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RESEARCH NOTE

IMPACT OF COVID-19 ON STOCK MARKET PERFORMANCE OF TOURISM AND LEISURE INDUSTRY

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The COVID-19 pandemic has inflicted significant damage to the world economy, and the tourism and leisure industry is no exception. This article investigates the effect of COVID-19 pandemic, vaccine rollouts, and government policy responses on Australia's tourism and leisure industry. To do so, we use data on stock market performances of the travel and leisure industry as key indicators. Our findings show that while vaccine rollouts help for a partial recovery of the travel and leisure industry, full and speedy recovery remains a challenge under stringent policies related to COVID-19 safety, suggesting the enormous magnitude of the task ahead in terms of policy responses.

Key words: COVID-19; Tourism; Leisure; Stock market; Vaccinations

Introduction

Since the first quarter of 2020, governments worldwide have imposed a series of lockdowns and travel restrictions following the declaration of COVID-19 pandemics by WHO. The stringent government responses have caused severe disruption to the tourism and leisure sector, resulting in significant economic and social costs around the world (see, e.g., Brodeur et al., 2021; Duro et al., 2021; Fotiadis et al., 2021; Rezapour et al., 2021; Sigala, 2020; for a comprehensive review). As a result, the impact of COVID-19 on tourism performance has been featured in the recent tourism literature (e.g., Daglis & Katsikogianni, 2022; Ghosh, 2022; Hailemariam & Dzhumashev, 2022; Kourentzes et al., 2021; Lin et al., 2022). A comprehensive review of initial COVID-19 research related to the tourism and hospitality industry can be found in Ye et al. (2023).

The recovery and revival of the tourism industry largely depends on consumers' confidence,

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uptake of vaccine rollouts, and the stringency of government policies. To shed light on this complex issue, we examine how COVID-19 vaccine rollouts and government policy responses influence the performance of the tourism and leisure industry. Understanding the link between these key variables is at most priority to policymakers to formulate appropriate policy responses. It is well established in the literature that stock market performance is a strong predictor of investments decisions and economic activities (e.g., Daglis et al., 2022; Li et al., 2021).

Data and Methodology

Methodology

We begin with a benchmark econometric specification that relates the tourism and leisure equity performance to the key explanatory variables as follows:

$$yt = \beta_0 + \beta_1 COVID19_t + \beta_2 Vaccine_t + \beta_3 Policy\_stringency_t + \beta_4 Oilreturn_t + \vartheta_t \quad (1)$$

where y_t denotes the tourism and leisure stock market performance (including stock price index and total returns) at time t and $COVID19_t$ indicates the number of COVID-19-related deaths, $Vaccine_t$ is the total vaccinations administered per 100 people. $Policy\_stringency_t$ is an index measure of government policy stringency to contain the prevalence of the coronavirus and ϑ_t denotes the idiosyncratic error term.

While the linear model in equation (1) is helpful in serving as a benchmark, it cannot account for complexities from nonlinearity and time-varying dependence between the time series variables. To address this issue, we employ a data-driven wavelet coherence approach. The wavelet coherence method is a bivariate framework for studying the interaction between time series variables and their evolution over a continuous time and frequency space. While this approach has become a workhorse in the domain of applied economics and finance, it is not well utilized in the tourism literature, with a few exceptions (e.g., Sinha et al., 2022).

Following Torrence and Compo (1998), the squared wavelet coherence can be constructed using the equation as:

$$R^2_{XY}(k,f) = \frac{|C\left(f^{-1}W_{XY}(k,f)\right)|^2}{C(f^{-1}|W_x(k,f)|^2)C(f^{-1}|W_Y(k,f)|^2)} \quad (2)$$

where C represents a smoothing operator in both time and scale, and denotes the cross-wavelet power that measures the local covariance between two data series at each scale. Since the squared wavelet coherence is restricted to positive values (i.e., $0 \leq R^2_{XY}(k,f) \leq 1$), we use the phase differences, ϕ_{XY}, to determine the lead-lag relationships:

$$\phi_{XY}(k,f) = tan^{-1}\left(\frac{L\{C(f^{-1}W_{XY}(k,f))\}}{O\{C(f^{-1}W_{XY}(k,f))\}}\right) \quad (3)$$

where L and O denote the imaginary operator and real part operator of the smoothed cross-wavelet power, respectively.

Data

The study uses daily data over the period from January 27, 2020, to April 10, 2021. Data on daily total COVID-19 cases, deaths, and vaccination rollouts are sourced from Our World in Data. Daily data on West Texas Intermediate (WTI) oil returns and leisure and tourism stock returns are obtained from DataStream. We use aggregate indices of stock market prices and total returns for Australian travel and leisure companies listed on the Australian Stock Exchange (ASX). These indices are provided by The Financial Times Stock Exchange (FTSE) and available in Refinitiv DataStream. Total return is the overall return from all sources, including capital gains, dividends, and other distributions to shareholders. Data on government stringency index is sourced from the Oxford Covid-19 Government Response Tracker (OxCGRT). The OxCGRT collects detailed information on government policy measures, such as travel restrictions and lockdowns in response to the COVID-19 pandemic since January 1, 2020. Our choice of variables is based on the literature (e.g., Wang et al., 2021). We control for oil returns as it is one of the most important predictors of stock returns (e.g., Kilian & Park,

Table 1
Summary Statistics

Variable	Mean	*SD*	Min	Max
Total return index	1698.6	323.8	853.9	2346.7
Price index	413.3	77.6	208.1	566.6
Crude oil returns	0.08	9.1	−144.1	72.3
Stringency index	59.9	16.3	5.6	78.2
Total vaccinations per 100	32.2	32.5	0	110.2
Total cases per 1 million	975.2	730.8	0.2	4490.4
Total deaths per 1 million	26.3	14.9	0.0	52.6

2009; Sim & Zhou, 2015). Table 1 provides the descriptive statistics of the variables. The table shows significant variations in the variables as measured in the standard deviations relative to the mean.

An important empirical issue in the estimation of equation (1) could be the interdependence among the variables that raises the issue of multicollinearity. The coefficient estimates could be biased and inconsistent with inflated standard errors if the variables are linearly dependent (multicollinear). We use the variance inflation factor (VIF) method to detect the issue of multicollinearity. The rule of thumb is that a VIF value of greater than 10 suggests that the variables could be considered as a linear combination of other independent variables. The test results in Table 2 show that the VIF is way less than 10 for all explanatory variables, suggesting that there is no multicollinearity issue.

Results and Discussion

Benchmark Estimates

Table 3 provides the benchmark estimates on the relationship between COVID-19 deaths, cases, vaccinations, and the implications for the tourism and leisure stock market performance. The results show that COVID-19-related deaths significantly and negatively affect travel and leisure stock market performance, while vaccination rollouts have significant and positive effects. More precisely, an additional COVID-19-related death per 1 million people is associated with a reduction in the total stock return by 8 points and the price index by approximately 2 points. Similarly, the government stringency index is negatively associated with travel and leisure stock market performance.

Table 2
Variance Inflation Factor (VIF) Results for Multicollinearity Test

Variable	VIF
Total vaccinations per 100	5.57
Total deaths per 1 million	3.95
Stringency index	1.92
Crude oil returns	1.01
Mean VIF	3.11

Note. VIF value of less than 10 means that there is no issue of multicollinearity.

Interestingly, the vaccine rollouts have a significant positive effect on the travel and leisure stock performance (Table 3). As shown in Table 3, the coefficient on vaccination is statistically significant at the 1% level, suggesting the positive role of vaccine rollouts on tourism and leisure stock market performance. Comparing the estimated coefficients of the explanatory variables, the results suggest that vaccine rollouts are insufficient for the recovery of tourism and leisure activities. This result is consistent with the findings of Yang et al. (2022) and Lee and Chen (2022). Specifically, they found that an increase in COVID-19 cases and the associated level of government policy stringency significantly and negatively affect tourism revenue and pricing. Our findings also support the conclusions from Shin et al. (2021) and differ from Ram et al. (2022), who found that vaccine rollouts seem to have little or no influence on tourism demand and, hence, a limited role in resuming tourism activity. This is mainly due to the fact that they use a cross-sectional approach which cannot account for time-varying factors.

Wavelet Coherence Analysis

We conduct the wavelet coherence analysis to examine the time-varying relationship between

Table 3
COVID-19 Deaths, Vaccine Rollouts, and Tourism Performance

	Total Return of Tourism and Leisure Stocks	Price Index of Tourism and Leisure Stocks
Total COVID-19 deaths per 1 million	−8.036** (3.723)	−1.988** (0.888)
Total COVID-19 vaccinations per 100	5.515*** (0.514)	1.309*** (0.122)
Policy stringency index	−1.662** (0.736)	−0.399** (0.175)
Crude oil price return	3.206 (2.485)	0.772 (0.601)
Observations	157	157
R^2	0.757	0.751

Note. Robust standard errors are shown in parentheses.
**, ***Statistical significance at 5% and 1% significance levels, respectively.

the variables. Figure 1 displays the coherency and phase-difference between COVID-19-related deaths and tourism and leisure stock returns. The interpretations of the wavelet coherence results are as follows. The phase arrows in the figure show the direction of pairwise comovement of the COVID-19-related deaths/cases and the travel and leisure stock returns. Perfectly phased variables are indicated by arrows pointing to the right, whereas out-of-phase variables are represented by arrows pointing to the left. The regions bound by the contour lines stand for the 5% significance level, and the phase difference is captured by arrows. The in-phase and out-of-phase behavior represents the cyclical and anticyclical relationship between the variables in the wavelet coherence, respectively. The cold

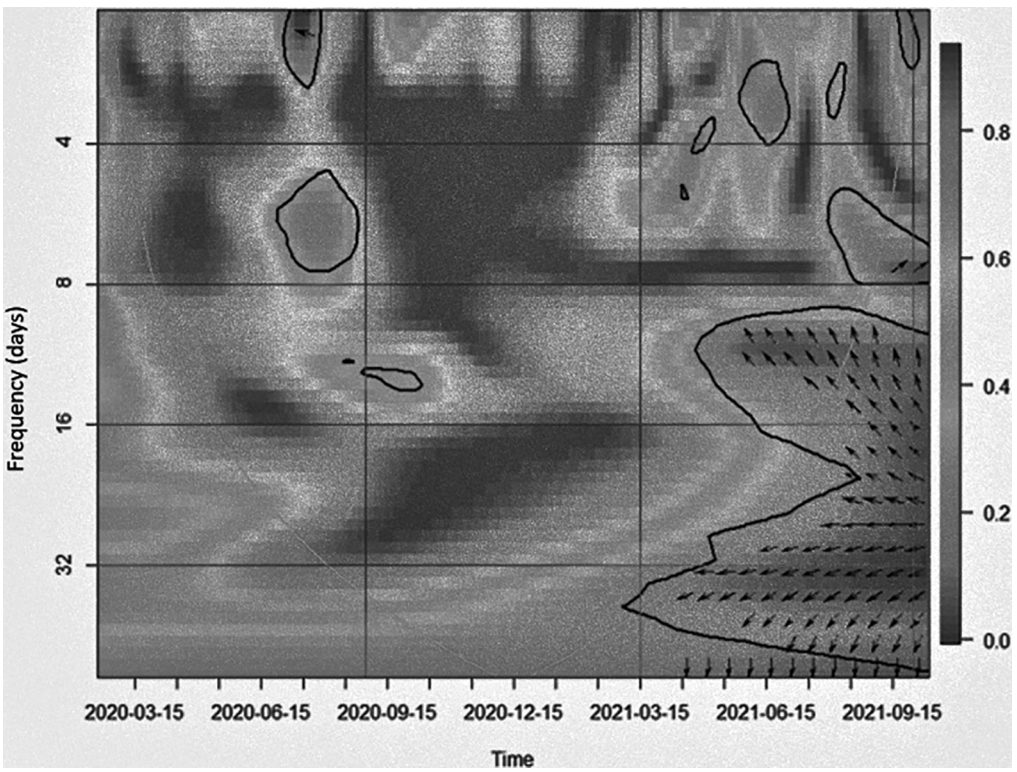

Figure 1. Wavelet coherence and phase of COVID-19 deaths and tourism and leisure stock returns.

(blue) colors denote a weak correlation between the two data series, whereas warmer (red) colors indicate a strong correlation between the variables. Specifically, arrows pointed to the right (left) imply the two series are in-phase (out-of-phase). Left-up and right-down arrows suggest the first series is leading, otherwise the first series is lagging.

Figure 1 shows evidence of strong comovements for the 4–32-day frequency bands between COVID-19 deaths and tourism and leisure sector activities in Australia. At low frequencies (8–16 days), we find red islands with predominantly up-left and left arrows, suggesting that COVID-19-related death negatively affects tourism and leisure stock returns. Specifically, an increase in COVID-19 deaths causes a decline in tourism and leisure stock returns. These findings lend support to the existing evidence on detrimental effects on the tourism sector (see, e.g., Fodiatis et al., 2021; Gössling et al., 2020; Karabulut et al., 2020; Lee & Chen, 2022), especially for countries with high tourism shares in the GDP such as Australia (Welfens, 2020).

Figure 2 presents the results for the coherency and phase between the COVID-19 cases and tourism and leisure stock returns. The figure shows a high degree of coherency for the entire period for the sample period at low frequencies (below 32 days). During the initial periods of the COVID-19 pandemic, the degree of coherency was very high both at low and high frequency bands (8 to 32 days). The results also show a time-varying dependence in the strength of the dependence between the variables as the correlation scale ranges from red color for high correlation to blue for low correlation.

Figure 3 shows the wavelet coherence plot between COVID-19 vaccination rates and tourism and leisure stock returns. Again, we identify huge islands of strong dependency over the 32 days frequency band over the full sample period, and the arrows mostly point down to the right. The results suggest that the vaccination rate is leading the tourism and leisure sector. Our results support the findings of Rouatbi et al. (2021), who documented that

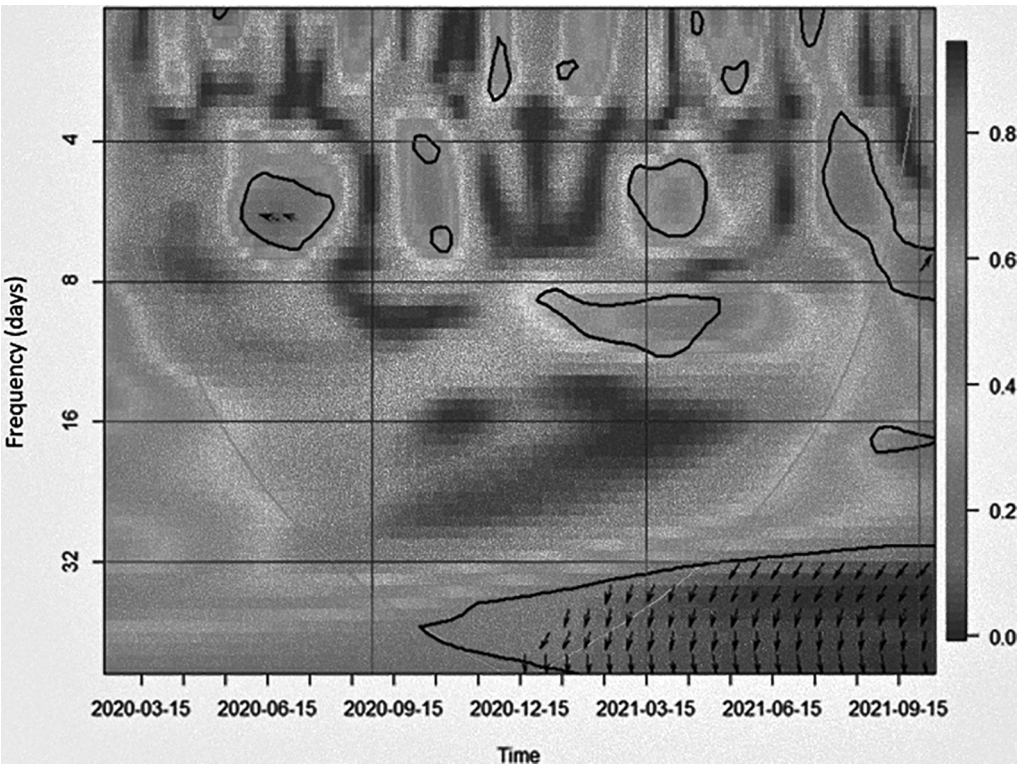

Figure 2. Wavelet coherence and phase of COVID-19 cases and tourism and leisure stock returns.

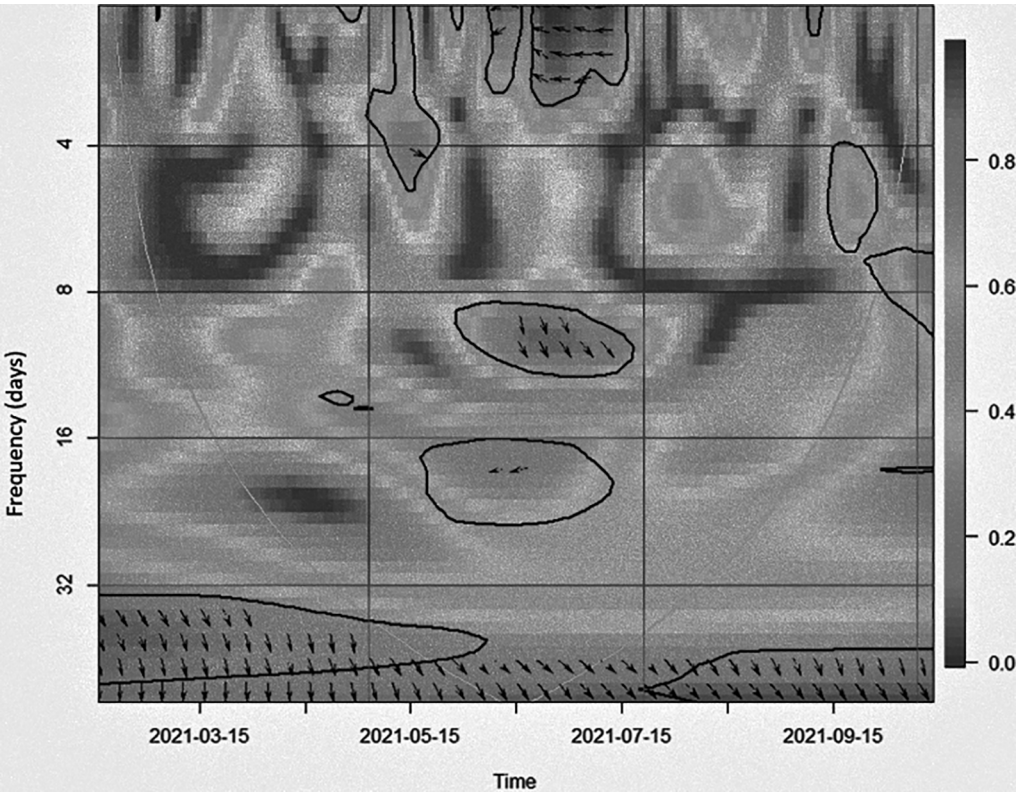

Figure 3. Wavelet coherence and phase of COVID-19 vaccines and tourism and leisure returns.

COVID-19 vaccination plays an important role in stabilizing the global equity market.

Conclusion

The COVID-19 pandemic and the associated policy responses have caused significant disruptions in Australia's tourism and leisure industry. In this article, we empirically examined the impact of the pandemic on tourism and leisure activity and provide evidence on the role of vaccine rollouts in the recovery of the tourism and leisure industry in Australia. To do so, we employ a simple linear regression model and the wavelet coherence approach and utilize daily data on tourism and leisure stock returns, COVID-19 deaths, and vaccine rollouts. The results from the linear model and the wavelet approach establish evidence on the role of vaccine rollouts and government policy stringency index on the performance of the travel and leisure industry. The primary advantage of the wavelet approach is that it pins down the nonlinear time-varying dependence structure in the variables, which is found to be stronger across low and high frequencies.

Our findings reveal that an increase in COVID-19 deaths is associated with a negative and significant effect on tourism and leisure returns. In addition, the government policy stringency index is negatively associated with tourism and leisure activity. Finally, we find that vaccine rollouts significantly and positively affect the recovery of the tourism and leisure industry. Therefore, relaxing the existing policy stringencies is vital to restore leisure and travel activities to the pre-COVID level. More importantly, policymakers should take action to restore consumer confidence and reactivate the tourism sector in the post-COVID-19 period, exploring new features such as transition to digital and green tourism systems.

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