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Contagion Effect of Seasonality in the ASEAN Plus 3 Equity Markets

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ABSTRACT

This study investigates the presence of contagion effect of seasonality in the ASEAN plus 3 markets. The study employs the month-end closing prices of each market's broad based stock indexes over the period of 20 years from January 1987 to December 2006. The analysis begins by establishing evidence of seasonality effect in sample markets. Using Granger causality approach, the study finds evidence of causal linkages with Hong Kong and Korea prevailing as leaders to the other ASEAN markets. The time-series regression analysis confirms that these markets, particularly Korea, have contagion effect on stock returns in Singapore and Malaysia. The study further investigates for the causal linkages due specifically to seasonality effect. Consistent with the results in the general market conditions, Korea remains the leader market in the ASEAN region as well as Hong Kong. Overall, the results lend strong support to the view that seasonality effect in some stock markets is contagious. Specifically, seasonality in Malaysia, Indonesia as well as Hong Kong can be significantly predicted by similar trends in Korea. However, in predicting seasonality in Singapore, the contagion effect from Malaysia and Indonesia are even more significant than that from Korea. From investment standpoint, the findings imply that investors in these affected (follower) markets should observe the trends in the leader markets in order to improve their chance to exploit the seasonality effect.

ABSTRAK

Kajian ini menguji kewujudan jangkitan kesan bermusim dalam pasaran-pasaran ASEAN + 3. Kajian menggunakan harga penutup akhir bulan indeks utama setiap pasaran bagi tempoh 20 tahun dari Januari 1987 hingga Disember 2006. Analisis dimulakan dengan memperoleh bukti kesan bermusim dalam sampel pasaran. Menggunakan pendekatan sebab-akibat Granger, kajian memperolehi bukti hubungan penyebab yang

menyarankan Hong Kong dan Korea bertindak sebagai pemimpin kepada pasaran-pasaran ASEAN. Analisis regresi siri masa mengesahkan bahawa pasaran-pasaran tersebut, khususnya Korea, mempunyai kesan jangkitan ke atas pulangan di Singapura dan Malaysia. Kajian seterusnya memfokus kepada hubungan sebab-akibat yang melibatkan kesan bermusim. Selari dengan hasil yang diperoleh dari keadaan pasaran secara umum, Korea kekal pasaran pemimpin bagi rantau ASEAN dan juga Hong Kong. Secara keseluruhan, hasil kajian menyediakan sokongan kukuh kepada pendapat bahawa dalam beberapa pasaran tertentu, kesan bermusimnya boleh berjangkit ke pasaran lain. Secara khusus, kesan bermusim di Malaysia, Indonesia, dan Hong Kong boleh diramalkan secara signifikan berdasarkan tren yang sama di Korea. Manakala dalam kes Singapura, kesan bermusimnya boleh diramalkan dengan secara yang lebih signifikan berdasarkan kesan bermusim di Malaysia dan Indonesia berbanding dengan kesan bermusim di Korea. Dari sudut pelaburan, penemuan kajian ini menyarankan bahawa para pelabur di pasaran pengikut sepatutnya memerhatikan trend di pasaran pemimpin untuk meningkatkan peluang mereka dalam pengeksploitasian kesan bermusim.

INTRODUCTION

Four decades after it was re-introduced (Rozeff & Kinney 1976), stock market seasonality remains an intriguing issue in empirical finance. Started as January effect in most developed markets particularly in the U.S. (Haugen & Jorion 1996; Keim 1983; Rozeff & Kinney 1976), seasonality in more recent studies is more commonly viewed from a broader perspective. The evolution is partly attributed to the failure to consistently explain anomalous January returns with tax loss selling hypothesis. This hypothesis is indisputably the most compelling and tested explanation of January effect, but it also implies inexistence of seasonal month effect in the absence of tax on capital gains. The paradox is that there are evidences of January effect in such systems (Kato & Schallheim 1985; Jones, Pearce, & Wilson 1987) and there are evidences against January effect where the tax motivation applies (Cox & Johnston 1998; Mehdian & Perry 2002). This study uses a sample of markets that exhibit different tax systems on capital gains. Even though tax-loss selling hypothesis is not the focus of this study, this feature is expected to provide an additional edge in discussing seasonality effect as it would indirectly provide new evidence on the hypothesis.

The primary objective of this study is to investigate to what extent seasonality effect in a particular equity market is contagious to other equity markets. Thus, in addition to build more evidence in the literature of Asian emerging stock markets, this study contributes mainly in its attempt to find from neighboring markets any particular information that can be used to improve the ability of investors to predict and accordingly exploit the seasonality. To some extent, this study is motivated by the growing evidence of integration in international financial markets (Narayan, Smyth, Nandha 2004) but more so by a particular study by Masih and Masih (1999). The latter, which studied world's most advanced stock markets as well as four emerging Asian stock markets (Hong Kong, Thailand, Singapore, and Malaysia), found that there were particular markets that set the trend for specific geographical regions particularly in the case of Southeast Asia region. Extending from their argument that greater integration leads to greater contagion effect within the effected markets, the present study examines the extent to which such contagion effect influences stock market seasonality.

To achieve its objective, this study focuses on the ASEAN-5 markets namely, Malaysia, Thailand, Singapore, Indonesia, and the Philippines to form ASEAN as a region, particularly because these countries are better proximate in economic and geographic senses compared to the other members. The inclusion of three of the largest Asian markets, namely, Japan, Hong Kong, and Korea, is deemed important given the role that they play in the ASEAN region (Masih & Masih 1999; Narayan et al. 2004). A certain degree of relationships is expected given that these markets especially Hong Kong and Korea are also influenced by the same shocks such as the 1997 Asian that had started in and badly influenced the ASEAN regions (Chancharoenchai & Dibooglu 2006). The ASEAN markets are ideal for testing the existence of contagion effect because they comprise of equity markets that are characterized as ones with poor and/or lacking information dissemination and transparencies, thereby making monitoring of investments in these equity markets very costly. This study hypothesizes that when a particular return pattern emerges in the leader/origin equity market(s), other equity markets follow suits (i.e., a contagion effect occurs) because investors in these markets would find it more efficient to act based on patterns in the origin equity markets rather than investigating for information. The role of the origin markets, if given to the plus 3 component, could easily be exaggerated given the importance of these markets in influencing the economic conditions of the emerging ASEAN-5 markets.

The remainder of the article is organized as follows. Section 2 reviews the existing literature on stock market seasonality and contagion effects. Section 3 describes the data and methodology. Section 4 presents the results while section 5 concludes and discusses the implications from this study.

LITERATURE REVIEW

One of the earliest and most important studies on stock market seasonality effect is that by Rozeff and Kinney (1976) to the extent that it has been held responsible for reviving interests on the issue of January effect. Using the average monthly returns on the NYSE over a 70-year period between 1904 to1974, they found that the average return in January is abnormally higher than any other months except for the period of 1929 to 1940. In a shorter study period between 1963 and 1979, Keim (1983) still found evidence of January effect in a sample of securities traded in the NYSE. In period which includes more recent years from 1926 until 1993, Haugen and Jorion (1996) found the January effect remained elegance with no significant sign of disappearing. This evidence is further supported by more recent study by Pietranico and Riepe (2004). Even though studies on January effect are still lacking in the other parts of the worlds, the market anomaly remains supported. The study by Gultekin and Gultekin (1983) could be the most comprehensive with respect to January effect as an international phenomenon. They found significantly unusual market activity in January in the U.S. as well as in several other European countries, Australia, Japan, and Singapore. Similarly findings are found in more recent studies (Noor Azuddin, Beal, & Delpacitra. 2005; Silvapulle 2004) which put greater emphasis on evidence from Asian markets. While interests on January effect or seasonality effect in general have not shown any significant sign of diminishing, some studies devote their efforts toward finding the explanations for the market anomaly.

Among explanations offered for the January effect, the most frequently cited and tested is tax-loss selling hypothesis (Badrinath & Lewellen 1991; Dyl & Maberly 1992; Eakins & Sewell 1993, Fant & Peterson 1995; Keim 1983; Reinganum 1983). The basic argument of the tax-loss selling hypothesis is that investors holding poor performing stocks will take short positions at the end of the year to reduce the net taxable capital gains. January reports abnormal positive returns as a result of investors reentering the market at the same time, thereby creating

upward pressure in stock prices. As convincing as it is, this argument also implies that in countries where tax motivation does not apply, as in the case of Malaysia, January or month following the tax month should not exhibit abnormal returns. Consistent with this argument, Othman (1991) found no evidence of abnormal returns in January from a sample of six sectoral indexes in Malaysian equity market. Nonetheless, using more recent data, Mohd Rahimie (2002), Noor Azuddin et al. (2005), and Ruzita, Abu Hassan Shaari, and Dwipraptono (2006) found evidence in favor of the January/February effect in the same market.

This contradicting evidence in Malaysia is by no means unique. In fact, similar evidence has been found in other countries and as such, rather commonly used to challenge the tax-loss selling hypothesis. Kato and Schallheim (1985) found that January effect was presence in a sample of Japanese firms despite the no capital gains tax system in the country during the period. Similarly, extending their search back to 1871, Jones *et al.* (1987) found the January effect in the U.S. market had already existed since the pre-tax period. Evidence against tax-loss selling in a country with capital gains taxes is not negligible either. In a sample of firms listed in NYSE and AMEX over the period of 1888 to 1992, Cox and Johnston (1998) found that stocks with high potential for tax loss selling did not exhibit abnormal return in January. Similarly, using major market indexes Mehdian and Perry (2002) also found that after the 1987 market crash the January return was no more significantly different from returns of other months. Thus, this issue is still far from being solved because obviously there are other explanations to January effect besides tax-loss selling hypothesis. The list includes small firm hypothesis and "window dressing" or "performance hedging" (Cuny, Fedenia, & Haugen 1996).

The search for explanations of the seasonality effect remains far from being exhaustive, however motivated by the findings of Masih and Masih (1999) and Narayan et al. (2004), this study is more interested on the implication of the increasing stock market integration on the ability to predict seasonality effect. The importance of stock market integration comes parallel with the growing importance of free capital mobility arising from the introduction of various economic integration mechanisms. For instance, liberalization of barriers to trade promotes stock market integration because it improves capital flows across national borders (Narayan et al. 2004). In a study which involve world's most advanced stock markets as well as Asian emerging stock markets (Hong Kong, Thailand, Singapore, and Malaysia), Masih and Masih (1999) found that there was a particular market that sets the trend for specific geographical

regions. In the case of Southeast Asia, they found that the stock market fluctuations are mostly influenced by the regional (i.e. Hong Kong) rather than the advanced markets. The implication from this imperfect integration, whereby the region is still characterized as one with leader-follower markets (Masih & Masih 1999) is that, it indirectly creates an arbitrage opportunity among stock markets within the region. The present study predicts that one such opportunity might come from the potential contagion effect of stock market seasonality, which is defined as abnormally high return patterns in one equity market (leader/origin) that triggers similar abnormally high return patterns in other equity markets. In other words, this leader-follower linkage elevates the ability of investors in the follower equity market to predict and subsequently exploit seasonality effect in their market by observing the trend in the leader equity markets.

DATA AND METHODOLOGY

This study employs macro-level data to examine seasonality effect in the selected stock markets following the approach used by previous studies (Gu & Simon 2004; Johnston & Cox 2002; Mehdian & Perry 2002; Noor Azuddin et al. 2005; Othman 1991; Pandey 2002; Rozeff & Kinney 1976; Ruzita et al. 2006). Among other things, macro-level data minimizes the microstructure problem introduced in individual and/or institutional stocks (Johnston & Cox 2002), allows seasonality to be more easily detectable (Pandey 2002), and avoids issues related to portfolio formation (Gu & Simon 2004). The monthly closing indexes, defined as the price index on the last trading day of the month, are drawn from Thompson Financial Datastream. Selecting for each country one broad-based stock market index that is most frequently referred to represent the equity market condition and that have full 12-month data starting January 1987 until December 2006 provides this study with the following sample indices: (1) KLSE Composite Index for Malaysia, (2) JSE Composite Index for Indonesia, (3) Straits Times Index for Singapore, (4) SET Index for Thailand, PSE Composite Index for the Philippines, KSE Composite Index for Korea, Hang Seng for Hong Kong, and Nikkei for Japan. All indices are expressed in the U.S. dollar. There are two important facts to note, first, that this study uses Hong Kong in place of China for reasons that: (1) data for China is only available starting 1991; (2) the results of our pilot study using available data suggests that China has no particular influence on the other countries in the region; and (3) previous evidence

on the leading role of Hong Kong in the regional stock markets (Masih & Masih 1999; Narayan et al. 2004). Second, this study has a good combination of sample markets in the sense that all the ASEAN countries selected exempt tax on capital gains while all the plus 3 countries impose tax on capital gains.

The price index data is used in the form of monthly rate of return as in the formula below;

$$R_{i,t} = \frac{PI_{i,t} - PI_{i,t-1}}{PI_{i,t-1}} \times 100\%, \quad (1)$$

where, $PI_{i,t}$ is the price of the ith market index on the last trading day of month t. For the purpose of identifying the seasonal month, we calculate for each equity market the average returns for month t as follow;

$$R_{i,t} = \frac{\sum_{y=1}^{n} R_{i,t,y}}{n_i}, \quad (2)$$

where, y is year 1987 to 2006, t is month of the year and i is the broad based index of the ith market.

To ensure that the time-series analyses employed in this study are appropriate, we test the two basic assumptions of OLS, i.e., the normality of the distribution and the stationarity of the return series. As reported in Table 1, the Jarque-Bera statistics indicate that the normality distribution assumption is violated (i.e. the null hypothesis (H_0: $JB = 0.00$) that the series are normally distributed is consistently rejected). Such violation in normality assumption is nonetheless normal for stock return series. Of

TABLE 1. Descriptive statistics, normality distributions and stationarity tests of return series; 1987-2006

Market	MAS	INDO	PHIL	SNG	THAI	KOR	HKG	JPN
Mean	0.009	0.014	0.010	0.010	0.009	0.012	0.012	0.004
Std. Dev.	0.093	0.132	0.107	0.077	0.106	0.109	0.080	0.069
Skewness	0.407	1.906	0.850	–0.457	0.140	0.942	–0.466	0.337
Kurtosis	7.889	16.666	7.450	7.803	4.376	9.059	7.849	3.908
J-B Stats	245.6**	201.3**	226.9**	239.1**	19.7**	402.6**	243.8**	12.8**
ADF Stats	–9.1**	–12.9**	–12.9**	–14.3**	–13.7**	–14.9**	–15.5**	–14.9**

Notes: In each test, N = 240 months. All Jarque-Bera (J-B) and Augmented Dickey-Fuller (ADF) (lag 12) statistics are significant at 1 percent level.

greater concern in time-series analysis the stationarity of the time series data, which in this study is supported given that the null hypothesis (H_0: $\gamma = 0$) that the series have a unit root is consistently rejected.

Granger Causality Test The empirical analysis begins by employing the Granger causality test to investigate the directions of causality between the stock indices of the eight markets. Given that the direction of the Granger causality is a good indication of the leader and follower among the sample markets, the resulting lead-lag relationship can be translated as indication of markets, which originate the contagion and get the spillover effect.

According to Granger (1969), time series Y_t are said to cause another time series X_t if time series X_t can be predicted better by using past values of Y_t than by using only the historical values of series X_t. This causality test is expressed in the following regression equations:

$$R_{X,t} = \alpha_0 + \sum_{i=1}^{m} \beta_i R_{Y,T-i} + \sum_{i=1}^{m} \alpha_j R_{X,i-j} + \varepsilon_t, \tag{3}$$

where, R are the monthly returns, m is a particular autoregressive lag length and μ_t is a white noise. The test for causality is based on the Wald F-statistics. If the F-statistic is greater than the critical value of a given significant level for an F(m, T-2m-1) distribution, the null hypothesis that return series Y_t does not Granger-cause return series X_t would be rejected.

Time Series Regression Tests The presence of seasonality effect is statistically tested using time-series regression model, which initially is used by Pietranico and Riepe (2004) to detect seasonality effect and can be written as follow;

$$R_{i,t} = \alpha_i + \beta_1 \left(D_{i,t}^{S} \right) + \varepsilon_{i,t}, \tag{4}$$

where, $R_{i,t}$ are the monthly returns on the ith index at the end of month t, a_i is intercept term for the ith index, b is estimated coefficient of the explanatory factor, and e_i is error term in the ith index equation. Meanwhile, D^S is the dummy variable defined generally as follows;

$$D^S = \begin{cases} 1 & \text{if s month is the seasonal month for the respective market} \\ 0 & \text{otherwise} \end{cases} \tag{5}$$

If the coefficient of the dummy variable is significantly positive, the return series is said to exhibit an abnormally positive pattern in the seasonal month and thus a proof of the presence of seasonality effect in the sample markets.

Following Kanas (2005) and Narayan et al. (2004), the second time-series regression model is estimated to trace the presence of contagion effect in general. The model extends Equation (4) to include return series of the other ASEAN plus 3 countries that based on the directions of Granger Causality have been identified as the leaders or origins of contagion effect. The resulting time-series regression model in general is expressed in the following equation;

$$R_t^A = \alpha^A + \beta_1^A \left(D_t^A\right) + \beta_2 \left(D_{1,t}^O\right) + \mathrm{K} + \beta_5 \left(D_{5,t}^O\right) + \varepsilon_t^A, \qquad (6)$$

where, α^A is the intercept term for the affected equity market, R_t is return on the index at the end of month t, O is the equity markets that is identified as the origins of the contagion effect, A is the equity market that is identified as potentially affected by the seasonal patterns in the origin market, β is the response of A equity market's return to the respective O equity market's returns, D^A is the seasonal month dummy variable of the respective affected market (Equation 5), and e^A is the error term in the affected equity market equation. The specification in Equation (6) predicts that monthly returns on stocks of a particular equity market are explained not only by the pattern of returns in seasonal months, but also by the patterns of returns on stocks of the other ASEAN plus 3 equity markets that have been identified to originate/trigger the patterns. In short, the return patterns in the "origin" equity markets are contagious to the other equity markets in the region.

Equation (6) is, however, not a direct test on the contagion effect of stock market seasonality because it represents the general linkages among the stock returns of the eight equity markets. To dictate specific linkages due to seasonality, Equation (6) is modified as,

$$R_t^A = \alpha^A + \beta_1 \left(R_{1,t}^{*A}\right) + \mathrm{K} + \beta_5 \left(D_{5,t}^{*O}\right) + \varepsilon_t^A, \qquad (7)$$

where, R^* are returns of months that have been identified to exhibit seasonality effect. The other variables follow the definitions in Equation (6).

RESULTS AND DISCUSSION

In this study, the stock market seasonality is examined in a prolonged manner similar to Silvapulle (2004). Specifically, the seasonal months are defined as two months with the highest average returns. For each equity market, we calculate and plot the average monthly returns

(Equation 2) on the respective market index over the 20-year study period. The trends and related statistics of the average monthly returns are depicted in Figure 1 and Table 2, respectively. The results indicate that the seasonal months are appropriately associated with February/December in Malaysia and Hong Kong, October/December in Indonesia, January/December in the Philippines and Thailand, April/December in Singapore and Japan, and January/November in Korea. Accordingly, in the dummy variable of Equation (5), these months take the value of 1 while the rest zero.

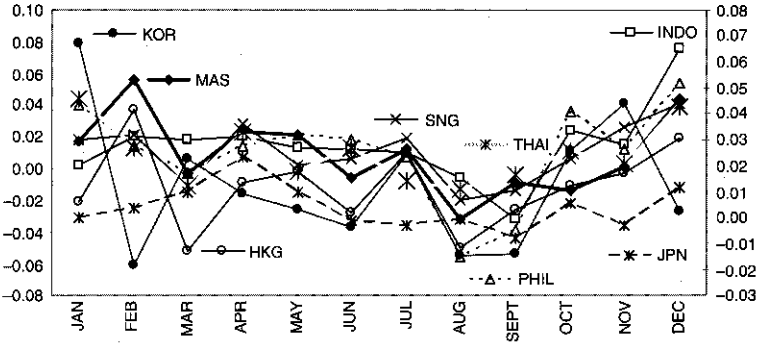

FIGURE 1. Average monthly returns for each of the ASEAN Plus 3 equity markets; 1987-2006

Table 2 presents several noteworthy results regarding the return patterns in the sample markets. First, all stock markets except Thailand consistently report August as the month with the lowest or second lowest average monthly returns. However, as shown in Figure 1, all markets including Thailand report negative average August returns. The "quiet month" of August is not unique to the sample markets. Mohd Rahimie (2002) noted that this phenomenon was also common in the U.S. and the U.K. Pertaining specifically to Malaysia, the results so far differ from those in Othman (1991) where the average monthly returns of January (March) stand highest (lowest) but are similar to those in Mohd Rahimie (2002), Pandey (2002), and Ruzita et al. (2006). Second, the "regionality" feature of the ASEAN-5 countries is evidenced by the correlations that are consistently positive (0.313 to 0.687) and highly significant ($a < 0.01$). With respects to the correlation between ASEAN-5 markets with the plus 3 components, the strongest relation is with Hong Kong and relatively milder with Japan particularly in the case of Indonesia.

TABLE 2. Descriptive statistics of and correlations between the ASEAN plus 3 equity markets

Statistics	Min (Month)	Max (Month)	1	2	3	4	5	6	7
	–0.032	0.056							
1. MAS	(Aug/Oct)	(Feb/Dec)							
	–0.032	0.076	0.31						
2. INDO	(Sept/Aug)	(Dec/Oct)	3						
	–0.056	0.054	0.42	0.44					
3. PHIL	(Aug/Sept)	(Dec/Jan)	0	7					
	–0.020	0.041	0.64	0.47	0.58				
4. SNG	(Aug/Sept)	(Dec/Apr)	6	0	9				
	–0.013	0.044	0.54	0.44	0.56	0.68			
5. THAI	(Aug/Mar)	(Jan/Dec)	2	0	7	7			
	–0.018	0.067	0.21	0.30	0.28	0.34	0.44		
6. KOR	(Feb/Aug)	(Jan/Nov)	6	8	5	9	3		
	–0.013	0.042	0.53	0.34	0.48	0.76	0.55	0.29	
7. HKG	(Mar/Aug)	(Feb/Dec)	5	4	4	1	7	2	
	–0.008	0.023	0.22	0.13	0.21	0.39	0.29	0.45	0.33
8. JPN	(Sept/Aug)	(Apr/Dec)	2	1	9	5	6	5	2

Note: In the second and third columns, the first month in parentheses refers to the month with lowest or highest whereas the second month refers to the second lowest or highest average monthly returns.

Preliminary Results Using specification in Equation (6), we statistically quantify whether the abnormal returns that often occur during the same months in the respective equity market are significant and accordingly can be used as evidence of seasonality effect. The results as reported in Table 3 show that the coefficients of the seasonal dummy variables are positive and significant in all markets except for Indonesia (still it is significant at conventional level) and Japan. While evidence of seasonality effect in Korea and Hong Kong might be driven by tax motivation, evidence in the ASEAN-5 countries are against the hypothesis. More importantly, the fact that most of these markets exhibit significant seasonality effect allows us to proceed with the next quest to determine whether this seasonality has contagion effect. In the meantime, the low R^2 values (0.3% to 3.6%) indicate that more regressors are necessary to explain the returns in the sample markets.

In this study, the additional regressor is determined according to the theory of contagion effect, which hypothesizes that there is a particular event in certain market(s) that triggers similar effect on other markets. To

TABLE 3. Regression of monthly returns of individual equity market on seasonal month dummy

Market	a	b_{SD}	t(a)	t(b_{SD})	Adj-R^2	S.E.	F-Stats	D-W Stats
MAS	0.001	0.049	0.137	3.131**	0.036	0.091	9.803	1.851
INDO	0.007	0.042	0.789	1.857	0.010	0.132	3.447	1.629
PHIL	0.002	0.045	0.321	2.435*	0.020	0.106	5.929	1.643
SNG	0.005	0.029	0.966	2.202*	0.016	0.077	4.849	1.851
THAI	0.003	0.039	0.353	2.133*	0.015	0.106	4.550	1.787
KOR	0.004	0.052	0.476	2.782**	0.027	0.108	7.740	1.917
HKG	0.007	0.029	1.265	2.090*	0.014	0.080	4.368	1.996
JPN	0.001	0.016	0.250	1.348	0.003	0.069	1.816	1.934

Note: In Panel A, * indicates significance at 5% level while abbreviations min = minimum, max = maximum, mon = month, MAS = Malaysia, THAI = Thailand, INDO = Indonesia, and SNG = Singapore. In Panel B, each cell contains coefficient followed by the (t-stat) and *, **, and *** indicates significance at 10%, 5%, and 1% levels, respectively.

be rigorous, the Granger causality tests are repeated using five different lags (1, 3, 6, 9, and 12 months) on each pair of equity markets. Only significant relationships in more than 2 lags are considered for the purpose of establishing origin-affected links in this study. The detailed results of the Granger Causality tests are not reported to conserve space, but instead are reproduced in the form of a diagram in Figure 2, which dictates the direction as well as the intensity of the causality. As denoted in Figure 2, significant causality relationships in all 5 lags, 4 lags, and 3 lags are respectively categorized as most persistent, moderate, and considerable evidence of causalities. The diagram generates three important patterns: (1) there are seven most persistent Granger causalities running from stock prices in Hong Kong to Korea and Indonesia, from Korea to Singapore, Malaysia and Singapore, from Thailand to Malaysia, and from Malaysia to Indonesia; (2) there are two moderate Granger causalities coming from equity markets in Hong Kong to Singapore and between Malaysia and the Philippines; and (3) there is only one Granger causality with considerable intensity running from Malaysia to Thailand. While most of the Granger causalities are unidirectional, two involving Malaysia and Thailand and Malaysia and the Philippines are bidirectional.

Furthermore, the patterns in Figure 2 indicate that there are two markets that seem to have leading role onto others. Somewhat consistent with the results of Masih and Masih (1999), Hong Kong stock market seems to precede the movements in three other markets, namely Korea,

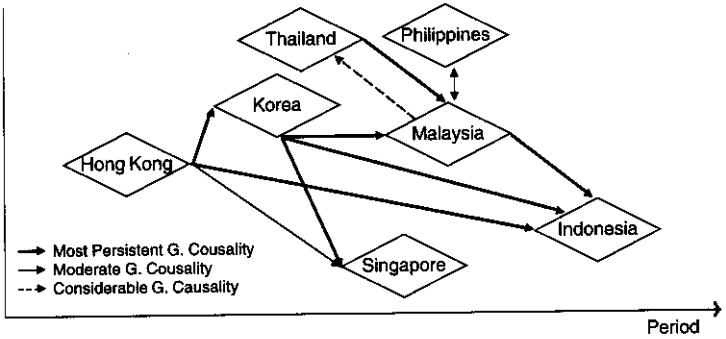

FIGURE 2. Causality direction of the movement of the equity markets in ASEAN plus 3 countries

Indonesia, and Singapore. Korean stock market in turn precedes the movements in Malaysia, Indonesia, and Singapore. Accordingly, Hong Kong and Korea should be identified as the location of the "outbreak" of the seasonality effect in these markets. In other words, to detect the contagion effect of stock market seasonality, returns on stocks traded in Hong Kong would be the explanatory factor for returns on Korean, Indonesian, and Singaporean stocks. In similar manner, Korean returns would be the explanatory factor for returns on Malaysia, Singapore, and Indonesia. The leading role of Hong Kong and Korean equity markets are expected given their sophistication and stability relative to the ASEAN-5 equity markets. Using the directions of the Granger causality in Figure 2 as basis for specifying the models in Equation (6) for estimating the contagion effect of seasonality result in the following specifications for five equity markets:

$$R_t^{INDO} = \alpha^{INDO} + \beta_1\left(R_t^{MAS}\right) + \beta_2\left(R_t^{THAI}\right) + \beta_3\left(R_t^{KOR}\right)\beta_4\left(R_t^{HKG}\right) + \varepsilon_t^{INDO}. \tag{6a}$$

$$R_t^{MAS} = \alpha^{MAS} + \beta_1\left(R_t^{THAI}\right) + \beta_2\left(R_t^{PHIL}\right)\beta_3\left(R_t^{KOR}\right) + \varepsilon_t^{MAS}. \tag{6b}$$

$$R_t^{SNG} = \alpha^{SNG} + \beta_1\left(R_t^{KOR}\right) + \beta_2\left(R_t^{HKG}\right) + \varepsilon_t^{SNG}. \tag{6c}$$

$$R_t^{PHIL} = \alpha^{PHIL} + \beta_1\left(R_t^{MAS}\right) + \varepsilon_t^{PHIL}. \tag{6d}$$

$$R_t^{KOR} = \alpha^{KOR} + \beta_1\left(R_t^{HKG}\right) + \varepsilon_t^{KOR}. \tag{6e}$$

Each of the specifications above will be tested on the contemporaneous and lagged effects (limited to lag 6) of the returns on stocks of leader or origin equity markets as well as adjusted to control for seasonality effect.

The results from employing Equations (6) for testing the contagion effects in Indonesian, Malaysian, Singaporean, the Philippines, and Korean stock returns are reported in Table 4. In general, the tests yield evidence in support of such relations, particularly in the case of Korea, Singapore, and Malaysia. Specifically, for Korean stock markets, the current as well as the lagged returns (–1 and –3) of Hong Kong report coefficients that are significant (R^2 = 12.8%). For Singaporean stock market, the coefficients of current returns of Hong Kong and Korea and lag 1 returns of Korea are significant, (R^2 = 60.9%). But it is the contagion effect for Malaysian market that seems to provide more meaningful implication on investment. Four lagged returns of Korea and lag 2 returns of Thailand are significant when explaining returns of Malaysia. In short, if the specification employed in this study is a reasonable estimation of contagion effect, then the coefficient of lagged returns of origin stock markets suggest that there is contagion effect of seasonality coming from the respective markets to the Korean, Singaporean, and Malaysian stock markets.

The results for Indonesian equity market is slightly weaker but still suggest that there is indeed contagion effect coming from Malaysia (lag 5) and Korea (lag 1). Similarly is Thailand which contagion effect is detected in lag 1 from Malaysia. The evidence in Thailand may not have much implication on investment because the role of Malaysian equity market is limited to its contemporaneous influence. In other words, the movement of the Malaysian stock returns precedes the movement of the stock returns in Philippines by 1 month and Indonesian by 5 months, but contemporaneous with that of Thailand. The results of controlling seasonal dummy variable in estimated models, as presented in Table 5, do not seem to change the results in Table 4. Therefore, given that the coefficients of dummy variables are significant only in Malaysia and Korea, the remaining of the article would concentrate on these two markets in discussing the influence of contagion effect on the stock market seasonality.

Overall, the findings so far intuitively suggest that investors in the affected markets have the advantage of being able to rely on the condition of the origin stock markets to predict the stock price conditions in the former markets. Investors in Malaysian stock market, for instance, could

TABLE 4. Regressions of monthly returns of affected equity market on monthly returns of the origin equity markets, 1987-2006

Variables	PHIL	t(stats)	THAI	t(stats)	KOR	t(stats)	SNG	t(stats)	MAS	t(stats)	INDO	t(stats)
C	0.004	0.648	0.005	0.850	0.007	0.912	–0.001	–0.221	0.000	0.074	0.002	0.179
MAS	0.467	7.106**	0.607	9.337**							–0.029	–0.231
MAS(-1)	0.181	2.780**	0.120	1.865							0.182	1.483
MAS(-2)	–0.094	–1.428	–0.002	–0.023							0.146	1.191
MAS(-5)	–0.033	–0.516	–0.010	–0.156							0.287	2.517**
MAS(-6)	–0.089	–1.371	–0.063	–0.980							0.054	0.493
HKG					0.378	4.484**	0.684	16.188**			0.251	1.925
HKG(-1)					0.237	2.822**	–0.009	–0.210			0.145	1.110
HKG(-2)					–0.012	–0.142	0.048	1.112			–0.201	–1.533
HKG(-3)					–0.230	–2.754**	–0.075	–1.710			0.007	0.054
HKG(-6)					–0.013	–0.160	–0.028	–0.642			–0.039	–0.305
KOR							0.079	2.438**	–0.059	–1.211	0.119	1.412
KOR(-1)							0.087	2.714**	0.169	3.509**	0.184	2.154*
KOR(-3)							0.039	1.215	–0.128	–2.669**	0.111	1.270
KOR(-5)							0.038	1.200	0.115	2.429**	0.099	1.121
KOR(-6)							0.030	0.976	0.109	2.289*	0.040	0.465
THAI									0.320	5.484**	0.316	3.077**
THAI(-1)									–0.016	–0.276	0.010	0.096
THAI(-2)									0.140	2.412**	0.147	1.390
THAI(-3)									0.003	0.054	–0.041	–0.391
THAI(-6)									–0.015	–0.254	0.071	0.677

continued

TABLE 4. (cont.)

Variables	PHIL	t(stats)	THAI	t(stats)	KOR	t(stats)	SNG	t(stats)	MAS	t(stats)	INDO	t(stats)
PHIL									0.179	3.032**		
PHIL(-1)									–0.001	–0.026		
PHIL(-3)									–0.101	–1.805		
PHIL(-6)									0.006	0.103		
Adj-R^2	0.220		0.317		0.128		0.609		0.427		0.274	
S.E.	0.089		0.088		0.102		0.048		0.070		0.114	
DW Stats	1.983		2.100		2.093		1.986		2.259		1.917	
F-Stats	10.377		16.471		5.892		26.973		9.263		4.141	

Note: Asterisk * and ** indicates significance at the 5% and 1% levels, respectively. Durbin-Watson (DW) statistics » 2.00 indicate no autocorrelations in the residuals. Also note that the results of several lags that report insignificant coefficient are omitted to conserve space.

TABLE 5. Regressions of monthly returns of affected market on monthly returns of the origin markets and seasonal dummy variable, 1987-2006

Variables	PHIL	t(stats)	THAI	t(stats)	KOR	T(stats)	SNG	t(stats)	MAS	t(stats)	INDO	t(stats)
C	0.000	–0.044	0.002	0.294	–0.001	–0.152	–0.004	–0.977	–0.003	–0.580	–0.004	–0.474
D(S)	0.024	1.506	0.018	1.134	0.046	2.576**	0.018	2.068*	0.020	1.527	0.035	1.640
MAS	0.457	6.945**	0.600	9.188**							–0.027	–0.215
MAS(-1)	0.174	2.671**	0.115	1.779							0.196	1.602
MAS(-2)	–0.086	–1.300	0.005	0.072							0.179	1.447
MAS(-5)	–0.026	–0.406	–0.005	–0.072							0.271	2.374*
MAS(-6)	–0.089	–1.374	–0.063	–0.980							0.055	0.504
HKG					0.379	4.561**	0.678	16.148**			0.246	1.892
HKG(-1)					0.228	2.745**	–0.005	–0.121			0.129	0.989
HKG(-2)					–0.008	–0.101	0.043	1.000			–0.190	–1.456
HKG(-3)					–0.216	–2.606**	–0.072	–1.653			–0.021	–0.156
HKG(-6)					–0.023	–0.284	–0.025	–0.589			–0.025	–0.191
KOR							0.081	2.515**	–0.046	–0.941	0.121	1.442
KOR(-1)							0.083	2.595**	0.156	3.197**	0.174	2.047*
KOR(-3)							0.035	1.103	–0.131	–2.737**	0.096	1.099
KOR(-5)							0.032	1.033	0.115	2.428**	0.091	1.027
KOR(-6)							0.031	0.991	0.115	2.397*	0.052	0.605
THAI									0.319	5.478**	0.302	2.939**
THAI(-1)									–0.014	–0.242	0.022	0.215
THAI(-2)									0.139	2.409**	0.125	1.176
THAI(-3)									0.003	0.056	–0.024	–0.224

continued

TABLE 5. (cont.)

Variables	PHIL	t(stats)	THAI	t(stats)	KOR	T(stats)	SNG	t(stats)	MAS	t(stats)	INDO	t(stats)
THAI(-6)									–0.027	–0.460	0.050	0.470
PHIL									0.168	2.828**		
PHIL(-1)									0.000	–0.005		
PHIL(-6)									0.020	0.358		
Adj-R^2	0.224		0.318		0.149		0.615		0.430		0.280	
S.E.	0.089		0.088		0.100		0.048		0.069		0.114	
DW Stats	1.991		2.095		2.067		1.997		2.254		1.902	
F-Stats	9.414		14.591		6.114		25.837		9.003		4.124	

Note: Asterisk * and ** indicates significance at the 5% and 1% levels, respectively. Durbin-Watson (DW) statistics » 2.00 indicate no autocorrelations in the residuals. Also note that the results of several lags that report insignificant coefficient are omitted to conserve space.

observe the stock price movements in Thailand and more so in Korea 6 months in advance to predict the Malaysian stock price in month *t*. More importantly, this information might be very useful to predict and exploit the abnormal returns in Malaysian seasonal monthly, namely in February and December. Investors in Korea could do the same by observing the stock prices in Hong Kong 3 months in advance. However, whether or not such trading rule can be of practical use depend on whether the affected and the origin equity markets exhibit abnormal returns in the same month. The problem is, in the case of Malaysia, the seasonality is associated with February/December while those in Korea and Thailand are associated with January/December and January/November. To address this concern, we run another Granger causality tests which use only seasonal month returns as reported in Table 2 as the variables.

As with the first test, the detail results are not reported to conserve space whereas only the important Granger causalities are extracted and reproduced in Figure 3. Compared to the first test, this Granger causality test produces less significant causalities but whenever it does, the causality is always unidirectional. Also, unlike the results in the first test which indicate the tendency of Hong Kong to dominate the leading role, this test suggests Korea to assume the leading role of the other markets including Hong Kong. Other than that, similar to the previous test results, movement in Korean stock market still leads those in Singapore, Malaysia, and Indonesia. Interestingly, both Malaysian and Indonesian stock markets precede the more developed market in the region, i.e. Singapore. The lead-lag relationship between Malaysia and Singapore is not totally unexpected; instead it conforms well with the nature of the seasonality in

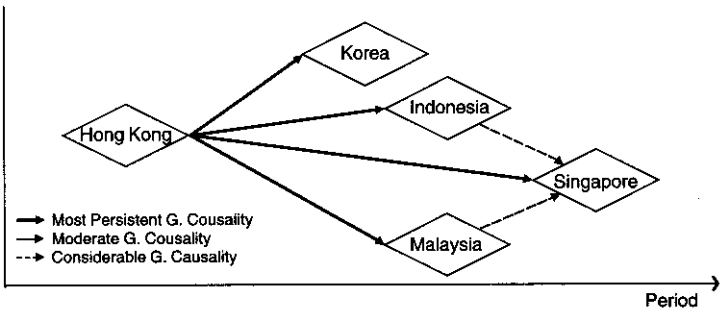

FIGURE 3. Causality direction in the movement of the equity markets in ASEAN Countries

these markets. That is, seasonality in the former is more pronounce in February whereas in the latter, it takes place in December. While the same justification explains the lead-lag relationship between Korea (January) and Hong Kong (February) and between Korea and Malaysia, it does not seem to explain that between Indonesia and Singapore as both report highest average returns in December.

Using the relationships that emerge from the Granger causality tests as basis, we form and run the following regression models (based on Equation 7) to quantify whether such relationship can induce intuitive meanings:

$$R_t^{*SNG} = \alpha^{*SNG} + \beta_1 \left(R_t^{*MAS}\right) + \beta_2 \left(R_t^{*INDO}\right) + \beta_3 \left(R_t^{*KOR}\right) + \varepsilon_t^{*SNG} . \quad (7a)$$

$$R_t^{*MAS} = \alpha^{*MAS} + \beta_1 \left(R_t^{*KOR}\right) + \varepsilon_t^{*MAS} . \quad (7b)$$

$$R_t^{*INDO} = \alpha^{*INDO} + \beta_1 \left(R_t^{*KOR}\right) + \varepsilon_t^{*INDO} . \quad (7c)$$

$$R_t^{*HKG} = \alpha^{*HKG} + \beta_1 \left(R_t^{*KOR}\right) + \varepsilon_t^{*HKG} . \quad (7d)$$

Since the variables used in Equations (7) already incorporate seasonality, we only adjust them to include the lagged effects (limited to 6 lags) of the returns on stocks of the origin equity markets. Consistent with the results of the Granger causality tests, the results in Table 5 in general provide strong evidence of contagion effect particularly with respect to Malaysia and Singapore where the seasonality effect to some extent is due to seasonality (return patterns) in Korea. In the case of Singapore, the contagion effect is also triggered in Malaysia and more so in Indonesia. In addition, the contagion effect from Korea is also significantly important in predicting returns in Hong Kong and Indonesia. Regarding the leading role of Korea, the resulting adjusted-R^2 shows that its seasonal month returns explain about 3.6% and 4.0% of the fluctuations in Hong Kong and Indonesia, but it explains as high as 38.8% variations in returns on stocks traded in Malaysia.

Intuitively, these results suggest that the abnormal performance of the origin stock markets in Korea, Malaysia, and Indonesia are not confined to their national borders. Instead they are contagious and infecting the neighboring equity markets, which in this case are Hong Kong, Malaysia, Indonesia, and Singapore. From investment standpoint, these contagious relationships indicate that during the seasonal months of February and December of year *t*, prices of stocks traded in Malaysia seem to have responded significantly to the lag 1 seasonal month returns

TABLE 6. Regressions of seasonal month returns of domestic on those of the "origin" equity markets

Variables	HKG	t(stats)	MAS	t(stats)	INDO	T(stats)	SNG	t(stats)
C	0.006	2.277*	0.006	2.469**	0.005	0.870	0.002	0.923
KOR	–0.016	–0.456	–0.017	–0.494	–0.016	–0.174	–0.005	–0.171
KOR(-1)	0.125	3.578**	0.390	11.144**	0.348	3.907**	0.012	0.337
KOR(-2)	–0.019	–0.527	–0.021	–0.572	–0.019	–0.202	–0.003	–0.079
KOR(-3)	–0.026	–0.732	–0.086	–2.372	0.064	0.692	0.107	2.836**
KOR(-4)	–0.019	–0.528	–0.021	–0.572	–0.019	–0.202	–0.004	–0.099
KOR(-5)	–0.017	–0.492	–0.031	–0.881	0.002	0.026	0.050	1.338
KOR(-6)	–0.016	–0.460	–0.017	–0.498	–0.016	–0.176	–0.003	–0.080
AS							0.213	4.049**
MAS(-1)							–0.006	–0.118
MAS(-2)							–0.184	–3.436**
MAS(-3)							–0.005	–0.090
MAS(-4)							0.093	1.769
MAS(-5)							–0.005	–0.094
MAS(-6)							–0.028	–0.717
INDO							0.078	3.816**
INDO(-1)							–0.001	–0.055
INDO(-2)							0.009	0.450
INDO(-3)							–0.001	–0.057
INDO(-4)							0.052	2.496**
INDO(-5)							–0.002	–0.083
INDO(-6)							0.088	4.370**
Adj-R^2	0.040		0.388		0.036		0.254	
S.E.	0.033		0.033		0.085		0.026	
DW Stats	2.027		2.042		2.004		2.000	
F-Stats	2.385		22.129		2.246		4.769	

Note: Asterisk ** and * indicate significant at the 1% and 5% levels, respectively. Durbin-Watson statistics » 2.00 indicate no autocorrelations in the residuals.

in Korea. In other words, efficient investors in Malaysia should be able to win big the abnormal high returns in February/December of year t by observing the performance of Korea returns in January/November of year $t-1$. Similar interpretation applies to Hong Kong and Indonesia. Pertaining to Singapore, in general the abnormal returns in April/December of year t can be predicted by patterns of returns in January/December of year $t-3$ in Korea, February/December in year t and $t-2$ in Malaysia and October/December of year t, $t-4$, and $t-6$ in Indonesia.

CONCLUSION AND IMPLICATION

This study examines the issue of contagion effect of seasonality in five emerging markets that are normally clustered as the ASEAN-5 namely, Malaysia, Singapore, Thailand, the Philippines and Indonesia—plus 3 other markets that are commonly considered as the most developed markets in Asian, namely Japan, Korea, and Hong Kong. A unique characteristic shared among the ASEAN-5 markets is the tax exemption on capital gain, which by itself is significant in the literature on seasonality in stock market because tax-loss selling hypothesis has been a widely-accepted explanation of seasonality effect. On the contrary, all the plus 3 components of the sample markets impose tax on capital gains and therefore, serve as a control group. The preliminary results suggest presence of seasonality effect in these markets regardless of tax motivation. Specifically, where tax motivation applies, evidence of the seasonality effects is only significant in Hong Kong and Korea. On the contrary, where tax motivation does not apply, all markets indicate evidence of seasonality effect. In short, this study provides additional evidence inconsistent with the tax-loss selling hypothesis.

The rests of the tests are aimed to investigate the presence of contagion effect of seasonality in stock market. Using Granger causality tests on the general returns data, we find evidence that some equity markets lead the others. Considering a slightly broader span (by using two months with the highest returns) in examining seasonality, we conduct two regression analyses, first using all monthly returns and then using only the seasonal month returns. The first regression models that are formed based on the causality directions confirm that there are contagion effects in the general stock market performance. The contagion effects in the ASEAN-5 markets are more commonly to be initiated from outside the region, that is, from Hong Kong and Korea.

The second regression models are formed based on Granger causality tests using only seasonal month returns. The results suggest that the movement in Korean stock market precedes those in Malaysia, Singapore, and Indonesia, as well as Hong Kong. Finally, the results from regressions confirm that seasonality in Korea has lagged contagion effect on seasonality in all of these markets. In the case of Singapore, its seasonality is also explained by current and lagged seasonal returns in Malaysia and Indonesia. It is rather interesting to note that in both analyses, there seems to be no indication that Japan has any particular role in leading the other

stock markets. This result is rather unexpected given the customary of associating the Japanese market when discussing the conditions of stock markets in the region. Overall, our analysis provides strong evidence of contagion effect of stock market seasonality in the ASEAN plus 3 markets. From the investment standpoint, the contagion effect implies that decision should not solely based on the confined condition of one own market, but other markets in the Asian region as a whole.

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