Tourism Stocks, Implied Volatility and Hedging: A Vector Error Correction Study

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The relationship between equity investments in the U.S. tourism industry and implied volatility is examined. Implied volatility is designed to capture how expected market risk affects investor decisions. To manage this risk, a hedge portfolio is constructed by writing covered calls. Results show that while implied volatility negatively affects tourism stocks in the long run, its effect in the short run is muted. Conversely, there is evidence that tourism Granger causes implied volatility in the short run. These results suggest that the tourism sector, often at the frontline of geopolitical risks, is a key driver of near-term volatility.

INTRODUCTION

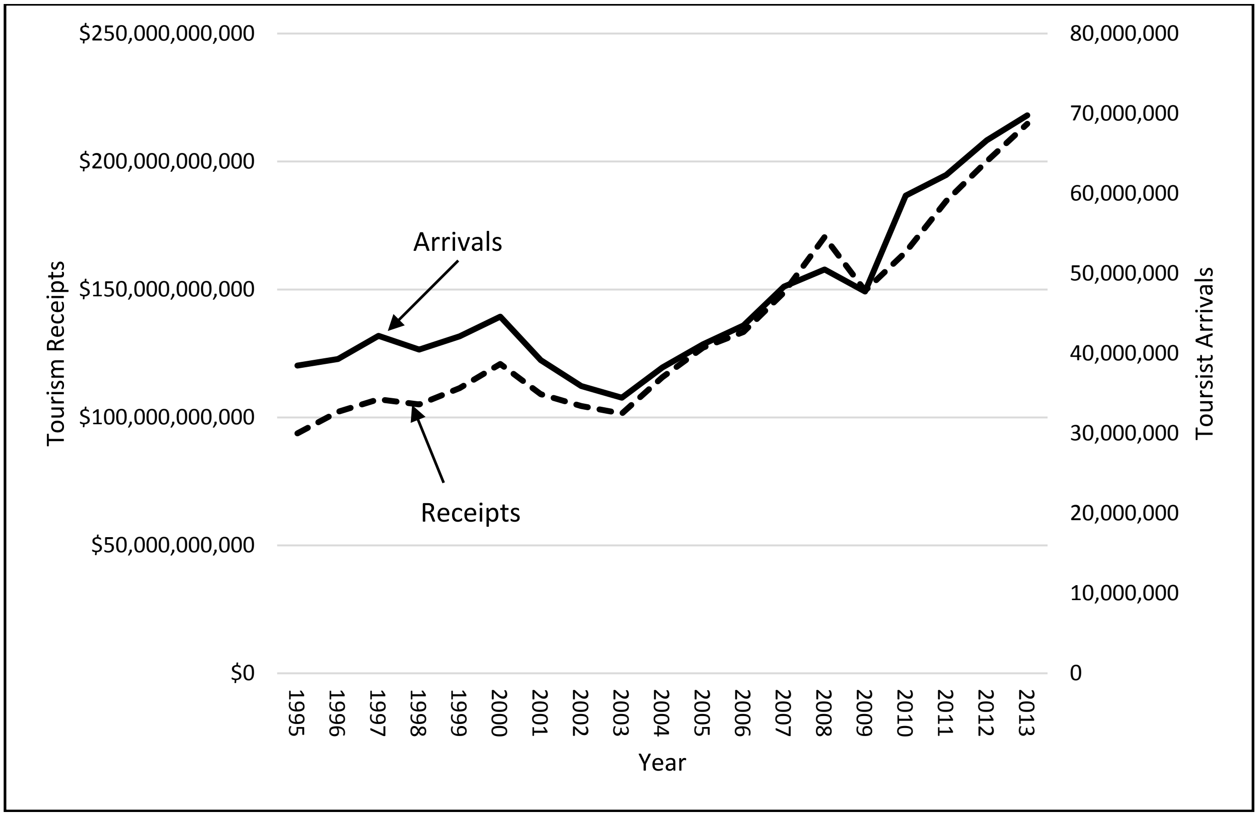
The hospitality industry – with businesses in lodging properties, airlines, restaurants, cruise lines, car rentals, travel agencies, and tour operators – is unique in that its success is strictly grounded on customer care and comfort. In the absence of these attributes, and even when business disruptions are externally induced, it is difficult for these businesses to sustain their operations and thus, create long term value for their investors (Rusu et al, 2014). An instance of the vulnerability of this industry came in the wake of the Ebola outbreak in 2014. There were several media reports on how tourists from various countries cancelled their planned trips to African countries far removed from the epicenter of the outbreak in West Africa.[1]

In the United States, CNBC Online reported on October 1, 2014 – when the first Ebola case was diagnosed in the United States – about growing concerns that foreign tourists might be scared away. On the same day, the U.S. stock market fell by more than a percentage point. Airline and other travel-related stocks were particularly hit hard as their shares tumbled by more than three percentage points. And for good measure, the Chicago Board Options Exchange (CBOE) volatility index – widely considered the investor fear gauge – rose to its highest level since the end of the Great Recession in 2010.

The gravity of the impact of negative news on tourism stocks speaks to the rising economic importance of this industry, which has been growing at a faster pace than the global economy (World Travel & Tourism Council, March 23, 2015). According to the United Nations World Tourism

Organization (UNWTO, 2014), tourism is one of the top five export categories for over 80 percent of countries. It is also the main source of foreign exchange earnings for about four of 10 countries. Worldwide, the UNWTO projects international tourist arrivals to rise by more than three percent per year. The United States remains a top travel destination, with annual tourism receipts exceeding $200 billion. Recent U.S. travel data, summarized in Figure 1, show that both tourist arrivals and receipts doubled over the 10-year period ending in 2013. The UNWTO projects that this figure will continue to rise.

FIGURE 1
U.S. TOURISM DATA 1995-2013



Data source: International tourism receipts from the World Development Indicators (WDI); tourist arrivals from U.S. Office of Travel and Tourism Industries

The economic impact of the tourism industry in the United States and the lodging sector in particular has been particularly impressive. According to the American Hotel and Lodging Association (2013 Lodging Industry Profile), lodging businesses supported about eight million jobs in 2013 and maintained a top ten presence in almost every state in the country. Table 1 shows that in the 10-year period ending in 2013, revenues and pre-tax profits jumped by 55 percent and 220 percent, respectively.

TABLE 1
LODGING INDUSTRY FINANCIAL STATISTICS: 2003-2013

YEAR	Number of Properties	Number of Rooms (millions)	Average Occupancy Rate	Average Room Rate	Revenue per Available Room	Sales (billions)	Pre Tax Profits (Billions)
2013	52,887	4.9	62.2%	$110.35	$68.64	$163.00	$41.0
2012	52,529	4.9	61.4%	$106.15	$65.16	$155.50	$39.0
2011	51,214	4.8	60.0%	$101.70	$61.05	$146.90	$34.1
2010	51,015	4.8	57.6%	$98.07	$56.47	$133.70	$28.2
2009	50,800	4.7	54.7%	$97.85	$53.50	$125.70	$24.5
2008	49,505	4.6	60.4%	$106.84	$64.37	$140.60	$25.8
2007	48,062	4.5	63.1%	$103.87	$65.52	$139.40	$28.0
2006	47,135	4.4	63.3%	$97.78	$61.93	$133.40	$26.6
2005	47,590	4.4	63.1%	$90.88	$57.36	$122.70	$22.6
2004	47,598	4.4	61.3%	$86.24	$52.90	$113.70	$16.7
2003	47,584	4.4	61.1%	$82.52	$50.42	$105.30	$12.8

Source: American Hotel & Lodging Association

These emerging trends have engaged the interest of researchers seeking to understand the broad economic impact of the industry. Towing the path of existing research, this study uses the vector error correction model to examine the short- and long-run dynamics of market risk and equity valuation in the hospitality sector. The rest of the paper is organized as follows: Section 2 presents a summary of the literature. Section 3 describes the sample data and methodology. Empirical results are presented in section 4, followed by conclusions in the final section.

LITERATURE

There are two main aspects of the literature on the economic impact of tourism. One aspect deals with the linkages between tourism and economic growth while the other focuses on the impact of specific risk factors on the industry. The discussions on tourism and growth are also two-pronged. The first includes studies that show evidence of the so-called growth-led tourism. These studies support the argument that economic growth facilitates tourism so that countries with supportive infrastructure are more likely to maximize the economic benefits of tourism. Studies that support this view include Fairbanks (2013), Odhiambo (2011), and Payne and Mervar (2010).

The second set of tourism-growth studies are those that attempt to show the positive impact of tourism on economic development. This view of tourism-led growth is in part supported by the contention that international tourism receipts are a major source of foreign exchange earnings and therefore generate employment and income opportunities. In support of this view, Akinboade and Braimoh (2010) show a unidirectional causality from tourism earnings to real GDP in South Africa. For the East African country of Zambia, Odhiambo (2012) shows evidence of a causal flow from tourism development to economic growth. Similar evidence has also been documented for Latin American countries by Eugenio-Martín, Morales, and Scarpa (2004); Greece, by Dritsakis (2004); Israel, by Krakover and Shaul (2004); and Taiwan, by Kim, Chen, and Jang (2006).

With regard to risk, a number of studies have examined the impact of specific risks on tourism demand. Risk factors include exchange rate, inflation, monetary policy, and political climate. For example, Chen, Liao, and Huang (2010) investigate the effects of changes in monetary policy on hospitality stocks, which include airlines, hotels, restaurants and tourism firms. They find that among the four sectors, hotel and tourism stocks exhibit a higher mean return and reward-to-risk ratio during expansionary monetary periods. Another equity market study is by Gričar and Bojnec (2013) who examine the relationship between inflation and hospitality stocks. They find the two series to be cointegrated, with inflation negatively impacting the valuation of tourism stocks.

Exchange rate is a key risk factor found to particularly impact inbound tourism. The traditional reason, as summarized by McCarthy (2006) and Requena-Silvente and Walker (2007), is that as the value of a currency rises, imports become more expensive, leading to rising costs and reduced tourism demand. Greenwood (2007) has also presented evidence which shows that exchange rate has a direct influence on how much inbound tourists are willing to spend during their visit, spending less when the value of the domestic currency increases.

In a study on the impact of the valuation of the pound sterling on inbound tourism in the UK, Thomas (1986) shows a clear inverse relationship between the two. Similarly, Ruane (2014) finds that the strong U.S. dollar, which intensified in 2014, led to a falloff in Japanese tourists in the U.S. Pacific island of Guam by more than six percent. This translated to an overall economic decline of $37 million. On the other hand, U.S. tourism export revenues grew remarkably between 2002 and 2013. This, according to Brand USA, was largely due to the dollar's weak value during that period. The significance of these findings are reinforced in an important conclusion by Crouch (1993), which show that a 10 percent devaluation in a currency produces an increase in international tourism demand of almost one percentage point. Going forward, the gap which this study purposes to fill – at least in part – is to show how perceived market risk affects equity market valuation in the broad tourism industry.

DATA AND METHODOLOGY

The study examines the short and long run dynamics between expected market risk and stock valuation in the tourism industry. To that end, the relationships between travel and tourism stocks (TT), implied volatility (IV), and a buy-write hedge portfolio (BW) are examined. Implied volatility captures the *expected* risk that options traders have priced into the contract. The hedge portfolio is constructed by selling near-term at-the-money call options on a diversified stock index. Daily data, from December 2004 to March 2012, are obtained for each of the variables and then used in a vector autoregressive (VAR).

Implied volatility is measured by the Chicago Board Options Exchange (CBOE) volatility index, VIX. The buy-write portfolio is the CBOE S&P 500 *BuyWrite* index compiled by *OptionMetrics*. The stock portfolio is the Dow Jones Travel & Tourism Index, which captures movements in the broad hospitality sector. With a focus on the target variable, TT, the following vector autoregressive (VAR) model is specified:

$$TT_t = \lambda_0^1 + \sum_{i=1}^{m} \lambda_{1i}^1 TT_{t-i} + \sum_{i=1}^{n} \lambda_{2i}^1 IV_{t-i} + \sum_{i=1}^{p} \lambda_{3i}^1 BW_{t-i} + \varepsilon_t^1 \tag{1}$$

The innovation or impulse term is defined by ε_t. This *unrestricted* approach in VAR modeling can only allow us to make inferences on the variables' short-run dynamics. To examine their long run relations, the variables must be integrated of the same order so that one can proceed with the vector error correction model (Johansen, 1991). Granger (1988) explains that when variables are cointegrated, causality should exist in at least one direction. Engle and Granger (1987) have shown that a VAR model in levels, with nonstationary variables, may lead to spurious results. They further explain that even when the variables are cointegrated of the same order, a VAR model in first differences is misspecified unless the error-correction term, which represents the long-run relationship between the variables, is reintroduced into the VAR. When this is done, the result is the vector error correction model (VECM), of the form:

$$\Delta TT_t = \delta_0 + \sum_{i=1}^{m} \delta_{1i} \Delta TT_{t-i} + \sum_{i=1}^{m} \delta_{2i} \Delta IV_{t-i} + \sum_{i=1}^{m} \delta_{3i} \Delta BW_{t-i} + \delta_{4i} EC_{t-1}^{1} + \varpi_t \qquad (2)$$

where Δ is the first difference operator, ϖ is a white noise Gaussian error term, and EC_{t-1} is the error correction term derived from Equation (1) in the following manner:

$$EC_{t-1} = \alpha_0 + \alpha_1 TT_{t-j} - \alpha_2 IV_{t-j} - \alpha_3 BW_{t-j} \qquad (3)$$

The coefficient of the error correction term, δ_4, measures the single period response of TT to departures from equilibrium. It is otherwise referred to as the speed of adjustment toward long-run equilibrium. To preserve its economic interpretation, δ_4 must be negative and significant. Otherwise, long-run causality cannot be inferred; only short-run causality can be verified.

RESULTS

Unit root test results, using Phillips-Perron (PP) approach, are summarized in Table 2. Although these results are consistent with those obtained with the Augmented Dickey-Fuller (ADF) method, the low power of the ADF test, pointed out by West (1988), inspires the preference for the PP test. The results show that at their level, the null hypothesis of unit root (nonstationarity) cannot be rejected. The p-values are more than 0.05. After first differencing, however, the series become stationary, confirming the existence of a long run relationship. Both the Final Prediction Error (FPE) and Akaike Information Criterion (AIC) settled on six lags.

TABLE 2
PHILLIPS-PERRON UNIT ROOT TEST RESULT

	Level		1st Difference	
	Adj t-Stat	**P-value**	**Adj t-Stat**	**P-value**
TT	-1.0030	0.7541	-36.4446	0.0000
IV	-2.5555	0.1027	-44.8450	0.0001
BW	-1.6658	0.4485	-42.4096	0.0000

Null hypothesis: Series has unit root (non-stationary)
TT: Dow Jones U.S. Travel & Tourism Index; IV: CBOE implied options volatility; BW: CBOE S&P 500 BuyWrite Index.

Johansen Cointegration Test

The null hypothesis for the Johansen test of cointegration is that the number of cointegrating equations in the model is zero, meaning that there is no long-run relationship among the variables. As Table 3 shows, both the Trace test and the Maximum Eigenvalue test reject this null hypothesis at the 0.05 level. The results indicate that there is at least one cointegrating equation (that is, at least one error correction term) in the system equation. Cointegration tests include an intercept term but no deterministic trend in the cointegrating equation.

TABLE 3
JOHANSEN COINTEGRATION TEST

Unrestricted Cointegration Rank Test (Trace) +

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	P-value*
None *	0.0183	35.1731	29.7971	0.0109
At most 1	0.0070	10.7529	15.4947	0.2272
At most 2	0.0011	1.4910	3.8415	0.2221

Unrestricted Cointegration Rank Test (Maximum Eigenvalue) ++

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	P-value*
None *	0.0183	24.4203	21.1316	0.0166
At most 1	0.0070	9.2618	14.2646	0.2650
At most 2	0.0011	1.4910	3.8415	0.2221

+ Trace test indicates 1 cointegrating equation at the 0.05 level
++ Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level
+++ denotes rejection of the hypothesis at the 0.05 level
*MacKinnon-Haug-Michelis (1999) p-values

The normalized cointegrating coefficients and their standard errors (in parentheses) are presented in Table 4. These are estimated in a long run model in which each variable is defined as a dependent variable. With the transportation and tourism index (TT) as dependent variable (first panel of Table 4), it is found that in the long-run, implied volatility (IV) Granger causes tourism stocks. Expectedly, the direction of impact is negative and statistically significant. In effect, the expectation of bad news tends to have a long run negative impact on the performance of tourism and transportation stocks. Also, the long run impact of the hedge portfolio on TT is negative. However this is not significant.

The middle panel of Table 4 is the case where implied volatility (IV) is the target variable. Although there appears to be a reverse negative causality from TT to IV, none of the variables in the system has a significant long run impact on IV. The bottom panel is the case where BW is the dependent variable. While there is no evidence of long run causality running from TT to BW, there is a positive one-way long run causality from IV to BW. This outcome is consistent with option pricing theory in that expected volatility has a positive impact in the valuation of options. Thus, the expectation of rising market risk motivates a risk management position using a hedge portfolio.

TABLE 4
NORMALIZED COINTEGRATION COEFFICIENTS

TT	**IV**	**BW**
1.0000	-23.1639 *	-0.1615
	(5.5803)	(0.8713)
IV	**TT**	**BW**
1.0000	-0.0432	0.0070
	(0.1513	(0.0492)
BW	**TT**	**IV**
1.0000	-6.1919	143.4281 *
	(17.2837)	(36.0068)

* Significant at the 0.05 level (standard errors in parentheses)
TT: Dow Jones U.S. Travel & Tourism Index; IV: CBOE implied volatility; BW: CBOE S&P 500 BuyWrite Index.

Vector Error Correction

Using the system equation within the VECM, we can verify the statistical significance of the system coefficients and obtain the residuals of each model. Table 5 shows the long run causality results when two of the three variables are jointly considered as explanatory variables.

TABLE 5
VECTOR ERROR CORRECTION ESTIMATES – LONG-RUN CAUSALITY

Response Variable	Coefficient	Std. Error	t-statistic	P-value
TT	-0.0001	0.0002	-0.6720	0.5017
IV	0.0005*	0.0002	2.4385	0.0149
BW	0.0003	0.0007	0.3885	0.6977

* Significant at the 0.05 level
TT: Dow Jones U.S. Travel & Tourism Index; IV: CBOE implied options volatility; BW: CBOE S&P 500 BuyWrite Index.

The VEC estimates provide us with two pieces of important information. First, the value of the coefficient, called the speed of adjustment, tells us how quickly it takes for equilibrium to be restored when there has been a departure from it. Second, the economic interpretation of this coefficient requires it to be both negative and statistically significant. As can be seen in Table 5, none of the coefficients satisfy these criteria. Either the sign is negative but not significant or it is positive and in one case, significant. Therefore, there is no evidence of a long run causality running from two of the variables, jointly, to the third.

From the system equations, we can also verify the existence of short run Granger causality among the variables. The joint test of significance is carried out using Wald statistics. The results are summarized for each variable in Table 6. Results in Panel A show no evidence of short run causality from any of the variables to the tourism index. On the other hand, Panel B reveals that in the short run, and rather surprisingly, TT Granger causes implied volatility.

TABLE 6
SHORT-RUN CAUSALITY (WALD TEST)

Panel A. Target Variable: TT	**Chi-square**	**P-value**
TT	14.2137 *	0.0273
IV	7.7241	0.2590
BW	4.2085	0.6485
Panel B. Target Variable: IV		
TT	22.2777 *	0.0011
IV	44.8561 *	0.0000
BW	6.3364	0.3866
Panel C. Target Variable: BW		
TT	23.7571 *	0.0006
IV	15.2556 *	0.0184
BW	8.4757	0.2053

* Significant at the 0.05 level
TT: Dow Jones U.S. Travel & Tourism Index; IV: CBOE implied options volatility; BW: CBOE S&P 500 BuyWrite Index.

The causality results in Panel C show that both the tourism and volatility variables impact the hedge portfolio. This short run impact is insightful because in its design, a covered call hedge can mitigate the downside risk in the stock portfolio. By its construct, however, such a strategy outperforms the underlying portfolio in a bear market but underperforms it in a bull market. In either of these cases, significant moves in the tourism sector should impact the outcome of this hedge position. And as a hedge portfolio, a buy-write position should naturally respond to market volatility, not only because volatility is a key component in option valuation but also, because hedge portfolios are designed to soften the adverse impact of systematic risk.

CONCLUSIONS

This study examined the relationship between tourism stocks, volatility, and a hedge position. The inquiry sought to determine if expected volatility and a hedging position have an impact on the valuation of tourism stocks. Cointegration tests show that in the long run, implied volatility Granger causes travel and tourism stocks; and it does so in a negative way. This outcome suggests that the negative impact of expected volatility on tourism stocks has a long memory. Evidence of this was observed after the 9-11 attacks and the 2008 financial crisis. Following each of these events, tourism receipts and arrivals in the United States fell drastically and the sectoral weakness lasted for several years.

The empirical analysis produced no evidence that investor hedging practices affect the performance of tourism stocks either in the short or long run. Expectedly, implied volatility has a significant positive impact on the hedge portfolio. This outcome is intuitive since the fear of a financial loss is a strong motivator to hedge. When all the variables are considered in concert, there is no evidence of long run causality from any of the two variables to the third.

In the short run, neither implied volatility nor the hedge portfolio Granger causes tourism stocks. However, and rather interestingly, the tourism portfolio Granger causes implied volatility as well as the hedge portfolio. These latter results reveal a curious characteristic about the tourism industry. It tends to be more acutely distressed in crisis times than other sectors of the market. For example, on account of the Ebola news on October 9, 2014, the U.S. stock market dropped by two percentage points. Correspondingly, tourism stocks declined by almost three percent and the CBOE volatility index rose to a multi-year high. These empirical outcomes suggest that in the near term, the performance of the tourism industry tends to influence investor risk perception and therefore, the decision to hedge. It also means that investments in this industry require a long gestation period, especially, during extreme market shocks.

ENDNOTES

1. See for example: "Confusion, Fear of Ebola Keep Tourists Out of Africa," Bloomberg, August 29, 2014 (accessed October 4, 2014), http://www.bloomberg.com/news/2014-08-28/country-confusion-keeps-ebola-fearing-tourists-away-from-africa.html; "Ebola Virus Outbreak Threatens Africa's Tourist Industry," The Wall Street Journal, August 19, 2014 (Accessed October 4, 2014) http://online.wsj.com/articles/ebola-virus-outbreak-threatens-africas-tourist-industry-1408462301; "Ebola fears slowing tourist flow to Africa," Reuters, August 20, 2014 (Accessed October 4, 2014) www.reuters.com/article/2014/08/20/us-health-ebola-africatourism-idUSKBN0GK1GG20140820.

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