International equity market comovements: Economic fundamentals or contagion?

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Abstract

We investigate the return comovement in international equity markets with a focus on the distinction between economic fundamentals and contagion. We examine the potential macro news effect based on a comprehensive data set of macroeconomic news announcements made in the U.S., U.K., and Japan. Our results show that the bulk of the observed comovement in the intraday and overnight returns of the international equity markets cannot be attributed to public information about economic fundamentals. In contrast, foreign market returns exert a dominant influence on the subsequent domestic market returns. Overall, our findings suggest that future inquiry on market comovement may focus on the distinction between contagion and trading on private information, rather than public information.

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1. Introduction

In this paper, we compare the extent to which return comovement between international equity markets may be explained by economic fundamentals versus contagion. Earlier studies establish the economic significance of equity market comovement across national borders (e.g., Becker et al., 1990; Hamao et al., 1990), but finding the source of the...
comovement has been difficult for academics and practitioners. Understanding the determinants of the comovement has profound implications for international diversification, market integration/efficiency, and the cost of capital for multinational firms.

The traditional view stresses the role of common fundamental factors (Solnik, 1974a,b; Stulz, 1981; Adler and Dumas, 1983), but it is difficult to account for the large comovement around the globe in extreme circumstances often without apparent new information. King and Wadhwani (1990) propose an alternative explanation for the market linkage. They argue that trading of stocks in one market per se affects stock prices in other markets, even if the source of the trading is purely noise. They call this the “market-contagion” hypothesis.

To distinguish between the two competing explanations, economic fundamentals and contagion, we separate the influence of foreign markets on the domestic markets into two components: one that is driven primarily by economic fundamentals and the other by foreign market returns. Specifically, we examine the market comovement between the domestic intraday (and overnight) returns and foreign intraday returns for the U.S., U.K., and Japan, conditional on both the macroeconomic news announcements and the most recent foreign intraday returns. In a linear return-generating model, we measure the marginal effect of the foreign market returns and the macro news effect. If the foreign returns are redundant after controlling for the macroeconomic news announcements, then evidence for the contagion hypothesis is weaker. On the other hand, if the foreign returns do have a separate and substantial influence, then the evidence favoring the contagion hypothesis is stronger.

King and Wadhwani (1990) argue that the return correlation between markets increases with the volatility in each market, and they interpret this as evidence supporting contagion hypothesis. Karolyi and Stulz (1996) also find evidence consistent with this interpretation. On the other hand, Ross (1989) argues that market volatility is related to the underlying information flow including public information. Public information flows may then be associated with higher volatility and more pronounced comovement, all in the context of a rational approach to asset pricing.

In this paper, we try to distinguish between these two views by examining the return comovement between market conditional on the volatility of foreign news in a nonlinear return-generating model. Using our approach, we gauge the extent to which return comovement changes as the volatility of the macro news varies. The contagion hypothesis implies that the return comovement should change very little after controlling for the volatility of public information. This model also captures the intuition of McQueen and Roley (1993), who stress that macroeconomic news may have nonlinear effect on stock returns.

Our sample includes stock index returns and 14 different macroeconomic news announcements from U.S., U.K., and Japan for the period from January 1, 1985 to December 31, 1996. In the study, we mitigate the “stale open quote problem” in both the U.S. (Stoll and Whaley, 1988) and Japanese markets (Hamao et al., 1990) by choosing the “opening” price as the price index quoted at 10:00 am in each market. Furthermore, we account for the stylized volatility patterns using the Glosten et al. (1993) asymmetric GARCH model and estimate both conditional mean and volatility equations simultaneously.
Our empirical results show that the bulk of the observed return comovement in the international equity markets cannot be traced to public information about economic fundamentals. We show that our macroeconomic announcement data do convey valuation-relevant information to the capital markets, a result in the spirit of Flannery and Protopapadakis (2002). However, foreign intraday returns play a dominant role in influencing domestic market returns even after we control for the impact of macroeconomic news. This result is robust for both linear and nonlinear news models and across all three countries. Our findings suggest that foreign market returns convey information distinct from the public information flows about economic fundamentals (as measured by the macroeconomic news announcements). In this case, domestic market traders may have incentive to infer the unobservable information from the previous foreign market returns and incorporate valuation information into their subsequent domestic trading. At the same time, the noise embedded in foreign market returns may also be transmitted into the domestic market, thereby connecting returns in the two markets.

We find evidence, however, that the return effect of foreign macroeconomic news increases when the announcements are accompanied by large foreign intraday returns and when the volatility of the announcements is large. This result is consistent with the conjecture of McQueen and Roley (1993) that the effect of macroeconomic news announcements depends on the context in which investors interpret them, not just the announcements themselves. Nevertheless, the nonlinear news effects measured here are still too small to have a material impact on the basic return comovement between market.

Overall, we find for each country in our sample that returns from the two preceding foreign market sessions are far more important than the preceding domestic returns and macroeconomic news announcements taken together in explaining the domestic intraday and overnight returns. This suggests an interesting path to pursue in future work on international equity market comovement: focus on distinguishing between the contagion hypothesis (e.g., Bae et al., 2001; Forbes and Rigobon, 2002; Connolly and Wang, 2002) and the hypothesis of trading on private information (e.g., Craig et al., 1995).

Our comprehensive data set of macro news events (2902 announcements in total from three countries) distinguishes our paper from the earlier studies (e.g., Cornell, 1983; Pearce and Roley, 1985; Hardouvelis, 1987; Ito and Roley, 1987), which tend to examine one macro event or news from one country. Moreover, to isolate the potentially short-lived news effect (Ederington and Lee, 1993), we focus on intraday and overnight returns. This setup distinguishes our paper further from the earlier studies, which often explore news effects using longer horizon data (e.g., monthly returns in King et al., 1994).

This paper is related to Connolly and Wang (1998, 2002) on stock market comovement between countries. Connolly and Wang (1998) demonstrate that the macro news shocks play a more important role in explaining volatility linkage between markets than in explaining return linkage. Connolly and Wang (2002) study the effects of market volatility, dispersion of beliefs and extreme returns on equity market comovement. The present paper distinguishes itself from the two papers by focusing on the role of public information and in using specific tests designed to distinguish news versus trading effects as sources of equity market return comovement.

The paper proceeds as follows. Section 2 describes the data and summary statistics. Section 3 introduces the conditional mean and volatility models used in our empirical
investigation and the specific test hypotheses. Section 4 reports our empirical results, and Section 5 concludes.

2. Data and summary statistics

2.1. Stock returns

We estimate our empirical models with daily stock index returns from the U.S., U.K., and Japan for the sample period January 1, 1985 through December 31, 1996. The Japanese market opens at 9:00 am and close at 3:00 pm, although there is a 2-h break, 11:00 am to 1:00 pm (Tokyo local time). The U.K. market opens at 9:00 am and closes at 4:30 pm (London local time). The U.S. market opens at 9:30 am and closes at 4:00 pm (New York local time.) Fig. 1 shows the timing of trading in the three markets and the periods corresponding to our intraday and overnight returns in each market.

In the study, we consider close-to-open “overnight” returns and open-to-close “intraday” returns. Since there are potential stale-price problems associated with opening prices of the U.S. (Stoll and Whaley, 1988) and Japanese (Hamao et al., 1990) stock indices, we collected intraday values for these indices and computed intraday and overnight returns with post-opening prices of the respective indices. For Japan, we choose the 10:00 price as the opening price in our analysis to minimize the stale-price problems. Specifically, we calculate the overnight return on day \( t \) as \( \ln(\text{Nikkei 225 at 10:00 am on day } t) - \ln(\text{Nikkei 225 at close on day } t - 1) \). Our intraday return on day \( t \) is calculated as \( \ln(\text{Nikkei 225 at close on day } t) - \ln(\text{Nikkei 225 at 10:00 am on day } t) \).

For our U.S. return series, we used the S&P500 index as our measure of the stock market. Following Becker et al. (1992) and Craig et al. (1995), we choose the 10:00 price as the opening price in our analysis to minimize the stale-price problems. The overnight return on day \( t \) is given by \( \ln(\text{S&P500 at 10:00 am on day } t) - \ln(\text{S&P500 at close on day } t - 1) \). Our intraday return on day \( t \) is the percentage change in the value of the S&P500 from 10:00 to the close of trading on day \( t \), calculated as \( \ln(\text{S&P500 at close on day } t) - \ln(\text{S&P500 at 10:00 am on day } t) \).

For the U.K., we use FTSE 100 index with the 9:00 am opening prices and 4:30 pm closing prices. The stale-price problem is much less important for this market because firm quotes are used instead of transaction prices and there is a half-hour premarket period each day. We calculate the overnight return on day \( t \) as \( \ln(\text{FTSE 100 at 9:00 am on day } t) - \ln(\text{FTSE 100 at close on day } t - 1) \). Our intraday return on day \( t \) is the percentage change in the value of the FTSE 100 from 9:00 to the close of trading, calculated as \( \ln(\text{FTSE 100 at close on day } t) - \ln(\text{FTSE 100 at 9:00 am on day } t) \).

Note also that in our conditional volatility model, we use the 1-month Eurodollar interest rate for the U.S., the 1-month Euro-yen interest rate for Japan, and the 1-month Euro-sterling interest rate for the U.K. When matching interest rate data to intraday and overnight return data, we adjust for timing variations so that interest rate observations precede the last equity index value used in calculating equity returns. This renders the interest rate observations predetermined variables in our empirical work.
Fig. 1. Timing conventions for intraday and overnight index returns for the U.S., U.K., and Japanese equity markets.
2.2. Macroeconomic news announcements

Pearce and Roley (1985) show that in the U.S. markets three real economic announcements—industrial production (IP), unemployment rate (UR), and merchandise trade balance (TD)—and three monetary economic announcements—money supply (MS), consumer price inflation (CPI), and producer price inflation (PPI)—have a measurable influence on the domestic stock market. We choose these six macroeconomic announcements as a fair and parsimonious representation of the economic fundamentals for the U.S. market. We obtain the U.S. actual announcement data and the median survey estimates from MMS International (Money Market Services). For the U.K. and Japanese markets, we choose four comparable domestic macroeconomic announcements.

The U.K. macroeconomic announcements that we study include M3 (1985–1990) and M4 (1991–1996) money supply (MS), retail price inflation (CPI), industrial production (IP), and the unemployment rate (UR). The U.K. news data are collected from the Financial Times. Our Japanese macroeconomic news announcements include money supply (MS), industrial production (IP), consumer price index (CPI), and wholesale price index (PPI). The money supply announcement gives the monthly money stock (M2 plus certificates of deposit) estimates. We collected most of the Japan monthly preliminary announcement data by hand from the Nihon Keizai Shinbun.2

Of course, we do not claim that these announcements exhaust all macroeconomic news, but rather that they are selected based on the trade-off between a fair representation of economic fundamentals (given previous studies) and the need for a parsimonious set of news events in our empirical investigation. Other than the U.S. money supply series, all the news announcements are made monthly.

To capture new information from each announcement, we use the unexpected component of each announcement in our study, not the raw announcement figures. The unexpected components of the U.S. announcements are calculated as the percentage difference between the actual announcement values and the median expected values. The median expected values are calculated from the MMS surveys of market participants and observers. Since we do not have similar expected values on the announcements for Japan and the U.K., we built an ARIMA model for each actual news announcement series and use residual from the model to measure the unexpected value of the news. These residuals can be interpreted as the unexpected percentage change in the news and hence are comparable to the measurement approach we use for U.S. announcements.3

Fig. 2 shows the distribution of these announcements across the calendar month.4 Interestingly, it shows that there is considerable clustering in macroeconomic news. Specifically, the percentage of total news announcements across the sample peaks for

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2 The Bank of Japan provided some announcement data for 1995 and 1996.
3 We do not report here, but the models are often simple ARMA(1,1) models with an AR(12) term added. The need to estimate the expected component introduces an additional source of error into our estimates. Murphy and Topel (1985) analyze the problem, showing that point estimates still have desirable properties, but standard errors must be adjusted upward to reflect the additional source of error. We report the consequences of this adjustment later in the paper.
4 We are grateful to a referee whose question led to development of Fig. 2.
each country in the middle of the calendar month. Japan shows another spike late in the month. The monthly distribution appears to be quite leptokurtic for the U.S. but more platykurtic for the U.K.

2.3. Summary statistics

Table 1 reports summary statistics on the stock returns and macroeconomic news announcements. Panel A shows that the volatility of intraday returns is larger than the volatility of overnight returns in the full sample and all three subsamples. Similarly, the average return is often larger for intraday returns than overnight returns for the U.S. and U.K. data. These results are consistent with earlier studies. The volatility finding may reflect a greater information flow during the intraday period and/or it may reflect the effect of trading in generating higher volatility. Panel B shows there is substantial variation (volatility) in each news announcement series. The note indicates that 13 news announcements are made monthly while only 1 (i.e., U.S. money supply) is made weekly. There are totally 2902 news announcements in our sample from January 1985 to December 1996.

3. Models and test hypotheses

3.1. General framework and notation

Let $R_{it}^{dc}$ and $R_{it}^{co}$ be country $i$’s domestic intraday and overnight stock index returns, respectively, on calendar day $t$, where $i$ = JP, UK, US. We decompose each return measure into two components: one that is expected, conditional on the current information set for
the corresponding returns, and an unexpected component captured in the residual term. The character of this decomposition depends, of course, on the content of the information set. In this study, we focus on the information set generated by the current intraday and

Table 1

Panel A: Stock index return

<table>
<thead>
<tr>
<th>Country</th>
<th>Return</th>
<th>Mean</th>
<th>S.D.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>$r_{oc}$</td>
<td>0.0006</td>
<td>0.0077</td>
<td>-0.163</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td>$r_{co}$</td>
<td>0.00004</td>
<td>0.0054</td>
<td>-0.066</td>
<td>0.087</td>
</tr>
<tr>
<td>U.K.</td>
<td>$r_{oc}$</td>
<td>0.0005</td>
<td>0.0073</td>
<td>-0.054</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td>$r_{co}$</td>
<td>0.0001</td>
<td>0.0058</td>
<td>-0.095</td>
<td>0.061</td>
</tr>
<tr>
<td>Japan</td>
<td>$r_{oc}$</td>
<td>-0.0002</td>
<td>0.0103</td>
<td>-0.130</td>
<td>0.083</td>
</tr>
<tr>
<td></td>
<td>$r_{co}$</td>
<td>0.0005</td>
<td>0.0086</td>
<td>-0.045</td>
<td>0.070</td>
</tr>
</tbody>
</table>

Panel B: Macroeconomic news announcement

<table>
<thead>
<tr>
<th>Country</th>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>CPI_{US}</td>
<td>-0.0057</td>
<td>0.139</td>
<td>-2.00</td>
<td>3.00</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>IP_{US}</td>
<td>0.014</td>
<td>0.177</td>
<td>-2.00</td>
<td>3.00</td>
<td>182</td>
</tr>
<tr>
<td></td>
<td>PP_{US}</td>
<td>0.024</td>
<td>0.483</td>
<td>-3.00</td>
<td>4.00</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>UR_{US}</td>
<td>-0.0005</td>
<td>0.0062</td>
<td>-0.067</td>
<td>0.053</td>
<td>184</td>
</tr>
<tr>
<td></td>
<td>TD_{US}</td>
<td>-0.0003</td>
<td>0.041</td>
<td>-0.833</td>
<td>0.303</td>
<td>202</td>
</tr>
<tr>
<td></td>
<td>MS_{US}</td>
<td>0.078</td>
<td>1.72</td>
<td>-49.0</td>
<td>26.0</td>
<td>789</td>
</tr>
<tr>
<td>U.K.</td>
<td>CPI_{UK}</td>
<td>0.0007</td>
<td>0.070</td>
<td>-0.957</td>
<td>1.10</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>IP_{UK}</td>
<td>-0.0043</td>
<td>0.253</td>
<td>-4.01</td>
<td>3.03</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>UR_{UK}</td>
<td>0.0005</td>
<td>0.038</td>
<td>-1.534</td>
<td>0.259</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>MS_{UK}</td>
<td>0.0005</td>
<td>0.099</td>
<td>-1.32</td>
<td>1.75</td>
<td>155</td>
</tr>
<tr>
<td>Japan</td>
<td>CPI_{JP}</td>
<td>0.0037</td>
<td>0.179</td>
<td>-1.323</td>
<td>4.133</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>PP_{JP}</td>
<td>0.001</td>
<td>0.093</td>
<td>-1.248</td>
<td>2.47</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>IP_{JP}</td>
<td>-0.005</td>
<td>0.475</td>
<td>-5.827</td>
<td>6.779</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>MS_{JP}</td>
<td>0.0003</td>
<td>0.0145</td>
<td>-0.016</td>
<td>0.021</td>
<td>156</td>
</tr>
</tbody>
</table>

Notes on news announcements: U.S. industrial production announcements are released monthly by the Federal Reserve Board before the U.S. market opens. Unemployment data are released by the Bureau of Labor Statistics monthly before the U.S. market opens. The merchandise trade deficit data are announced monthly by the Foreign Trade Division of the Department of Commerce, also before the U.S. market begins trading. Consumer price index and producer price index data are announced monthly by the Bureau of Labor Statistics at 8:30 am. Finally, weekly U.S. money stock (M1) announcements are made by the Federal Reserve on Thursday afternoons, after the U.S. market closes, but before trading begins in Japan. The Japanese money supply announcements are usually made on Friday of the first or second week of the month. Until November 28, 1996, the Bank of Japan announced the money supply and wholesale price index in the afternoon, while the market was still open. From that point forward, the announcements have been made at 8:50 am Tokyo time. Japanese industrial production data are the monthly index of industrial production computed by the Ministry of International Trade and Industry (MITI). This announcement does not have a fixed release date, but is usually made toward the end of the month. The industrial production announcement is made by the MITI, generally at 1:30 pm (while the market in Tokyo is open). The consumer price index is released monthly at slightly irregular times by the Management and Coordination Agency, after it is reported to the Japanese cabinet. Our macroeconomic news announcements for the U.K. include M3 money supply (MS), retail price inflation (CPI), industrial production (IP), and the unemployment rate (UR). These announcements are made at 11:30 am while the market in London is open at roughly monthly intervals (King and Wadhwani, 1990).
overnight returns and macroeconomic news announcements from both the domestic and foreign countries. Specifically, denote the current information set for the domestic intraday stock index returns on calendar day $t$ by $\Omega_{it}^{oc}$. This information set contains the current returns and announcements, if any, that occur between domestic market $i$’s close on calendar day $t - 1$ and the subsequent domestic market close on calendar day $t$. Similarly, denote the current information set for the domestic, overnight stock index returns on calendar day $t$ by $\Omega_{it}^{co}$. It consists of domestic and foreign market returns and announcements, if any, that occur between domestic market $i$’s open on calendar day $t - 1$ and the subsequent domestic market open on calendar day $t$. With this setup, we write the decomposition of country $i$’s domestic intraday and overnight returns, respectively, as follows:

$$R_{oc}^{it} = E(R_{oc}^{it} | \Omega_{it}^{oc}) + \epsilon_{it}$$

and

$$R_{co}^{it} = E(R_{co}^{it} | \Omega_{it}^{co}) + \epsilon_{it},$$

where $i = JP, UK, US$. \hfill (1)

To proceed further, we need some notation to distinguish the components of the information set. Select a domestic market, and label the immediately preceding foreign market “foreign market 1” and the other market “foreign market 2”. For example, the U.S. market has the U.K. as foreign market 1 and Japan as foreign market 2. Given this convention, denote by FR$_{ji}$ the intraday return and by FN$_{ji}$ macroeconomic announcements from foreign market $j$, for $j = 1, 2$.

We separate all domestic macroeconomic announcements made on calendar day $t$ into three groups. The first group consists of the domestic announcements made before the domestic market opens, which we call “domestic news 1” (denoted by DN1). The second group contains the domestic announcements made during the domestic intraday trading, which we call “domestic news 2” (denoted by DN2). The third group consists of the domestic announcements made after the domestic market close, which we call “domestic news 3” (denoted by DN3). Thus, we may write the current information sets for the domestic intraday and overnight stock index returns, respectively, as follows: for $i = JP, UK, US$,

$$\Omega_{it}^{oc} = \{R_{oc}^{it}, FR_{oc}^{it}, FR2_{oc}^{it}, DN1_{oc}^{it}, DN2_{oc}^{it}, DN3_{oc}^{it}, FN1_{oc}^{it}, FN2_{oc}^{it}\},$$

and

$$\Omega_{it}^{co} = \{R_{oc}^{it-1}, FR_{oc}^{it-1}, FR2_{oc}^{it-1}, DN1_{oc}^{it-1}, DN2_{oc}^{it-1}, DN3_{oc}^{it-1}, FN1_{oc}^{it-1}, FN2_{oc}^{it-1}\}, \hfill (2)$$

where FR$_{ji,t}$ and FR$_{ji,t}$ is foreign market $j$’s intraday return and macroeconomic announcements, respectively, occurred between domestic market $i$’s close on calendar day $t - 1$ and the subsequent domestic market close on calendar day $t$; DN$_{ji,t}^{oc}$ is the “domestic news $j$” announcements in country $i$ occurring between domestic market $i$’s open on calendar day $t - 1$ and the subsequent domestic market open on calendar day $t$, etc.

Fig. 1 shows the timing of trading in the three markets and the periods corresponding to our intraday and overnight returns in each market. Some examples may help to clarify the timing considerations that went into formulating the information sets of macroeconomic
news announcements (i.e., specifying the timing on particular announcements) that underlie the regression models in this section.

**Example 1.** The U.S. money supply announcements are released after the U.S. market closes, while the other five U.S. announcements are made before the market opens. Accordingly, the U.S. money supply announcement enters both the intraday and overnight U.S., U.K., and Japanese return models on day \( t - 1 \), whereas the other U.S. announcements are included in both the overnight U.S. return model and the intraday U.K. return model on day \( t \).

**Example 2.** All Japanese announcements are made during Japanese market trading hours and, hence, they enter U.K. and U.S. return models on day \( t \), but they only enter the intraday Japanese return model on day \( t - 1 \). The same Japanese news announcements enter the overnight return models on day \( t - 1 \).

**Example 3.** All U.K. announcements are made during U.K. market trading hours and, hence, they enter the U.K. intraday return model and the U.S. overnight and intraday return models on day \( t \). The same U.K. news announcements appear on day \( t - 1 \) in the U.K. overnight return model.

### 3.2. Conditional mean models

Given the information sets in Eq. (2), we consider two different empirical models for the conditional means of intraday and overnight index returns in Eq. (1). In doing so, we also control for any Monday and post-holiday effects (French, 1980; Gibbons and Hess, 1981), by including a Monday and post-holiday dummy variable, \( MHD_{it} \).

#### 3.2.1. The linear news model

We first consider a linear model where the domestic intraday (overnight) index returns are a linear function of the previous domestic and foreign market returns and the macro news shocks from the three countries as follows: for \( i = \text{JP, UK, US} \),

**Intraday:**

\[
R_{it}^{\text{oc}} = c_i + \alpha_i \cdot R_{it-1}^{\text{oc}} + \beta_{i1} \cdot FR1_{it}^{\text{oc}} + \beta_{i2} \cdot FR2_{it}^{\text{oc}} + \gamma_{i1} \cdot CDN1_{it}^{\text{oc}} \\
+ \gamma_{i2} \cdot CDN2_{it}^{\text{oc}} + \gamma_{i3} \cdot CDN3_{it}^{\text{oc}} + \delta_{i1} \cdot CFN1_{it}^{\text{oc}} \\
+ \delta_{i2} \cdot CFN2_{it}^{\text{oc}} + \phi_i \cdot MHD_{it} + \epsilon_{it}. \tag{3}
\]

**Overnight:**

\[
R_{it}^{\text{co}} = c_i' + \alpha_i' \cdot R_{it-1}^{\text{oc}} + \beta_{i1}' \cdot FR1_{it}^{\text{oc}} + \beta_{i2}' \cdot FR2_{it}^{\text{oc}} \\
+ \gamma_{i1}' \cdot CDN1_{it}^{\text{co}} + \gamma_{i2}' \cdot CDN2_{it}^{\text{co}} + \gamma_{i3}' \cdot CDN3_{it}^{\text{co}} \\
+ \delta_{i1}' \cdot CFN1_{it}^{\text{co}} + \delta_{i2}' \cdot CFN2_{it}^{\text{co}} + \phi_i' \cdot MHD_{it} + \epsilon_{it}. \tag{4}
\]

The \( c_i, \alpha_i, \beta_{i1}, \beta_{i2}, \gamma_{i1}, \gamma_{i2}, \gamma_{i3}, \delta_{i1}, \delta_{i2}, \) and \( \phi_i \) terms are parameters to be estimated. Note that in this model all news variables have a prefix C indicating that they are the vectors of the *unexpected* components of the corresponding macroeconomic announce-
ments. For example, CDN_ji is the vector of the unexpected components of the “domestic news j” announcements in country i made between domestic market i’s close on calendar day t−1 and the subsequent domestic market close on calendar day t. On the other hand, CFN_ji is the vector of the unexpected components of foreign market news announcements in country j made between domestic market i’s open on calendar day t−1 and the subsequent market open on calendar day t.

In this model, we measure the effect of macro news shocks on the domestic intraday and overnight returns relative to the effect of the previous trading in both domestic and foreign markets. To help organize the evidence, we formulate a number of hypothesis tests as follows. Our first test asks whether immediately prior domestic and foreign returns affect current domestic returns, after controlling for the macroeconomic announcements. Specifically, test 1 has two components:

- Test 1.1: Do the immediately prior domestic overnight (intraday) returns affect the current domestic intraday (overnight) returns? The null hypothesis is $a = 0$ ($a' = 0$).
- Test 1.2: Do the previous foreign intraday returns affect the current domestic intraday (overnight) returns? The null hypothesis is $b_1 = b_2 = 0$ ($b_1' = b_2' = 0$).

Note that all foreign intraday returns considered in this paper occur essentially during the domestic overnight trading period. Therefore, if the domestic market is efficient in processing information from the foreign intraday returns, then one may find that the foreign intraday returns significantly affect the domestic overnight returns, but less so on the domestic intraday returns.

Our second test evaluates whether macroeconomic announcements have a measurable impact on domestic returns, in addition to the return comovement between markets. Test 2 also has two components:

- Test 2.1: Does public release of domestic economic news affect domestic intraday (overnight) returns? The null hypothesis is $c_1 = c_2 = c_3 = 0$ ($c_1' = c_2' = c_3' = 0$).
- Test 2.2: Does public release of foreign economic news affect domestic intraday (overnight) returns? The null hypothesis is $d_1 = d_2 = 0$ ($d_1' = d_2' = 0$).

Our third test evaluates the broader hypothesis of market integration. It focuses on whether foreign markets returns and news taken together affect domestic stock returns. Test 3 has two components:

- Test 3.1: Do trading and news in foreign market 1 (i.e., the immediately prior foreign market) taken together affect domestic intraday (overnight) returns? The null hypothesis is $b_1 = d_1 = 0$ ($b_1' = d_1' = 0$).
- Test 3.2: Do trading and news in foreign market 2 taken together affect domestic intraday (overnight) returns? The null hypothesis is $b_2 = d_2 = 0$ ($b_2' = d_2' = 0$).

### 3.2.2. The nonlinear new model

King and Wadhwani (1990) find that the return correlation between the U.S. and U.K. stock markets varies with the volatility in each market. They interpret this as evidence
supporting their contagion hypothesis. Ross (1989) argues that market volatility is related to the underlying information flow including public information. In this paper, we investigate Ross’ interpretation and focus on the role of public information shocks and, in particular, the effect of macro news volatility, rather than price volatility itself. Specifically, we use the absolute values of the unexpected macroeconomic news announcements to proxy for the volatility due to public information flow. We formulate our nonlinear model as follows:

Intraday:  
\[ R_{it}^{oc} = c_i + (\alpha_i + \gamma_{i1} \cdot |CDN1_{it}^{oc}| + \gamma_{i2} \cdot |CDN2_{it}^{oc}| \]
\[ + \gamma_{i3} \cdot |CDN3_{it}^{oc}|) \cdot R_{it}^{co} + (\beta_{i1} + \delta_{i1} \cdot |CFN1_{it}^{co}|) \cdot FR_{it}^{oc} \]
\[ + (\beta_{i2} + \delta_{i2} \cdot |CFN2_{it}^{co}|) \cdot FR2_{it}^{oc} + \phi_i \cdot MHD_{it} + \epsilon_{it}, \]  
(5)

Overnight:  
\[ R_{it}^{co} = c_i' + (\alpha_i' + \gamma_{i1}' \cdot |CDN1_{it}^{co}| + \gamma_{i2}' \cdot |CDN2_{it}^{co}| \]
\[ + \gamma_{i3}' \cdot |CDN3_{it}^{co}|) \cdot R_{it-1}^{co} + (\beta_{i1}' + \delta_{i1}' \cdot |CFN1_{it}^{co}|) \cdot FR_{it}^{co} \]
\[ + (\beta_{i2}' + \delta_{i2}' \cdot |CFN2_{it}^{co}|) \cdot FR2_{it}^{co} + \phi_i' \cdot MHD_{it} + \epsilon_{it}, \]  
(6)

Note that all news variables inside the absolute value operator are the same as in the linear news model. If the return comovement coefficients (i.e., \( \alpha, \beta_1, \beta_2 \)) drop substantially after controlling for the volatility of the macro news shocks, then the shift in return correlation between markets may simply reflect common economic fundamentals, rather than contagion. On the other hand, if the return comovement does not change much after taking into account of the public information shock, then the contagion hypothesis is strengthened.

To investigate the public information-induced volatility effect, we formulate a specific test hypothesis with two components as follows:

- **Test 4.1:** Does the volatility of the domestic news shock affect the own-market correlation between the intraday and overnight stocks returns? The null hypothesis is \( \gamma_1 = \gamma_2 = \gamma_3 = 0 \) (\( \gamma_1' = \gamma_2' = \gamma_3' = 0 \)).
- **Test 4.2:** Does the volatility of the foreign news shock affect the cross-market lead-lag (contemporaneous) correlation? The null hypothesis is that the vector \( \delta_1 = \delta_2 = 0 \) (\( \delta_1' = \delta_2' = 0 \)).

### 3.3. Conditional volatility models

Extensive empirical evidence indicates that stock return volatility exhibits clustering phenomenon, i.e., high volatility in one period tends to be followed by high volatility in the next period (Bollerslev et al., 1992). In addition, this effect is asymmetric, i.e., the effect is more pronounced when the market is falling than rising (Nelson, 1991; Engle and Ng, 1993; Glosten et al., 1993). In order to account for the asymmetric volatility clustering...
effect, we model the intraday and overnight residual terms in Eq. (1), using the Glosten–Jagannathan–Runkle (GJR) asymmetric GARCH volatility model as follows:

\[
\begin{align*}
\text{Intraday:} & \quad \varepsilon_{it} \mid \Omega_{it}^{oc} \sim N(0, h_{it}^{oc}), \quad h_{it}^{oc} = \omega_0 + \omega_{i1} \cdot \varepsilon_{i,t-1}^2 + \omega_{i2} \cdot h_{it-1}^{oc} + \omega_{i3} \cdot \varepsilon_{i,t-1}^2 \nonumber \\
& \quad \quad + \omega_{i4} \cdot \text{MHD}_{it} + \omega_{i5} \cdot \text{INT}_{it}. \quad (7) \\
\text{Overnight:} & \quad \varepsilon_{it} \mid \Omega_{it}^{oo} \sim N(0, h_{it}^{oo}), \quad h_{it}^{oo} = \omega_{i0}^o + \omega_{i1}^o \cdot \varepsilon_{i,t-1}^2 + \omega_{i2}^o \cdot h_{it-1}^{oo} \nonumber \\
& \quad \quad + \omega_{i3}^o \cdot \varepsilon_{i,t-1}^2 + \omega_{i4}^o \cdot \text{MHD}_{it} + \omega_{i5}^o \cdot \text{INT}_{it}. \quad (8)
\end{align*}
\]

Note that our volatility models account for the Monday and post-holiday effect by including the Monday and post-holiday dummy variable, MHD\(_{it,p}\). The volatility models also account for the interest rate effect (Glosten et al., 1993) by incorporating a comparable domestic interest rate, INT\(_{it,p}\), for each country. We use a nonlinear maximum-likelihood method (Berndt–Hall–Hall–Hausman) to estimate each of our two conditional mean models in Eqs. (3)–(6) along with the conditional volatility model in Eqs. (7) and (8). To insure that the resulting models are based on well-behaved volatility functions, we applied the battery of six volatility model specification tests proposed by Engle and Ng (1993) to each conditional model that we estimate.\(^5\)

4. The empirical results

4.1. The linear news model: News versus trading

In Table 2, we report parameter estimates and test results for the linear news model developed in Section 3.2.1. For all three countries, the parameter estimates indicate that both domestic and foreign market returns significantly affect subsequent domestic market returns even after controlling for the impact of macro news shocks. These results are also confirmed in Tests 1.1 and 1.2. Interestingly, foreign market returns seem to exert a greater influence on the domestic market than previous own market trading. For example, for Japanese overnight market, the coefficient (\(\beta_1\)) on the U.S. intraday return is about four times the coefficient (\(\alpha\)) on the previous Japanese intraday return, 0.232 versus 0.062. Of course, this result is partly due to the fact that the U.S. intraday return overlaps with the contemporaneous Japanese overnight return. However, the U.S. intraday return also has a greater impact on the subsequent Japanese intraday return (with coefficient 0.236) than the previous Japanese intraday return (with coefficient \(-0.148\)). Moreover, foreign intraday returns tend to have a greater impact on the domestic overnight market than the domestic intraday market. For example, the coefficient of the U.K. intraday return in the U.S.

\(^5\) We found that our empirical volatility models passed all the tests proposed by Engle and Ng (1993). To conserve space, we do not report the volatility test results, but they are available upon request.
Table 2
Responses of stock index returns to macroeconomic news announcements (linear model)

Panel A: Estimation results

<table>
<thead>
<tr>
<th></th>
<th>JP Intraday</th>
<th>JP Overnight</th>
<th>UK Intraday</th>
<th>UK Overnight</th>
<th>US Intraday</th>
<th>US Overnight</th>
</tr>
</thead>
<tbody>
<tr>
<td>$c$</td>
<td>-0.0001 (0.0002)</td>
<td>0.0004* (0.0001)</td>
<td>0.0005* (0.0001)</td>
<td>0.023 (0.071)</td>
<td>0.0004* (0.0001)</td>
<td>0.028 (0.085)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>-0.148* (0.015)</td>
<td>0.062* (0.011)</td>
<td>-0.071* (0.025)</td>
<td>0.122* (0.008)</td>
<td>-0.058* (0.023)</td>
<td>-0.016 (0.010)</td>
</tr>
<tr>
<td>$\beta_1$</td>
<td>0.236* (0.012)</td>
<td>0.232* (0.017)</td>
<td>0.066* (0.012)</td>
<td>0.060* (0.004)</td>
<td>0.015 (0.014)</td>
<td>0.030* (0.006)</td>
</tr>
<tr>
<td>$\beta_2$</td>
<td>0.065 (0.024)</td>
<td>0.121* (0.018)</td>
<td>0.002* (0.021)</td>
<td>0.365* (0.006)</td>
<td>0.016 (0.010)</td>
<td>0.016 (0.010)</td>
</tr>
<tr>
<td>CPIJP</td>
<td>0.0002 (0.001)</td>
<td>-0.0004 (0.0006)</td>
<td>-0.0003 (0.0006)</td>
<td>0.002 (0.002)</td>
<td>CPIUS</td>
<td>-0.0003 (0.001)</td>
</tr>
<tr>
<td>IPJP</td>
<td>-0.001 (0.0004)</td>
<td>0.001* (0.0002)</td>
<td>IPUK</td>
<td>0.0002 (0.0007)</td>
<td>CPIUS</td>
<td>-0.0008 (0.001)</td>
</tr>
<tr>
<td>MSPJP</td>
<td>-0.007 (0.112)</td>
<td>0.040 (0.037)</td>
<td>-0.0001 (0.001)</td>
<td>-0.001 (0.001)</td>
<td>PPIUS</td>
<td>-0.0003 (0.0006)</td>
</tr>
<tr>
<td>PPIJP</td>
<td>0.002 (0.002)</td>
<td>-0.001 (0.001)</td>
<td>URUK</td>
<td>0.006*** (0.004)</td>
<td>0.00003 (0.0005)</td>
<td>0.001 (0.002)</td>
</tr>
<tr>
<td>$\delta_1$</td>
<td>CPIUS</td>
<td>0.001*** (0.001)</td>
<td>-0.003* (0.0004)</td>
<td>CPIJP</td>
<td>0.0002 (0.0004)</td>
<td>0.00003 (0.0001)</td>
</tr>
<tr>
<td></td>
<td>0.001 (0.001)</td>
<td>0.001* (0.0005)</td>
<td>IPUK</td>
<td>0.0003 (0.0003)</td>
<td>0.0002 (0.0001)</td>
<td>0.0001 (0.001)</td>
</tr>
<tr>
<td></td>
<td>0.001 (0.001)</td>
<td>0.0002 (0.0007)</td>
<td>PPIUS</td>
<td>0.002 (0.002)</td>
<td>0.0001 (0.001)</td>
<td>0.001 (0.002)</td>
</tr>
<tr>
<td></td>
<td>0.004 (0.004)</td>
<td>-0.003 (0.003)</td>
<td>MSJP</td>
<td>-0.146 (0.100)</td>
<td>-0.070*** (0.038)</td>
<td>CPIUK</td>
</tr>
<tr>
<td></td>
<td>0.001 (0.030)</td>
<td>0.123 (0.024)</td>
<td>MSUS</td>
<td>0.00003 (0.0001)</td>
<td>MSUS</td>
<td>-0.0003 (0.0003)</td>
</tr>
<tr>
<td></td>
<td>-0.00001 (0.00001)</td>
<td>-0.0001 (0.0001)</td>
<td>URUS</td>
<td>0.00001 (0.00001)</td>
<td>URUS</td>
<td>-0.0001 (0.0003)</td>
</tr>
<tr>
<td>$\delta_2$</td>
<td>CPIUK</td>
<td>0.006** (0.003)</td>
<td>-0.005* (0.002)</td>
<td>PPUIUS</td>
<td>0.000 (0.001)</td>
<td>MSJP</td>
</tr>
<tr>
<td></td>
<td>-0.001 (0.001)</td>
<td>0.0003 (0.0006)</td>
<td>TDUS</td>
<td>-0.001 (0.002)</td>
<td>0.0004 (0.0004)</td>
<td>PPIJP</td>
</tr>
<tr>
<td></td>
<td>-0.008* (0.001)</td>
<td>0.008* (0.0005)</td>
<td>URUS</td>
<td>-0.053* (0.022)</td>
<td>-0.036* (0.008)</td>
<td>CPIJP</td>
</tr>
<tr>
<td></td>
<td>0.005 (0.008)</td>
<td>0.003 (0.004)</td>
<td>MSUS</td>
<td>-0.0260 (0.050)</td>
<td>0.00001 (0.00003)</td>
<td>IPUS</td>
</tr>
</tbody>
</table>
Panel B: Mean equation tests

<table>
<thead>
<tr>
<th>JP</th>
<th>Intraday</th>
<th>Overnight</th>
<th>UK</th>
<th>Intraday</th>
<th>Overnight</th>
<th>US</th>
<th>Intraday</th>
<th>Overnight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td></td>
<td></td>
<td>Test</td>
<td></td>
<td></td>
<td>Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>92.6*</td>
<td>30.8*</td>
<td>1.1</td>
<td>8.26*</td>
<td>218.9*</td>
<td>1.1</td>
<td>6.42*</td>
<td>2.58</td>
</tr>
<tr>
<td>1.2</td>
<td>467.5*</td>
<td>294.2*</td>
<td>1.2</td>
<td>32.3*</td>
<td>4372.6*</td>
<td>1.2</td>
<td>35.4*</td>
<td>557.4*</td>
</tr>
<tr>
<td>2.1</td>
<td>3.65</td>
<td>17.2*</td>
<td>2.1</td>
<td>3.16</td>
<td>1.61</td>
<td>2.1</td>
<td>13.3**</td>
<td>1.01</td>
</tr>
<tr>
<td>2.2</td>
<td>71.4*</td>
<td>446.0*</td>
<td>2.2</td>
<td>10.9</td>
<td>23.6*</td>
<td>2.2</td>
<td>14.0***</td>
<td>0.363</td>
</tr>
<tr>
<td>3.1</td>
<td>474.9*</td>
<td>263.7</td>
<td>3.1</td>
<td>35.4*</td>
<td>303.9*</td>
<td>3.1</td>
<td>32.6*</td>
<td>517.5*</td>
</tr>
<tr>
<td>3.2</td>
<td>59.1*</td>
<td>357.2*</td>
<td>3.2</td>
<td>6.68</td>
<td>4176.3*</td>
<td>3.2</td>
<td>14.8*</td>
<td>22.9*</td>
</tr>
</tbody>
</table>

Intraday:

\[
R_{it}^{oc} = \alpha_i + \beta_{11} \cdot R_{it}^{oc} + \beta_{12} \cdot R_{it}^{oc} + \gamma_{13} \cdot \text{CDN1}_{it}^{oc} + \gamma_{14} \cdot \text{CDN2}_{it}^{oc} + \gamma_{15} \cdot \text{CDN3}_{it}^{oc} + \delta_{11} \cdot \text{CFN1}_{it}^{oc} + \delta_{12} \cdot \text{CFN2}_{it}^{oc} + \phi_i \cdot \text{MHD}_{it} \\
+ \varepsilon_{it} \mid \Omega_{it}^{oc} \sim N(0, \Omega_{it}^{oc})
\]

Overnight:

\[
R_{it}^{co} = \alpha_i' + \beta_{11}' \cdot R_{it}^{co} + \beta_{12}' \cdot R_{it}^{co} + \gamma_{13}' \cdot \text{CDN1}_{it}^{co} + \gamma_{14}' \cdot \text{CDN2}_{it}^{co} + \gamma_{15}' \cdot \text{CDN3}_{it}^{co} + \delta_{11}' \cdot \text{CFN1}_{it}^{co} + \delta_{12}' \cdot \text{CFN2}_{it}^{co} + \phi_i' \cdot \text{MHD}_{it} \\
+ \varepsilon_{it} \mid \Omega_{it}^{co} \sim N(0, \Omega_{it}^{co})
\]

*R 1% significance.

** 5% significance.

*** 10% significance.
overnight market (0.198) is about twice that in the U.S. intraday market (0.105). This result is consistent with existing evidence that the domestic market is efficient in processing information from foreign intraday returns (Lin et al., 1994).

Estimates in Table 2 also show that the returns in the immediately preceding foreign market (i.e., foreign market 1) tend to have a greater impact on the domestic market than returns in the more distant foreign market (i.e., foreign market 2). For example, for the U.S. overnight market, the coefficient ($\beta_1$) of U.K. intraday return (0.198) is more than six times the coefficient ($\beta_2$) of the Japanese intraday returns (0.030). Similar results also hold for other markets. This result is consistent with the view that the immediately preceding foreign market returns may contain more new information. Note, however, for the UK overnight market the U.S. intraday return is more important than the Japanese intraday return. This is the only exception to the phenomenon just described.

What about the macro news effect? First, it is important to demonstrate that macroeconomic news used in our sample is relevant for valuing equity in the markets studied here. Accordingly, we conduct a standard $F$-test to demonstrate the importance of our news variables. When macroeconomic news announcements (both foreign and domestic) are the only regressors in our linear news models (3) and (4), these news variables are statistically related (at the 1% significance level) to overnight returns for all three countries, and to Japanese intraday returns. Specifically, the $F$-test values corresponding to the null hypothesis that all news terms are zero in a regression of returns on a constant, the Monday-holiday dummy variable, and the foreign and domestic macroeconomic news announcements are as follows ($p$-values are in parentheses): Japan intraday $-377.2$ (0.00), Japan overnight $-277.9$ (0.00), U.K. intraday $-17.98$ (0.21), U.K. overnight $-29.39$ (0.01), U.S. intraday $-17.35$ (0.24), and U.S. overnight $-38.94$ (0.00) These test results show clearly that there is valuation information in the macroeconomic announcement data, a result similar to findings in Flannery and Protopapadakis (2002). However, Table 2 indicates that the incremental explanatory power of the macroeconomic news announcements diminishes sharply in the presence of the foreign market returns.

Tests 2.1 and 2.2 together indicate that the Japanese market seems to be more sensitive to macro news than the other two markets. A closer look at the estimates reveals that both consumer price index (CPI) and money supply (MS) announcements for U.S. and U.K. have a significant impact on the Japanese intraday and overnight markets. In addition, U.S. industrial production (IP) news exerts a measurable influence on the Japanese overnight market. For the U.S. market, the U.S. merchandise trade balance (TD) and unemployment rate (UR) announcements significantly affect U.S. intraday and overnight markets. Also, the U.S. unemployment rate (UR) announcements significantly affect both the intraday and overnight U.K. markets. Foreign macro news, generally, has no measurable impact on the U.S. market, except for the Japanese consumer price index (CPI) announcements. Overall, the U.S. announcements exert a greater influence than the news from U.K. and Japan.

Despite this evidence on the importance of macroeconomic news announcements, Tests 3.1 and 3.2 show that taking both foreign market returns and news together, returns in the immediately preceding foreign market (foreign market 1) tend to have a greater influence on domestic market returns than the more distant foreign market (foreign market 2). The only exception lies again in the U.K. overnight market where the U.S. market is more important than the Japanese market.
Finally, it is important to note that these conclusions about the impact of macroeconomic news represent a reasonable case for the possible impact of public information on the market comovement. Following the method suggested by Murphy and Topel (1985), we find that ignoring the estimation error from calculating expectations of the U.K. and the Japanese macroeconomic news announcements cuts the standard error in half. If we double the standard errors (this is the approximate solution; the exact solution varies slightly across the columns in Table 2), we find that 7 of the 15 coefficients on news terms in Table 2 that were significantly different from zero using conventional standards for statistical significance are still significant. The standard error adjustment renders the remaining eight estimates insignificantly different from zero. By contrast, only one inference about coefficients on foreign returns (out of nine) is affected by the adjustment. If we take the estimation error seriously, the evidence favoring a role for foreign trading returns over public information releases in market return movement is strengthened importantly.

4.2. The nonlinear news model: The volatility effect of macroeconomic announcements

In Table 3, we report the parameter estimates and test results for the nonlinear news model described in Section 3.2.2. Using Table 2 as the benchmark, we are particularly interested in whether the return comovement coefficients (i.e., $\alpha$, $\beta_1$, $\beta_2$) change substantially after controlling for the volatility of macro news announcements. Table 3 shows that the coefficients are essentially the same after controlling for public information shocks. For example, the return comovement coefficients for Japanese overnight market ($\alpha$, $\beta_1$, $\beta_2$) are (0.062, 0.232, 0.121) and (0.059, 0.249, 0.118) in Tables 2 and 3, respectively. Similar results hold in other markets. This indicates that the volatility effect of return comovement (i.e., return comovement tends to be high when market volatility is high) is not likely due to common economic fundamentals. This result therefore strengthens the explanation of return comovement offered by King and Wadhwani (1990): the shift in return comovement is likely due to contagion.

Although macro news volatility does not much affect the level of the unconditional return comovement between markets, there is evidence that the macro news effect is stronger in the nonlinear model (Table 3) than in the linear model (Table 2). For example, for Japanese intraday market, none of the four domestic news announcements matter for the intraday market returns in Table 2, whereas all four announcements are significant in Table 3. Similarly, for the U.K. overnight market, the number of significant foreign announcements increases from two in the linear model to six in the nonlinear model. This result is consistent with the finding of McQueen and Roley (1993) that macroeconomic news may have nonlinear effect on stock returns, depending on the state of economy. Our result suggests that while macro news may not have a direct effect on stock returns, it may affect the return comovement between markets, albeit small. Tests 4.1 and 4.2 confirm that the news volatility does have incremental impact on the return comovement between markets, particularly for the Japanese and U.K. markets.

The key finding from Table 3 is that the public information-induced volatility effects are too small to account substantially for the return comovements between equity markets. King and Wadhwani (1990) show that the cross-market contemporaneous return corre-
Table 3  
Responses of stock index returns to macroeconomic news announcements (nonlinear model)

Panel A: Estimation results

<table>
<thead>
<tr>
<th></th>
<th>JP</th>
<th>Intraday</th>
<th>Overnight</th>
<th>UK</th>
<th>Intraday</th>
<th>Overnight</th>
<th>US</th>
<th>Intraday</th>
<th>Overnight</th>
</tr>
</thead>
<tbody>
<tr>
<td>$c$</td>
<td>0.00002 (0.0002)</td>
<td>0.371 (0.145)</td>
<td>0.0005* (0.0001)</td>
<td>0.017 (0.073)</td>
<td></td>
<td>0.0003** (0.0001)</td>
<td>0.0001 (0.0001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.072* (0.018)</td>
<td>0.059* (0.013)</td>
<td>0.065* (0.012)</td>
<td>0.017 (0.073)</td>
<td></td>
<td>0.010 (0.030)</td>
<td>0.093* (0.010)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_1$</td>
<td>0.236* (0.012)</td>
<td>0.246* (0.017)</td>
<td>0.070* (0.014)</td>
<td>0.020* (0.007)</td>
<td></td>
<td>0.088* (0.018)</td>
<td>0.199* (0.009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\gamma_2$</td>
<td>0.090* (0.026)</td>
<td>0.118* (0.019)</td>
<td>0.0002 (0.021)</td>
<td>0.378* (0.007)</td>
<td></td>
<td>0.011 (0.014)</td>
<td>0.046* (0.006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPIJP</td>
<td>0.150*** (0.090)</td>
<td>0.075 (0.157)</td>
<td>0.730 (1.21)</td>
<td>0.532* (0.188)</td>
<td></td>
<td>-0.248 (0.283)</td>
<td>0.110 (0.182)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPJP</td>
<td>-0.280* (0.015)</td>
<td>-0.028 (0.040)</td>
<td>-0.179* (0.036)</td>
<td>0.221* (0.018)</td>
<td></td>
<td>0.447 (0.293)</td>
<td>0.017 (0.081)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSJP</td>
<td>-0.894* (0.039)</td>
<td>-0.047 (0.066)</td>
<td>0.551 (0.679)</td>
<td>0.343* (0.128)</td>
<td></td>
<td>0.022 (0.157)</td>
<td>-0.008 (0.075)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPIJP</td>
<td>-0.438*** (0.266)</td>
<td>0.308*** (0.189)</td>
<td>1.22 (1.15)</td>
<td>0.007 (0.365)</td>
<td></td>
<td>0.886** (0.415)</td>
<td>-0.091 (0.269)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Mean equation tests

<table>
<thead>
<tr>
<th></th>
<th>JP</th>
<th>Test</th>
<th>Intraday</th>
<th>Overnight</th>
<th>UK</th>
<th>Test</th>
<th>Intraday</th>
<th>Overnight</th>
<th>US</th>
<th>Test</th>
<th>Intraday</th>
<th>Overnight</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>717.3*</td>
<td>4.06</td>
<td>26.6*</td>
<td>176.5*</td>
<td>4.1</td>
<td>211.3*</td>
<td>7.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>74.8*</td>
<td>294.2*</td>
<td>55.2*</td>
<td>51.4*</td>
<td>4.2</td>
<td>5.47</td>
<td>12.76</td>
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</table>
tion between the U.S. and U.K. stock markets increases with the volatility in each market. Our results suggest that the public information flow such as foreign news announcements account for only a small part of the volatility effect. Consequently, the evidence lends some support to the contagion hypothesis that emphasizes the transmission of noise-induced volatility across markets.

5. Conclusion

Extensive empirical evidence establishes a strong comovement in international equity markets particularly for the contemporaneously correlation between the foreign intraday returns and the domestic overnight returns in the U.S., U.K., and Japanese markets. In this paper, we investigate two competing explanations of the comovement: economic fundamentals versus contagion. Specifically, we explore a comprehensive data set of the macroeconomic news announcements made in the U.S., U.K., and Japan from 1985 to 1996. We separate the influence of the foreign markets on the domestic markets into two components: one that is driven primarily by economic fundamentals and the other by foreign market returns.

In our empirical analysis, we distinguish the unconditional news effect from the conditional news volatility effect of the macroeconomic announcements. The most important finding is that the macro news effect is too small to account for any economically sizeable part of the return comovement among the three national equity markets. By contrast, returns from the previous foreign market session exert an econom-

Notes to Table 3:

Intraday:

\[ R^{oc}_{ijt} = \gamma_0 + (\gamma_1 + \gamma_{11} \cdot |CDN1^{oc}_{ijt}| + \gamma_{12} \cdot |CDN2^{oc}_{ijt}| + \gamma_{13} \cdot |CDN3^{oc}_{ijt}|) \cdot R^{oc}_{i-1} + (\beta_1 + \delta_1 \cdot |CFN1^{oc}_{ijt}|) \cdot FR^{oc}_{ijt} + (\beta_{12} + \delta_{12} \cdot |CFN2^{oc}_{ijt}|) \cdot FR^{oc}_{ijt} + \phi_1 \cdot MHD_{ijt} + \epsilon_{ijt} \cdot \Omega^{oc}_{ijt} \]

\[ \Omega^{oc}_{ijt} \sim N(0, h^{oc}_{ijt}) h^{oc}_{ijt} = \omega_{00} + \omega_{10} \cdot \epsilon_{ijt-1} + \omega_{11} \cdot \epsilon_{ijt-1} + \omega_{12} \cdot h^{oc}_{ijt-1} + \omega_{13} \cdot \epsilon_{ijt-1} \]

\[ + \omega_{24} \cdot MHD_{ijt} + \omega_{35} \cdot INT_{ijt}, \quad i = JP, UK, US. \]

Overnight:

\[ R^{oc}_{ijt} = \epsilon_t' + (\alpha_1 + \gamma_{11} \cdot |CDN1^{oc}_{ijt}| + \gamma_{12} \cdot |CDN2^{oc}_{ijt}| + \gamma_{13} \cdot |CDN3^{oc}_{ijt}|) \cdot R^{oc}_{i-1} + (\beta_1 + \delta_1 \cdot |CFN1^{oc}_{ijt}|) \cdot FR^{oc}_{ijt} + (\beta_{12} + \delta_{12} \cdot |CFN2^{oc}_{ijt}|) \cdot FR^{oc}_{ijt} + \phi_1 \cdot MHD_{ijt} + \epsilon_{ijt} \cdot \Omega^{oc}_{ijt} \]

\[ \Omega^{oc}_{ijt} \sim N(0, h^{oc}_{ijt}) h^{oc}_{ijt} = \omega_{00} + \omega_{10} \cdot \epsilon_{ijt-1} + \omega_{12} \cdot h^{oc}_{ijt-1} + \omega_{13} \cdot \epsilon_{ijt-1} \]

\[ + \omega_{24} \cdot MHD_{ijt} + \omega_{35} \cdot INT_{ijt}, \quad i = JP, UK, US. \]

\( R^{oc}_{ijt} \) and \( R^{oc}_{ijt} \) are domestic market \( i \)'s intraday and overnight returns, respectively, on calendar day \( t \). \( FR^{oc}_{ijt} \) is foreign market \( j \)'s intraday return occurred between domestic market \( i \)'s close on calendar day \( t-1 \) and the domestic market’s close on calendar day \( t \). \( CDN^{oc}_{ijt} \) (\( CDN^{oc}_{ijt} \)) is the vector of the unexpected “domestic news” in country \( i \) occurred between market \( i \)'s close (open) on calendar day \( t-1 \) and its close (open) on calendar day \( t \). \( CFN^{'oc}_{ijt} \) (\( CFN^{'oc}_{ijt} \)) is the vector of the unexpected foreign market news in country \( j \) occurred between market \( i \)'s close (open) on calendar day \( t-1 \) and its close (open) on calendar day \( t \).

* 1% significance.
** 5% significance.
*** 10% significance.
ically significant impact on subsequent domestic market returns and apparently contain information distinct from economic fundamentals.

Our results suggest that the bulk of the observed comovement in the intraday and overnight returns of the international equity markets cannot be attributed to public information and, in particular, economic fundamentals. Consequently, further work on the sources of comovement in international equity markets might encompass the distinction between contagion and trading on private information, rather than public information.

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References