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Does vaccination help to reduce financial stress on tourism subsectors?

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Abstract

Although there is rapid vaccination progress in the US and improvement in broad service activity upon reopening, no meaningful recovery has been achieved in tourism-related sectors until now. Therefore, we take a deep dive into tourism-related sectors and investigate how the effect of COVID-19 vaccination progress differentiates on the financial distress of tourism subsectors. Using a time-varying parameter VAR model, we quantify the financial distress in each tourism subsector and relate these measures with a daily number of newly vaccinated people. Our empirical findings indicate that specific tourism subsectors respond more to vaccination progress, and accordingly, financial stress has started to decline in these sectors. However, the effects of vaccination on airlines and hotel sectors are insignificant, implying that the recovery process will take longer in these subsectors.

Keywords: Pandemic; Covid-19; Uncertainty; Vaccination; Tourism; Hospitality; Economy.

1. Introduction

Due to the unprecedented challenges led by the COVID-19 pandemic, economic activity contracted worldwide in 2020, and many businesses have experienced substantial losses in their revenues. Given the peculiar nature of the shock, sectors including higher contact with people and more social interaction have suffered much. In this respect, the course of the pandemic, the restrictions launched to contain the spread of the coronavirus, and the fear and hesitancy of traveling had a significant impact on the travel and leisure sectors, primarily transportation, hotels, and restaurants, at the global level.

Several studies have attempted to examine the role of the pandemic on the tourism industry by using the stock market returns as a benchmark, for instance, Wang et al. (2021) for nine major tourism destinations, including the US, Lin, and Falk (2021) for three Nordic countries, Kaczmarek et al. (2021) for a panel of 52 countries, Bashir and Kumar (2021) for four tourism and leisure stock indices (Global, Europe, North America, and Asia-Pacific), Lee and Chen (2020) for a panel of 65 countries, and Chen et al. (2020) for the US. Overall, previous empirical evidence suggests that: (i) COVID-19 pandemic shock adversely affected the stock returns of the firms in the tourism - related sectors and firm values declined following the shock, (ii) the impact of the shock on the travel and leisure industry depends on the composition of the tourism stock indices, (iii) response of stock returns to infection and mortality rate may change significantly, (iv) pandemic-led variations in the uncertainty and investor sentiment caused stock returns to decline.

Beginning 2021, advances in mass vaccination have acted as a game-changer in the fight against the spread of the coronavirus. Mass inoculation in the US has started as of December 14th, 2020, and before the end of May 2021, more than 100 million jabs were administered. The success in vaccination helped ease travel restrictions, especially for domestic travel, and facilitated efforts towards resuming the normal economic activity. Recent evidence suggests that progress in vaccination is associated with improvement in confidence and an increase in travel intentions (see Williams et al. (2021) and Gursoy et al. (2021)). However, there is yet no evidence regarding the impact of vaccination on the level of financial distress in the travel and leisure sector.

Against this backdrop, this study examines how the connectedness in stock price returns of the tourism and hospitality industry has evolved over the period, including the pandemic and the aftermaths. In this context, we contribute to the literature on analyzing how the pandemic and the general uncertainty surrounding it have impacted the financial performance of firms in the tourism industry (Chen et al., 2020; Lee and Chen, 2020; Lin and Falk, 2021). Previous studies in this area have focused on how individual firms have been impacted, and industry-level inferences are then drawn as an aggregate of how performance indicators at the firm level have changed (see, e.g., Ozdemir et al., 2021; Sharma and Nicolau, 2020). Although the findings from this strand of literature provide important insights into some of the challenges faced by the tourism industry during the pandemic, there are at least two reasons why standard approaches to assess performance may not capture the specific processes that facilitated the current industry-wide financial distress.

First, during major system-wide shocks, fundamental economic drivers like changes in oil prices, fluctuations in currency, and monetary policy measures undertaken by governments do not fully capture the evolution of stock market fluctuations. The COVID-19 crisis has caused extreme volatility in global stock markets, which cannot merely be attributed to changes in fundamental economic drivers. Other factors, such

as changes in investor perceptions towards uncertainty during the course of such shocks, undoubtedly also play a role and warrant further investigation. Second, the vast majority of studies that have been conducted to investigate how the pandemic has affected the performance of tourism firms treat the firms in the tourism sector as independent of each other. Given that firms, and indeed subsectors within an industry, may be connected to a degree to which shocks would flow from one firm to another, this independence assumption can potentially lead to inaccurate conclusions about performance effects.

After examining how COVID-19 has contributed to the increased financial stress experienced by the tourism industry, we shift our focus to more recent times to further investigate the effect of the improvement of the vaccination roll-out on the financial distress of tourism subsectors by controlling several indicators, such as COVID-19 cases, Twitter sentiment, uncertainty due to infectious diseases, stringency index, and financial variables, such as the Fed funds rate and VIX index. In this regard, this paper also enriches the literature on investigating the effect of vaccination on travel attitude. For instance, using survey data, Garcia and Pino (2022) show that vaccinated people are more willing to take a holiday trips. Similarly, Ram et al. (2021) investigate how vaccination against the COVID-19 and mobility restrictions affect people's behavioral intentions to travel and their actual travel patterns. Mladenovic et al. (2021) examine the effect of the provision of free-of-charge vaccines to inbound tourists in Serbia. However, this study differs from previous studies by directly investigating the impact of vaccination on the financial distress of the tourism industry subsectors.

The empirical results indicate that the financial stress of the tourism sector has increased over the period with the uncertainty caused by the pandemic, and there is heterogeneity in the financial distress of the firms among the subsectors of the tourism sector. Regarding the determinants of financial distress, the results suggest that advances in inoculation against COVID-19 help mitigate financial distress only in the restaurant and travel&tourism sectors. The divergence in the vaccination-related restrictions against domestic and international travel might be a factor behind the heterogeneous impact of the vaccination on the tourism subsectors. Hence, our findings imply that sector-specific stimulus and rescue programs can be designed by policymakers to speed up the recovery in specific tourism subsectors. Since each tourism subsector has a different level of financial distress and the effectiveness of vaccination progress affects tourism subsectors heterogeneously, policymakers may consider targeted lending programs and credit measures to sustain the recovery and create a more effective resilience strategy.

2. Data

Our data set comprises publicly-listed tourism-related firms in the United States that are members of the Russell 3000 index. We select firms categorized under different tourism sub-sectors (tourism & travel, hotels, airlines, and restaurants) and gather daily data on the stock price return of those companies for the period of August 28, 2014 - May 7, 2021. Table 1 lists publicly traded companies in the Russel 3000 index under each subsector. Additionally, we collect a set of financial and macroeconomic variables, including the CBOE volatility index (VIX), federal funds rate (FFR), and Twitter sentiment index, which is a new daily measure of consumer confidence constructed by Hatzius et al. (2020) using millions of tweets that comment on economic conditions. We utilize the daily Infectious Disease Equity Market Volatility Tracker

(EMVID) index of Baker et al. (2020) to evaluate uncertainty connected to infectious disease outbreaks. More specifically, by scanning over 3,000 US Newspapers, the EMVID index is constructed based on daily counts of articles containing terms such as flu, disease, coronavirus, virus, pandemic, etc.

To evaluate how the US government has responded against the COVID-19 pandemic, we use the newly created stringency index of Hale et al. (2020) calculated as the average of nine sub-indices, namely; cancellation of public events, gathering size restrictions, workplace closing, including school closing, closure of public transportation, staying at home requirements, restrictions on international travel, restrictions on internal movement, public information campaigns. These sub-indices take values between 0 (the least stringent) and 100 (the most stringent) based on the response level of the government. Finally, we collect daily data on new COVID cases and new vaccinations to capture the progress of the infections and vaccinations. Our data is obtained from different sources, including Goldman Sachs, Bloomberg terminal, and the University of Oxford. All series made stationary using log difference if needed.

Table 1: The list of the tourism companies publicly traded in the Russel 3000 index

Airlines	Hotels	Restaurant	Travel & Tourism
Southwest Airlines Co	Wyndham Destinations Inc	McDonald's Corp	Sabre Corp
Alaska Air Group Inc	Marriott Vacations Worldwide C	Starbucks Corp	Carnival Corp
American Airlines Group Inc	Vail Resorts Inc	Darden Restaurants Inc	Booking Holdings Inc
Hawaiian Holdings Inc	Choice Hotels International In	Yum! Brands Inc	Expedia Group Inc
SkyWest Inc	Hyatt Hotels Corp	Chipotle Mexican Grill Inc	TripAdvisor Inc
JetBlue Airways Corp	Hilton Worldwide Holdings Inc	Bloomin' Brands Inc	Avis Budget Group Inc
Copa Holdings SA	Marriott International Inc/MD	Del Taco Restaurants Inc	Liberty TripAdvisor Holdings I
Delta Air Lines Inc		Fiesta Restaurant Group Inc	
Allegiant Travel Co		Aramark	
		Domino's Pizza Inc	
		Brinker International Inc	
		Carrols Restaurant Group Inc	
		El Pollo Loco Holdings Inc	
		Denny's Corp	
		Jack in the Box Inc	
		Noodles & Co	
		Cracker Barrel Old Country Sto	
		Cheesecake Factory Inc/The	
		Biglari Holdings Inc	
		Dunkin' Brands Group Inc	
		Wendy's Co/The	
		Dine Brands Global Inc	
		Chuy's Holdings Inc	
		Papa John's International Inc	
		BJ's Restaurants Inc	

Notes: This table lists the publicly traded companies in the Russel 3000 index under each tourism sub-sector.

3. Methodology

3.1. *Dynamic connectedness measure based on a TVP-VAR model*

Following the study of Antonakakis and Gabauer (2017), we compute the connectedness measure for each tourism sub-sectors using a time-varying parameter VAR (TVP-VAR) model. The idea of this measure is based on a variance decomposition obtained from the TVP-VAR model. More precisely, variance decomposition allows us to divide the forecast error variances into fractions due to the shocks to the company's stock returns. As suggested by the BIC criteria, we separately estimate the TVP-VAR model with one lag to obtain the forecast error variance decomposition for each tourism subsector.

More precisely, we utilize the following TVP-VAR model:

$$r_t = B_t r_{t-1} + u_t \quad u_t \sim N(0, S_t) \quad (1)$$

$$vec(B_t) = vec(B_{t-1}) + v_t \quad v_t \sim N(0, R_t) \quad (2)$$

where r_t denotes the stock return of the firms listed in the corresponding tourism sub-sector, B_t shows the time varying coefficient matrix. Furthermore, v_t and u_t are a vector of i.i.d error terms.

As suggested by Pesaran and Shin (1998), we then calculate the H -step ahead (scaled) generalized forecast error variance decomposition (GFEVD) by rewriting the TVP-VAR model as a TVP-VMA process by means of: $r_t = \sum_{i=1}^p B_{it} r_{t-i} + u_t = \sum_{j=0}^{\infty} A_{jt} u_{t-j}$, where A_{jt} is the time-varying VMA coefficient matrix. Subsequently, we normalize the GFEVD ($\phi_{ij,t}^g(H)$) to obtain the (scaled) GFEVD, ($\tilde{\phi}_{ij,t}^g(H)$) since the variance shares of the own-variable and cross-variable might not sum up to one. This measure denotes the impact of firm j on firm i based on the proportion of the forecast error variance attributable to firm j :

$$\phi_{ij,t}^g(H) = \frac{S_{ii,t}^{-1} \sum_{t=1}^{H-1} (l_i' A_t S_t l_j)^2}{\sum_{j=1}^k \sum_{t=1}^{H-1} (l_i A_t S_t A_t' l_i)} \quad \tilde{\phi}_{ij,t}^g(H) = \frac{\phi_{ij,t}^g(H)}{\sum_{j=1}^k \phi_{ij,t}^g(H)}$$

with $\sum_{j=1}^k \tilde{\phi}_{ij,t}^g(H) = 1$, $\sum_{i,j=1}^k \tilde{\phi}_{ij,t}^g(H) = k$, and l_i demonstrates a selection vector with unity on the i th position and zero otherwise. Finally, the total connectedness measures (TCI) can be calculated using the GFEVD:

$$TCI_t = k^{-1} \sum_{j=1}^k \sum_{i=1, i \neq j}^k \tilde{\phi}_{ji,t}^g(H) \quad (3)$$

where TCI illustrates the average influence that shocks to the stock returns of one firm have on the total forecast error variances of the other firms' stock returns.

During periods of elevated uncertainty, the standard firm-specific measures of performance tend to be less reliable. In other words, given the system-wide distress under such intervals, the usual accounting and finance indicators like profits and losses, and stock behavior of individual firms do not fully reflect the true performance outlook for companies. Instead, the effects resulting from the aggregate market-wide financial distress tend to be much more pertinent. The COVID-19 crisis has crippled the global tourism industry and, in the process, spawned immense concerns about its future. In this regard, financial distress modeled under an approach like the TVP-VAR model based dynamic total connectedness index, as used in this study, has the potential to serve as a useful instrument for assessing the state of the sector and that of individual companies. Hence, our newly constructed TVP-VAR-based measure denotes the fraction of forecast error variances that arises from cross variance shares. Higher values of TCI_t imply that the co-movement of the stock return of the tourism firms is strong, indicating that a shock to one firm will impact others substantially. Therefore, we interpret the connectedness index as a measure of financial distress in the industry.

3.2. *Determinants of financial stress across tourism subsectors*

To examine the determinants of the financial distress in each tourism subsectors, we estimate a regression of the form:

$$TCI_t = \alpha + \beta Vaccinations_t + \gamma X_t + e_t \quad (4)$$

where TCI_t alternatively represents the total connectedness of hotels, travel & tourism, restaurants, and airlines. $Vaccinations_t$ is the logarithm of daily new COVID-19 vaccinations. The vector X_t includes control variables, namely, first difference of FFR, logarithm of stringency index, logarithm of EMVID index, level of twitter sentiment index, and logarithm of new COVID-19 cases. The sample period for the linear regression covers the period January 1, 2020 to May 7, 2021, beginning with the initiation of the COVID-19 and encompassing the March 2020 period in which the coronavirus started spreading over the world and also covering the second and third waves of COVID-19 around December 2020 and February 2021.

4. Results

Figure 1 provides the total connectedness index of the TVP-VAR model for tourism subsectors, separately. Results indicate that total connectedness varies with respect to time. The changes in the financial distress over the period are consistent with the timeline of the pandemic and the measures taken by governments against the spread of the coronavirus that had devastating implications for the travel and leisure industry. For instance, financial distress is relatively lower and more stable in all subsectors before the emergence of the outbreak. However, with the inception of the pandemic, the elevated uncertainty led the financial distress in the tourism sector to surge. In the more recent period, there has been a limited decline in the financial distress among firms in the restaurant sector, but the airport and hotels are still under high stress.¹

Our dynamic connectedness estimates suggest heterogeneity in the financial distress of the three subsectors in the aftermath of the pandemic. Thus, to further investigate the phenomena, we zoom in to the January 2020 -May 2021 period when inoculation against the coronavirus became widespread in the US. Regression results in Table 1 suggest that higher stock return connectedness is associated with stricter measures against the spread of the coronavirus and more COVID cases in all three sectors. Similarly, an increase in the uncertainty due to infectious diseases (EMVID) increases the total connectedness in all subsectors except for restaurants. The impact of financial variables on connectedness is consistent with the expectations. The financial stress increases as the fear in the stock market rise, and increases in the Feds fund rates lead to lower distress.

Regarding the impact of the new vaccinations on the stock return connectedness of the tourism firms, our results indicate heterogeneity among the tourism subsectors. There is no statistically significant evidence

¹As a robustness check, we replicate the same methodology by replacing stock returns with volatility of stock prices, where the volatility of the company's stock price is defined as the absolute return: $V_{i,j} = |\ln P_t - \ln P_{t-1}|$, as suggested by Forsberg and Ghysels (2007) and Wang et al. (2016). The dynamic connectedness index for the volatility of stock prices presented in Figure A1 of the Appendix is in line with the corresponding estimates for the stock returns. In other words, the time-varying course of the financial distress is consistent with the timeline of the emergence of the pandemic and the developments following it.

that improvements in vaccination against the coronavirus lead to lower financial distress in airlines and hotels sectors, while results suggest that new jobs are linked with lower connectedness in the restaurant and travel & tourism sectors. The significance of the advances in vaccination rolled in mitigating the financial distress only in the restaurant and travel & tourism sectors deserves further discussion. Despite the improvement of the vaccination roll-out in both the US and its main developed partners, especially in Europe, as of the first half of 2021, there has been a divergence between the travel restrictions regarding domestic and international travel, which mainly affects the part of the travel and leisure sector that relies on international travel more than domestic travel, such as the airlines and hotels. On the other hand, with the vaccination progress, many restaurants have started to serve in their areas by requiring COVID-19 vaccination for indoor dining. Similarly, considering that many tourist destinations declared themselves open to vaccinated visitors, people have started to make bookings for next year's holiday, which decreases the financial distress on travel & tourism sector.

Figure 1: Return connectedness of tourism and hospitality industry subsectors



Notes: This figure separately shows the dynamic total connectedness of the returns of tourism subsectors. Results are based on a TVP-VAR model with lag length of order one (BIC) and a 10-step-ahead generalized forecast error variance decomposition.

Table 2: Determinants of return connectedness across tourism sub-sectors

	Dependent variable : Return Connectedness			
	Airlines	Hotels	Restaurants	Travel & Tourism
New Vaccinations	0.0004 (0.000)	0.0004 (0.000)	-0.0034** (0.002)	-0.0032*** (0.001)
New COVID Cases	0.0105*** (0.004)	0.0084*** (0.003)	0.0238** (0.012)	0.0197*** (0.008)
FFR	-0.0349* (0.020)	-0.0614*** (0.023)	-0.0256 (0.036)	-0.0407 (0.030)
VIX	0.0177 (0.015)	0.0175 (0.016)	0.1106*** (0.034)	0.0834*** (0.026)
Stringency Index	0.0362*** (0.007)	0.0212*** (0.005)	0.0791*** (0.021)	0.0666*** (0.014)
EMVID	0.0059** (0.003)	0.0061** (0.003)	0.0046 (0.008)	0.0124** (0.006)
Twitter Sentiment	0.0049 (0.005)	0.0019 (0.004)	-0.0181* (0.011)	-0.0051 (0.007)
Constant	4.125*** (0.042)	4.122*** (0.044)	3.596*** (0.098)	3.615*** (0.073)
R-squared	0.94	0.90	0.94	0.96
F-statistic	701.9	402.7	680.8	1005.9
Prob(F-statistic)	0.00	0.00	0.00	0.00
Number of Obs.	335	335	335	335

Notes: The table reports the estimation results of equation (4). ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Robust standard errors are shown in parentheses. The sample period is from January 1, 2020 to May 7, 2021.

5. Conclusion

Uncertainty driven by the COVID-19 pandemic has affected the tourism companies globally. Our results indicate that certain tourism subsectors respond more to vaccination progress, and accordingly, financial stress has been started to decline in these sectors. However, the effects of vaccination on airlines and hotels sectors are insignificant, which can be interpreted with the divergence in international and domestic travel restrictions. Widespread vaccination campaigns led the restrictions in the domestic travel to further ease and resulted in lower financial distress in the restaurant firms that can be considered more responsive to domestic tourism activities.

Our results have several important policy implications. Given that the uncertainty associated with the COVID-19 pandemic affects sub-sectors differently, policies aiming to support the tourism industry need to be designed at the sector level. Moreover, there may also be a link between the measures taken by the countries and the financial stress in the tourism sector, which requires more policy coordination at the global

level. For individual firms, it is important to act more prudently, considering that other firms in the sector may create additional risks through connectedness in the industry. For the investors, portfolio diversification, which helps distribute the firm and sector-specific risks, is suggested.

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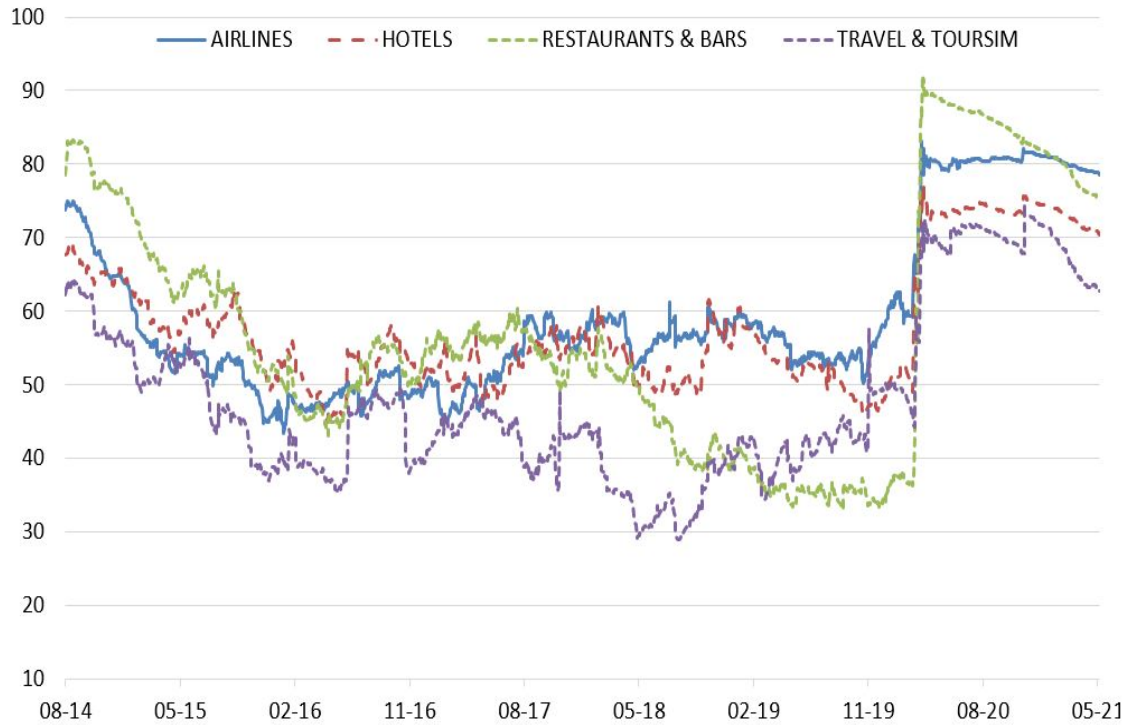
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Appendix

Figure A1: Volatility connectedness of tourism and hospitality industry subsectors



Notes: This figure separately shows the dynamic total connectedness of the return volatilities of tourism subsectors. Results are based on a TVP-VAR model with lag length of order one (BIC) and a 10-step-ahead generalized forecast error variance decomposition.