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# DOES THE COVID-19 MEDIA COVERAGE AFFECT AH PREMIUM DISPARITY?

***Abstract.*** *This article explores the dynamic causality between the COVID-19 Media Coverage Index (MCI) in China (Chinese mainland and Hong Kong) and the AH premium index (both price and volatility) by applying a novel time-varying causality technology. Our findings show that the MCIs in China do not significantly cause the log-prices of the AH premium index throughout the full sample period, whereas significantly positive and time-varying causalities from the MCIs in China to the volatilities of the AH premium index are detected. The results thus provide evidence that the change of the MCIs does not lead to a wider or narrower AH premium but unidirectionally causes the change of its volatilities. Furthermore, the effect of MCIs in Chinese mainland on the AH premium volatilities is more pronounced and stable compared to that in Hong Kong, which*



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*indicates that the AH premium disparity is more sensitive to the media coverage in the Chinese mainland than in Hong Kong. Finally, the causal relationship from the MCIs in China to the AH premium volatilities disappears after November 2021. Our results provide implications for policymakers to decrease the fluctuation of the AH premium by effectively guiding the trend of media coverage; the results also remind AH stock investors to pay more attention to the COVID-19 media coverage.*

***Keywords**: COVID-19 MCI, AH premium; time-varying causality.*

**JEL Classification: C32, C53, F39, G11**

## 1. Introduction

Nowadays, the COVID-19 pandemic not only causes disruptions in offline trading activities, which deals a heavy blow to the real economy, but also brings extreme panics among investors and wreaks havoc in global financial markets (So et al., 2021). As an effective medium of information dissemination, media coverage naturally contains the panic information of investors caused by the COVID-19 pandemic, and thus obviously influences investment decisions (Akhtaruzzaman et al., 2022). Furthermore, it plays an important role in predicting financial asset prices using text mining techniques (Niu et al., 2021), and in explaining financial risk contagion (Dong et al., 2021).

Recently, a growing number of studies have focused on how COVID-19 media coverage affects the financial markets, such as the stock market (Huynh et al., 2021), the cryptocurrency market (Umar et al, 2021), and the precious metals market (Atri et al., 2021). All of these studies reach a consensus that COVID-19 media coverage in one country is an important predictor of financial market crashes and can enhance financial market volatility in this country. However, for cross-listed stock markets which are subject to systemic risks in multiple regions, this conclusion is far from sufficient. In theory, the prices of cross-listed stocks in different markets are influenced by multiple stock markets, which are deeply affected by the COVID-19 media coverage in those regions. Therefore, the media coverage in different regions may have significant effect on the cross-listed stock markets. Among cross-listed stocks, the AH premium puzzle has received widespread attention (Deng et al., 2021; Zhang et al., 2022a). The puzzle describes companies cross-listed on the Chinese mainland stock market (A-share market) and the Hong Kong stock market (H-share market), whose A-share prices are chronically higher than the exchange-adjusted H-share prices. The Hang Seng Index Company developed the Hang Seng Stock Connect China AH Premium Index (AHP) in 2007 to measure the general premium position of AH stocks[1]. The AHP index contains 4,149 daily observations from January 3, 2006 to April 9, 2022, of which 3,535 observations have an index value greater than 100. i.e., for

[1] AHP index calculates the premium of A-shares versus H-shares by taking the total A-share market value of the constituent stocks against the total H-share market value. This index starts on January 3, 2006.

85.2% of the trading days, indicating that the A-share prices of AH stocks are at a general premium to the corresponding H-share prices. Furthermore, there are 2,346 trading days when the AHP index is above 120, implying that a deep premium status for AH stocks is quite prevalent. More surprisingly, the AHP index hit its peak at 208.06 on January 16, 2008, when the A-share prices of AH stocks are more than double their H-share prices. Given the long-standing status of the AH premium situation, whether the COVID-19 media coverage in different regions has an impact on the AHP index deserves careful study.

In recent years, some research has gradually paid attention to cross-listed stocks during the COVID-19 epidemic periods. Some studies focus on the effects of relevant variables, such as government intervention and Robinhood traders, on cross-listed securities during COVID-19 (Aharon et al., 2022), and some other studies tend to figure out whether there is a change in the causal relationship between the A-share and the H-share prices of AH stocks during the pandemic (Lu et al., 2022). However, the above studies subdivide the data into subgroups using the COVID-19 period as a criterion, providing merely indirect evidence for the impact of the COVID-19 pandemic on cross-listed stocks, especially the AH stocks. Direct investigation into the impact of COVID-19 media coverage on AH cross-listed stocks, particularly on the AH premium, is rather limited. Therefore, studying this topic is meaningful to fill the research gap. Indeed, a potential mechanism exists for COVID-19 media coverage to influence AH premiums. Akhtaruzzaman et al. (2022) argue that the information carried by COVID-19 media coverage can easily influence investor sentiments. Song et al. (2015) further confirm that the AH premium is significantly affected by investor sentiments. Hence, it is likely that the COVID-19 media coverage influences the AH premium by affecting investor sentiments. To better understand the impact of the COVID-19 media coverage on the AH premium and to figure out whether this effect in Chinese mainland differs from that in Hong Kong, this paper examines the impact of the COVID-19 media coverage on the price and volatility of the AHP index in China (Chinese mainland and Hong Kong) using the Coronavirus Media Coverage Index (MCI) developed by RavenPack[2].

This paper applies the time-varying causality technique proposed by Shi et al. (2018, 2020) to explore the effect of the MCIs on the prices and volatilities of the AHP index. The existing literature on the impact of MCI on financial variables mainly employs TVP-VAR connectedness or wavelet analysis techniques (Akhtaruzzaman et al., 2022; Umar et al., 2021, 2022). The TVP-VAR connectedness approach is applicable to stationary variables. However, for non-stationary variables, such as the AHP prices in this paper, the TVP-VAR connectedness model does not generate robust results. Wavelet analysis can effectively decompose nonstationary time series. The wavelet coherence analysis

[2] Ravenpack calculates the percentage of news related to the COVID-19 as the Coronavirus Media Coverage Index. Values range between 0 and 100 where a value of 70.00 means that 70 percent of news related to the COVID-19. One can refer to https://coronavirus.ravenpack.com/.

and the wavelet phase-difference analysis can further explore the co-movement features among variables. However, this method cannot capture the real-time causal links among variables. Fortunately, Shi et al. (2018) combine the recursive evolving window (REW) algorithm with the Granger test based on the VAR model and propose a new sup Wald statistic to detect the time-varying causalities. Their results show that this dynamic causality method outperforms the previous real-time causality tests based on the rolling window or forward expanding window algorithms. Moreover, Shi et al. (2020) further prove that the causal relationship based on the LA-VAR model remains robust even for nonstationary variables with an integration order not exceeding two. Based on these advantages, a growing number of studies apply this novel technology to detect the time-varying causality of financial variables (Emirmahmutoglu et al., 2021; Dogan et al., 2022). Inspired by these successful applications of the novel time-varying causality technique, this study extends it to examine the dynamic causalities from the MCIs to the prices and volatilities of the AHP index to examine the dynamic causalities on the prices and volatilities between the MCIs and the AHP index.

Our empirical results provide interesting findings. The MCIs in both Chinese mainland and Hong Kong have no causal effect on the AHP prices throughout the full sample period, but they have positive time-varying causal effects on the AHP volatilities. Specifically, the MCIs are not the cause of the AHP prices, indicating that the changes in the COVID-19 media coverage rate do not subsequently lead to significant changes in AH premium prices. However, the MCIs in China have positive time-varying causalities on the AHP volatilities from the start of the sample period to November 2021. This is a strong signal that a change in media coverage rate will lead to a congruent change in AH premium volatilities. Notably, the effect of the MCIs on AHP volatilities is more pronounced and stable in Chinese mainland than in Hong Kong, suggesting that the AH premium disparity is more sensitive to media coverage from Chinese mainland than from Hong Kong. Finally, we find that the above causalities disappeared since November 2021, which may result from the anti-epidemic policies and the normalisation of the COVID-19 epidemic.

This article provides three contributions to the existing literature. Firstly, we innovatively investigate the impact of the MCIs on the AH premium. The existing literature on the effect of COVID-19 on the price disparity of cross-listed stocks is quite limited. To our best knowledge, Xue and Zhou (2021) is the only study to examine how COVID-19 affects AH premium using confirmed cases as a proxy variable. However, the confirmed cases describe only one aspect of the COVID-19 pandemic. Our research provides an alternative perspective on how COVID-19 granger causes AH premium. Furthermore, this paper also extends the existing literature on how the pandemic affects market anomalies. Secondly, a novel time-varying causality technique proposed by Shi et al. (2018, 2020) is applied in this article. As mentioned earlier, this technique is able to generate robust time-varying causality results for all stationary and some nonstationary variables, which complement the existing methods (such as TVP-VAR connectedness and wavelet analysis) to study the impact of the MCIs on financial variables. Finally, this paper is also supplementary to Lu et al. (2022) who used the methods of Shi et al. (2018, 2020) to explore the dynamic causal relationship between the A-share and H-share of AH stocks. The authors speculate that the dynamic causality between the two markets may break down due to the COVID-19 pandemic. This article explores the impact of the MCIs on the AH premium as a complementing material.

The rest of this article is organised as follows: Section 2 describes the model. Section 3 presents the data. Section 4 gives the empirical results, and Section 5 is the conclusion and limitation.

## 2. Methodology

This article mainly uses the time-varying causality techniques of Shi et al. (2018, 2020) and the extension of this approach by Lu et al. (2022). Denote $\boldsymbol{y}_t$ as a *k*-dimension vector, the LA-VAR model can be expressed as:

$$\boldsymbol{y}_t = \boldsymbol{\alpha}_0 + \boldsymbol{\alpha}_1 t + \sum_{i=1}^{q} \boldsymbol{\beta}_i \boldsymbol{y}_{t-i} + \sum_{j=q+1}^{q+d} \boldsymbol{\delta}_j \boldsymbol{y}_{t-j} + \boldsymbol{\varepsilon}_t \tag{1}$$

where $t$ denotes time trend; $d$ represents the maximum integration order of $\boldsymbol{Y}$, where $\boldsymbol{Y} = (\boldsymbol{y}_1, ..., \boldsymbol{y}_T)'_{T\times k}$ with $T$ observations; $q$ is the optimal lag order of the original VAR model as suggested by the BIC value. Additionally, $\boldsymbol{\alpha}_0$, $\boldsymbol{\alpha}_1$, $\boldsymbol{\beta}_i$, $\boldsymbol{\delta}_j$ are all column vectors contains $k$ elements; $\boldsymbol{\varepsilon}_t$ is error term. The expression in Equation (1) can be transformed into a matrix form as:

$$\boldsymbol{Y} = \boldsymbol{\tau}\boldsymbol{\Gamma}' + \boldsymbol{X}\boldsymbol{\Phi}' + \boldsymbol{Z}\boldsymbol{\Psi}' + \boldsymbol{\varepsilon} \tag{2}$$

where $\boldsymbol{\tau} = (\boldsymbol{\tau}_1, \cdots, \boldsymbol{\tau}_T)'_{T\times 2}$, $\boldsymbol{\tau}_t = (1, t)'_{2\times 1}$; $\boldsymbol{\Gamma} = (\boldsymbol{\alpha}_0, \boldsymbol{\alpha}_1)_{k\times 2}$; $\boldsymbol{X} = (\boldsymbol{x}_1, \cdots, \boldsymbol{x}_T)'_{T\times kq}$, $\boldsymbol{x}_t = (\boldsymbol{y}'_{t-1}, \cdots, \boldsymbol{y}'_{t-q})'_{kq\times 1}$; $\boldsymbol{Z} = (\boldsymbol{z}_1, \cdots, \boldsymbol{z}_T)'_{T\times kd}$, $\boldsymbol{z}_t = (\boldsymbol{y}'_{t-q-1}, \cdots, \boldsymbol{y}'_{t-q-d})'_{kd\times 1}$; $\boldsymbol{\Phi} = (\boldsymbol{\beta}_1, \cdots, \boldsymbol{\beta}_q)_{k\times kq}$; $\boldsymbol{\Psi} = (\boldsymbol{\delta}_{q+1}, \cdots, \boldsymbol{\delta}_{q+d})_{k\times kd}$; $\boldsymbol{\varepsilon} = (\boldsymbol{\varepsilon}_1, \cdots, \boldsymbol{\varepsilon}_T)'_{T\times k}$.

Suppose $\boldsymbol{\varphi} = \mathrm{vec}(\boldsymbol{\Phi})$ is a row vector with length $k^2 q$, $\boldsymbol{R}$ is a $m \times k^2 q$ matrix of 0 and 1, where $m$ represents the number of restrictions in the null hypothesis. Then, the null hypothesis of Granger non-causality is given by:

$$H_0 : \boldsymbol{R}\boldsymbol{\varphi} = 0 \tag{3}$$

The Wald statistic under the null hypothesis can be expressed as:

$$W = (\boldsymbol{R}\hat{\boldsymbol{\varphi}})'\{\boldsymbol{R}[\hat{\boldsymbol{\Omega}} \otimes (\boldsymbol{X}'\boldsymbol{Q}\boldsymbol{X})^{-1}]\boldsymbol{R}'\}^{-1}(\boldsymbol{R}\hat{\boldsymbol{\varphi}}),\ \hat{\boldsymbol{\varphi}} = \mathrm{vec}(\hat{\boldsymbol{\Phi}}),\ \hat{\boldsymbol{\Omega}} = \frac{\hat{\boldsymbol{\varepsilon}}'\hat{\boldsymbol{\varepsilon}}}{T}, \tag{4}$$

where $\otimes$ denotes the Kronecker product, $\hat{\boldsymbol{\Phi}} = \boldsymbol{Y}'\boldsymbol{Q}\boldsymbol{X}(\boldsymbol{X}'\boldsymbol{Q}\boldsymbol{X})^{-1}$ using Ordinary Least Squares estimators, where $\boldsymbol{Q} = \boldsymbol{Q}_\tau - \boldsymbol{Q}_\tau \boldsymbol{Z}(\boldsymbol{Z}'\boldsymbol{Q}_\tau \boldsymbol{Z})^{-1}\boldsymbol{Z}'\boldsymbol{Q}_\tau$, $\boldsymbol{Q}_\tau = \boldsymbol{I}_T - \boldsymbol{\tau}(\boldsymbol{\tau}'\boldsymbol{\tau})^{-1}\boldsymbol{\tau}'$. The Wald statistic is proved to have asymptotical $\chi^2_m$ distribution. Hence, the series being tested have the causal relationship if the corresponding critical value is lower than the Wald statistic.

Shi et al. (2018, 2020) propose a sup Wald test based on the above Wald statistic and the REW algorithm. The sup Wald statistic at point is given by:

$$SW_f(f_0) = \sup_{f_2=f,\, f_1\in[0,\, f_2-f_0]} \left\{W_{f_1}^{f_2}\right\} \tag{5}$$

where $f_1$ and $f_2$ represent the begin and end points of the target window, respectively, $0 \le f_1 \le f_2 \le 1$ , $f_0$ represents the minimum sample size of $f_w = f_2 - f_1$, $W_{f_1}^{f_2}$ denotes the Wald test from $f_1$ to $f_2$ with a size fraction of $f_w$.

Then we can work out $T - \lfloor T \times f_0 \rfloor + 1$ sup Wald statistics as $f$ rolls from $f_0$ to 1. These statistics correspond one to one with time interval $[\lfloor T \times f_0 \rfloor, T]$. Then, we employ the bootstrap method to set only one critical value (*scv*) for these sup Wald statistics. If $SW_{f_t}(f_0) \ge scv$, $t = T \times f_t$, then the causality exists at time t.

The test above is robust and precise. However, the test fails to figure out whether the existing causal effects are negative or positive. To achieve this goal, a $f_*$ that satisfies Equation (6) can be found.

$$W_{f_*}^{f_t} = \sup_{f_2=f,\, f_1\in[0,\, f_2-f_0]} \left\{W_{f_1}^{f_2}\right\} = SW_{f_t}(f_0) \tag{6}$$

if $SW_{f_t}(f_0) \ge scv$, two variables have a causal relationship at time *t*. Then, whether the existing causal effects are positive or not can be further judged according to the sign of the $\boldsymbol{R}\hat{\boldsymbol{\varphi}}$, where the $\hat{\boldsymbol{\varphi}}$ is estimated using the data within the time regions $[\lfloor T \times f_* \rfloor, \lfloor T \times f_t \rfloor]$.

## 3. Data description

The MCIs of China (Chinese mainland and Hong Kong) are obtained from the website of Ravenpack and the AHP index prices together with its historical volatilities are available at Wind China. All these variables are daily data, generating 591 observations from January 2, 2020 to April 29, 2022. The time paths for the above variables are shown in Figure 1. In the subsequent sections, the log-prices of the AHP index will be used for time-varying causality analysis due to its better statistical properties.

It can be observed in Figure 1, two subplots in the first row show the trends of the MCIs in Chinese mainland and in Hong Kong. Two MCIs have similar movements. In the initial phase of the COVID-19 pandemic, the media coverage rate increases significantly. The MCIs in the Chinese mainland quickly hit the top at 90.05% on March 23, 2020. At almost the same time, the MCIs in Hong Kong also reach a local maximum of 84.01% on March 31, 2020. Subsequently, the two indices fluctuate with slightly downward trends until the end of the sample period. It is worth noting that the vibration amplitude of the MCIs in Hong Kong during that period is much larger than that of the MCIs in the Chinese mainland. Overall, both MCIs show a sudden increase followed by a slow decrease trend. On the other hand, two subplots in the second row exhibit the prices and historical volatilities of the AHP index. During the sample periods, the AHP prices have undergone a significant change. The value of the AHP prices increases from 126.35 on January 2, 2020 to 138.49 on April 30, 2022, indicating that the general premium rate of A-share prices relative to H-share prices for AH stocks increases from 26.35% to 38.49%. In addition, the AHP prices fluctuate greatly, reaching their minimum value of 123.07 on February 7, 2020. Later, the AHP prices experienced multiple sharp rises and falls and hit the top at 151.71 on March 15, 2022. Meanwhile, for the historical volatilities of the AHP index, the majority of observations have volatilities between 1% and 20%, and a small part of the volatilities exceed 20%. The value of the AHP volatilities arrive at the maximum value at 79.81% on February 4, 2020 which is more than twice of the other values during the sample period. All of the above information indicates a significant change in the AH premium status during the COVID-19 pandemic, and further analysis of whether the MCIs have causal effects on the prices and volatilities of the AHP index is vital and meaningful.

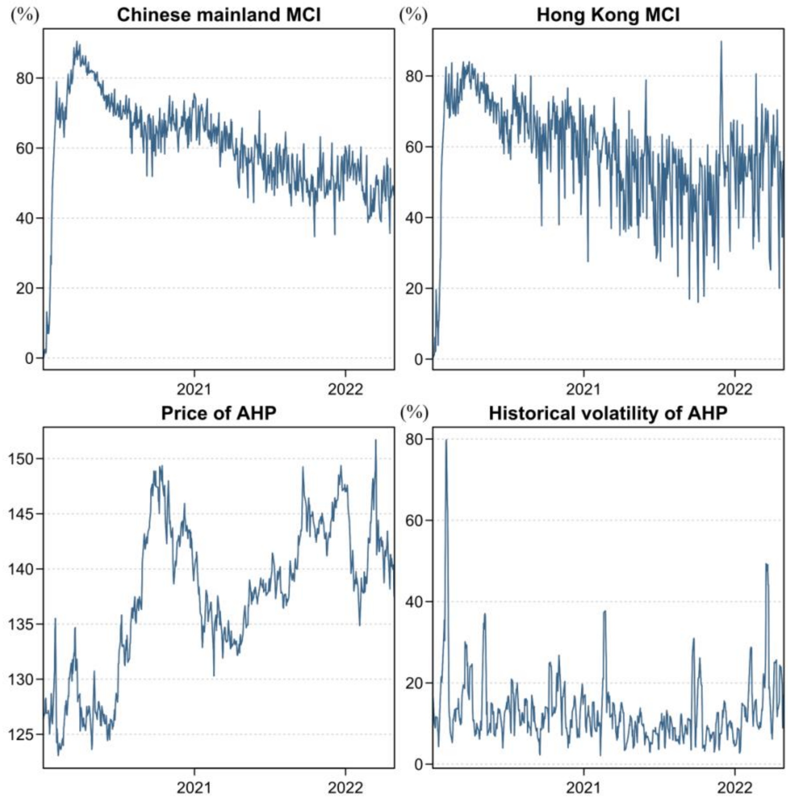


**Figure 1. Time paths of the analysed variables**

Table 1 reports the descriptive statistics for the four variables mentioned above. The average values of the MCIs in the Chinese mainland and in Hong Kong are 60.18 and 58.53, respectively. These two values are not much different, indicating similar media coverage rate of COVID-19 in the two regions. Moreover, the standard deviation of the media coverage rate in the Chinese mainland (13.81%) is slightly lower than that in Hong Kong (14.90%). As for the AHP index, its average price and volatility are 137.47 and 13.16 accordingly. That is to say, the average premium rate of A-share prices relative to H-share prices for AH stocks is 37.47% over the whole period and the average annualised volatility of this premium is 13.16%. We further check the shape of the distributions for these time series. The historical volatility of the AHP index is positively biased, while the other three series are negatively skewed. In addition, except for the AHP prices, which are platykurtic, the other three sequences are leptokurtic. All the results of the Jarque-Bera (JB) tests show that these variables do not follow a normal distribution.

**Table 1. Descriptive statistics**

| | **Mean** | **Std. Dev.** | **Skewness** | **Kurtosis** | **JB** |
|---|---|---|---|---|---|
| $MCI_{\text{China}}$ | 60.1791 | 13.8151 | -1.0293$^{***}$ | 6.3847$^{***}$ | 390.6171$^{***}$ |
| $MCI_{\text{HK}}$ | 58.5278 | 14.8977 | -1.1128$^{***}$ | 4.9767$^{***}$ | 220.4692$^{***}$ |
| $P_{AHP}$ | 137.4742 | 6.8020 | -0.3408$^{***}$ | 2.1573$^{***}$ | 28.6815$^{***}$ |
| $Vol_{\text{AHP}}$ | 13.16 | 9.01 | 3.2531$^{***}$ | 19.3641$^{***}$ | 7694.9405$^{***}$ |

Note: The $^{***}$ represents the test significantly refuses the null hypothesis at 1% significance level.

## 4. Empirical results

4.1. The results of stationary test

To ensure the robustness of the results, we employ the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test for our analysis. The results of the stationarity tests are reported in Table 2. The results show that $MCI_{China}$, $MCI_{HK}$, and $Vol_{AHP}$ are stationary at the level ($I(0)$) while $\ln P_{AHP}$ is stationary at the first difference ($I(1)$). Subsequently, when testing the time-varying causal effects of $MCI_{\text{China}}$ and $MCI_{\text{HK}}$ on $\ln P_{AHP}$, the LA-VAR model with the maximum integration order *d*=1 is applied as the base model. When testing the time-varying causal effects of $MCI_{\text{China}}$ and $MCI_{\text{HK}}$ on $Vol_{AHP}$, the stationary VAR model is used as the base model.

**Table 2. Results of stationarity tests**

| | | $MCI_{\text{China}}$ | $MCI_{\text{HK}}$ | $\ln P_{AHP}$ | | $Vol_{AHP}$ |
|---|---|---|---|---|---|---|
| | | Level | Level | Level | First difference | Level |
| **ADF** | Intercept | -4.3705$^{***}$ | -4.8467$^{***}$ | -2.0440 | -8.0942$^{***}$ | -6.4857$^{***}$ |
| **PP** | Intercept | -31.1831$^{***}$ | -158.1617$^{***}$ | -8.7689 | -522.6172$^{***}$ | -102.2995$^{***}$ |
| **Conclusion** | | $I(0)$ | $I(0)$ | / | $I(1)$ | $I(0)$ |

Notes: $^{***}$ indicates statistically significant at 1% level.

4.2. Time-varying causality from MCIs to AHP prices

In this subsection, the time-varying causalities from the MCIs in the Chinese mainland and in Hong Kong to the log-prices of the AHP index are examined. As mentioned above, the LA-VAR model is employed as the basic model for two pairings ( $MCI_{China} \sim \ln P_{AHP}$ pairing and $MCI_{HK} \sim \ln P_{AHP}$ pairing). For $MCI_{China} \sim \ln P_{AHP}$ pairing, the best lag order $q$ for the original VAR model is 4 with the smallest BIC=-3.6384, and for $MCI_{HK} \sim \ln P_{AHP}$ pairing, the $q$ is 1 with the smallest BIC=-2.7736. Based on these models and REW algorithm, time-varying causality tests are applied with the homoscedasticity assumption. The causal results are shown in Figure 2.

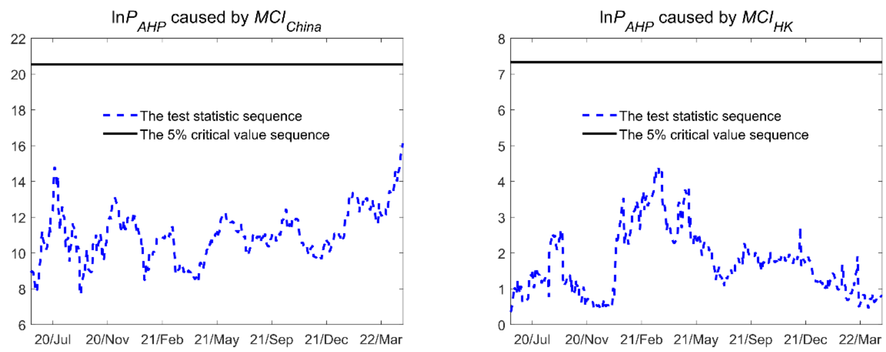


**Figure 2. Time-varying causality tests from the MCIs in China to AHP prices**

The blue dashed and black solid lines in Figure 2 represent the sup Wald statistics and the bootstrapped critical value, respectively. If the sup Wald statistics are greater than the critical value, significant causalities are detected at the corresponding time points at the 5% significance level. For the entire sample period, the sup Wald statistics in both panels are much smaller than the bootstrapped critical values, so the null hypothesis of no Granger causality from MCIs to AHP prices cannot be rejected. The non-causal relationships further indicate that the change in the COVID-19 related media coverage in Chinese mainland and in Hong Kong cannot lead to a narrower or a wider AH premium price. As is well known, the increase or decrease in the AH premium price is triggered by the substantial increase or decrease in the A-share prices relative to the H-share prices of AH stocks. Hence, one possible reason to explain the noncausality is that the COVID-19 media coverage may have only slight impact on both A-share prices and H-share prices of AH stocks, which leads to almost no change in AH premium price. In fact, compared to non-cross-listed firms, cross-listed firms are larger in firm size and more capable of generating stable cash flows even in crises (Cumming et al., 2017), and thus have better risk tolerance in the face of crises. For example, Ghadhab (2021) studies the role of the US cross-listed stocks during the global financial crisis of 2007-2009. They find that the cross-listed companies outperform non-cross-listed peers during and post the crisis. Based on the facts above, it is reasonable that cross-listed stocks are more or less resilient to financial crises. Hence, the COVID-19 media coverage may have no significant causal effect on AH stocks and thus have no causal effect on AH premium prices.

Overall, in this subsection, we examine the time-varying causalities from the MCIs in China to the AHP price. Noncausality is detected over the full sample periods. This result provides evidence that the media coverage about the COVID-19 pandemic has no effect on the prices of the AH premium.

#### 4.3. Time-varying causality from MCIs to AHP volatilities

To comprehensively study the leading role of the COVID-19 media coverage on the AH premium disparity, the dynamic causal effects of the MCIs on the AHP volatilities are further investigated. Likewise, the time-varying causality tests are conducted for two additional pairings ( $MCI_{China} \sim Vol_{AHP}$ pairing and $MCI_{HK} \sim Vol_{AHP}$ pairing). Here, the stationary VAR model is employed as the base model for both pairings. For $MCI_{China} \sim Vol_{AHP}$ pairing, the optimal lag order $q$ of the base model is 6 with the smallest BIC=3.5961. For $MCI_{HK} \sim Vol_{AHP}$ pairing, the $q$ is also 6 with the smallest BIC=4.4160. All other details are in line with those in Section 4.2. The dynamic causal results are illustrated in Figure 3.

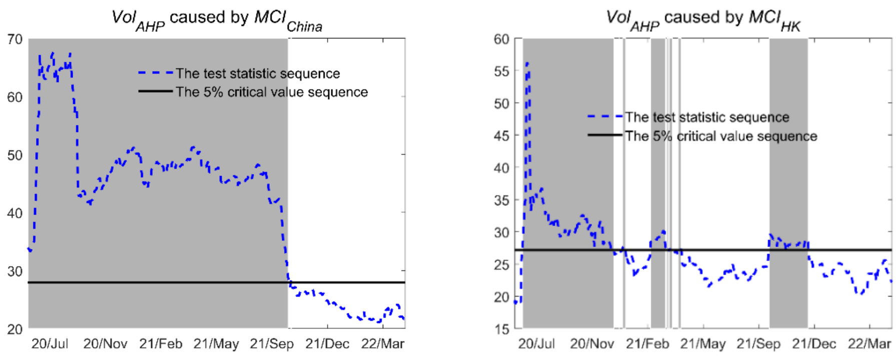


**Figure 3. Time-varying causality tests from the MCIs in China to AHP volatilities**

To highlight the causal relationships, the time regions with significant causalities at 5% significance level are marked in grey. From the left panel, the MCIs in the Chinese mainland is a significant Granger cause of the AHP volatilities from July 18, 2020, corresponding to the beginning of the test dates, to September 30, 2021. Subsequently, the causal effects disappear. As a comparison, the causal effects of the MCIs in Hong Kong on the AHP volatilities are shown in the right panel. Although the MCIs in Hong Kong also have time-varying causalities on the AHP volatilities, the significance of this causal effect changes frequently, indicating an unstable causal connection between the COVID-19 media coverage in Hong Kong and the fluctuation of AH premium. The significant time periods of these causal effects contain July 2, 2020 to December 14, 2020, December 2, 2020 to January 4, 2021; February 18, 2021 to March 17, 2021, March 19, 2021 to March 22, 2021, March 24, 2021 to March 29, 2021, April 9, 2021 to April 4, 2021, and September 20, 2021 to November 29, 2021.

Currently, we come to the conclusion that there are significant time-varying causal effects from the MCIs in both regions to the AHP volatilities. However, what this causal relationship represents remains a mystery. Does the change in the MCIs lead to a change in the AHP volatilities in the same or inverse direction? To answer this question, we further explore the sign of the causal effects following Lu et al. (2022). As mentioned earlier, the base model for both tests is VAR(6), then the time-varying effects of 6 MCIs' lagged terms on the AHP volatilities are calculated and exhibited in Figure 4.

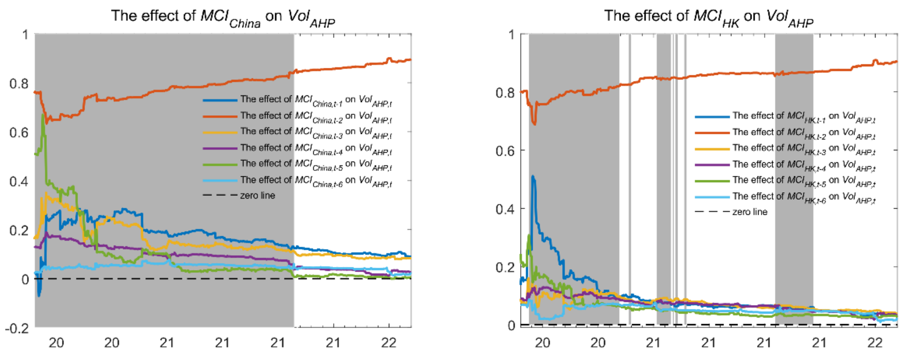


**Figure 4. Causal effects of the MCIs in China on AH premium volatility**

Likewise, the time regions with significant causal relationship are marked in grey, and the black dashed zero lines are used to help identify the sign of the causal effects. From the left panel of Figure 4, all the lagged terms of the MCIs in Chinese mainland have positive time-varying effects on the AHP volatilities in the grey zones except for $MCI_{China,t-1}$. In a very short period, the effect of $MCI_{China,t-1}$ on the AHP volatilities is slightly negative, but quickly turns positive. Despite the slightly negative causal effect of the lagged terms, the overall effects of MCIs in the Chinese mainland on the AHP volatilities are strongly positive. Similarly, from the right panel of Figure 5, all the lagged terms of MCIs in Hong Kong have strong positive time-varying effects on the AHP volatilities in the grey zones. It is notable that the $MCI_{China,t-2}$ and $MCI_{HK,t-2}$ have the strongest positive effects on the AHP volatilities relative to the other lagged terms, suggesting that the COVID-19 media coverage has a strong predictive effect on the AHP volatilities two trading days later.

From the above time-varying causal results, three interesting findings are extracted. First, there exists strongly positive time-varying causalities from the MCIs in China to the AHP volatilities. That is, an increase (decrease) in COVID-19 related media coverage rate can enhance (reduce) the fluctuations of the AH premium. This finding is reasonable and intuitive. The COVID-19 media coverage contains information that easily affect investor sentiments (Akhtaruzzaman et al., 2022), and an increase in the MCIs makes a dramatic change in investor sentiments. Moreover, large swings in investor sentiments can then lead to huge bias in investment decisions, which further amplify the rises or falls of financial asset prices and thus increase the financial market volatilities (Gong et al., 2022). Corbet et al. (2021) and Liu et al. (2020) further confirm that the media coverage on the COVID-19 pandemic will increase the volatilities of the A-share and H-share markets. When the volatilities of these two markets increase, the ratio of the A-share prices to the H-share prices of AH stocks also fluctuates sharply, and thus enhance the volatilities of the AHP index. Our results are consistent with those of Atri et al. (2021) and Xue and Zhou (2021), who demonstrate that the COVID-19 pandemic and its associated media coverage significantly increase the volatilities of financial variables.

Second, from the causal effects on AHP volatilities, we find that the significant causal effect from the MCIs in Chinese mainland to the AHP volatilities is more pronounced and stable compared to that of the MCIs in Hong Kong. This result indicates that it is the Chinese mainland, rather than Hong Kong, that dominate the information transmission mechanism in terms of the leading role of media coverage on the AH premium volatility. One possible reason to explain the phenomenon is the home market advantage[3]. Specifically, as most AH cross-listed companies are registered in the Chinese mainland, their fundamentals are directly impacted by systemic risks (such as COVID-19) in the Chinese mainland. Therefore, relative to the H-share host markets, AH crosslisted stock investors are more sensitive to the information from the A-share home market (Li and Shi, 2021; Zhang et al., 2022b). The MCIs in the Chinese mainland, a type of information released by the home market, are of greater interest for AH stock investors and thus have more impact on their investment decisions. Applying the mechanism in the first finding, the MCIs in Chinese mainland have more significant and long-lasting leading effects on the AHP volatilities than the MCIs in Hong Kong. This finding is in line with the results of Ghadhab and Hellara (2016) and Frijns et al. (2018), who found that the home market factors dominate the price discovery process for cross-listed stocks.

Third, we are surprised to find that the causal effects of the MCIs in China on the AHP volatilities have disappeared since November 2021. It shows that the COVID-19 media coverage no longer causes any fluctuations in the AH premium volatilities. This may be due to the government's anti-COVID-19 policy and the

[3] According to data from Wind China, until April 30, 2022, 146 of the 149 AH cross-listed firms are registered in Chinese mainland, so the A-share market is the home market of AH cross-listed firms.

normalisation of the epidemic. While the COVID-19 pandemic is affecting people's normal lives, the Chinese government actively formulates anti-epidemic policies aiming to reduce the impact of this pandemic. Their zero tolerance attitude towards the epidemic, together with the strict implementation of the 'dynamic zero-COVID' policy, effectively prevents the spread of the virus. Although a few scholars argue that non-economic interventions during the pandemic can put pressure on financial markets, and further deteriorate the liquidity and stability of cross-listed securities (Aharon et al., 2022), most studies still agree that active government response to the COVID-19 pandemic has a positive impact on investor and businesses confidence (Narayan et al., 2021). In the early stage of the COVID-19 pandemic, the COVID-19 media coverage always brings panic sentiments to investors due to inadequate epidemic preparedness and control measures. With the normalisation of the epidemic, the gradually maturing epidemic prevention system strengthens the investor and businesses confidence, and further eliminates the influential mechanism of media coverage on investor sentiments. Once the MCIs have almost no impact on the investor sentiments, this may further cut off the predictive power from the MCIs to the AHP volatilities.

Overall, in this subsection, we explore the time-varying causality from the MCIs in China to the AHP volatilities. The results show that the MCIs in China have obvious positive and dynamic causalities to the AHP volatilities. In addition, compared to the MCIs in Hong Kong, the effect of the MCIs in Chinese mainland on the AHP volatilities is more persistent. Finally, we find that the above causal effects disappear after November 2021.

## 5. Conclusion and limitation

The COVID-19 virus is sweeping the world, and the related news spread fast by the media coverage. When the news is absorbed by investors, the investor sentiment will be greatly affected, and irrational investment decisions will then flood into the financial markets. Therefore, a growing number of studies start to pay attention to the impact of media coverage on investor sentiment (Akhtaruzzaman et al., 2022; Liu et al., 2020), investment decisions (Sun et al., 2021), and the whole financial markets (Haroon and Rizvi, 2020). This article aims to figure out how the COVID-19 media coverage in China affects the AH premium disparity by employing a novel time-varying causality techniques proposed by Shi et al. (2018, 2020). Our findings show that the MCIs in China do not significantly cause the log-prices of the AH premium index throughout the full sample period, while significantly positive and time-varying causalities from the MCIs in China to the volatilities of the AH premium index are detected. In addition, we find that the causal effect of the MCIs in Chinese mainland on the AHP volatilities is more pronounced and stable than that of the MCIs in Hong Kong. Finally, the causal effects of the MCIs in China on the AHP volatilities disappeared since November 2021. Our conclusions are impressive for both policymakers and investors. For policymakers, they should steer the trend of media coverage and stabilise investor sentiments in the face of an epidemic crisis, which can further stabilise the stock markets. For AH stock investors, they should pay more attention to the media coverage related to the COVID-19 pandemic. When there is a high proportion of crisis-related news, they should withdraw their capital to hedge their risk.

While the above sections of this paper have important implications and contributions, there are still some limitations of this paper that could provide valuable suggestions for further research. One of the major limitations is that we only use the AH cross-listed firms as our subjects, so our results cannot be extended to cross-listed stocks across the world. As data become more available, the dynamic causal relationship between COVID-19 media coverage and cross-listed stocks across the globe can be further investigated. Secondly, besides the MCIs, Ravenpack has developed other indices to measure the impact of the epidemic on investor's psychology, such as the panic index and the sentiment index. In recent literature, several scholars have also conducted studies using these indices (Atri et al., 2021; Huynh et al., 2021). In further research, these indices can be used to examine whether they have significant influences on cross-listed stocks. Finally, we use the historic volatilities collected from Wind China for our analysis. As realised volatilities have more accuracy in capturing volatiles of financial variables, one can use high-frequency data to calculate realised volatilities for further research if possible.

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## REFERENCES

[1] **Aharon, D.Y., Baig, A.S., Delisle, R.J. (2022), *The Impact of Robinhood Traders on the Volatility of Cross-Listed Securities*.** *Research in International Business and Finance*, 60, 101619;

[2] **Akhtaruzzaman, M., Boubaker, S., Umar, Z. (2022), *COVID-19 Media Coverage and ESG Leader Indices*.** *Finance Research Letters*, 45, 102170;

[3] **Atri, H., Kouki, S., Gallali, M.I. (2021), *The Impact of COVID-19 News, Panic and Media Coverage on the Oil and Gold Prices: An ARDL Approach*.** *Resources Policy*, 72, 102061;

[4] **Corbet, S., Hou, Y.G., Hu, Y., Oxley, L., Xu, D. (2021), *Pandemic-related Financial Market Volatility Spillovers: Evidence from the Chinese COVID-19 Epicentre*.** *International Review of Economics and Finance*, 71, 55-81;

[5] **Cumming, D., Hou, W., Wu, E. (2017),** ***The Value of Home-country Governance for Cross-Listed Stocks***. *European Journal of Finance*, 23(7-9), 674-706;

[6] **Deng, L., Liao, M., Luo, R., Sun, J., Xu, C. (2021),** ***Does Corporate Social Responsibility Reduce Share Price Premium? Evidence from China's A-and H-Shares***. *Pacific-Basin Finance Journal*, 67, 101569;

[7] **Dogan, E., Majeed, M.T., Luni, T. (2022),** ***Are Clean Energy and Carbon Emission Allowances Caused by Bitcoin? A Novel Time-varying Method***. *Journal of Cleaner Production*, 347, 131089;

[8] **Dong, M., Xiong, X., Li, X. (2021),** ***The Role of Media Coverage in Measuring the Systemic Risk of Chinese Financial Institutions***. *Applied Economics*, 53(53), 6138-6152;

[9] **Emirmahmutoglu, F., Denaux, Z., Topcu, M. (2021),** ***Time-varying Causality between Renewable and Non-renewable Energy Consumption and Real Output: Sectoral Evidence from the United States***. *Renewable and Sustainable Energy Reviews*, 149, 111326;

[10] **Frijns, B., Indriawan, I., Tourani-Rad, A. (2018),** ***The Interactions between Price Discovery, Liquidity and Algorithmic Trading for US-Canadian Cross-listed Shares***. *International Review of Financial Analysis*, 56, 136-152;

[11] **Ghadhab, I. (2021),** ***Cross-listing and Crisis***. *Journal of Asset Management*, 22(7), 539-558;

[12] **Ghadhab, I., Hellara, S. (2016),** ***Price Discovery of Cross-listed Firms***. *International Review of Financial Analysis*, 44, 177-188;

[13] **Gong, X., Zhang, W., Wang, J., Wang, C. (2022),** ***Investor Sentiment and Stock Volatility: New Evidenc**e*. *International Review of Financial Analysis*, 80, 102028;

[14] **Haroon, O., Rizvi, S.A.R. (2020),** ***COVID-19: Media Coverage and Financial Markets Behavior - A Sectoral Inquiry***. *Journal of behavioral and experimental finance*, 27, 100343;

[15] **Huynh, T.L.D., Foglia, M., Nasir, M.A., Angelini, E. (2021),** ***Feverish Sentiment and Global Equity Markets during the COVID-19 Pandemic***. *Journal of Economic Behavior and Organization*, 188, 1088-1108;

[16] **Li, H., Shi, Y. (2021),** ***A New Unique Information Share Measure with Applications on Cross-listed Chinese Banks***. *Journal of Banking and Finance*, 128, 106141;

[17] **Liu, H., Manzoor, A., Wang, C., Zhang, L., Manzoor, Z. (2020),** ***The COVID-19 Outbreak and Affected Countries Stock Markets Response***. *International Journal of Environmental Research and Public Health*, 17(8), 2800;

[18] **Lu, X., Ye, Z., Lai, K.K., Cui, H., Lin, X. (2022),** ***Time-varying Causalities in Prices and Volatilities between the Cross-listed Stocks in Chinese Mainland and Hong Kong Stock Markets***. *Mathematics*, 10(4), 571;

[19] **Narayan, P.K., Phan, D.H.B., Liu, G. (2021),** ***COVID-19 Lockdowns, Stimulus Packages, Travel Bans, and Stock Returns***. *Finance Research Letters*, 38, 101732;

[20] **Niu, Z., Liu, Y., Gao, W., Zhang, H. (2021),** ***The Role of Coronavirus News in the Volatility Forecasting of Crude Oil Futures Markets: Evidence from China***. *Resources Policy*, 73, 102173;

[21] **Shi, S., Phillips, P.C.B., Hurn, S. (2018),** ***Change Detection and the Causal Impact of the Yield Curve***. *Journal of Time Series Analysis*, 39(6), 966-987;

[22] **Shi, S., Hurn, S., Phillips, P.C.B. (2020),** ***Causal Change Detection in Possibly Integrated Systems: Revisiting the Money-income Relationship***. *Journal of Financial Econometrics*, 18(1), 158-180;

[23] **So, M.K.P., Chu, A.M.Y., Chan, T.W.C. (2021),** ***Impacts of the COVID-19 Pandemic on Financial Market Connectedness***. *Finance Research Letters*, 38, 101864;

[24] **Song, S., Yi, Y., Tan, J. (2015),** ***Is AH Share Premium Justified? Market Sentiment, Speculative Stocks and AH Premium***. *Nankai Business Review*, 18(2), 92-102;

[25] **Sun, Y., Bao, Q., Lu, Z. (2021),** ***Coronavirus (Covid-19) Outbreak, Investor Sentiment, and Medical Portfolio: Evidence from China, Hong Kong, Korea, Japan, and U.S.*** *Pacific-Basin Finance Journal*, 65, 101463;

[26] **Umar, Z., Jareño, F., Escribano, A. (2022),** ***Dynamic Return and Volatility Connectedness for Dominant Agricultural Commodity Markets during the COVID-19 Pandemic Era***. *Applied Economics*, 54(9), 1030-1054;

[27] **Umar, Z., Jareno, F., Gonzalez, M.O. (2021),** ***The Impact of COVID-19-related Media Coverage on the Return and Volatility Connectedness of Cryptocurrencies and Fiat Currencies***. *Technological Forecasting and Social Change*, 172, 121025;

[28] **Xue, S., Zhou, S. (2021),** ***Coping with the Pandemic: Market Segmentation and Differential Stock Market Reactions to COVID-19***. *Available at SSRN* 3988143;

[29] **Zhang, W., Li, H., Cao, S. (2022a),** ***Does the Shanghai-Hong Kong Stock Connect Policy Reduce China's A-H Share Price Premium****? Applied Economics Letter*s, 29(15), 1428-1433;

[30] **Zhang, X., Xu, R., Liu, X. (2022b),** ***Premiums between Cross-listed Shares: Determinants and Assessment of Financial Reform Policy Effectiveness***. *China and World Economy*, 30(3), 75-99.