Does Market Integration Promote to Firm Information Efficiency? Empirical Evidence for Malaysia Listed Firms
(Adakah Integrasi Pasaran Menggalakkan Kecekapan Maklumat Firma? Bukti Empirik untuk FIrma-Firma Tersenarai)

TAI KUI GUAN
AIA Berhad

HOOY CHEE WOOI
Universiti Sains Malaysia

ABSTRACT

Global information transmits fast into share price if a company is highly integrated with the world market. On the contrary, a segmented firm that has higher integration with local market is expected to have slow response to global information. This paper tested whether the above is true for listed firms in Malaysia, a fast-emerging market that consists of large pool of both integrated and segmented firms. The degree of market integration is measured by the variance ratios approach proposed by Akdogan (1997) while informational efficiency is captured by the price delay measure suggested by Hou and Moskowitz (2005). We analyzed a panel of 265 firms from 1995 to 2010 and found that firms with higher integration with world market have better global information efficiency while segmented firms were significantly slow to impound global news. Our results are robust to the choice of different proxies of informational efficiency as well as different control variables and a variety of alternative regression specifications. Our findings imply that the policymakers should consider further liberalize the Malaysian stock market to increase its transparency and reduce information barriers so that information efficiency can be improved and contribute to economic growth agenda.

Keywords: Informational efficiency; Market integration; Price delay; Variance ratios; financial crisis

ABSTRAK

Maklumat dunia melintas pantas ke dalam harga saham jika sesebuah syarikat sangat terintegrasi dengan pasaran dunia. Di sebaliknya, firma bersegmentasi yang mempunyai integrasi yang lebih tinggi dengan pasaran tempatan dijangka membalas lebih perlahan terhadap maklumat dunia. Kertas ini menguji sama ada perkara di atas adalah benar bagi firma-firma tersenarai di Malaysia, sebuah pasaran yang pesat berkembang yang terdiri daripada sekumpulan besar firma berintegrasi dan firma bersegmentasi. Tahap integrasi pasaran diukur dengan pendekatan nisbah varians yang dicadangkan oleh Akdogan (1997) manakala kecekapan maklumat diukur dengan kelewatan harga yang dicadangkan oleh Hou dan Moskowitz (2005). Kami telah menganalisa satu panel 265 firma dari tahun 1995 hingga 2010 dan mendapati bahawa firma yang mempunyai integrasi yang lebih tinggi dengan pasaran dunia mempunyai kecekapan maklumat dunia yang lebih baik manakala firma-firma bersegmentasi amat lambat dalam penyerapan maklumat dunia. Keputusan kami adalah mantap dalam pilihan proksi kecekapan maklumat dan pembolehubah kawalan yang berbeza serta pelbagai spesifikasi regresi alternatif. Penemuan kami mengimplikasikan bahawa pembuat dasar perlu mempertimbangkan untuk meliberalisasikan lagi pasaran saham Malaysia bagi meningkatkan ketelusan dan mengurangkan halangan maklumat supaya kecekapan maklumat dapat dipertingkatkan dan menyumbang kepada agenda pertumbuhan ekonomi.

Kata kunci: kecekapan maklumat; integrase pasaran; kelewatan harga; nisbah varians; krisis kewangan

INTRODUCTION

Over the past decades, fast pace of market deregulation, liberalization, and globalization, couple with advanced information technology have led to increasingly integration of emerging market into the world market. This is reflected in tremendous grow in direct and portfolio investments into emerging market, as well as active foreign listing and acquisition activities. Empirical evidence suggests that when firms are highly integrated with the world market, they tend to enjoy

lower price volatility, lower cost of capital, and increasing real investment opportunities. All this has spurred local productivity and contribute to economic growth (Bekaert et al. 2005; Bekaert & Harvey 2000; Henry 2000; Mitton 2006; Tai 2007).

The speed of informational transmissions is expected to improve under a more globally integrated stock market. When a market is more integrated with the world, there will be a higher compliance to international norms in terms of corporate governance, more liberalized in foreign equity ownership, stringent disclosure rules, and more competitive pricing (Hooy & Lim 2013). Similarly, at the firm level, the dissemination of global information is expected to be faster for the more globally integrated firm than those segmented firms. If a firm is highly integrated with the world market, the quality and speed of information arrival is expected to become better and faster, respectively. This will leads to higher degree of informational efficiency at firm level. Basically, firm level information efficiency is sensitive to the extent how firm has diversified its global systematic risk. On the other hand, if firm is not integrated with the world market, one would expect the firm to be sluggish in global information efficiency and response slower to global news but response relatively faster to local news. Since most of the emerging markets are less liberalized, the absence of foreign equity ownership and participation in local stock market might diminishes the benefits from international information sharing, hence, some of the local firm are exposed more to local market shocks.

Albuquerque et al. (2009) has developed a theoretical model to highlight the information asymmetry between local and global investors in acquiring global information causes local investors to underreact to the movements of global factors. Stocks that are not accessible to global investors are unlikely to incorporate global information into its prices in a timely and accurate way. Empirically, Bae et al. (2012) has tested and reinforced the empirical validity of this information asymmetry hypothesis on market liberalization process. Their paper examined the impact of market liberalization (proxy by degree of investibility) on price delay with respect to local and global markets information,[1] and found that market frictions including restriction on foreign equity ownership in emerging countries are likely to impede swift processing of global market information. The paper concludes that removal of ownership restrictions could improves the degree of informational efficiency of emerging stock markets, in other words, market integration can promote information efficiency.

This paper focuses on a small and open emerging country, Malaysia. Bursa Malaysia, the Malaysian stock market, is one of the rapidly growing and leading equity market in emerging countries. Indeed, Malaysia was claimed as one of the highly integrated market with the world (see Bekaert & Harvey 1995; Tai 2007). As Malaysia is a small and open economy that based heavily on external trade climate, the Malaysian public listed firms hence are highly expose to global information. With the eruption of the 1997 Asian financial crisis and the implementation of the capital control and fixed exchange rate policy in 1998, the Malaysian equity market has had a dynamic integration with the world market over the one and a half decade. The pegging was lifted in July 2005, but then there was the outbreak of the US subprime crisis and European sovereign debt crisis in the late 2000s. Hence, Malaysia's firms can serve as good platforms to examine how global information was impounded at the firm level given the variation in their market integration over time.

To test firm level information efficiency, we used the price delay proposed by Hou and Moskowitz (2005). We also followed the approach of Akdogan (1997) to measure the degree of firm level integration with local and global stock markets. Finally, we employed panel regression model to determine the association between these two concepts. We documented empirical evidence to support the integration-effect hypothesis where the delay to global market information was negatively related to firm integration with the world market; while firm integration with the local market is positively associated with the price delay. The results were robust across different panel estimations, alternative proxies for price delay proposed by Hou (2007), and added control variables on financial crises. Overall, our study suggested that policy efforts aim to remove both direct and indirect barriers aid to enhance informational efficiency of Malaysian public listed firms.

Our contribution is twofold. First, we provide the first empirical evidence at firm level to establish the impact of market integration on information efficiency. To date, there is no such empirical work at firm level albeit Hooy and Lim (2013) has provides the first empirical evidences on the link between market information efficiency with market integration at the aggregate market level. Second, we adopted the integration measure at market level proposed by Akdogan (1997) to construct firm level measures that distinguishes the market efficiency process of globally integrated firms versus the locally integrated firms. As Hooy and Lim (2013) was using country level data, they only measure world market integration on market efficiency.

The remainder of the paper is organized as follows. Section 2 demonstrates literature review of this study. Section 3 methodology and the sample of this study. Section 4 addresses the results and main findings. Section 5 presents robustness analysis and Section 5 concludes.

LITERATURE REVIEW

The irrelevant assumptions of the conventional asset pricing theory assumed that the market is frictionless and investors are well diversified. These assumptions had limited the ability of researchers to investigate the relative efficiency of stock markets. A breakthrough was achieved by Hou and Moskowitz (2005), who proposed the price delay measure to

measure the effect of market frictions on cross-sectional return predictability. Hou and Moskowitz (2005) suggest that transaction costs, information costs and institutional force have delayed the stock price adjustment process. In the extant literature, the price delay has been applied to investigate the association between speed of stock price adjustment and market frictions (Hou & Moskowitz 2005), accounting quality (Callen et al., 2010), option pricing (Blau & Brough 2011; Phillips 2010), short sales (Boehmer & Wu 2010; Chen & Rhee 2010; Saffi & Sigursson 2011), market liberalization (Bae et al., 2012; Chiang et al. 2008) and market integration (Hooy & Lim 2012).

Many studies also examine the determinants of price delay. For example, Bae et al. (2012) investigates the effect of market liberalization on asymmetry information market efficiency for 21 emerging stock markets. The degree of asymmetric information efficiency is proxied by the price delay of Hou and Moskowitz (2005) while the market liberalization (or investibility) is proxied by degree open factor.[2] They further classified the stocks into three investable groups based on the investibility weight, e.g. non-investable stock (foreigners own zero percent of local stocks), partially investable stocks (foreigners ownership up to 50 percent) and highly investable stocks (foreigners ownership more than 50 percent). They documented a positive association between investable stocks and the speed of stock price adjustment to new global market information after control for firm size, turnover, volatility and analyst coverage. Bae et al. (2012) concluded that the participation of global investors in local stock markets have facilitated the diffusion of global market information into local stock prices and this is consistent with the theory of asymmetric information of Albuquerque et al. (2009). Overall, the findings from Bae et al. (2012) research indicate that the openness of the local market to foreign investors or liberalization had improved the overall informational efficiency of local markets.

Next, price delay also has been applied to examine the relationship between short sales constraints and price discovery process at the firm-level. Among the popular studies include Chen and Rhee (2010), Boehmer and Wu (2010) and Saffi and Sigursson (2011). On top of that, Chen and Rhee (2010) examined the effect of short sales on Hong Kong Stock Exchange (HKSE) efficiency by using the price delay measure. They found that shortable stock prices were faster to adjust to new market-wide information than nonshortable stocks. The estimated results were significant even the stock market is in bull time and after control for firm characteristics like trading volume, firm size, liquidity and share prices.[3]

Similar to Chen and Rhee (2010) study, Boehmer and Wu (2010) investigated the effect of short selling on price delay. The sample study consists of stocks listed on New York Stock Exchange (NYSE) and the analysis was based on high frequency data, daily data set from January 2005 to June 2007. The estimated results were supported by Chen and Rhee (2010) research, suggesting that short selling has contributed to more efficient stock pricing in developed market. Saffi and Sigursson (2011) also found similar findings where there was a positive relationship between short sales and price delay measure.

Besides, the price delay also has been extended to investigate the issue of accounting quality and informational efficiency. Callen et al. (2010) has examined the effect of accounting quality on price delay processes for stocks listed in CRSP across the period of 1981 to 2006. They posit that poor accounting quality has a positive relationship with price delay measure and thus, investors demand higher future returns to compensate for poor accounting quality. The accounting quality was proxied by accrual quality, earnings surprises, loss frequency and special items. Following Hou and Moskowitz (2005) model, Callen et al. (2010) documented that poor accrual quality, more frequent loss stocks and large negative special items tend to exhibit the positive relationship with the price delay measures. Consistent with the price delay literature, findings from Callen et al. (2010) study has suggested that the level of accounting quality significantly affects the degree of informational efficiency in any firms.

Most of the empirical studies on price delay discussed so far had focused on firm-level analysis. However, Lim and Hooy (2010) is the first study to examine the speed of stock price adjustment to new market-wide information by using the aggregate country level dataset. Their findings were consistent with price delay literature where emerging countries tend to exhibit the higher values of delay measures than developed countries. The larger of price delay indices in emerging markets indicate that these markets are slower in incorporating global news into local stock prices. Moreover, they also documented that small market size, restrictions on foreign equity ownership, lower trading volume and short sales restriction had impeded the stock price adjustment processes. Subsequently, Hooy and Lim (2013) investigate whether a more integrated stock market is associated with the price delay measure as a proxy for information efficiency. They employed the adjusted pricing errors from an equilibrium international asset pricing model as a proxy for market integration to explain the aggregate country-level price delay as informational efficiency measures. Using data from 49 countries, they documented robust evidence supporting the hypothesis that markets more integrated with the world are also more efficient, but this positive association is only significant in the sub-sample of emerging stock markets. The paper do not provides firm level analysis on the issue. This is the research gap that our paper is contributed to fill up.

METHODOLOGY AND DATA

ASYMMETRY INTEGRATION AND THE SPEED OF STOCK PRICE ADJUSTMENT

We test the effect of asymmetry market integration on informational efficiency via the panel regression model. In line with the literature in price delay, we control the effects of other determinant variables. We introduce four common determinants for price delay which are the degree of foreign investibility, firm size, firm turnover, and firm volatility. Adopted from Hooy and Lim (2013), our empirical model is shown below:

$$DELAY = \alpha_i + \beta_1 INTEGM_{i,t} + \beta_2 INTEGW_{i,t} + \beta_3 Control + \eta_i + \tau_t + \varepsilon_{i,t} \quad (1)$$

where $DELAY$ is the firm specific price delay at time t. $INTEGM_{i,t}$ and $INTEGW_{i,t}$ are firm i integration indexes with local and world market, respectively. Following the literature in price delay research our control variables are market investability, firm size, firm liquidity proxy by turnover and firm volatility. Market investability is calculate by the proportion of foreign investors' shareholdings; firm size is the natural log if market capitalization; turnover is number of shares traded over the year scaled by the number of shares outstanding; and firm volatility is the natural logarithms of standard deviation of weekly stock returns in a year. The symbol η_i is firm fixed-effect which capture all the time-invariant firm level characteristics; τ_t is the time-effect which represent common shocks; while $\varepsilon_{i,t}$ denotes the white noise residuals.

PRICE DELAY

We use a two-factor market model to gauge the speed of stock prices adjustment to global information so that we can control for local market returns. The annual price delay index of each firm is obtained by regressing the firm weekly returns with the restricted four weeks lagged returns on both the local and world market portfolios over the fiscal year. Four weeks lagged market returns are chosen because it is considered a fair amount of time for a firm to respond to new market-wide information (Hou & Moskowitz 2005). The returns generating model is shown in the following equation:

$$r_{i,t} = \alpha_i + \delta_i r_{M,t} + \sum_{n=1}^{4} \delta_i^{(-n)} r_{M,t-n} + \gamma_i r_{W,t} + \sum_{n=1}^{4} \gamma_i^{(-n)} r_{W,t-n} + \varepsilon_{i,t} \quad (2)$$

where $r_{i,t}$ denotes the return of firm i at week t. $r_{M,t}$ and $r_{W,t}$ represent the KLCI and MSCI weekly value-weighted index returns in week t, respectively. $r_{M,t-n}$ and $r_{W,t-n}$ are KLCI and MSCI weekly value-weighted lagged index returns, respectively for *n= 1, 2, 3 and 4*. $\varepsilon_{i,t}$ denotes the white noise error terms. Local market portfolio $(r_{M,t})$ is obtained from the projection of local market portfolio on world portfolio. So $r_{M,t}$ represents the part of returns variation in local market that is not able to capture by $r_{W,t}$. Hence, $r_{M,t}$ is orthogonal to $r_{W,t}$.

We follow Hou and Moskowitz (2005) to construct the price delay indexes, taking one minus the ratio of R^2 from restricted model $\gamma_i^{(-n)} = 0, \forall n \in [1,4]$ over R^2 from unrestricted model given below:

$$DELAY = 1 - \frac{R^2_{\gamma_i^{(-n)}=0, \forall n \in [1,4]}}{R^2} \quad (3)$$

The larger the value of the *DELAY* implies a greater delay in the response of firm to world and local market-wide news. Basically, the delay series is an inverse measure of market efficiency.

ASYMMETRY MARKET INTEGRATION- THE VARIANCE RATIO MODEL

We follow Akdogan (1997) to decompose the systematic risk into 2 components to measure the different integration process of firms with local market (KLCI), and integration with world market (MSCI).[4] Hence, the issue of asymmetry integration of local versus global markets is addressed via the two-index return generating process:

$$r_{i,t} - r_{F,t} = \alpha_i + \beta_M [r_{M,t} - r_{F,t}] + B_W [r_{W,t} - r_{F,t}] + \varepsilon_{i,t} \quad (4)$$

where $r_{i,t} - r_{F,t}$ is the firm *i* excess returns at week *t*, $r_{M,t} - r_{F,t}$ and $r_{W,t} - r_{F,t}$ denote the local and global market risk premiums at time *t*. The epsilon $(\varepsilon_{i,t})$ represents the white noise error terms. The variance of stock *i* can be decomposed into three components by dividing both sides of Equation (4) with the variance of $r_{i,t}$.

$$A_i + B_i + C_i = 1 \tag{5}$$

where

$$A_i = \frac{\beta_M^2 \operatorname{var}(r_M)}{\operatorname{var}(r_i)} = INTEGM_i \tag{6}$$

$$B_i = \frac{\beta_W^2 \operatorname{var}(r_W)}{\operatorname{var}(r_i)} = INTEGW_i \tag{7}$$

$$C_i = \frac{\operatorname{var}(\varepsilon_i)}{\operatorname{var}(r_i)} \tag{8}$$

A_i and B_i measure the proportion of local and world systematic risks' contribution to firm's *i* variation while C_i measures the proportion of firm's *i* unsystematic risk. Intuitively, the greater the value of A_i indicates that firm *i* is driven by local systematic risk. In contrast, if firm *i* is more integrated with world stock market, one should expect the value for B_i to be greater than A_i.

DATA DESCRIPTION

The weekly closing prices for individual firms are retrieved form Thomson DataStream, while data for foreign equity ownership are obtained from Bursa Malaysia. The analysis is based on weekly US dollar returns. We obtain weekly closing prices (Wednesday) of individual stock, annual series of market capitalization, and trading volume from DataStream. Firm volatility is proxied by the standard deviation of stock returns within a year.

The sample study includes stocks that are listed since January 1995 and still survived until December 2010 (16 years in total). This period covered all the episodes of financial crises of the last decade, from the Asian Financial crisis to Dot-Com Bubble and US Subprime crisis. We restricted our sample to active firms only and excluded those suspended and delisted. We also excluded observations which closing prices are either zero or are missing (Bae, et al. 2004). We merged these firms-level data from DataStream with foreign ownership annual data obtained from Bursa Malaysia. After these filtration, we were left with 265 firms.

World stock market return is proxied by the value-weighted Morgan Stanley Capital International (MSCI) All Country World Index. Local stock market returns are captured by the value-weighted FTSE Bursa Malaysia Kuala Lumpur Composite Index (KLCI). Moreover, the world and local markets risk free rates are proxy by the US 3-month Treasury bill rates and Malaysia Interbank 3-month rate (quoted by Maybank), respectively.

RESULTS AND DISCUSSIONS

Table 1 presents the descriptive statistics. The mean and median of *DELAY* are 0.6053 and 0.6316, respectively, implying that Malaysian firms are in general, sluggish in response to global news, as the average delay value for world market level was estimated with a mean of 0.3356 only, while for Malaysia market level the mean was about 0.5. In terms of the market integration, Malaysian firms are more integrated with local market instead of world market where the mean for *INTEGM* is greater than *INTEGW*. Next, the percentage of foreign equity ownership (*INVEST*) varies considerably across firms and the range is zero to 87.19% with a mean of 18.23%. This suggests that Malaysia is a favourable destination for global investors for their portfolio diversification. Similarly, the values of market capitalization (*SIZE*) also vary significantly across firms, ranging from USD 0.57 million to USD 21,915.89 million with mean USD 407.73 million. Trading volume (*VOLUME*) and volatility of stock returns (*VOLATILITY*) also show wide cross-sectional variation. We check the correlation matrix and find that the pairwise correlation of our explanatory variables level are less than 0.5, safely exclude us from multicollinearity issue. The result is as reported in Table 2.

TABLE 1. Descriptive statistics of main variables

	Mean	Median	Standard Deviation	Maximum	Minimum
DELAY	0.6053	0.6316	0.1985	0.9865	0.0385
INTEGM	0.2536	0.2277	0.1820	0.8876	0.0000
INTEGW	0.0759	0.0406	0.0896	0.5746	0.0000
INVEST (%)	18.23	10.33	19.87	87.19	0.00
SIZE (million of USD)	407.73	66.78	1316.99	21915.89	0.57
TURNOVER (million of USD)	192.09	37.56	480.15	7013.10	0.06
VOLATILITY (%)	7.11	6.16	4.02	39.91	1.03

Note: This table presents descriptive statistics of main variables over the period of 1995-2010. The total number of observation is 4240. *DELAY* is constructed based on Hou and Moskowitz (2005) model. *INTEGM* and *IMTEGW* are integration with local and world stock markets, respectively. *INVEST* is the proportion of foreign equity ownership on local stocks. *SIZE* is the market capitalization of local stock in millions of USD. *VOLUME* represents the number of shares traded (in million) in a year. *VOLATILITY* denotes the standard deviation of firm weekly returns in a year.

TABLE 2. Correlation matrix between delay measure and its determinant variables

	DELAY	*INTEGRM*	*INTEGRW*	*INVEST*	*SIZE*	*TURNOVER*	*VOLATILITY*
DELAY	1.0000						
INTEGM	0.4143	1.0000					
INTEGW	-0.3657	0.0080	1.0000				
INVEST	-0.0588	0.0383	0.0441	1.0000			
SIZE	0.0094	0.3288	0.2367	0.3204	1.0000		
TURNOVER	0.0230	0.1318	-0.0758	-0.0744	-0.0137	1.0000	
VOLATILITY	0.0740	0.2546	-0.2433	-0.2344	-0.3738	0.1730	1.0000

Note: This table report the correlation coefficients among the variables. The total number of observation is 4240.

Figure 1 shows the trend of average firm *DELAY*, *INTEGM* and *INTEGW* over the sample period. It is clear that the degree of informational efficiency for firm listed in Bursa Malaysia has improved significantly over the years after the Bursa Malaysia embarked on a series of liberalization reforms in the early 2000s as a result of the 1997/98 Asian financial crisis. We can see also *INTEGM* has started to decline after 1998 but it was disrupted by the 2001 US dot.com bubble burst, but the downtrend continues after that. In fact, prior to 2009, *INTEGM* is higher than *INTEGW*, suggests that Malaysian firms are generally more segmented and less integrated with the world market. However, over time, the gap has becoming narrow since 2001 until 2009 when more firms are actually integrated with the world than the local market. Perhaps the 2001 US dot.com crisis has introduced a structure change in world stock market integration. We will account for this possibility in our robustness section. Another interesting observation is during financial crises of 1997-98, 2001, and 2007-08, INTEGM reaches its peaks while INTEGW suffered a significant drop (except the 2001 case). This provides us some empirical ground to investigate further in robustness test to control for financial crises in our model in the later section of this paper.

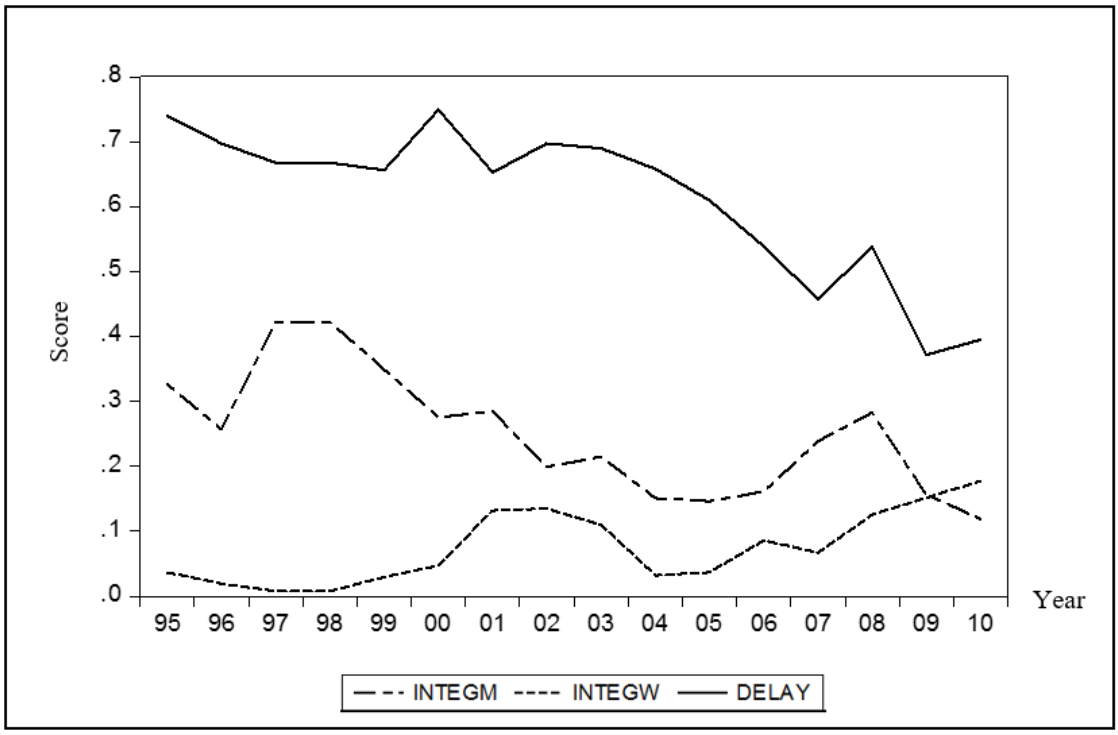

FIGURE 1. Evolution of Market Integration and Price Delay over Time.

Table 3 reports the determinants of price delay using three different estimation methods; i.e. pooled OLS, two-way fixed effects and two-way random effects models. *INTEGW* has a negative sign and it is statistically significant with price delay in these models. The negative relation suggests that when Malaysian firms are integrated with the world, the degree of informational efficiency with respect to new global market information have improved where the firms' prices are faster in response to world news, or a lower value of price delay. On the other hand, *INTEGM* shows a positive and strong significant relationship with delay measure across these different models. This indicates that Malaysian firms are sluggish in response to new global market information when it is integrated with local market. Thereby, the findings are consistent with prior evidence that the removal of legal restrictions and reduce country-level barriers will improved foreign direct investment in local capital market (Hooy and Lim, 2013).

In terms of control variables, *INVEST*, *SIZE*, *TURNOVER*, and *VOLATILITY* have showed negative relationship with price delay under the pooled OLS model. In the two-way fixed effects setting, though all the control variables have negative signs with price delay, they are statistically insignificant at all levels. Next, *INVEST* and *TURNOVER* remain negatively and significantly associated with price delay in the two-way random effects model.

We check the model specification tests using redundant fixed-effect and Hausman tests. Based on the test statistics, the pooled OLS and two-way random effects models were rejected. This implies that after considers the possibility of heterogeneity among Malaysian firms and possibly omitted time-dependent variables, the two-way fixed effect model is the most efficient in explaining the determinant variables of price delay in Malaysian stock market.

TABLE 3. Determinants of Price Delay

	Pooled OLS	Fixed Effects	Random Effects
INTERCEPT	0.7487***	0.5387***	0.5382***
	(0.0000)	(0.0000)	(0.0000)
INTEGM	0.5678***	0.5972***	0.5973***
	(0.0000)	(0.0000)	(0.0000)
INTEGW	-0.8673***	-0.9507***	-0.9358***
	(0.000)	(0.0000)	(0.0000)
INVEST	-0.0742***	-0.0189	-0.0246**
	(0.0000)	(0.4457)	(0.0272)
SIZE	-0.0151***	-0.0004	-0.0018
	(0.0000)	(0.9330)	(0.2393)
TURNOVER	-0.0025***	-0.0001	-0.0006*
	(0.0013)	(0.8538)	(0.0408)
VOLATILITY	-0.0764***	-0.0042	-0.0001
	(0.0000)	(0.5821)	(0.9826)
Firm Dummies	No	Yes	Yes

Year Dummies	No	Yes	Yes
No. of Firms	265	265	265
Observations	4240	4240	4240
R^2	0.3455	0.6031	0.3637
Adjusted R^2	0.3446	0.5744	0.3628
Redundant Fixed-Effect Tests			
Cross-Section/Period F		9.1936***	
		(0.0000)	
Hausman Tests			
Cross-section and period random			16.3391**
			(0.0120)

Note: This table presents the determinants of price delay. The dependent variable is based on Hou and Moskowitz (2005) model. The results are tested across three different models, namely pooled OLS model, two-way fixed effects model, and two-way random effects model. *INTEGM* and *INTEGW* are integration with local and world stock markets. *NVEST* is the proportion of foreign equity ownership on local stocks. *SIZE* is measured by natural logarithm of market capitalization of local stock in millions of USD in a year. *VOLUME* is the logarithm of number of shares traded in a year. *VOLATILITY* is the standard deviation of firm weekly returns in a year. Numbers in (.) are *p-value*. H_0 of the Redundant Fixed-Effect Tests is Pooled regression is preferable than a Fixed Effect model; while H_0 of Hausman Test is Random Effect is preferable than a Fixed Effect model.

ROBUSTNESS CHECKS

ALTERNATIVE PRICE DELAY

The first robustness check involves whether our core findings are consistent across alternative proxy for dependent variable. For this purpose, we use a logistic transformation of original price delay (*LDELAY*) introduced by Hou (2007). According to Hou (2007), the transformed version of price delay aid to remove the excess skewness and kurtosis of the original price delay while preserving its monotonicity. Besides, the delay indexes also not being restricted between zero and one.

Table 4 reports the estimated coefficients based on pooled OLS, two-way fixed effects and two-way random effects models. Again, *INTEGW* and *INTEGM* show the expected signs and both are statistically significant with *LDELAY* across the three models. Moreover, the model specification tests have strongly rejected the pooled OLS and two-way random effects models. Overall, this robustness test confirms the finding in previous section where the speed of stock price adjustment to global information is explained by both integration measures.

TABLE 4. The Logistic Transformation of Price Delay

	Pooled OLS	Fixed Effects	Random Effects
INTERCEPT	1.2532***	0.2076*	0.1887*
	(0.0000)	(0.0626)	(0.0620)
INTEGM	2.7497***	2.9610***	2.9621***
	(0.0000)	(0.0000)	(0.0000)
INTEGW	-4.2935***	-4.7441***	-4.6528***
	(0.0000)	(0.0000)	(0.0000)
INVEST	-0.3803***	-0.1576	-0.1153*
	(0.0000)	(0.2253)	(0.0507)
SIZE	-0.0683***	0.0030	-0.0072
	(0.0000)	(0.8826)	(0.3551)
TURNOVER	-0.0123***	-0.0005	-0.0032**
	(0.0011)	(0.7714)	(0.0409)
VOLATILITY	-0.4040***	-0.0410	-0.0125
	(0.0000)	(0.2638)	(0.6636)
Firm Dummies	No	Yes	Yes
Year Dummies	No	Yes	Yes
No. of Firms	265	265	265
Observations	4240	4240	4240
R^2	0.3305	0.5861	0.3510
Adjusted R^2	0.3296	0.5562	0.3501
Redundant Fixed-Effect Tests			
Cross-Section/Period F		8.7489	
		(0.0000)	
Hausman Tests			
Cross-section and period random			38.1185
			(0.0000)

Note: This table presents the results from first robustness tests. The original price delay is replaced with the logistic transformation of price delay (*LDELAY*) proposed by Hou (2007). The estimations are tested across pooled OLS model, two-way fixed effects model, and two-way random effects model. *INTEGM* and *INTEGW* are integrated with local and world stock markets respectively. *NVEST* is the proportion of foreign equity ownership in local stocks markets. *SIZE* is measured by natural logarithm of market capitalization of local stock in millions of USD in a year. *VOLUME* is the logarithm of number of shares traded in a year. *VOLATILITY* is the standard deviation of firm weekly returns in a year. Numbers in [.) are *White period* standard error while (.) are *p-value*. H_0 of the Redundant Fixed-Effect Tests is Pooled regression is preferable than a Fixed Effect model; while H_0 of Hausman Test is Random Effect is preferable than a Fixed Effect model.

CONTROLLING FOR THE IMPACT OF FINANCIAL CRISIS

In the second robustness check, we controlled the impact of financial crisis via dummy variable. Based on the literature survey, the dummy variables for financial crisis include Asian Financial Crisis (1997-1998), Dot-Com Bubble (2000-2001), and US Subprime Crisis (2008-2009).

Table 5 reports the estimated results using the pooled OLS model. The results from column (1) through (4) consistently show that all the competing variables including *INTEGW* and *INTEGM* are statistically significantly with *DELAY* and *LDELAY*. In addition, these variables also exhibited the expected signs after controlling for the crises periods. The negative relation between Asian Financial Crisis and US Subprime Crisis with price delay imply that unfavourable news during the crisis periods are spread instantaneously across Malaysian stock market.

TABLE 5. Controlling for Financial Crises

	DELAY	*LDELAY*
CONSTANT	0.6287	0.6277
	(0.0000)	(0.0000)
INTEGM	0.6038	2.9511
	(0.0000)	(0.0000)
INTEGW	-0.8911	-4.4623
	(0.0000)	(0.0000)
INVEST	-0.0417	-0.2108
	(0.0003)	(0.0006)
SIZE	-0.0078	-0.0304
	(0.0000)	(0.0001)
TURNOVER	-0.0013	-0.0059
	(0.0051)	(0.0059)
VOLATILITY	-0.0224	-0.1234
	(0.0003)	(0.0001)
D9798	-0.1658	-0.8718
	(0.0000)	(0.0000)
D0001	0.0668	0.3286
	(0.0000)	(0.0000)
D0809	-0.0988	-0.4723
	(0.0000)	(0.0000)
R^2	0.4363	0.4241
Adjusted R^2	0.4351	0.4229

Note: This table presents the results from second robustness tests where we controlled the effect of financial crisis in pooled OLS model. *DELAY* is original price delay developed by Hou and Moskowitz (2005) while *LDELAY* is the alternative delay by Hou (2007). *INTEGM* and *INTEGW* are integration with local and world stock markets respectively. *NVEST* is the proportion of foreign equity ownership in local stocks. *SIZE* is measured by natural logarithm of market capitalization of local stock in millions of USD in a year. *VOLUME* is the logarithm of number of shares traded in a year. *VOLATILITY* is the standard deviation of firms' weekly returns in a year. *D9798* is the dummy variable for Asian Financial Crisis. *D0001* is the dummy variable for Dot-Com Bubble. *D0809* is the dummy variable for US Subprime Crisis. Numbers in (.) are *p-value*.

CONCLUSION

In this paper, we examined the effect of market integration on informational efficiency at the firm level. We conducted a series of panel regression modelling focusing on the degree of market integration of 265 firms listed in Bursa Malaysia and the results changed in terms of stock price efficiency. We found that informational efficiency was likely to improve for more globally integrated firm. The finding was complement to Hooy and Lim (2013) which documented similar evidence at the aggregate country level. At firms' level, our results show that more segmented or locally integrated firms have less world information efficiency. Overall, we found a solid empirical evidence to claim that market integration and informational efficiency are positively associated, and so Malaysia stock market was generally increasingly integrated with the world.

Our findings imply that the policymakers like the Securities Commission and the Ministry of Finance, should consider to further liberalize the Malaysian stock market to increase its transparency and reduce information barriers. This would ensure a higher level of firm integration can be achieved to improve their information efficiency. With higher information efficiency, this implies better resource allocation and hence higher productivity for the nation. For example, the removal of statutory foreign restrictions on investment will likely to attract more foreign institutional investors. This will surely improve the corporate governance level of the listed firms. With more foreign participants, local investors will also have more access to higher-quality and more reliable information in the market. On the other hand, however, when market is vulnerable to foreign news the regulator should also need to tighten their surveillance system and closely monitor the trading activities in the market in order to control for unhealthy speculation that is not based on fundamental value.

NOTES

[1] Bae et al. (2012) used the degree open factor to proxy for the degree of investibility. These data were obtained from Standard & Poor's Emerging Markets Database (EMDB).

[2] The degree of open facto is retrieved from Standard & Poor EMDB database. It is used to measures the amount of a company's market capitalization that a foreign entity can legally own.

[3] Chen and Rhee (2010) is the first study to explore the role of short sales on speed of stock prices adjustment to market-wide information during the up (bull) market period.

[4] Barari (2004) modified the two-factor model and applied to address the issues on regional versus global integration.

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Tai Kui Guan
AIA Berhad
Senior Associate
Partnership Distribution
No 19, Jalan Kelawai, 10250 Penang
MALAYSIA
Email: kuiguan.tai@aia.com

Hooy Chee Wooi*
School of Management
Universiti Sains Malaysia
11800 USM Pulau Pinang
MALAYSIA
Email: cwhooy@usm.my

* Corresponding Author