap market indices, which corroborates the findings of Jayasuriya, Shambora, and Rossiter (2009); Talpsepp and Rieger (2010), and Kayal and Maheswaran (2018) who found that the magnitude of leverage effect in unconditional volatility is more significant in mature markets compared to emerging markets.

Table 6. Result summary for TOY effect and the leverage effect.

Panel A: TOY effect: Is the return of the first month of the tax year significantly higher than the returns of other months?								
Market categorization	**Markets**	**The first month of tax year**	**Full sample (2000-2018)**		**Sub-sample (2000-2008)**		**Sub-sample (2009-2018)**	
			OLS	**EGARCH**	**OLS**	**EGARCH**	**OLS**	**EGARCH**
Developed	Australia	July	No	No	No	No	Yes	Yes
	Hong Kong	April	Yes	No	No	No	Yes	No
	Japan	January	No	No	No	No	No	No
	New Zealand	April	Yes	No	No	No	Yes	Yes
	Singapore	January	No	No	No	No	No	No
Emerging	India	January	No	No	No	No	No	No
	Malaysia	January	No	No	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	No	No
	Emerging Large	January	No	No	No	No	No	No
	Developed Small	January	No	No	No	No	No	No
	Emerging Small	January	No	No	No	No	No	No

Table 6. Continue…

Panel B: Leverage effect: Is the leverage effect visible in the EGARCH variance equation?				
Market categorization	**Markets**	**Full sample (2000-2018)**	**Sub-sample (2000-2008)**	**Sub-sample (2009-2018)**
Developed	Australia	Yes	Yes	No
	Hong Kong	Yes	Yes	Yes
	Japan	No	No	No
	New Zealand	No*	Yes	No
	Singapore	Yes	Yes	Yes
Emerging	India	No*	Yes	No*
	Malaysia	Yes	Yes	No*
	Philippines	Yes	Yes	No*
	Thailand	No*	No*	No*
	Taiwan	Yes	No	No
	South Korea	Yes	Yes	No
Regional index	Developed Large	Yes	Yes	Yes
	Emerging Large	Yes	Yes	Yes
	Developed Small	No*	No*	No*
	Emerging Small	Yes	Yes	No*

Note: * indicates the negative sign, but is statistically insignificant, of the leverage coefficients (δ) in the EGARCH variance equation.

4. CONCLUSION

This study provides a comprehensive examination of the existence of the TOY effect in fifteen stock market indices of the Asia Pacific region, where research in this field has previously been inadequate and lacking. Our findings

indicate that the TOY effect became visible again in three developed stock markets with the tax year not ending in December after the GFC, and in contrast, became 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 has remained 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 (Huynh, 2020; Lu & Gao, 2016; Wong et al., 2006). 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 behaviors of investors in the stock markets.

We also find evidence that the leverage effect in the unconditional volatility after negative shocks is significantly higher than that of positive shocks across the examined stock indices, however, this effect is more conspicuous in mature stock indices than emerging indices. This could be explained by more investors being involved in developed stock markets compared to that of emerging markets. Our findings also propose a 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 this anomaly into consideration to create higher rates of abnormal profit. The presence of the leverage effect plays a critical role in financial risk controlling, hedging approaches, and option pricing. It also supports investors in their decision-making in the stock market. Another contribution is for researchers, as this study sheds more comprehensive light on the current trends of seasonality effect in stock returns, and advances our understanding of stock market anomalies and asset pricing theories.

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REFERENCES

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

Brown, P., Keim, D. B., Kleidon, A. W., & Marsh, T. A. (1983). Stock return seasonalities and the tax-loss selling hypothesis: Analysis of the arguments and Australian evidence. *Journal of Financial Economics*, *12*(1), 105-127.Available at: https://doi.org/10.1016/0304-405x(83)90030-2.

Campbell, J. Y., & 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.

Caporin, M., & Costola, M. (2019). Asymmetry and leverage in GARCH models: A news impact curve perspective. *Applied Economics*, *51*(31), 3345-3364.Available at: https://doi.org/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.

De Bandt, W. F., & Thaler, R. H. (1987). Further evidence on investor overreaction and stockmarket sensitivity. *Journal of Finance*, *42*(3), 557-581.Available at: https://doi.org/10.1111/j.1540-6261.1987.tb04569.x.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25*(2), 383-417.Available at: https://doi.org/10.2307/2325486.

Giovanis, E. (2009). The month-of-the-year effect: Evidence from GARCH Models in Fifty Five Stock Markets. *SSRN Electronic Journal*, *1*(1), 20-49.

Gray, P., & 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. Y. (2015). The June phenomenon and the changing month of the year effect. *Accounting and Finance Research*, *4*(3), 1-8.Available at: https://doi.org/10.5430/afr.v4n3p1.

Gultekin, M., & Gultekin, N. (1983). Stock market seasonality. *Journal of Financial Economics*, *12*(4), 469-481.

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. A., & Jorion, P. (1996). The January effect: Still there after all these years. *Financial Analysts Journal*, *52*(1), 27-31.Available at: https://doi.org/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.

Huynh, D. N. (2020). *An empirical investigation of the turn-of-the-year effect in the Asia pacific stock markets.* Master's Thesis, Swinburne University of Technology.

Huynh, N., Dao, A., & Nguyen, D. (2021). Openness, economic uncertainty, government responses, and international financial market performance during the coronavirus pandemic. *Journal of Behavioral and Experimental Finance*, *31*, 100536.Available at: https://doi.org/10.1016/j.jbef.2021.100536.

Jayasuriya, S., Shambora, W., & Rossiter, R. (2009). Asymmetric volatility in emerging and mature markets. *Journal of Emerging Market Finance*, *8*(1), 25-43.Available at: https://doi.org/10.1177/097265270900800102.

Kato, K., & Schallheim, J. S. (1985). Seasonal and size anomalies in the Japanese stock market. *Journal of Financial and Quantitative Analysis*, *20*(2), 243-260.Available at: https://doi.org/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.* Paper presented at the Springer Proceedings in Business and Economics. Springer, Cham.

Li, J., & Gong, J. (2015). Volatility risk and January effect: Evidence from Japan. *International Journal of Economics and Finance*, 7(6), 1-30.Available at: https://doi.org/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.

McAleer, M., & Hafner, C. M. (2014). A one line derivation of EGARCH. *Econometrics*, *2*(2), 92-97.Available at: https://doi.org/10.3390/econometrics2020092.

Nelson, D. B. (1990). Stationarity and persistence in the GARCH (1, 1) model. *Econometric Theory*, *6*(3), 318-334.Available at: https://doi.org/10.1017/s0266466600005296.

Nelson, D. B., & Cao, C. Q. (1992). Inequality constraints in the univariate GARCH model. *Journal of Business & Economic Statistics*, *10*(2), 229-235.Available at: https://doi.org/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.Available at: https://doi.org/10.13106/jafeb.2019.vol6.no3.19.

Officer, R. R. (1975). Seasonality in Australian capital markets: Market efficiency and empirical issues. *Journal of Financial Economics*, *2*(1), 29-51.Available at: https://doi.org/10.1016/0304-405x(75)90022-7.

Patel, J. (2015). The January effect anomaly reexamined in stock returns. *Journal of Applied Business Research*, *32*(1), 317.Available at: https://doi.org/10.19030/jabr.v32i1.9540.

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.Available at: https://doi.org/10.1108/17468800610674462.

Raj, M., & 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), 81-83.Available at: https://doi.org/10.1080/135048594358195.

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

Talpsepp, T., & Rieger, M. O. (2010). Explaining asymmetric volatility around the world. *Journal of Empirical Finance*, *17*(5), 938-956.Available at: https://doi.org/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), 565.

Tinic, S. M., & West, R. R. (1984). Risk and return: Janaury vs. the rest of the year. *Journal of Financial Economics*, *13*(4), 561-574.

Tong, W. H. (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.Available at: https://doi.org/10.1007/bf01732896.

Tran, Q., Huynh, N., & Huynh, N. (2022). *Trading-off between being contaminated or stimulated: Are emerging countries doing good jobs in hosting foreign resources?* Paper presented at the In The 62nd Annual Conference of the New Zealand Association of Economists. New Zealand.

Tsay, R. (2005). *Analysis of financial time series* (2nd ed.). New York: Wiley.

Wachtel, S. B. (1942). Certain observations on seasonal movements in stock prices. *The journal of business of the University of Chicago*, *15*(2), 184-193.Available at: https://doi.org/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.

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