



Analyzing Lead-Lag Relationships in the Tourism Sector: A Pairwise Granger Causality Approach to Weekly Share Prices of Companies

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Abstract

Understanding the evolution of the tourism industry in the face of the pandemic is critical not only for the rehabilitation of these enterprises, but also for shaping future policy and preparation for comparable global disasters. The performance of any companies is dependent upon the share price. As a result, understanding the relationship between a company's performance and share price is critical for navigating the complexity of financial markets and guaranteeing long-term success in an ever-changing business landscape. secondary data pertaining to the weekly share price of Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited for the period ranging from 1-1-2018 to 1-1-24 were selected for the present study. Pair-wise analysis of the lead-lag relationship Granger Causality Tests among weekly share prices of companies like Expedia Ltd, MakeMyTrip Ltd, and Thomas Cook (India) Limited are critical for investors, financial analysts, and policymakers.

Keywords: tourism industry, share price, weekly share price, Granger Causality Tests

Publication History

Received: 14 July 2026 **Accepted:** 20 August 2026, **Published:** 25 September 2026



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Introduction

The study of tourism-related businesses in India before and during the COVID-19 epidemic is crucial for understanding the devastating impact of this global health disaster on a sector that has been a vital contributor to India's economy. Prior to COVID-19, tourism was critical to economic growth, job creation, and the promotion of India's cultural heritage. It was an important source of income for a variety of businesses, ranging from hotels and travel agencies to local sellers, and it contributed significantly to the country's GDP. The pandemic, on the other hand, posed unprecedented hurdles to these businesses, resulting in disruptions, closures, and major economic setbacks. Investors, financial analysts, and corporate strategists must examine the success of organisations based on share prices. Share prices are more than simply numbers; they represent a company's financial health, market perception, and overall business strategy. Analysis of share price movements allows stakeholders to evaluate investor confidence, detect prospective market trends, and make informed investment decisions. Understanding the factors that influence share



prices also provides vital information into a company's competitiveness, risk exposure, and overall market posture. A thorough examination of this topic is required for policymakers, industry stakeholders, and researchers to estimate the amount of the damage, discover adaptive techniques used by enterprises, and develop effective recovery measures. Understanding the evolution of the tourism industry in the face of the pandemic is critical not only for the rehabilitation of these enterprises, but also for shaping future policy and preparation for comparable global disasters.

Need and Significance of the Study

The performance of any companies is dependent upon the share price. A careful assessment of a company's share price performance assists in developing successful communication strategies with shareholders, implementing changes to corporate operations, and optimising financial structures. As a result, understanding the relationship between a company's performance and share price is critical for navigating the complexity of financial markets and guaranteeing long-term success in an ever-changing business landscape. Pair-wise analysis of the lead-lag relationship Granger Causality Tests among weekly share prices of companies like Expedia Ltd, MakeMyTrip Ltd, and Thomas Cook (India) Limited are critical for investors, financial analysts, and policymakers. The Granger Causality Tests assist determine whether past share price values of one firm provide useful information for predicting future share prices of another company. Understanding lead-lag dynamics can provide useful insights into the market's interdependence and causal links, helping investors to make better educated judgements about portfolio allocations. This analysis can also help with risk management measures and provide a better understanding of broader market trends. Furthermore, for organisations working in the travel and hospitality sector, such as Expedia, MakeMyTrip, and Thomas Cook, a thorough understanding of lead-lag connections can be very valuable in navigating the industry's dynamic and competitive market.

Review of Related Literature

Despite its flaws, Granger (1980) and others, including well-known econometricians (Sims 1972, Bernanke & Blinder 1992), maintain that the technique can be used to discover causal effects. Granger's paradigm has been used by researchers in a wide range of fields, including neuroscience (Bergmann & Hartwigsen 2021, Reid et al. 2019) and environmental sciences (Cox & Popken 2015). Other researchers have pointed out problems in the technique and attempted to separate it as Granger causality or G-causality (Holland 1986, Bressler & Seth 2011). Granger causality has generally been based on assuming a linear vector autoregressive (VAR) model and considering tests on the VAR coefficients in the bivariate scenario (Lütkepohl 2005). However, in real-world systems with multiple time series, considering only the relationship between two series might lead to erroneous conclusions (e.g., Lütkepohl 1982). Network Granger causality seeks to account for potential confounders or to consider many series concurrently (Eichler 2017, Basu et al. 2015). Since its introduction, the dispute over Granger's concept of causality has raged on. Sheehan and Grieves (1982) utilised Granger causality to prove that the US gross national product causes sunspots; Noble and Fields (1983) argued that an alternate model would have resulted in a different result. Despite its shortcomings, Granger (1980) and others, including famous econometricians (Sims 1980, Bernanke & Blinder 1992), have claimed that the technique can be utilised to identify causal effects. Granger's paradigm has been employed by researchers in a variety of practical disciplines, ranging from neuroscience (Bergmann & Hartwigsen 2021, Reid et al. 2019) to environmental sciences (Cox & Popken 2015). Other scholars have highlighted the approach's flaws and attempted to distinguish it as Granger causality or G-causality (Holland 1986, Bressler & Seth 2011).

Objective of the Study

- To identify the Lead-Lag relationship among the weekly share price of Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited.

Hypotheses of the Study

- There is no significant Lead-Lag relationship among the weekly share price of Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited.

Research Methodology

The study is analytical in nature and is based on secondary data pertaining to the weekly share price of Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited for the period ranging from 1-1-2018 to 1-1-24. Augmented



Dickey-Fuller test, Vector Auto regression Estimates, VAR Lag Order Selection Criteria and Pair wise Granger Causality Tests were used. The data source is Yahoo Finance.

Result and Discussion

The first part of the analysis deals with the examination of the given security prices to know whether it is stationarity, for which Unit Root Test based on Augmented Dickey-Fuller method is relied. The details are as shown below.

Table 1.1: Unit Root Test- Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited

Null Hypothesis: Expedia Ltd has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.185500	0.2121
Test critical values:	1% level		-3.451078	Not Significant
	5% level		-2.870561	
	10% level		-2.571647	
Null Hypothesis: MakeMy Trip Ltd has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.677392	0.4418
Test critical values:	1% level		-3.451078	Not Significant
	5% level		-2.870561	
	10% level		-2.571647	
Null Hypothesis: Thomas Cook(India) Limited has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			0.071465	0.9631
Test critical values:	1% level		-3.451078	Not Significant
	5% level		-2.870561	
	10% level		-2.571647	

Source: yahoo finance (Author's own calculation)



The table presents the results of an Augmented Dickey-Fuller (ADF) test for the series Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited used to determine whether a time series has a unit root, which is an indication of non-stationarity. The null hypothesis in this case is that Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited has a unit root. The test statistic for the variable "Expedia Ltd" is -2.1855, and the corresponding p value is 0.2121, which is significantly higher than the p values at the 1%, 5%, and 10% levels, indicating that we accept the null hypothesis of a unit root. This suggests that "Expedia Ltd" is most likely stationary. Similarly, for "Make My Trip Ltd" and "Thomas Cook(India) Limited," the p values of Augmented Dickey-Fuller test are greater than the significant level, confirming acceptance of the unit root hypothesis. As a result, Make My Trip Ltd "and " Thomas Cook (India) Limited, "are most likely not stationary as well. Hence to conclude, Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited data found not stationary at the original data.

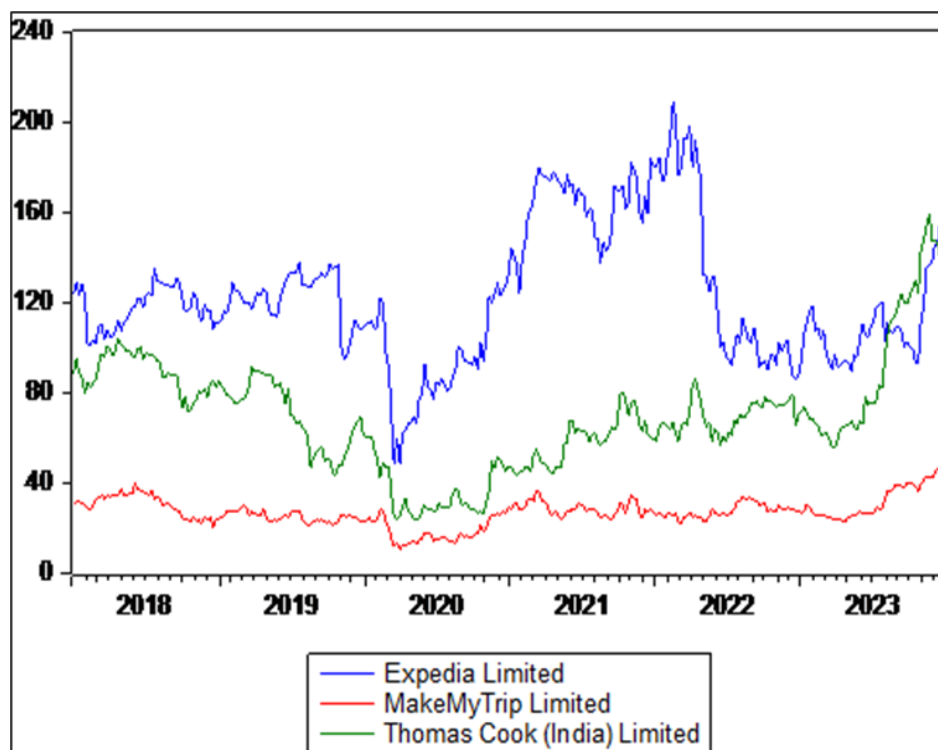


Figure 1.1: Line Chart- Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited

Figure 1.1 shows the weekly line graph of Expedia Ltd; Make My Trip Ltd and Thomas Cook (India) Limited from the period of 1-1-2018 to 1-1-2024. It is very clear that the share prices of the above companies are definitely not stationary.

**Table 1.2: Unit Root Test- d (Expedia Ltd), d (Make My Trip Ltd) and d (Thomas Cook (India) Limited)**

Null Hypothesis: Expedia Ltd1 has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-15.39201	0.0000*
Test critical values:	1% level		-3.451078	Significant
	5% level		-2.870561	
	10% level		-2.571647	
Null Hypothesis: MakeMy Trip Ltd1 has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-15.01895	0.0000*
Test critical values:	1% level		-3.451078	Significant
	5% level		-2.870561	
	10% level		-2.571647	
Null Hypothesis: Thomas Cook(India) Limited1 has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-14.85974	0.0000*
Test critical values:	1% level		-3.451078	Significant
	5% level		-2.870561	
	10% level		-2.571647	

Source: yahoofinance (Author's own calculation)

In the presented group, Unit Root Test conducted on financial time series data comprising the first difference in the share price of Expedia Ltd, MakeMy Trip Ltd and Thomas Cook (India) Limited over the period from 1-1-2018 to 1-1-2024. In all cases, the p values of Augmented Dickey-Fuller test statistic are significantly lower than the p values at the 1%, 5%, and 10% levels, indicating that rejection of the null hypothesis of a unit root. Hence to conclude, Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited data found stationary at the first difference.

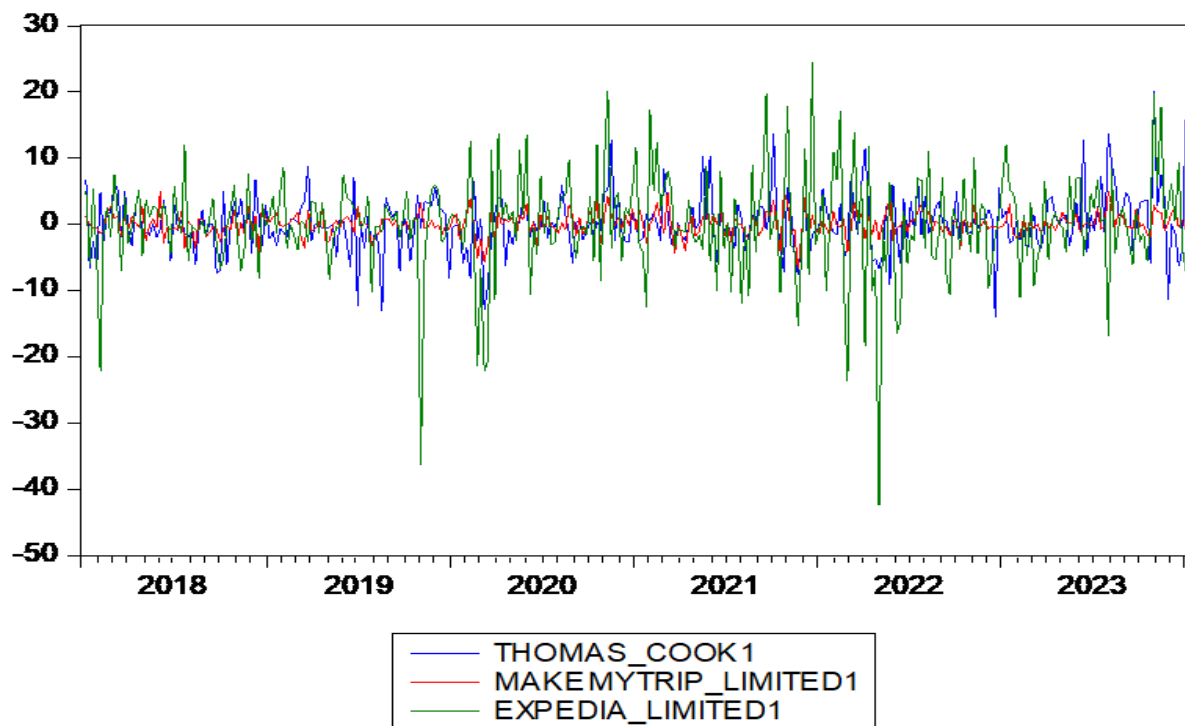


Figure 1.2: Line Chart- - d (Expedia Ltd, Make My Trip Ltd and Thomas Cook (India) Limited)

Figure 1.2 shows the weekly line graph in the first difference of Expedia Ltd; Make My Trip Ltd and Thomas Cook (India) Limited from the period of 1-1-2018 to 1-1-2024. It is very clear that the share prices of the above companies are definitely stationary.

As we understood, the above original data is not stationary. As such, practically it is not possible to examine the long term relationship between the variables. Hence only a short term relationship can be identified, through Granger Causality Tests.



Table 1.3: Vector Autoregression Estimates – d (Expedia Ltd), d (Make My Trip Ltd) and d(Thomas Cook (India) Limited)

	Thomas Cook (India) Limited 1	Expedia Ltd 1	MakeMy Trip Ltd 1
Thomas Cook (India) Limited 1(-1)	-0.039045	0.076969	0.029232
	(0.05986)	(0.10611)	(0.02493)
	[-0.65230]	[0.72538]	[1.17245]
Thomas Cook (India) Limited 1(-2)	0.043698	0.073347	0.006926
	(0.05930)	(0.10513)	(0.02470)
	[0.73685]	[0.69770]	[0.28039]
Expedia Ltd 1(-1)	0.026905	0.002182	0.012392
	(0.03689)	(0.06540)	(0.01537)
	[0.72925]	[0.03337]	[0.80639]
Expedia Ltd 1(-2)	-0.024262	0.068522	0.024051
	(0.03697)	(0.06554)	(0.01540)
	[-0.65621]	[1.04546]	[1.56172]
MakeMy Trip Ltd 1(-1)	0.275666	-0.126779	-0.114544
	(0.15769)	(0.27954)	(0.06568)
	[1.74811]	[-0.45352]	[-1.74387]
MakeMy Trip Ltd 1(-2)	0.290096	-0.020347	-0.099799
	(0.15840)	(0.28079)	(0.06598)
	[1.83145]	[-0.07247]	[-1.51264]
C	0.171576	0.048024	0.048639
	(0.24739)	(0.43854)	(0.10304)
	[0.69355]	[0.10951]	[0.47202]
R-squared	0.031801	0.009695	0.021664
Adj. R-squared	0.012692	-0.009851	0.002355
Sum sq. resids	5768.237	18126.25	1000.764
S.E. equation	4.355969	7.721777	1.814384
F-statistic	1.664196	0.496018	1.121964
Log likelihood	-895.4010	-1073.448	-623.0269
Akaike AIC	5.803222	6.948217	4.051620
Schwarz SC	5.887397	7.032392	4.135795
Mean dependent	0.201197	0.069888	0.046302
S.D. dependent	4.383878	7.684024	1.816524

Source: yahoo finance (Author's own calculation)

The outcomes of a Vector Autoregression (VAR) model for d (Expedia Ltd), d (Make My Trip Ltd) and d (Thomas Cook (India) Limited) show the coefficients for each variable at various time lags. For example, the value -0.039045 under Thomas Cook (India) Limited (-1) shows that a one-unit rise in the previous period's



Thomas Cook (India) Limited corresponds to a -0.039045 unit reduction in the present period, all other variables being constant. The numbers in brackets are the coefficients' standard errors, which aid in determining their precision. Each variable has a constant term (C), and R-squared values demonstrate how well the model fits the data. The F-statistic evaluates the overall relevance of the model. In conclusion, this VAR model provides estimates for how each variable depends on its past values and the values of the other variables.

Table 1.4: VAR Lag Order Selection Criteria – d (Expedia Ltd), d (Make My Trip Ltd) and d(Thomas Cook (India) Limited)

Endogenous variables: d (Expedia Ltd), d (Make My Trip Ltd) and d (Thomas Cook (India) Limited)						
Lag	Log L	LR	FPE	AIC	SC	HQ
0	-2537.474	NA	2778.214*	16.44319*	16.47944*	16.45769*
1	-2532.120	10.56946	2844.567	16.46679	16.61178	16.52476
2	-2526.588	10.81226	2909.206	16.48924	16.74297	16.59068
3	-2517.391	17.79899*	2905.626	16.48797	16.85043	16.63288
4	-2511.511	11.26472	2965.145	16.50816	16.97936	16.69655
* indicates lag order selected by the criterion						

Source: yahoo finance (Author's own calculation)

The above Vector Autoregression (VAR) model containing endogenous variables d (Expedia Ltd), d (Make My Trip Ltd) and d (Thomas Cook (India) Limited), as well as an exogenous variable C (constant term). The goal is to find the model's optimal lag order. To evaluate model performance at different lag orders (0 to 4), the asterisks (*) indicated the lag order that was decided based on each criterion, with the LR test, AIC, and SC lag order being 1. This indicates that zero period lag is seen to be best for capturing the relationships between the variables in the model as per the lowest coefficient of AIC.

Table 1.5: Pairwise Granger Causality Tests – d (Expedia Ltd), d (Make My Trip Ltd) and d (Thomas Cook (India) Limited)

Null Hypothesis:	Obs	F-Statistic	Prob.
Expedia Ltd 1 does not Granger Cause Thomas Cook (India) Limited 1	311	1.32536	0.2672
Thomas Cook (India) Limited 1 does not Granger Cause Expedia Ltd 1		0.44462	0.6415
MakeMy Trip Ltd 1 does not Granger Cause Thomas Cook (India) Limited 1	311	3.76070	0.0243
Thomas Cook (India) Limited 1 does not Granger Cause MakeMy Trip Ltd 1		0.97415	0.3787
MakeMy Trip Ltd 1 does not Granger Cause Expedia Ltd 1	311	0.05797	0.9437
Expedia Ltd 1 does not Granger Cause MakeMy Trip Ltd 1		1.77449	0.1713

Source: yahoofinance (Author's own calculation)

Granger causality tests help determines whether one time series can be used to predict another. Accordingly, Granger Causality relationship between Expedia Ltd 1 and Thomas Cook (India) Limited 1 was examined and the test result of F-statistic is 1.33 with a p-value of 0.2672. Since the p-value is greater than 0.05, we do not reject the null hypothesis. This suggests that Expedia Ltd 1 does not Granger Cause Thomas Cook (India) Limited 1. It means that the past values of Expedia Ltd's time series do not provide useful information for predicting the future values of Thomas Cook (India) Limited's time series. In simpler terms, changes or patterns in Expedia Ltd's data do not seem to be influencing or predicting changes in Thomas Cook (India) Limited's data, based on the statistical test. Likewise, as per the Granger Causality relationship, no past values do not seem to be influencing or predicting changes between Thomas Cook (India) Limited 1 and Expedia Ltd 1; Thomas Cook (India) Limited 1 and Make My Trip Ltd 1; Make My Trip Ltd and Expedia Ltd 1 and Expedia Ltd 1 and Make My Trip Ltd 1. But, as per the Granger Causality relationship, past



values of Make My Trip Ltd 1 do seem to be influencing or predicting changes between Thomas Cook (India) Limited 1, as the F-Statistic is 3.761 and the p value is 0.0243(p value lower than 5%). Thus, it is clear that changes or patterns in Make My Trip Ltd 1 data do seem to be influencing or predicting changes in Thomas Cook (India) Limited's 1 data.

Conclusion

The study concluded that the variable Make My Trip Ltd 1 Granger causes Thomas Cook (India) Limited's 1. This implies that past values of Make My Trip Ltd 1 contain information that can be used to predict future values of Thomas Cook (India) Limited's 1. This predictive power can be useful for making informed decisions and strategies. At the same time, bear in mind that there is no long-term relationship between the security prices of Make My Trip Ltd and Thomas Cook (India) Limited.

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