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The Spillover Effects of U.S. and Japanese Public Information News in Advanced Asia-Pacific Stock Markets

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Abstract

This paper investigates the nature of information leadership of the U.S. and Japan in the advanced Asia-Pacific stock markets. Instead of just relying on return and return volatility spillovers from major markets, specific and disaggregated news events are also utilized. In particular, the aim is to examine the nature of spillover effects of scheduled announcements of the U.S. and Japanese macroeconomic variables in the advanced Asia-Pacific stock markets of Australia, Hong Kong and Singapore for the period 2 January 1991 to 31 May 1999. The investigation reveals that both U.S. and Japanese announcement news elicit significant first and second moment influences on the returns of the other markets, in general, and that there is a complex array of significant market responses to various news announcements. There is also strong evidence of markets responding differently to bad news announcements compared to overall news (including both good and bad news) announcements which indicate that the information content of each economic announcement is a source of tradable information rather than the act of releasing economic figures. Thus, this paper contributes to the literature by shedding light on the important drivers of the documented information leadership of the U.S. and Japanese stock markets.

JEL Classification: G14, G15, F36

Keywords: Information spillovers, Announcement news

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1. Introduction

The existence of financial market linkages among advanced equity markets is well documented. Empirics suggest, in general, i) significant interdependence of market movements (Hamao, Masulis and Ng, 1990, Theodossiou and Lee, 1993, Koutmos and Booth, 1995), ii) information leadership role of the U.S. market (Eun and Shim, 1989, Arshanapalli and Doukas, 1993, Connolly and Wang, 2000, and to a less extent, Bae, Karolyi and Stulz, 2000), and iii) intensification of inter-market linkages after the 1987 global stock market crash (Arshanapalli and Doukas, 1993). Interestingly, researchers report a negligible role of the Japanese market in information leadership among the markets of the U.S. and Western Europe and an absence of significant market linkages between Japan and other major markets[1].

Similar patterns exist for Asia-Pacific stock markets in terms of significant first and second moment return spillover effects (Janakiramanan and Lamba, 1998; Pan, Liu and Roth, 1999; Arshanapalli, Doukas and Lang, 1995), increasing market linkages and informational leadership of the U.S. after the 1987 crash (Arshanapalli, Doukas and Lang, 1995) and for the post-1997 Asian crisis period (Chow, 1999)[2]. The U.S. market has been providing a significant leading influence in the Asia-Pacific Markets (Arshanapalli, et al, 1995; Ghosh, Saidi and Johnson, 1999; Janakiramanan and Lamba; 1998, Lin and Pan, 1997; Liu, Pan and Fung, 1996). The other major economic influence in the Asia-Pacific region is coming from Japan and the influence of the Japanese stock market movements on the rest of the markets in the region is thus of importance. A number of studies report significant spillover effects from

[1] Bae and Karolyi (1994), however, report that the degree of market linkages between the U.S. and the Japanese stock markets were significantly understated when good and bad market returns were not investigated separately.
[2] Kaminsky and Schmukler (1999) report that large stock market movements in Asia were triggered by local and neighboring country news and herding instincts of the markets during the 1997-1998 crisis period.

both the U.S. and Japan to the Asia-Pacific markets. These include Cha and Cheung (1998), Liu and Pan (1997) and Ng (2000). However, despite close economic linkages (especially from the late 1980s) between Japan and other regional countries, the Japanese influence had not been very strong until the onslaught of the financial crises in the East Asian countries in 1997 (see Chow, 1999; Ghosh, Saidi and Johnson, 1999).

Given the leadership role of the U.S. and Japanese stock markets for the Asia-Pacific markets, a logical next step in the analysis of the market linkages would be to investigate the impact of disaggregated information flows from these two major markets. It is of great interest to examine the degree to which different types of information that move the U.S. and the Japanese markets directly affect the Asia-Pacific markets. Stock markets, in general, are influenced by both public and private information. The latter can be an extension of the former in that heterogeneous interpretations of the implication of public information may lead to different responses from market participants. Scheduled announcements of macroeconomic data in the U.S. and Japan inject new information regarding their respective domestic economic conditions to the markets, and to the extent that market participants are caught by surprise and their optimal responses are dependent on their interpretation of the news, significant market movements will result. These include i) significant adjustments to the current equilibrium prices of financial assets, and either ii) heightened levels of volatility due to divergent interpretations of the news in the market and the resulting increased volumes of trade, or iii) lower levels of volatility due to the release of information that reduces the degree of market uncertainty. To the extent that the U.S. and Japanese stock market movements have an influence in the Asia-Pacific markets, these information events are watched carefully for their impact on the market conditions in the region. Significant information content of these announcements will thus directly be factored into the prices in the Asia-Pacific markets.

Although there is some empirical evidence of the U.S. announcement news spillover effects in foreign financial markets, they are confined to advanced markets[3] and there has been no published research on the news spillover effects of U.S. and the Japanese macroeconomic announcements in the Asian stock markets. This paper aims to address this important research issue by investigating the disaggregated information spillover effects from the U.S. and Japanese scheduled economic announcement events in the advanced Asia-Pacific stock markets of Australia, Hong Kong and Singapore. The main findings of this paper are that; i) both the U.S. and Japanese announcement news elicit significant first and second moment influences on the returns of the other markets, and that there is a complex array of significant market responses to various news announcements, ii) there is also strong evidence that markets responded differently to bad news announcements compared to overall news (including both good and bad news) announcements which indicates that the information content of each economic announcement was a source of tradable information rather than an act of information release.

The rest of the paper is organized as follows: Section 2 discusses the econometric modeling and data construction issues, section 3 reports and analyses the estimation results, and section 4 concludes this paper.

2. Data and econometric methodology

The stock markets investigated are the U.S. market and four advanced Asia-Pacific stock markets of Australia, Japan, Hong Kong and Singapore. Daily index observations (open,

[3] Becker, Finnerty and Friedman (1995) on the U.K. stock futures; Becker, Finnerty and Kopecky (1995) on the German and Japanese debt markets; Connolly and Wang (2000) on the U.K and the Japanese stock markets; and Kim (1998), Kim and Sheen (2000) on the Australian foreign exchange and debt markets.

high, low and close) of these markets were obtained from Commodities Systems, Inc. for the period 2 January 1991 to 31 May 1999. The indexes are the All Ordinaries, Nikkei 225, Hang Seng, Straight Times and Dow Jones Industrial, respectively for each country. Figure 1 shows the time line of the market trading hours of the Asia-Pacific and the U.S. markets, and the timing of the U.S. and the Japanese macroeconomic information releases. While there are overlaps between trading hours of the Asia-Pacific markets, the U.S. market is closed when the non-U.S. markets are operating. The information flow from the Japanese market, which can be regarded as regional information, is thus contemporaneous while U.S. market news (overnight in the Asia-Pacific), which constitutes global information, can influence the Asia-Pacific markets when they open three to four hours after the U.S. market closes. The spillover effects of the disaggregated flow of information from the U.S. and Japan, in the form of the news content of the scheduled announcements of macroeconomic variables, on the first and second moments of Asia-Pacific market returns are investigated over holding periods that include these announcements.

The dates and magnitudes of each of the scheduled public information releases in the U.S and Japan during the sample period were obtained from Money Market Services. In addition, (median) market survey expectations of the magnitudes of the economic data from the same source were used to proxy the expected components of the economic announcements. The announcement variables considered are ones that represent economic activities and ones that contain information on inflation, and only those variables with unbiased market expectations are included in this paper.[4] They are balance of payment (BOT), real GDP growth rate (GDP), retail sales growth rate (RET), unemployment rate (UE), producer price index inflation (PPI) and consumer price index inflation (CPI) for the U.S.;

[4] Market survey generated expectations of economic announcement variables are said to be unbiased if there is no persistent deviations in either direction from the corresponding realized actual variables. Econometrically, this is tested by running a simple regression of the actual on the expected variable and testing for the zero intercept and unit slope coefficient. The last row of Table 1 reports the p-values of this unbiasedness hypothesis.

trade balance (TB), current account balance (CAB), unemployment rate (UE), money supply growth rate (MS), wholesale price index inflation (WPI) and consumer price index inflation (CPI) for Japan. Table 1 reports the details of these announcement data[5]. All, except for the US GDP data, announcements were made monthly and the announcements cover the period January 1991 to May 1999 for the U.S. and early 1991 to mid-1999 for the Japanese announcements. The good and bad economic announcements[6] were equally likely, in general, during the sample periods. There were some exceptions; good news announcements were more common for the U.S. GDP data announcements (65% of the time), and bad news announcements were more frequent for the U.S. retail sales and Japanese unemployment news (61% and 75% of the time, respectively). However, the market expectations were shown to be unbiased overall which is due to the fact that these higher frequency observations were smaller in magnitudes. In all cases, the survey of market expectations are shown to be unbiased, as reported in the last row of Table 1.

The exact timing of the U.S. and Japanese macroeconomic announcements in relation to the market operating hours in the Asia-Pacific are also shown in Figure 1. The U.S. announcements are made one hour before the U.S. market opens (08:30 Eastern Standard Time) and while all the Asia-Pacific markets are closed. The market returns that capture the U.S. information releases are thus calculated over the closing price on the calendar day before the announcements and the opening price one calendar day after for the Asia-Pacific markets (overnight return on calendar date *t+1*, $\ln(P_{t+1}^{Open} / P_t^{Close}) \times 100$), and over the closing price observed the day before the announcement day and the opening price on the day of announcement for the U.S. market (overnight return on calendar date *t*, $\ln(P_t^{Open} / P_{t-1}^{Close}) \times 100$). The Japanese information releases are made at various times

[5] The announcement variables reported and used in the paper are raw announcement data as opposed to being standardized with market expectations.
[6] Good (bad) announcements are larger (smaller) than expected announcements of economic activity variables and lower (higher) than expected inflation variables (CPI, WPI and PPI) and unemployment rate.

throughout the announcement day; four announcements just before the Japanese market opening and the other two while the market is open. Thus, the Japanese announcements are made either just before market opening or while markets are open in the Asia-Pacific markets and while the U.S. market is closed. The impact of the Japanese economic announcements are then examined over the period between the closing price on the day before the announcement and the closing price on the day for the Asia-Pacific markets (daily return on calendar date *t*, $\ln(P_t^{Close} / P_{t-1}^{Close}) \times 100$), while the period for the U.S. market is over the closing price one calendar day before the announcements and the opening price on the same calendar date as the Japanese date (overnight return on calendar date *t*, $\ln(P_t^{Open} / P_{t-1}^{Close}) \times 100$).

The summary statistics of the index returns of the U.S. and the Asia-Pacific markets over daily and overnight holding periods are shown in Table 2. The means are fairly close to zero and the daily variances are spread over the two sub-holding periods. Although there is no immediately noticeable pattern in the skewness, a considerably higher kurtosis is observed during the overnight period in all cases, expect for the US, which suggests higher frequencies of extreme observations. The return series thus exhibit significant skewness, leptokurtosis, highly significant linear and non-linear serial correlations, and asymmetric responses of volatility to innovations. These characteristics are typical of high frequency financial return series. Empirical modeling of the returns must account for these moment characteristics and various researchers have shown that daily stock price movements, along with many other higher frequency financial time series, can be adequately modeled by a family of generalized autoregressive conditional heteroskedastic (GARCH) models. It has been reported that exponential GARCH models with an appropriate distributional assumption explain the daily stock price movements well[7]. In this paper, parsimonious MA (moving average) -

[7] see Bollerslev, et. al (1992) for an extensive survey of empirical papers.

EGARCH(1,1) models are used to model the return series with asymmetric response characteristics, and they are shown below.

$$R_{i,t}^{H} = \alpha_{i,c} + \alpha_{i,\mathrm{HOL}} \cdot HOL_{i,t} + \varepsilon_{i,t} + \sum_{k=1}^{q} \alpha_{i,k} \cdot \varepsilon_{i,t-k} \quad \text{(1a)}$$

$$\varepsilon_{i,t} = z_{i,t}\sqrt{h_{i,t}} \sim (0, h_{i,t}),\ \mathrm{z_{i,t}} \sim iid(0,1)$$

$$\ln h_{i,t}^{H} = \beta_{i,c} + \beta_{i,HOL} \cdot HOL_{i,t} + \beta_{i,h} \cdot \ln h_{i,t-1}^{H} + \beta_{i,\varepsilon 1} \cdot \frac{\varepsilon_{i,t-1}}{\sqrt{h_{i,t-1}}} + \beta_{i,\varepsilon 2} \cdot \left(\frac{|\varepsilon_{i,t-1}|}{\sqrt{h_{i,t-1}}} - \sqrt{\frac{2}{\pi}} \right) \quad \text{(1b)}$$

Where:

$R_{i,t}^{H}$ = Stock index returns over holding periods of daily (H = D, $\ln(P_t^{Close} / P_{t-1}^{Close}) \times 100$) and overnight (H = ON, $\ln(P_t^{Open} / P_{t-1}^{Close}) \times 100$) for five markets, i = Australia, Hong Kong, Japan, Singapore and the U.S.

$HOL_{i,t}$ = Seasonal dummy that takes the number of days between two successive observations. 1 for normal weekdays, 3 for Mondays and 2 or higher for days immediately following market closures due to holidays.

$h_{i,t}^{H}$ = Conditional volatility of $R_{i,t}^{H}$.

q = Number of moving average terms included in the conditional mean equation to remove serial correlation in the estimated standardized residuals, z_t.

The influences of the U.S. and the Japanese data releases are then investigated by including a news dummy ($USNEWS_{j,t}$ *and* $JPNEWS_{j,t}$) for each variable in the conditional mean and variance equations of the stock index returns [(1a) and (1b) above] measured over the period surrounding the data announcements, as discussed above, and examining the sign and significance of the estimated coefficients[8]. The news dummies take the value of one if there was a news content in the announcement (i.e. actual figure announced was different from the market expectations) and zero otherwise. [9]

[8] In place of the announcement news dummies, magnitudes of surprises measured by actual data released minus the MMS survey expectations were also tried. The results of the 'magnitude' estimations are much the same as the announcement dummy estimations reported in this paper, and so they are not reported to conserve space.

[9] This requires some measure of market expectations on the announcements, and the most common approach is to utilize market based survey expectations provided by Money Market Services. We follow this approach and proxy market expectations by the survey of the U.S. and the Japanese market expectations of their scheduled information releases generated by Money Market Services in the U.S. and Japan.

In addition to the general market responses to the overall news announcements, the effects of bad news announcements are also investigated for their potentially differential impact on the markets. In general, there is considerable evidence of stock markets showing higher levels of volatility and more intense volatility spillovers between markets during periods of crisis. Bad (worse than expected) economic data announcements would be perceived to have different information content than good ones thus eliciting different market responses. Bad news announcement days are when the magnitudes of the announced data were smaller than the market expectations for the economic activity variables (BOT, GDP and RET for the U.S.; and TB, CAB for Japan) and when higher than expected inflation data (PPI and CPI for the U.S.; and WPI, CPI and MS for Japan) and unemployment data were announced. The asymmetric news effects are then modeled by including not only the overall news dummy variables but also the bad news dummy for each variable in both the conditional mean and variance equations. The bad news dummies take the value of one on the days of bad news announcements and zero otherwise[10]. The final form of the models to be estimated are:

$$R_i^H = M(\cdot) + (\sum_{j=BOT}^{CPI} \alpha_{i,j} \cdot USNEWS_{j,t} + \sum_{j=BOT}^{CPI} \alpha_{i,j}^{Bad} \cdot USNEWS_{j,t}^{Bad}) \text{ for the US news effects} \quad (2a)$$

$$= M(\cdot) + (\sum_{j=TB}^{CPI} \alpha_{i,j} \cdot JPNEWS_{j,t} + \sum_{j=TB}^{CPI} \alpha_{i,j}^{Bad} \cdot JPNEWS_{j,t}^{Bad}) \text{ for Japanese news effects}$$

$$\ln h_i^H = V(\cdot) + (\sum_{j=BOT}^{CPI} \beta_{i,j} \cdot USNEWS_{j,t} + \sum_{j=BOT}^{CPI} \beta_{i,j}^{Bad} \cdot USNEWS_{j}^{Bad}) \text{ for the US news effects} \quad (2b)$$

$$= V(\cdot) + (\sum_{j=TB}^{CPI} \beta_{i,j} \cdot JPNEWS_{j,t} + \sum_{j=TB}^{CPI} \beta_{i,j}^{Bad} \cdot JPNEWS_{i,j}^{Bad}) \text{ for Japanese news effects}$$

[10] There also exists a potential for asymmetric effects of bigger shocks having larger impact on the volatility. This was modeled by the EGARCH models with above average news dummy for each variable that takes the value of one on days of larger than sample average (in magnitudes) surprise and zero otherwise. However, the estimation results, in general, do not differ significantly from the general estimation of announcement dummies, and so they are not reported in the paper to save space. Interest readers may obtain the results from the author.

Where

M(.) and V(.) are the right hand sides of (1a) and (1b), respectively.

Holding periods relevant for the investigation of the U.S. announcements are

Non-U.S. markets: H = ON (Overnight) at *t+1*, $(\ln(P_{t+1}^{Open} / P_{t}^{Close}) \times 100)$

U.S. market: H = ON at *t*, $(\ln(P_{t}^{Open} / P_{t-1}^{Close}) \times 100)$

Holding periods relevant for the investigation of the Japanese announcements are

Non-U.S. markets: H = D (Daily) at *t*, $(\ln(P_{t}^{Close} / P_{t-1}^{Close}) \times 100)$

U.S. market: H = ON at *t*, $(\ln(P_{t}^{Open} / P_{t-1}^{Close}) \times 100)$

j = BOT, GDP, RET, UE, PPI and CPI for the U.S. news and

TB, CAB, UE, MS, WPI and CPI for the Japanese news announcements.

The signs of the coefficients for the announcement dummies in the mean equation, $\alpha_{i,j}$ and $\alpha_{i,j}^{Bad}$, are to be interpreted as the general direction of price movements in the relevant markets following the information releases and so representing an average effect of each announcement. The volatility responses to the information events, shown by $\beta_{i,j}$ and $\beta_{i,j}^{Bad}$, depend on whether the data release adds to the existing information heterogeneity in the market (β*'s* > 0) or it resolves information asymmetry by providing level information playing field (β*'s* < 0). Some macroeconomic news announcements may increase the heterogeneity of beliefs and thus further disturb a financial market. This might occur for a low macroeconomic statistic for which a widespread consensus develops relatively easily about its importance and relevance. In the days approaching the next announcement, the market may settle towards some degree of homogeneity of beliefs. When surprises are revealed, the homogeneity evaporates giving rise to unusually high transaction volumes and thus conditional price volatility. In time, beliefs about the fundamental implications of the previous announcements begin to converge. The volume effect is represented by a positive announcement coefficient in the conditional volatility equation (β*'s* > 0). By contrast, some other types of macro news announcements may tend to almost immediately settle a market. For these macroeconomic statistics, some individual participants in asset markets may have a poor understanding or conviction about their importance and relevance, while others may have relatively better knowledge or conviction. Leading up to these announcements, trading occurs based on the diversity of knowledge or beliefs about the possible value that will be contained in the announcement. The release of new information, thus, adds to current information sets and so may have the effect of reducing the degree of information asymmetry in the market. After the announcements, the bigger the surprise, the less likely are the ill informed to trade, and the more likely is a price adjustment reflecting the knowledge or conviction of the other group. Thus the surprise in such announcements reduces volatility by sidelining those less able or unwilling to take a different position[11]. This effect is shown by a negative announcement coefficient in the conditional volatility equation (β*'s* < 0)..

3. Empirical results

Tables 3 and 4 report the estimation results of the U.S. and Japanese announcement news spillover effects, respectively[12]. The results reported are the Quasi-ML estimations of (2a) and (2b) where six news variables are included to pick up the overall impact of the

[11] A good example of an important participant who might act with knowledge and conviction is the central bank. After a large macroeconomic surprise, the central bank may adjust its policy instrument to affect the conditional mean of, say, the short term interest rate, but it may also decide to demonstrate an extra degree of firmness in its stance by acting to reduce the volatility of that rate (i.e. by "smoothing"). If market participants believe that is a credible stance, they will be less willing to trade.

[12] The EGARCH modeling of the index returns are shown to be successful in all cases. Significant negative asymmetric effect (negative $\beta_{\varepsilon 1}$) and volume effect (positive $\beta_{\varepsilon 2}$) are present. That is, higher conditional volatility was evident when the previous day's return was unexpectedly lower (a negative innovation) and larger in magnitude. The coefficient for the lagged volatility, β_h, is close to one in all cases suggesting that shocks to the volatility were fairly persistent. The holiday effect is also significantly present. In general, market returns were significantly lower and conditional volatility higher on days immediately following holidays. The diagnostics of the estimation are reported in the bottom panels of Tables 3 and 4. It is evident that the EGARCH models are effective in addressing the time series properties documented in Table 2. The skewness and kurtosis are significantly reduced, linear and non-linear serial correlations eliminated, and asymmetric volatility responses to innovations are removed (except for Singapore).

information releases and six bad news announcement dummies are used for worse than expected announcements[13].

U.S. information spillover effects

The overall U.S. news announcements, in general, had a positive effect on returns in all non-U.S. markets, except for the BOT news in Hong Kong and Singapore, as evidenced by positive and statistically significant news coefficients, $\alpha_{i,j}$'s (13 positive and only 3 negative coefficients). This suggests that the U.S. news, on average, improved market sentiments in the Asia-Pacific leading to upward adjustments of earnings forecasts for the markets. On the other hand, the spillover effect is mostly negative for the bad news announcements (11 negative and only 6 positive news coefficients, $\alpha_{i,j}^{Bad}$'s). This suggests that worse than expected U.S. economic performances generated negative sentiments on the likely future performances of the Asia-Pacific markets[14]. Interestingly, the BOT news elicited the opposite market responses in all but the Australian market. Overall, BOT news significantly dragged all the markets down, except for Australia, whereas unexpectedly bad data had the opposite impact. This suggests that worse than expected U.S. trade performances were perceived to suggest better than expected export performances of the Asia-Pacific countries to the U.S. goods market, and to the extent that export oriented firms weigh heavily in the Asia-Pacific market indexes (less so for Australia) this would have had an adverse impact. The BOT data, however, had a negative impact on market returns in the U.S. and this

[13] The models were also estimated for the smaller sample that ends just before the onset of the Asian financial crisis of July 1997. The results are essentially the same as those reported in this section except for marginally larger news coefficients, in general.

[14] This is consistent with the information leadership of the U.S. market reported in the literature. The U.S. information leads the market movements in the Asia-Pacific and so positive (negative) market sentiments in the U.S. would promote (dampen) index return performances in the regional markets.

downturn apparently overwhelmed the Australian market. The RET news had a consistent impact in Australia and Japan; overall news was associated with positive returns and bad news with negative returns. The overall UE news had a similar impact. Thus, news on the U.S. economic conditions tended to have a positive spillover effect overall and an adverse influence when the news was bad. The two inflation variables affected the regional markets in much the same way [overall (bad) news was associated with positive (negative) returns] perhaps due to the interest rate implications of an unexpected inflation shock[15]. However, the responses of the Singaporean market to the PPI news were in contrast to those of the other markets. A negative coefficient, although insignificant, for the overall PPI news, is observed as is the case in the U.S. market.

Turning to the news effect on the market volatility, strong U.S. news spillover effects are shown in all the markets. Although only a volatility reducing effect ($\beta_{i,j} < 0$) was significant in the U.S. for the overall news announcements, individual Asia-Pacific markets reacted differently to the overall news as evidenced by evenly distributed (10 each) significant positive and negative news coefficients, $\beta_{i,j}$'s. The announcements of worse than expected U.S. macroeconomic performances, however, had the effect of significantly lowering the level of conditional volatilities, in general (12 negative and 6 positive coefficients). These announcements apparently fed enough information to reduce the level of uncertainty in the minds of market participants regarding the health of the U.S. economy and its global influence. This might indicate that unexpected economic downturns in the U.S. cleared clouds of doubt concerning possible U.S. policy responses so as to reduce the level of uncertainty regarding their impact in these markets.

[15] Unexpectedly lower U.S. inflation would negate a need for the U.S. Federal Reserve to raise interest rates thus having a market boosting impact, and the opposite applies for higher than expected inflation announcements.

In sum, there is strong evidence of U.S. announcement news spillover effects in the Asia-Pacific. The market responses to news and the degree of impact of each announcement tended to vary across the markets. Collectively, however, the U.S. news effects are significantly present in returns and return volatilities of all the markets considered as evidenced by the jointly significant news coefficients (reported in the last three lines in the last panel of Table 3).

Japanese information spillover effects

The Japanese announcement news spillover effects are reported in Table 4. The first panel reports the news coefficients in the mean equations. There is no immediately discernable pattern of responses to overall news across the markets as shown by evenly distributed significant positive and negative news coefficients (6 and 5 for the overall news, and 6 and 8 for the bad news). The overall trade balance news is significant only in Japan and the U.S., and the negative coefficient suggests a significant drop in the market returns in these two markets. In contrast, worse than expected announcements significantly increased the returns in all markets except in Australia. This might suggest that unexpectedly bad Japanese trade performances implied unexpectedly better trade performances of the U.S. leading to improved market outlook, and to the extent that the U.S. market had a leading influence in the Asia-Pacific markets, this positive response of the U.S. market was followed by similar market movements in the region. Good Japanese external balance performances would then be interpreted as a bad news for the U.S. since some of the surpluses would be at the expense of the U.S. and so the expected fall in the U.S. equity market would cause a downturn in these markets. Also, increasing Japanese trade surpluses might have caused political discomfort leading to negative sentiments in the region. Interestingly, there is some evidence of worse than expected current account balance data having a market dampening effect in Hong Kong and Singapore. Apparently, worse than expected current account balance implied lower than expected capital outflows from Japan and these two markets were adversely affected as a result. Interesting results are also found for the unemployment rate news announcements. Overall unemployment news lowered the returns in Hong Kong and Singapore, while unexpected unemployment had a positive returns spillover effect in Australia and Hong Kong. The opposite pattern is shown for the U.S. market. A possible explanation is a portfolio rebalancing of international investors between Japan and other Asian markets. An announcement of an unexpected increase in unemployment would lead to declining confidence in the Japanese market leading to a contraction in the foreigners' investments in Japan. This would benefit other regional markets if the investors desired a stable regional portfolio. In the case of the U.S., a lower market return following bad Japanese unemployment data might be an indication of the potentially negative implication for the U.S. exporters in the Japanese goods market. The significant news coefficients for the three inflation related variables (MS, WPI and CPI) are positive for the overall news and negative for the bad news announcements. The negative influence of unexpected Japanese inflation may be explained by the adverse impact of the resulting weakness in the Yen on the external balance positions of the trading partners of Japan.

Significant Japanese news spillover effects on market volatilities are also present in all markets. In general, overall and bad news announcements had opposite effects in all markets suggesting that whether an information release had a volatility increasing or decreasing effect depends on its information content. Overall trade balance news significantly reduced volatility in Australia, Hong Kong and Singapore, while bad news had the opposite impact. Interestingly, however, the patterns of news effects in Japan and the U.S. are opposite to those of the other markets. The volatility reducing effect of worse than expected Japanese trade balance news in these two markets could have been due to the lower probability of trade conflict between them. This result is similar to the case of the U.S. trade balance news reported above, indicating that the Japanese and the U.S. trade balance data were an important source of information for market participants in the Asia-Pacific. The current account balance news, in general, had the opposite impact compared to the trade balance news. The overall news raised the volatility in Japan, Hong Kong and Singapore, while the bad news significantly reduced it in Hong Kong. This suggests that the services component in the current account obviously had a different news content than the trade balance component. This might be due to the role of Japan as a provider of capital and the services component of the Japanese current account was of some news value to the market watchers in the region. Overall news on the WPI inflation (and MS) increased volatility in all markets while the CPI inflation news significantly decreased it in all markets except for Australia. The opposite results are shown for the bad data announcements. This indicates that these two inflation data were perceived to convey different economic conditions of Japan. The WPI inflation (and MS) news could have caused a higher trading activity, due to the injection of tradable information on the Japanese economy, in these markets leading to a higher level of volatility. On the other hand, the volatility reducing effect of the CPI inflation news might be explained by apparent resolution of uncertainty regarding possible official policy responses to consumer inflation. This suggests that the consumer inflation figures, in general, would lead to a consensus of market opinion on the direction of the Japanese economy, whereas the wholesale inflation news added to the level of uncertainty in the Japanese market. This news subsequently had an adverse impact in the other markets, which were increasingly being linked to the Japanese market. However, the unexpected inflation in the form of WPI and MS had the volatility reducing effect in general, whereas the unexpectedly high CPI inflation raised volatility.

In sum, Japanese announcement spillover effects are found to be significant to varying extents in all five markets examined. In general, the markets made distinctive responses to each type of news (overall or bad) announced, and there were common responses to some announcements (BOT and inflation news) across the markets. The news effects are also jointly significant in the first and second moments of returns series in all cases[16].

4. Conclusions

This paper investigated the spillover effects of scheduled economic announcement news from the U.S. and Japan in the advanced Asia-Pacific stock markets of Australia, Hong Kong and Singapore. Specifically, return and return volatility of the stock markets were examined to ascertain the presence and the nature of the spillover effects. Two types of news announcements were used; the ones that relate to economic activities and the others on inflation. Both the U.S. and the Japanese announcement news spillovers were significant in general, and they had varying individual influences on the first and second moments of market returns. In general, the announcements of worse than expected performances of the U.S. economy had a negative returns impact in the U.S. and their spillover effects in the Asia-Pacific were in the same direction. The overall announcement news tended to have a positive effect, however. The spillover effects on market volatilities also exhibited asymmetric responses between the overall and bad news announcements. Although, mostly volatility reducing effects were found for worse than expected data announcements, overall news announcements exhibited both volatility increasing and decreasing spillover effects. It appears that the degrees of market uncertainty and heterogeneity of information ownership were lessened after the markets were surprised with bad news from the U.S. The Japanese

[16] See the last three lines in Table 4 where the joint significance hypothesis testing results are reported.

news announcements also provided valuable information for the other stock markets. Significant first and second moment spillover effects were reported in the market returns in the other Asia-Pacific and the U.S. The market responses were, in general, mixed and positive and negative effects were relatively evenly spread across the markets. In addition, there was no distinct pattern of overall/ bad news being consistently associated with either positive or negative spillover effects. However, there was some evidence of bad news announcements producing positive spillover effects on the return volatilities, with overall news increasing market volatilities on average.

In sum, it has been found that the advanced Asia-Pacific stock markets were responsive to disaggregated flows of information, in the form of scheduled economic announcement news, from the U.S. and Japan. This sheds important light on the underlying drivers of the information leadership of these two major markets through the traditional channel of stock return and volatility spillovers documented in the literature. The evidence, thus, supports the view that market participants in the Asia-Pacific stock markets closely follow the market developments in the U.S. and Japan and they incorporate the direct impact of disaggregated information flows as well as indirect flow of aggregated information in terms of the usual return and volatility spillovers.

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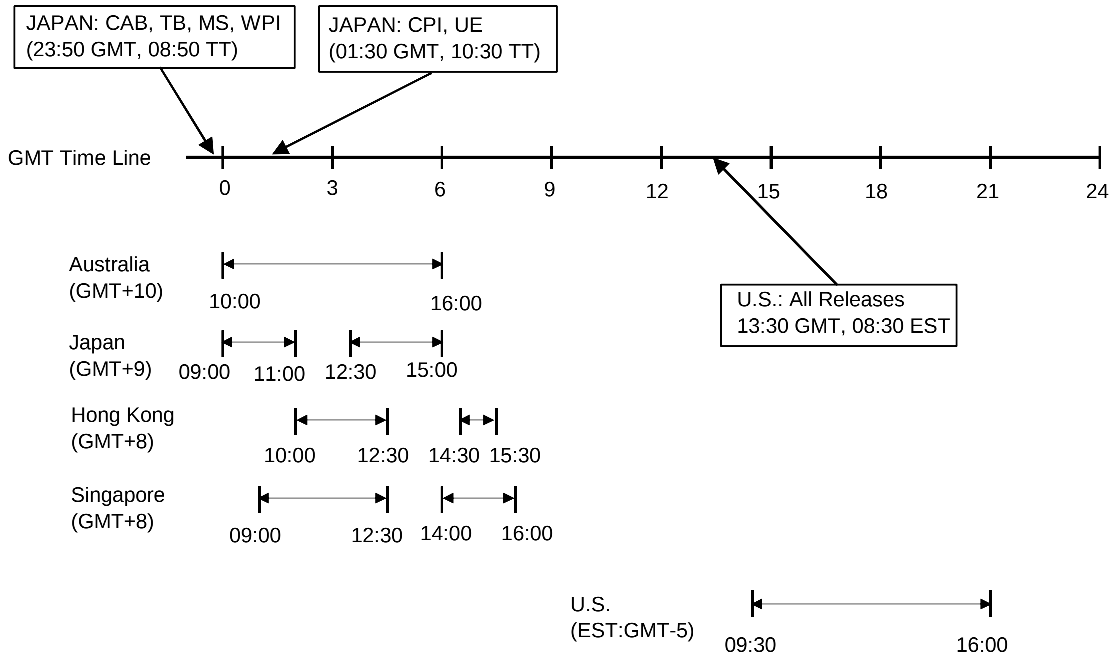
Figure 1: Trading hours and times for information releases



U.S. macroeconomic variables:

Balance of Trade (BT), Gross Domestic Product growth rate (GDP), Retail Sales growth rate (RET), Unemployment rate (UE), Producer Price Index inflation (PPI), Consumer Price Inflation (CPI).

Japanese macroeconomic variables:

Trade Balance (TB), Current Account Balance (CAB), Unemployment rate (UE), Money supply growth rate (MS), Wholesale Price Index inflation (WPI), Consumer Price Inflation (CPI).

Stock market Indexes:

All Ordinaries, Nekkei 225, Hang Seng, Straight Times and Dow Jones Industrial

Table 1: Summary of scheduled information releases from the U.S. and Japan

	U.S.						Japan					
	Balance of Payment (BOT)	Gross Domestic Product (GDP)	Unemploy-ment Rate (UE)	Retail Sales Growth (RET)	Consumer Price Index (CPI)	Producer Price Index (PPI)	Trade Balance (TB)	Current Account Balance (CAB)	Unemploy-ment Rate (UE)	Money Supply Growth (MS)	Wholesale Price Index (WPI)	Consumer Price Index (CPI)
Frequency of Announcements	Monthly	Quarterly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Source: Actual and MMS expected announcement figures	Money Market Services International						Money Market Services International					
Unit of Measurement	$ US billion	% change in GDP from previous quarter	Unemploy-ment Rate, %	% change of gross retail sales from previous month	% change in CPI from previous month	% change in PPI from previous month	Yen billion	Yen billion	Unemploy-ment Rate, %	% change in M3 from previous month	% change in WPI from previous month	% change in CPI from previous month
Announcement Time	See Figure 1						See Figure 1					
Data Period	January 1991 to May 1999						Jan-91 to Mar-99	Nov-93 to Mar-99	May-94 to Mar-99	Jan-91 to Apr-99	Apr-91 to Apr-99	Jan-91 to Mar-99
Total Number of Announcements within Data Period	100	34	101	89	99	86	99	56	60	99	96	98
No. (% of total) of good announcements[(a)]	43 (43%)	22 (65%)	45 (45%)	35 (39%)	42 (42%)	44 (51%)	46 (46%)	24 (43%)	15 (25%)	47 (47%)	49 (51%)	45 (46%)
No. (% of total) of bad announcements[(b)]	57 (57%)	12 (35%)	56 (55%)	54 (61%)	57 (58%)	42 (49%)	53 (53%)	45(57%)	45 (75%)	52(52%)	47 (49%)	53 (54%)
Test of unbiased expectations[(c)]	1.02 (0.38)	1.01 (0.75)	0.99 (0.57)	0.94 (0.33)	0.97 (0.4)	0.92 (0.4)	0.94 (0.35)	0.95 (0.44)	1.02 (0.69)	0.96 (0.13)	0.99 (0.66)	0.95 (0.06)

(a) (b) Good announcements are better than expected announcements of economic activity variables and lower than expected inflation variables (CPI, WPI and PPI) and unemployment rate.

(c)The unbiasedness is tested via $Actual_t = a + b\ Expected_t + e_t$. 'b' is reported with the p-value of the hypothesis of a=0 and b=1 in the bracket.

Table 2: Statistical properties of overnight and daily stock market index returns

	Australia		Japan		Hong Kong		Singapore		U.S.	
	Daily [(a)]	Overnight [(b)]	Daily	Overnight	Daily	Overnight	Daily	Overnight	Daily	Overnight
	Summary Statistics									
Mean	0.0373	0.0012	-0.0179	0.0109	0.0633	0.0042	0.0228	0.0281	0.0633	0.0243
Variance	0.6563	0.0421	2.0373	0.1528	3.0738	0.6819	1.7091	0.3546	0.7333	0.2558
Skewness	-0.3059	-1.0645	0.2321	-1.4664	0.0727	0.1688	0.5039	0.1632	-0.4533	-0.0725
Excess Kurtosis	5.5458	32.8117	2.7963	19.3741	11.2988	34.3461	12.0775	48.9803	6.8727	5.4996
	Test of Univariate *iid* [(c)]									
Q(20) : $\chi^2(20)$	35.98 **	52.55	24.95	44.33 ***	52.83 ***	62.89 ***	100.61 ***	61.71 ***	27.45	38.51 ***
	{0.0155}	{0.0001}	{0.2035}	{0.0014}	{0.0001}	{0.0000}	{0.0000}	{0.0000}	{0.1230}	{0.0077}
$Q^2(20)$: $\chi^2(20)$	426.27 ***	58.20	426.27 ***	426.27 ***	426.27 ***	426.27 ***	426.27 ***	426.27 ***	426.27 ***	426.27 ***
	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
E-N: $\chi^2(3)$	214.25 ***	38.15	21.38 ***	10.38 **	165.39 ***	149.73 ***	72.49 ***	8.12 **	384.44 ***	62.43 ***
	{0.0000}	{0.0000}	{0.0001}	{0.0156}	{0.0000}	{0.0000}	{0.0000}	{0.0436}	{0.0000}	{0.0000}

Stock market indexes are All ordinaries, Nikkei 225, Hang Seng, Streight Times, and Dow Jones Industrial

(a) $\ln(P_t^{Close} / P_{t-1}^{Close}) \times 100$

(b) $\ln(P_t^{Open} / P_{t-1}^{Close}) \times 100$

(c) Box-Pierce Q-test of serial correlation for linear and non-linear (squared) returns.
E-N is Engle and Ng (1993) 's joint sign bias test.

*, * and ***: Significance at 10, 5 and 1%, respectively.

Table 3: The impact of U.S. public information releases

$$R_i^H = M(\cdot) + (\sum_{j=BOT}^{CPI} \alpha_{i,j} \cdot USNEWS_{j,t} \; + \sum_{j=BOT}^{CPI} \alpha_{i,j}^{Bad} \cdot USNEWS_{j,t}^{Bad}),\; M(\cdot) = \text{right hand side of (1a)},$$

$$\ln h_i^H = V(\cdot) + (\sum_{j=BOT}^{CPI} \beta_{i,j} \cdot USNEWS_{j,t} \; + \sum_{j=BOT}^{CPI} \beta_{i,j}^{Bad} \cdot USNEWS_{j}^{Bad}),\; V(\cdot) = \text{right hand side of (1a)}$$

Holding periods are H = ON (Overnight) at *t+1*, for the Non-U.S. market: $[\ln(P_{t+1}^{Open} / P_t^{Close}) \times 100]$, and H = ON at *t*, $[\ln(P_t^{Open} / P_{t-1}^{Close}) \times 100]$ for the U.S. market, j = BOT, GDP, RET, UE, PPI and CPI.

	Australia		Japan		Hong Kong		Singapore		US	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
	Conditional Mean Equations									
α_{c}	0.0000	{0.9845}	-0.0181	{0.4937}	-0.0145 *	{0.0578}	0.0168 ***	{0.0044}	0.0110	{0.1080}
α_{Hol}	-0.0075 ***	{0.0014}	-0.2567 ***	{0.0000}	-0.0632	{0.1078}	-0.0693 ***	{0.0002}	-0.0142	{0.3734}
α_{BOT}	0.0074	{0.1975}	-0.0892	{0.3720}	-0.0557 ***	{0.0002}	-0.0875 ***	{0.0017}	-0.0793 **	{0.0362}
α_{GDP}	0.0094	{0.1037}	-0.0069	{0.9513}	0.0453	{0.1781}	0.0239 **	{0.0127}	0.0116	{0.7632}
α_{RET}	0.0080 **	{0.0184}	0.2220 **	{0.0121}	0.0831	{0.3239}	-0.0127	{0.2900}	0.0019	{0.9554}
α_{UE}	0.0373 ***	{0.0000}	-0.0010	{0.9887}	0.0784 *	{0.0626}	0.0643 ***	{0.0035}	0.0202	{0.5421}
α_{PPI}	0.0262 ***	{0.0000}	0.5075 ***	{0.0000}	0.2037 ***	{0.0092}	-0.0022	{0.9203}	-0.0455	{0.2686}
α_{CPI}	0.0098 ***	{0.0011}	0.2727 ***	{0.0098}	0.0752 **	{0.0488}	0.0660 ***	{0.0001}	0.0465	{0.1807}
$\alpha_{BOT\text{-}Bad}$	-0.0277 ***	{0.0100}	0.1240	{0.5584}	0.2879 **	{0.0252}	0.1531 ***	{0.0014}	-0.0976 *	{0.0687}
$\alpha_{GDP\text{-}Bad}$	-0.0319 ***	{0.0033}	0.3274 *	{0.0627}	0.0141	{0.7807}	0.0882 **	{0.0391}	-0.0612	{0.3256}
$\alpha_{RET\text{-}Bad}$	-0.0088 **	{0.0361}	-0.3930 ***	{0.0052}	0.0328	{0.7147}	-0.0526	{0.2264}	0.1026 *	{0.0713}
$\alpha_{UE\text{-}Bad}$	-0.0352 ***	{0.0000}	0.1022	{0.6947}	0.1315	{0.1123}	-0.0137	{0.5091}	-0.0014	{0.9801}
$\alpha_{PPI\text{-}Bad}$	-0.0258 ***	{0.0001}	-0.4120 **	{0.0138}	-0.4663 ***	{0.0000}	0.1081 **	{0.0254}	0.0886	{0.2593}
$\alpha_{CPI\text{-}Bad}$	-0.0713 ***	{0.0007}	0.0904	{0.7238}	-0.0815	{0.1413}	-0.1487 ***	{0.0000}	0.0757	{0.1955}
	Conditional Variance Equations									
β_{c}	-0.1145 ***	{0.0000}	-0.0305 ***	{0.0000}	-0.0591 ***	{0.0000}	-0.0430 ***	{0.0000}	-0.0820 ***	{0.0000}
$\beta_{\varepsilon 1}$	-0.0456	{0.2070}	-0.0815 ***	{0.0000}	-0.0598 *	{0.0551}	-0.0071 *	{0.0730}	-0.0314 **	{0.0403}
$\beta_{\varepsilon 2}$	0.3237 ***	{0.0000}	0.1258 ***	{0.0000}	0.1361 **	{0.0265}	0.1508 ***	{0.0000}	0.1377 ***	{0.0000}
β_{h}	0.9437 ***	{0.0000}	0.9847 ***	{0.0000}	0.9810 ***	{0.0000}	0.9912 ***	{0.0000}	0.9561 ***	{0.0000}
β_{Hol}	0.0651 ***	{0.0000}	0.2805 ***	{0.0000}	0.0458	{0.5467}	0.3715 ***	{0.0000}	0.1314 ***	{0.0000}
β_{BOT}	0.7501 ***	{0.0000}	-0.1070 ***	{0.0000}	-0.2042	{0.1687}	-0.0523 *	{0.0795}	-0.1555 ***	{0.0000}
β_{GDP}	0.4751 ***	{0.0000}	0.0312	{0.2955}	0.1721	{0.1469}	0.0212	{0.5838}	-0.1858 ***	{0.0000}
β_{RET}	-1.5379 ***	{0.0000}	0.0780 ***	{0.0002}	0.8328 ***	{0.0000}	-0.3833 ***	{0.0001}	-0.0781 ***	{0.0000}
β_{UE}	0.3423 ***	{0.0000}	-0.0274 *	{0.0935}	-0.0211	{0.9185}	0.4445 ***	{0.0000}	0.0723	{0.1398}
β_{PPI}	-0.3904 ***	{0.0012}	0.0163	{0.3879}	0.4975 ***	{0.0003}	-0.1839 ***	{0.0009}	0.0242	{0.1910}
β_{CPI}	0.7648 ***	{0.0010}	0.0581 **	{0.0466}	-0.2053	{0.3216}	0.7024 ***	{0.0000}	0.0331	{0.4314}
$\beta_{BOT\text{-}Bad}$	0.8877 ***	{0.0000}	-0.0067	{0.8908}	0.7986 ***	{0.0000}	-0.2674 ***	{0.0000}	0.2709 ***	{0.0000}
$\beta_{GDP\text{-}Bad}$	-0.1936 **	{0.0323}	-0.4102 ***	{0.0000}	0.1150	{0.3648}	-0.2995 ***	{0.0000}	0.1098	{0.2188}
$\beta_{RET\text{-}Bad}$	-0.4399 ***	{0.0000}	-0.1545 **	{0.0200}	-0.7129 ***	{0.0002}	-0.0531	{0.1367}	0.0461	{0.1660}
$\beta_{UE\text{-}Bad}$	-0.6109 ***	{0.0000}	-0.2789 ***	{0.0055}	0.1667	{0.4365}	-0.6324 ***	{0.0000}	-0.4214 ***	{0.0083}
$\beta_{PPI\text{-}Bad}$	-0.7088 ***	{0.0000}	0.0984	{0.1567}	0.3767 *	{0.0912}	-0.1242	{0.2908}	0.1432 **	{0.0339}
$\beta_{CPI\text{-}Bad}$	0.7470 ***	{0.0000}	-0.0913	{0.1712}	-0.1911	{0.4410}	-0.3279	{0.2036}	0.0487	{0.4131}
	Diagnostics									
Log-L	2996.1		1259.9		71.3		989.8		666.0	
q	5		2		3		0		8	
Skewness	-1.4899		-0.2140		-0.0688		-1.1688		-0.3242	
Kurtosis	28.6630		15.7940		8.2497		31.7499		2.7568	
Q(20)	21.68	{0.3579}	22.62	{0.3080}	13.80	{0.8406}	12.56	{0.8955}	13.97	{0.8322}
$Q^2(20)$	15.64	{0.7389}	8.13	{0.9910}	23.57	{0.2615}	18.42	{0.5599}	12.22	{0.9084}
E-N	1.05	{0.7892}	1.30	{0.7286}	4.56	{0.2070}	9.43 **	{0.0241}	2.42	{0.4905}
H0: $\alpha_{news}=0$	390 ***	{0.0000}	131 ***	{0.0000}	128 ***	{0.0000}	354 ***	{0.0000}	17	{0.1571}
H0: $\beta_{news}=0$	95022 ***	{0.0000}	1086 ***	{0.0000}	8890 ***	{0.0000}	1174346 ***	{0.0000}	1132 ***	{0.0000}
H0: $\alpha_{news}=\beta_{news}=0$	160231 ***	{0.0000}	1971 ***	{0.0000}	19803 ***	{0.0000}	1448276 ***	{0.0000}	1246 ***	{0.0000}

Tests of white noise on the standardized residuals of the estimations, z_t, are reported in the last panel.

Q(20) and $Q^2(20)$ are Q-tests of linear and non-linear serial correlations of z_t, and E-N is Engle and Ng test of joint sign bias for z_t.

Hypothesis testings include joint significance tests of news effects on the mean, conditional variance, and on both mean and variance.

*, * and ***: Significance at 10, 5 and 1%, respectively.

Table 4: The impact of Japanese public information releases

$$R_i^H = M(\cdot) + (\sum_{j=TB}^{CPI} \alpha_{i,j} \cdot JPNEWS_{j,t} + \sum_{j=TB}^{CPI} \alpha_{i,j}^{Bad} \cdot JPNEWS_{j,t}^{Bad}),\ M(\cdot) = \text{right hand side of (1a)},$$

$$\ln h_i^H = V(\cdot) + (\sum_{j=TB}^{CPI} \beta_{i,j} \cdot JPNEWS_{j,t} + \sum_{j=TB}^{CPI} \beta_{i,j}^{Bad} \cdot JPNEWS_{i,j}^{Bad}),\ V(\cdot) = \text{right hand side of (1a)}$$

Holding periods are H = D (Daily) at *t*, $[\ln(P_t^{Close} / P_{t-1}^{Close}) \times 100]$ for the non-U.S. markets and H = ON at *t*, $[\ln(P_t^{Open} / P_{t-1}^{Close}) \times 100]$ for the U.S. market, j = TB, CAB, UE, MS, WPI and CPI.

	Australia		Japan		Hong Kong		Singapore		US	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
	Conditional Mean Equations									
α_c	0.0250 *	{0.0865}	0.0276 ***	{0.0012}	0.0833 ***	{0.0024}	0.0585 ***	{0.0062}	0.0104	{0.1585}
α_{Hol}	-0.0487	{0.1782}	-0.2457 ***	{0.0000}	-0.1241 **	{0.0160}	-0.1441 ***	{0.0001}	0.0051	{0.7717}
α_{TB}	0.0048	{0.9428}	-0.2648 ***	{0.0095}	-0.1109	{0.1811}	-0.0688	{0.3343}	-0.1649 ***	{0.0000}
α_{CAB}	0.1521	{0.1468}	0.2963 **	{0.0322}	-0.0862	{0.5475}	-0.1316	{0.2100}	-0.0915 *	{0.0571}
α_{UE}	-0.1236	{0.1763}	-0.0515	{0.7477}	-0.3390 ***	{0.0008}	-0.1674 ***	{0.0069}	0.1572 ***	{0.0041}
α_{MS}	0.0630	{0.3572}	0.0375	{0.6692}	0.3005 ***	{0.0002}	0.0439	{0.4680}	0.0089	{0.8094}
α_{WPI}	0.0032	{0.9666}	-0.0224	{0.8167}	0.0625	{0.5228}	0.0800	{0.2141}	0.0307	{0.4890}
α_{CPI}	0.1322 *	{0.0570}	0.1673	{0.1104}	0.1952 **	{0.0345}	0.2107 ***	{0.0001}	-0.0004	{0.9917}
α_{TB-Bad}	0.0477	{0.6696}	0.5369 ***	{0.0012}	0.2528 *	{0.0655}	0.2404 ***	{0.0027}	0.1969 ***	{0.0001}
$\alpha_{CAB-Bad}$	-0.1546	{0.3801}	-0.3520	{0.2005}	-0.5546 *	{0.0587}	-0.3809 ***	{0.0031}	0.0461	{0.5012}
α_{UE-Bad}	0.2452 *	{0.0670}	-0.0108	{0.9673}	0.7762 ***	{0.0001}	0.2102	{0.1060}	-0.3009 ***	{0.0001}
α_{MS-Bad}	0.0214	{0.8165}	-0.2484 *	{0.0870}	-0.3575 **	{0.0258}	-0.1719 **	{0.0485}	-0.1251 **	{0.0349}
$\alpha_{WPI-Bad}$	-0.0310	{0.7772}	0.1128	{0.4116}	0.2402	{0.2490}	0.0307	{0.7151}	0.0880	{0.2870}
$\alpha_{CPI-Bad}$	-0.1400	{0.1639}	-0.4655 **	{0.0273}	-0.1046	{0.3004}	-0.1019	{0.3162}	0.0280	{0.7043}
	Conditional Variance Equations									
β_c	-0.0858 ***	{0.0000}	-0.0163 ***	{0.0000}	0.0157 ***	{0.0001}	-0.0748 ***	{0.0000}	-0.0938 ***	{0.0000}
$\beta_{\varepsilon 1}$	-0.0832 ***	{0.0000}	-0.0750 ***	{0.0000}	-0.0845 ***	{0.0000}	-0.0646 ***	{0.0000}	-0.0449 **	{0.0308}
$\beta_{\varepsilon 2}$	0.1182 ***	{0.0000}	0.0994 ***	{0.0000}	0.2078 ***	{0.0000}	0.2073 ***	{0.0000}	0.1420 ***	{0.0000}
β_h	0.9490 ***	{0.0000}	0.9861 ***	{0.0000}	0.9712 ***	{0.0000}	0.9798 ***	{0.0000}	0.9483 ***	{0.0000}
β_{Hol}	0.3085 ***	{0.0000}	0.1243 ***	{0.0000}	0.0640 **	{0.0382}	0.5082 ***	{0.0000}	0.0430 ***	{0.0000}
β_{TB}	-0.1479 ***	{0.0000}	0.0758 ***	{0.0051}	-0.4362 ***	{0.0000}	-0.5925 ***	{0.0000}	0.0514	{0.1061}
β_{CAB}	-0.0229	{0.6718}	0.0433 *	{0.0618}	0.1573 ***	{0.0013}	0.1532 ***	{0.0020}	-0.3654 ***	{0.0000}
β_{UE}	0.0563	{0.2908}	-0.2355 ***	{0.0019}	0.3504 *	{0.0617}	-0.0265	{0.6324}	0.4800 ***	{0.0000}
β_{MS}	0.0028	{0.8999}	-0.0556	{0.3786}	0.1780 **	{0.0483}	0.0877 **	{0.0202}	0.1158 ***	{0.0000}
β_{WPI}	0.0529 *	{0.0522}	0.0573 ***	{0.0000}	0.2977 ***	{0.0000}	0.3286 ***	{0.0000}	0.3619 ***	{0.0000}
β_{CPI}	0.1180 ***	{0.0000}	-0.1476 ***	{0.0000}	-0.1425 **	{0.0212}	-0.2567 ***	{0.0000}	-0.3300 ***	{0.0000}
β_{TB-Bad}	0.2781 ***	{0.0000}	-0.1105 **	{0.0134}	0.5316 ***	{0.0000}	0.4300 **	{0.0147}	-0.1449 ***	{0.0003}
$\beta_{CAB-Bad}$	-0.0598	{0.6160}	0.0103	{0.8892}	-0.2610 **	{0.0235}	-0.0983	{0.3016}	0.0811	{0.4151}
β_{UE-Bad}	-0.0639	{0.4854}	0.3317 ***	{0.0003}	-0.2367 *	{0.0502}	0.0012	{0.9928}	-0.2031 **	{0.0262}
β_{MS-Bad}	-0.0762	{0.2170}	0.0464	{0.3241}	-0.3063 ***	{0.0000}	-0.2829 ***	{0.0000}	-0.1354 *	{0.0666}
$\beta_{WPI-Bad}$	-0.2491 ***	{0.0019}	0.2509 ***	{0.0019}	-0.1311	{0.1849}	0.0268	{0.7727}	-0.2238 **	{0.0146}
$\beta_{CPI-Bad}$	0.0178	{0.7612}	0.2543 ***	{0.0000}	-0.0842	{0.1415}	-0.1371	{0.1263}	0.3652 ***	{0.0002}
	Diagnostics									
Log-L	-505.1		-1660.8		-1865.1		-1113.1		680.4	
q	1		0		1		2		8	
Skewness	-0.2234		0.1432		-0.1803		0.3912		-0.3267	
Kurtosis	1.1340		1.7480		2.3443		2.5675		2.6815	
Q(20)	19.15	{0.5118}	12.49	{0.8983}	18.59	{0.5483}	29.20 *	{0.0839}	11.72	{0.9253}
$Q^2(20)$	18.58	{0.5495}	15.20	{0.7646}	6.92	{0.9969}	20.42	{0.4318}	12.76	{0.8876}
E-N	4.98	{0.1733}	1.57	{0.6670}	3.44	{0.3293}	5.91	{0.1159}	3.37	{0.3387}
H0: $\alpha_{news}=0$	38 ***	{0.0002}	79 ***	{0.0000}	132 ***	{0.0000}	65 ***	{0.0000}	219 ***	{0.0000}
H0: $\beta_{news}=0$	210 ***	{0.0000}	1223 ***	{0.0000}	6924 ***	{0.0000}	1014 ***	{0.0000}	1299 ***	{0.0000}
H0: $\alpha_{news}=\beta_{news}=0$	339 ***	{0.0000}	1451 ***	{0.0000}	8795 ***	{0.0000}	1811 ***	{0.0000}	1724 ***	{0.0000}

Tests of white noise on the standardized residuals of the estimations, z_t, are reported in the last panel.

Q(20) and $Q^2(20)$ are Q-tests of linear and non-linear serial correlations of z_t, and E-N is Engle and Ng test of joint sign bias for z_t.

Hypothesis testings include joint significance tests of news effects on the mean, conditional variance, and on both mean and variance.

*, * and ***: Significance at 10, 5 and 1%, respectively.