The effects of coronavirus news on travel and leisure stocks: Evidence from the NARDL model

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Abstract: This study employs the NARDL model to investigate the asymmetric effects of COVID-19 news on the return and volatility of travel and leisure stocks in both the United States and the global context. Our findings reveal distinct long- and short-term impacts of COVID-19 news on these stocks, exhibiting asymmetry and lag effects. Various types of news, including panic-inducing reports, entity-related coronavirus news, and misleading information, contribute to adjustments in travel and leisure stock returns over the long term. Notably, panic-inducing news has a more pronounced long-term impact on stock volatility compared to a higher volume of news sources reporting coronavirus-related information in similar situations. We argue that regulatory bodies can influence the stock market by ensuring the accuracy and reliability of news content.
Keywords: tourism; NARDL; coronavirus news

1 Introduction

The global financial market has faced significant repercussions due to the COVID-19 pandemic [1]. The tourism market, characterized by the mobility of people across different locations, has been particularly hard-hit [2]. Kaczmarek et al. [3] highlighted a drastic decline in international tourist numbers, leading to substantial sell-offs in stocks related to the industry. Limited research has emphasized the adverse effects of COVID-19 on tourism and leisure stocks [4]. Several scholars, including Wang et al. have proposed that the extent of coverage in coronavirus news can influence travel and leisure stocks. Furthermore, in the era of abundant information, people can access coronavirus-related news more easily, amplifying its impact. Therefore, this study aims to explore the implications of coronavirus news on travel and leisure stocks.

In prior investigations, researchers have demonstrated the significant impact of coronavirus news on the tourism stock market, yet few have delved into its asymmetric effects [5]. Although limited research exists on the asymmetry of news and its relationship with travel and leisure stocks, it holds great significance for policymakers and investors. Investors can timely adjust their investment strategies based on this asymmetry, such as devising dynamic hedging strategies. Additionally, given the diverse asymmetric effects of different coronavirus news on travel and leisure stocks, investors can make nuanced investments to prevent over-investment or under-investment. Policymakers can also conduct real-time pricing of derivatives based on this asymmetry. Therefore, studying the asymmetric influence of coronavirus news on travel and leisure stocks is imperative.

When investigating the asymmetric impact of coronavirus news on travel and leisure stocks, it is crucial to employ news indices. In previous studies on coronavirus news and the stock market, the utilized news variables were relatively simplistic. Some scholars solely considered the number of news related to Covid-19 [6], while others transformed news information into an indicator of public sentiment [7]. In this paper, following the research of Cepoi [8], the indices are further refined, categorizing coronavirus news into five indices (The Panic Index (PI), The Media Hype Index (HY), The Fake News Index (FNI), The Contagion Index (CTI), and The Media Coverage Index (MCI)). This segmentation allows for the analysis of the asymmetric impact of coronavirus news on stock returns and volatility. The use of these coronavirus news prediction indicators effectively extracts all pertinent information, providing a more convincing decision-making basis for investors and policymakers.

This paper mainly studies the asymmetric relationship between coronavirus news on stock volatility and return, so we use the NARDL model for follow-up research. The NARDL model can distinguish between long-term asymmetry and short-

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term asymmetry, which means that we can find some specific characteristics when analyzing the asymmetric impact of corona virus news on tourism. In addition, according to the explanation of Rachani, the positive and negative effects of dependent variables on any explanatory variable can be clearly explained by using the NARDL model, so that we can analyze the positive and negative impact of the coronavirus news on travel stocks.

2 Methodology and Data

2.1 Methodology

We will use the asymmetric long-term regression equation in the following form.

$$Z_t = \beta^+ W_t^+ + \beta^- W_t^- + U_t \quad (1)$$

Among them, β^+ and β^- are asymmetric long-term parameters, and U_t is an independent and identically distributed process which has zero mean and finite variance. In which, W_t can be decomposed as follows.

$$W_t = W_0 + W_t^+ + W_t^- \quad (2)$$

W_t, as the initial uncertainty value, is an indicator of corona virus (PI, HY, FNI, CTI and MCI). While W_t^+ and W_t^- are the sum of positive and negative changes of uncertain values, which can be decomposed as follows.

$$W_t^+ = \sum_{i=1}^{t} \Delta W_i^+ = \sum_{i=1}^{t} max(\Delta W_i, 0) \quad (3)$$

$$W_t^- = \sum_{i=1}^{t} \Delta W_i^- = \sum_{i=1}^{t} min(\Delta W_i, 0) \quad (4)$$

Therefore, the following formula can be derived.

$$Z_t = \sum_{i=1}^{p} \varphi_i Z_{t-i} + \sum_{i=1}^{q} (\theta_i^+ W_{t-i}^+ + \theta_i^- W_{t-i}^-) + \varepsilon_t \quad (5)$$

In this equation, φ_i is regarded as an auto regressive parameter, θ_i and θ_i^- are asymmetrically distributed lags, ε_t is an independent identically distributed process, and ε_t has the characteristics of zero mean and the same variance. Therefore, the asymmetric error correction equation can be calculated.

$$\Delta Z_t = \rho Z_{t-1} + \theta^+ W_{t-1}^+ + \theta^- W_{t-1}^- + \sum_{i=1}^{p-1} \gamma_i \Delta Z_{t-i} + \sum_{i=0}^{q-1} (\delta_i^+ W_{t-i}^+ + \delta_i^- W_{t-i}^-) + \varepsilon_t \quad (6)$$

Among them, δ^+ and δ^- are positive and negative short-term adjustments of explanatory variables. And ρ and φ_i satisfy the following two equations.

$$\rho = \sum_{i=1}^{p} \varphi_i - 1 \quad (7)$$

$$\varphi_i = -\sum_{j=i+1}^{p} \varphi_j \ where\ j = 1, 2, \ldots, p-1 \quad (8)$$

In addition, the variables β, θ and ρ also satisfy the following equation:

$$\beta^+ = -\frac{\theta^+}{\rho} \quad (9)$$

$$\beta^- = -\frac{\theta^-}{\rho} \quad (10)$$

2.2 Data

For our analysis, we concentrate on the post-coronavirus epidemic period, specifically after January 2, 2020, utilizing daily data. As per Das et al.'s description, daily data proves more useful than weekly or monthly data due to its richer information content. Additionally, the method employed in this study effectively decomposes daily data. The stock data is sourced from Bloomberg and corresponding exchanges, while variables related to coronavirus news are obtained from the RavenPack Analytics tool, specifically designed for analyzing coronavirus-related information. The indices used in this study include: PI (Panic Index): This index quantifies the level of news mentions related to coronavirus-induced hysteria and panic. HY (Media Hype Index): This index signifies the percentage of news stories specifically about the coronavirus. FNI (Fake News Index): This index gauges the level of media discussion related to a new virus, encompassing fake news or misinformation associated with the coronavirus. CTI (Contagion Index): This index measures the percentage of all entities (such as companies, places, etc.) reported by the media to be infected with COVID-19. MCI (Media Coverage Index): This index indicates the percentage of all news sources reporting on the subject of the COVID-19 pandemic.

3 Analysis of Results

3.1 The impact of coronavirus news on the return of travel and leisure stocks

From Table 1, we can well explain the long-term dynamic results of these three coronavirus news indices (PI, FNI and CTI) and the stock return of tourism in the United States and the whole world. Among them, r represents travel and leisure stocks return. First, when a positive uncertain shock occurs, the L_W^+ of the three exponents is positive. On the contrary, if it is uncertain that the impact is negative, L_W^- will always be negative. This means that the return on travel and leisure stocks adjusts positively when a positive shock is encountered, and vice versa. In addition, the influence of long-term uncertainty caused by indices PI and FNI is also significant. Thus, shocks generated by news that causes people to panic and fake news that fools the public can lead to a long-term homothetic adjustment in the returns of travel and leisure stocks.

Second, according to Table 1, it can be found that the absolute value of long-term PI multiplier (L_{PI}^+, L_{PI}^-) is always less than that of long-term FNI multiplier (L_{FNI}^+, L_{FNI}^-). This means that when indices FNI and PI meet the same percentage of impact, the index FNI will have a greater impact on the return of stock. For example, if the index PI increases by 1%, then the stock return of the tourism for both United States and the whole world will increase by 0.004%. If the index PI drops by 1%, then the stock return of the tourism for both United States and the whole world will drop by 0.004%. When index FNI rises (falls) by 1%, the stock return of tourism in the United States and the world will rise (fall) by 0.013%. This means that under the same circumstances, the long-term impact of panic news on the return of travel and leisure stocks is less than that of fake news.

Tables 1 not only explain the long-term dynamic results well, but also give the conclusions of the short-term dynamic results. Although the impact of index FNI will not have a short-term impact on the stock return of tourism, the indices PI and CTI will have a short-term impact. Therefore, panic news and news about coronaviruses reported with entities can have a short-term impact on the return of travel and leisure stocks. According to Table 1, we can find that the shock of panic news will affect the stock return of tourism in the United States and the whole world in the short period. For example, the positive PI shock will lead to the lag 1, lag 3 and lag 4 adjustments in the stock return of the tourism in the United States. At the same time, this impact will have a negative adjustment of the stock return of the global travel and leisure stocks for lags 1 and lag 3. When the impact of PI is negative, the return of US travel and leisure stocks is adjusted to lag 2, the lag 3 and the lag 4. At the same time, this negative impact has a lag 3 and lag 4 adjustment on the global stock return of travel and leisure. The panic news will not have an immediate impact on the stock return of travel and leisure, but it will have a lagging effect.

According to Table 1, in the short-term, the news about coronaviruses reported with entities will also affect the stock return of tourism in the United States and the whole world. When the shock is positive, the return of travel and leisure stocks in United States will immediately make a negative adjustment, and negative adjustments will be made in the lag 1 and lag 2. Similar to the United States, the positive impact of CTI will immediately make a negative adjustment to the stock return of global tourism, and it will make a positive adjustment in lag 4. When the impact is negative, not only will the stock return of the travel and leisure in the United States immediately make negative adjustments, but also there will be negative adjustments in the lag 1, 2, 3 and 4. However, this negative impact will not immediately respond to the global stock return of travel and leisure, but it will produce negative adjustments in the lag 1 and the lag 4. That is, shocks generated by news about coronaviruses reported with entities not only lead to immediate adjustments in the returns of travel and leisure stocks, but also cause the returns to adjust in subsequent periods.

Table 1. NARDL estimation results for the impact of coronavirus news on the return of travel and leisure stocks.

PI			FNI			CTI		
	US	Global		US	Global		US	Global
r_{t-1}	-0.986*** (0.115)	-0.885*** (0.113)	r_{t-1}	-0.906*** (0.110)	-0.794*** (0.104)	r_{t-1}	-1.041*** (0.112)	-0.817*** (0.105)
PI_{t-1}^{+}	0.004*** (0.002)	0.004*** (0.001)	FNI_{t-1}^{+}	0.012** (0.006)	0.010** (0.005)	Δr_{t-2}	0.153* (0.085)	
PI_{t-1}^{-}	0.004*** (0.002)	0.004*** (0.001)	FNI_{t-1}^{-}	0.012** (0.006)	0.010** (0.005)	ΔCTI_{t}^{+}	-0.003*** (0.001)	-0.003*** (0.001)
ΔPI_{t-1}^{+}	-0.012*** (0.003)	-0.009*** (0.003)	Δr_{t-1}		-0.169* (0.094)	ΔCTI_{t-1}^{+}	-0.002*** (0.001)	
ΔPI_{t-3}^{+}	-0.014*** (0.003)	-0.011*** (0.002)	*Constant*	-0.009** (0.004)	-0.008*** (0.003)	ΔCTI_{t-2}^{+}	-0.003*** (0.001)	
ΔPI_{t-4}^{+}	0.006* (0.003)		L_{FNI}^{+}	0.013**	0.013**	ΔCTI_{t-4}^{+}		0.001* (0.001)
ΔPI_{t-2}^{-}	-0.007** (0.003)		L_{FNI}^{-}	-0.013**	-0.013**	ΔCTI_{t}^{-}	-0.001** (0.001)	
ΔPI_{t-3}^{-}	0.010*** (0.003)	0.008*** (0.002)				ΔCTI_{t-1}^{-}	-0.002*** (0.001)	-0.002*** (0.001)
ΔPI_{t-4}^{-}	-0.004** (0.002)	-0.005** (0.002)				ΔCTI_{t-2}^{-}	-0.002*** (0.001)	
Constant	-0.009** (0.004)	-0.008* (0.002)				ΔCTI_{t-3}^{-}	-0.003*** (0.001)	
L_{PI}^{+}	0.004***	0.004***				ΔCTI_{t-4}^{-}	-0.002** (0.001)	-0.002*** (0.001)
L_{PI}^{-}	-0.004***	-0.004***				*Constant*	-0.005 (0.004)	-0.004 (0.004)
						L_{CTI}^{+}	0.000	0.000
						L_{CTI}^{-}	-0.000	-0.000

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels.

3.2 The impact of coronavirus news on the volatility of travel and leisure stocks

Table 2 can explain the long-term dynamic results of the indices PI, HY and MCI and the volatility of the travel and leisure stocks in the United States and the whole world. RV represents travel and leisure stock volatility. First, when the uncertain impact is positive, L_W^+ is always significantly positive, and when the uncertain impact is negative, L_W^- is always significantly negative. Second, according to Table 2, it can be found that the absolute value of the long-term PI multiplier (L_{PI}^+, L_{PI}^-) in the United States is always greater than the long-term HY multiplier (L_{HY}^+, L_{HY}^-) and the long-term MCI multiplier (L_{MCI}^+, L_{MCI}^-) That is to say, when the three indices encounter the same impact, the index PI will have a greater impact on the volatility of Unite States travel and leisure stocks.

In addition to long-term dynamic results, Table 2 can also explain the short-term dynamic results. According to Table 2, it can be found that the impact of index PI will affect the volatility of travel and leisure stocks in the United States and the whole world in the short-term, resulting in a positive adjustment of the volatility. The volatility of Unite States travels and leisure stocks will only be affected by negative PI impact. When the negative PI shock occurs, the stock volatility of Unite States tourism will be immediately adjusted positively, and then it will be adjusted in lag 3 and lag 4. Although the positive PI shock will not affect the volatility of Unite States travel and leisure stocks, it will have an impact on the volatility of global travel and leisure stocks. When encountering positive PI impact, the volatility of global travel and leisure stocks will have a positive adjustment for lag 1. When the PI impact is negative, the volatility of global travel and leisure stocks will be adjusted positively immediately, and it will continue to be adjusted positively for lag 4.

Table 2 shows that the short-term impact of HY shock on the stock volatility of tourism in the United States and the whole world is more complicated. When encountering positive HY shock, the volatility of travel and leisure stocks will make a more complex response. The volatility of United States travel and leisure stocks will be adjusted positively immediately, and it will be adjusted positively for lag 1, lag 2, lag 3 and lag 4. The volatility change of the global travel and leisure stocks is similar to that of the United States. First, the volatility will be adjusted positively immediately, and it will be adjusted positively for lag 1, lag 2 and lag 4. When encountering negative HY shock, both the volatility of United States travel and leisure stocks and the volatility of global travel and leisure stocks will only make positive adjustments in lag 3 and lag 4. This implies that the positive shocks generated by the increasing number of coronavirus news have an immediate impact on the volatility of travel and leisure shocks and have a different degree of impact in the subsequent period. When such shocks are negative, the increasing number of coronavirus news does not have an immediate impact on the volatility of travel and leisure shocks, but the impact generated in the subsequent time will be found.

Although the short-term impact of MCI shock on the stock volatility of tourism in the United States and the whole world will not be reflected immediately, it will be adjusted for a short while. Table 2 shows that when there is a positive MCI shock, the volatility of United States travel and leisure stocks will have a positive adjustment for lag 1 and lag 3, and a negative adjustment for lag 2. After being impacted by positive MCI, the volatility of the global travel and leisure stocks will have a positive adjustment for lag 1. When encountering negative MCI shock, the volatility of travel and leisure stocks in the United States and the whole world will be adjusted positively. Both of them have a positive adjustment for lag 2.

Table 2. NARDL estimation results for the impact of coronavirus news on the volatility of travel and leisure stocks.

PI			HY			MCI		
	US	Global		US	Global		US	Global
RV_{t-1}	-0.207*** (0.036)	-0.202*** (0.036)	RV_{t-1}	-0.232*** (0.035)	-0.243*** (0.034)	RV_{t-1}	-0.157*** (0.026)	-0.145*** (0.026)
PI_{t-1}^+	0.0001*** (0.00004)	0.0001*** (0.00002)	HY_{t-1}^+		0.00001** (0.00000)	MCI_{t-1}^+	0.00001** (0.00000)	0.000003*** (0.00000)
PI_{t-1}^-	0.0001*** (0.00004)	0.0001*** (0.00001)	HY_{t-1}^-		0.000003** (0.00000)	MCI_{t-1}^-	0.000004* (0.00000)	0.000002** (0.00000)
ΔRV_{t-1}	-0.141*** (0.053)	-0.153*** (0.052)	ΔRV_{t-1}	-0.210*** (0.051)	-0.190*** (0.050)	ΔRV_{t-1}	-0.095* (0.051)	-0.147*** (0.050)
ΔRV_{t-2}	0.237*** (0.053)	0.237*** (0.053)	ΔRV_{t-2}	0.146*** (0.052)	0.185*** (0.051)	ΔRV_{t-2}	0.198*** (0.052)	0.188*** (0.051)
ΔRV_{t-3}	0.168*** (0.055)	0.231*** (0.034)	ΔRV_{t-3}	0.125** (0.053)	0.211*** (0.052)	ΔRV_{t-3}	0.142*** (0.052)	0.191*** (0.051)
ΔPI_{t-1}^+		0.0001** (0.00003)	ΔHY_t^+	0.00003** (0.00001)	0.000009* (0.00000)	ΔRV_{t-4}	0.107** (0.049)	
ΔPI_t^-	0.0001* (0.0001)	0.0001** (0.00001)	ΔHY_{t-1}^+	0.00007*** (0.00001)	0.0001*** (0.00000)	ΔMCI_{t-1}^+	0.0001*** (0.00001)	0.0001*** (0.00000)
ΔPI_{t-3}^-	0.0001** (0.0001)		ΔHY_{t-2}^+	0.00005*** (0.00001)	0.00003*** (0.00000)	ΔMCI_{t-2}^+	-0.00003** (0.00002)	
ΔPI_{t-4}^-	0.0001** (0.0001)	0.00004** (0.00002)	ΔHY_{t-3}^+	0.00004*** (0.00001)		ΔMCI_{t-3}^+	0.00003* (0.00002)	

Constant	0.00001 (0.0001)	0.00002 (0.00003)	ΔHY_{t-4}^{+}	0.00003** (0.00001)	0.00002** (0.00000)	ΔMCI_{t-2}^{-}	0.0001*** (0.00002)	0.00002*** (0.00000)
L_{PI}^{+}	0.001***	0.000***	ΔHY_{t-3}^{-}	0.00003** (0.00001)	0.0001*** (0.00000)	*Constant*	-0.0001 (0.0001)	-0.00009 (0.00006)
L_{PI}^{-}	-0.001***	-0.000***	ΔHY_{t-4}^{-}	0.00004*** (0.00001)	0.00001** (0.00000)	L_{MCI}^{+}	0.000***	0.000***
			Constant	-0.000004 (0.00006)	0.00001 (0.00002)	L_{MCI}^{-}	-0.000**	-0.000**
			L_{HY}^{+}	0.000*	0.000**			
			L_{HY}^{-}	-0.000*	-0.000**			

Note: *, **, and *** denote significance at the 10%, 5%, and 1% levels.

4 Conclusion

In this research, we use the more advanced NARDL model and we also refine the coronavirus news into five more scientific coronavirus news indices (PI, HY, FNI, CTI and MCI) in order to analyze the asymmetric impact of coronavirus news indices on the stock return and volatility of tourism in the United States and the whole world. The study found that the news of COVID-19 had different long-term and short-term impacts on the returns and volatility of travel stocks in the United States and the world.

In terms of the impact of coronavirus news on the return of travel and leisure stocks, the news which causes people to panic not only affects the return of travel and leisure stocks in the short run, but also causes the return to adjust in the long run. News about the coronavirus which reported with the entity causes short-term adjustment in the return of travel and leisure stocks, and the short-term effect of it is less than the effect of panic news. In addition, fake news that fools the public leads to a long-term adjustment in the return of travel and leisure stocks, and the long-term impact of fake news on the return of travel and leisure stocks is greater than that of panic news.

In terms of the impact of coronavirus news on the volatility of travel and leisure stocks, the long-term impact of panic news on the volatility of travel and leisure stocks is greater than the impact of more news sources reporting coronavirus news and more and more coronavirus news in the same situation. A negative shock associated with panic news would not only lead to an immediate adjustment in the volatility of global travel and leisure stocks, but would also lead to a subsequent adjustment in volatility. However, when such a shock is positive, global travel and leisure stock volatility does not adjust immediately and US travel and leisure stock volatility does not adjust actually. The impact of news sources reporting coronavirus news on the volatility of travel and leisure stocks, while not immediately evident, will gradually emerge over time thereafter.

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References

1. Harjoto, M. A., et al. (2021). COVID-19: Stock Market Reactions to the Shock and the Stimulus. Applied Economics Letters, Taylor & Francis Journals, 28(10):795-801.
2. Demiralay, S. and E. J. T. m. Kilincarslan (2019). The impact of geopolitical risks on travel and leisure stocks. 75(Dec.): 460-476.
3. Kaczmarek, T., et al. (2021). How to survive a pandemic: The corporate resiliency of travel and leisure companies to the COVID-19 outbreak. Tourism Management 84: 104281.
4. Liew, K. S. J. M. P. (2020). The effect of novel coronavirus pandemic on tourism share prices.
5. Akhtar, S., et al. (2013). Stock salience and the asymmetric market effect of consumer sentiment news. 37(11): 4488-4500.
6. Ambros, M., et al. (2020). COVID-19 pandemic news and stock market reaction during the onset of the crisis: evidence from high-frequency data. 1-4.
7. Lazzini, A., et al. (2021). Emotions, moods and hyperreality: social media and the stock market during the first phase of COVID-19 pandemic. Accounting, Auditing & Accountability Journal ahead-of-print(ahead-of-print).
8. Cepoi, C.O., (2020). Asymmetric dependence between stock market returns and news during COVID-19 financial turmoil. Finance Research Letters, 36.