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Research note

On the volatilities of tourism stocks and oil

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Introduction

Tourism is an oil intensive sector. The dependence of tourism on oil is largely due to its inherent transport component. Tourists move between places of origin and destinations using services which are frequently provided by tourism-related companies, and decisions about buying tourism services may, in part, be driven by oil price fluctuations, with longer journeys being less attractive in periods of large fluctuation. Consequently, we might state that tourism and its related support industries rely heavily on road and air transport, where oil is used as a fuel, or have oil expenses included directly among the costs, for example in the cruise segment. Other tourism activities such as scenic flights, jet boating and boat cruises (Becken & Simmons, 2002) are particularly vulnerable due to their dependence on fossil fuel (Becken & Lennox, 2012).

Despite the importance of oil, models that forecast tourism revenues or tourism-related stock performances rarely consider the impact of variations in oil prices. Changes in oil price can harm tourism activities due to the effect of oil prices on disposable income, production costs, transportation and economic uncertainty. Therefore, regardless of the possibility of moving away from oil-based transport, higher oil prices make tourism more expensive and negatively affect global tourism demand (Yeoman et al., 2007). Additionally, a rise in airfares causes tourists to choose closer destinations (Gillen, 2004). Overall, several authors suggest that higher oil prices negatively impact the tourism sector; see Becken (2011), Becken and Lennox (2012) and Yeoman et al. (2007), among others. Oil price movements are expected to have an immediate and negative impact on tourism, mainly because tourism is regarded as a luxury good (Dritsakis, 2004; Lim, Min, & McAleer, 2008; Nicolau, 2008).

Notably, financial market participants are exposed to the volatility of their investments, and this volatility plays an important role in portfolio formulation, risk management and hedging decisions, particularly derivative and option pricing. The equity prices of tourism-related companies are not an exception. Focusing on the crude oil market, worldwide volatility is increasing, and knowing whether this impacts the future volatility of tourism stocks might be of relevance to investors, particularly if oil volatility could help predict tourism stock volatility. For oil market risk, we focus on the implied oil volatility index (OVX), one of the most followed indicators in the energy market. This choice is based on the fact that this indicator is a forward-looking measure and thus contains information on investors' expectations of future market changes, a relevant factor in predictive analysis. For tourism stocks, we use risk measures based on high frequency data from the US market.

To the best of our knowledge, this is the first study of the ability of oil market volatility to predict the future volatility of tourism equity prices. Our empirical evidence shows that crude oil volatility predicts the volatility of tourism firms, mainly in the short-run. Our results help in understanding the economic sources of changes in tourism stock volatility and thus help tourism organizations,

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policy makers and investors make decisions in periods of higher uncertainty.

Method

To examine the impact of oil volatility on the volatility of tourism related stock price returns, we use the heterogeneous autoregression (HAR) model proposed by Corsi (2009) within a panel setting, as do Patton and Sheppard (2015). The standard HAR is given by:

$$\bar{y}_{h,t+h} = \mu + \phi_d y_t + \phi_w\left(\frac{1}{4}\sum_{i=1}^{4} y_{t-i}\right) + \phi_m\left(\frac{1}{17}\sum_{i=5}^{21} y_{t-i}\right) + \epsilon_{t+h} \quad (1)$$

where y_t is the daily realized volatility of firm price returns related to the tourism industry for day t, and $\bar{y}_{h,t+h} = \frac{1}{h}\sum_{i}^{h} y_{t+i}$ is the h-day average volatility. We use $\bar{y}_{w,t}$ to denote the average value over lags 2 to 5 ($\frac{1}{4}\sum_{i=1}^{4} y_{t-i}$) and $\bar{y}_{m,t}$ indicates the mean value between 6 and 22 days lag ($\frac{1}{17}\sum_{i=5}^{21} y_{t-i}$). To check the predictive performance of oil volatility on the volatility of tourism firms' stocks, we estimate the model with and without oil volatility (OVX) for horizons ranging from $h = 1$ to 22 days, roughly one month.[1]

Data and findings

We use high-frequency 5-min interval transaction prices of 105 tourism related stocks that were continuously part of the Russel 3000 index between October 5, 2007 and June 29, 2018.[2] The stock price data come from Kibot.com and include regular market trading sessions, i.e. between 9:30:00 and 16:00:00 (inclusive). The Chicago Board of Trade crude oil volatility index (OVX) measures market expectation of the 30-day volatility of crude oil prices.

We calculate the realized variance (RV), the bi-power variation (BV), the realized semivariance estimators, signed jumps and positive and negative jump variation of tourism equity returns.

The results shown in Table 1 show high volatility persistence in tourism industry stocks, as $\phi_d + \phi_w + \phi_m$ is close to 1. The basic HAR estimations with OVX indicate that oil volatility has a significant positive impact on the 1 and 5 day ahead cumulative volatility of tourism stocks. The explanatory power, as shown through the R-square values, of the models increases with the increase in the forecast horizon h and with the inclusion of oil volatility in the models.

Panel (b) of Table 1 shows the results for HAR where RV is decomposed into positive and negative semivariance (good and bad volatility respectively). Notably, bad volatility (negative semivariance) has a larger impact than good volatility (positive semivariance). This finding is a possible indication of the contagion effect, because the future volatility of the tourism industry increases more in response to bad news.

Finally, we use a simple approach to isolate the information from the signed jump variation, $\Delta J_t^2 \equiv RS_t^{+} - RS_t^{-}$. The results of signed jump models, with and without OVX, are shown in Table 2a. The effect of the signed jump variation, ΔJ_t^2, is uniformly positive and significant, showing that days dominated by positive (negative) jumps lead to higher (lower) future volatility. We note that the effect of both signed jump components is opposite, and for $h = 22$ (the longest horizon), the coefficients are equal in magnitude but opposite in sign.

For shorter horizons ($h = 1$ and $h = 5$), the negative (positive) jump component has a negative (positive) effect, implying that the future volatility increases more following a positive jump than it decreases following a negative jump.[3] This finding might be due to the cyclical nature of the tourism sector and its inherent seasonal component.[4] The tourism sector might draw huge profits during economic booms but at the same time, uncertainty about future performance also rises, implying higher risk for higher returns. This might be an indication of short-term mispricing and speculative gains. However, we posit that improving the quality of volatility forecasts helps accurate pricing and aids tourism planning.

We find oil volatility to be an important factor in analyzing the short-run financial performance of tourism related firms. Tourism firm managers and investors can hedge their short-run exposure to oil risk by taking a long position in oil volatility futures. However, the net payoff of such risk hedging strategies depends on the cost involved in maintaining a dynamic hedge position and thus requires attention. We leave the question of dynamic hedging of tourism stock volatility using oil futures to future research.

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[1] See Patton and Sheppard (2015) for details of the weight estimation and for the asymptotic distribution of the estimator that allows performing inference on the estimated parameters.

[2] The firms belong to the Travel & Leisure sector as classified by the Industry Classification Benchmark (ICB) developed by Dow Jones and FTSE, the most widely used global standard for company classification.

[3] To establish a statistically significant difference between the effects of signed jump components, we test the null $H_0: \varphi^{J+} = \varphi^{J-}$ and reject it for 1 day horizon.

[4] We examine the robustness of our results through a pseudo out-of-sample forecasting exercise, as in Patton and Sheppard (2015). The results are available on request and confirm our in-sample conclusions.

Table 1
HAR estimation results - estimation results for a panel of 105 tourism stocks, cumulative volatility.

$$\overline{RV}_{h,t+h} = \mu + \phi_d RV_t + \phi_d^+ RS_t^+ + \phi_d^- RS_t^- + \gamma RV_t I_{[r_t < 0]} + \phi_{OVX} OVX_t + \gamma_{OVX} OVX_t I_{[r_t < 0]} + \phi_w \overline{RV}_{w,t} + \phi_m \overline{RV}_{m,t} + \epsilon_{t+h}$$

	a). Basic HAR						b). HAR with decomposed RV					
	HAR-RV			HAR-RV-OVX			HAR-S-RV			HAR-S-RV-OVX		
	$h = 1$	$h = 5$	$h = 22$	$h = 1$	$h = 5$	$h = 22$	$h = 1$	$h = 5$	$h = 22$	$h = 1$	$h = 5$	$h = 22$
ϕ_d	0.546	0.362	0.234	0.545	0.360	0.233						
	(44.5)	(32.2)	(17.6)	(44.7)	(32.3)	(17.7)						
ϕ_d^+							0.477	0.277	0.155	0.472	0.274	0.152
							(27.0)	(30.0)	(13.1)	(26.5)	(28.6)	(13.1)
ϕ_d^-							0.565	0.404	0.280	0.561	0.401	0.278
							(37.0)	(21.1)	(13.4)	(37.4)	(21.2)	(13.6)
γ							0.049	0.043	0.035	0.056	0.045	0.037
							(4.9)	(5.6)	(4.6)	(4.9)	(5.1)	(3.7)
ϕ_{OVX}				0.035	0.050	0.052				0.037	0.050	0.052
				(4.2)	(2.8)	(1.5)				(4.3)	(2.9)	(1.5)
γ_{OVX}										−0.006	−0.002	−0.003
										(−1.4)	(−0.5)	(−0.6)
ϕ_w	0.269	0.331	0.284	0.267	0.328	0.281	0.270	0.333	0.285	0.269	0.330	0.283
	(30.6)	(27.7)	(13.7)	(30.2)	(27.3)	(13.6)	(31.3)	(27.9)	(13.7)	(30.9)	(27.5)	(13.6)
ϕ_m	0.123	0.187	0.293	0.120	0.182	0.287	0.124	0.187	0.293	0.120	0.182	0.288
	(16.7)	(13.7)	(13.3)	(15.9)	(13.3)	(13.5)	(16.9)	(13.7)	(13.3)	(16.0)	(13.4)	(13.5)
R^2	0.268	0.464	0.407	0.284	0.491	0.443	0.270	0.475	0.478	0.299	0.498	0.480

Notes: The h stands for the forecast horizon. The first model (HAR-RV) is the reference model which uses only realized variance. The second model (HAR-S-RV) is the extended version of the basic HAR model where realized variance is decomposed into its negative and positive realized semi-variances, and this specification includes an asymmetric term. In all cases, the last row shows the average value of R^2s for 105 individual firms. The t-statistics (robust) are in parentheses.

Table 2
Extended HAR estimation results - impact of signed jump variations future volatility for a panel of 105 tourism stocks, cumulative volatility.

$$\overline{RM}_{h,t+h} = \mu + \phi_J J_t^2 + \phi_{J^+} J_t^{2+} + \phi_{J^-} J_t^{2-} + \phi_C BV_t + \gamma RV_t I_{[r_t < 0]} + \phi_{OVX} OVX_t + \gamma_{OVX} OVX_t I_{[r_t < 0]} + \phi_w \overline{RV}_{w,t} + \phi_m \overline{RV}_{m,t} + \epsilon_{t+h}$$

	a). HAR with jump variations						b). HAR with signed jump variations					
	HAR-CJ			HAR-CJ-OVX			HAR-S-CJ			HAR-S-CJ-OVX		
	$h = 1$	$h = 5$	$h = 22$	$h = 1$	$h = 5$	$h = 22$	$h = 1$	$h = 5$	$h = 22$	$h = 1$	$h = 5$	$h = 22$
ϕ_J	0.164	0.076	0.028	0.144	0.063	0.019						
	(11.0)	(7.7)	(2.6)	(9.7)	(6.2)	(1.7)						
ϕ_{J^+}							0.635	0.353	0.213	0.586	0.321	0.192
							(31.5)	(25.6)	(10.3)	(29.0)	(24.4)	(9.9)
ϕ_{J^-}							−0.475	−0.310	−0.233	−0.444	−0.289	−0.220
							(−21.2)	(−13.7)	(−7.7)	(−19.8)	(−13.2)	(−7.4)
ϕ_C	0.034	0.035	0.029	0.032	0.033	0.027	0.029	0.031	0.025	0.028	0.030	0.024
	(10.4)	(5.9)	(4.8)	(9.8)	(5.7)	(4.6)	(9.1)	(5.4)	(4.4)	(8.8)	(5.3)	(4.3)
γ	0.276	0.194	0.133	0.358	0.245	0.166	0.209	0.151	0.103	0.276	0.193	0.129
	(22.2)	(18.1)	(11.6)	(25.7)	(20.4)	(11.8)	(16.3)	(15.4)	(10.9)	(18.9)	(17.6)	(11.3)
ϕ_{OVX}				0.084	0.083	0.076				0.073	0.076	0.070
				(8.8)	(4.4)	(2.1)				(7.8)	(4.0)	(2.0)
γ_{OVX}				−0.092	−0.063	−0.046				−0.070	−0.048	
				(−19.7)	(−11.7)	(−7.7)				(−14.9)	(−9.5)	
ϕ_w	0.483	0.477	0.370	0.461	0.461	0.359	0.437	0.448	0.352	0.423	0.437	0.344
	(57.6)	(32.2)	(15.3)	(55.6)	(32.4)	(15.3)	(53.5)	(32.3)	(15.6)	(52.1)	(32.4)	(15.7)
ϕ_m	0.186	0.225	0.322	0.176	0.216	0.313	0.174	0.219	0.317	0.166	0.210	0.309
	(24.5)	(15.9)	(14.2)	(22.6)	(15.3)	(14.4)	(23.4)	(15.6)	(14.2)	(21.7)	(15.1)	(14.4)
R^2	0.260	0.410	0.473	0.285	0.422	0.479	0.265	0.414	0.475	0.269	0.416	0.476

Notes: The h stands for the forecast horizon. HAR-CJ model includes signed jump information where quadratic variation has been decomposed into signed jump variation, ΔJ^2, and its continuous component using bipower variation, BV. HAR-S-CJ mode includes ΔJ_t^{2+} and ΔJ_t^{2-} obtained by decomposing ΔJ^2 using an indicator variable for the sign of the difference where $\Delta J_t^{2+} = \Delta J^2 I_{[RS_t^+ - RS_t^- > 0]}$. In all cases, the last row shows the average value of R^2s for 105 individual firms. The t-statistics (robust) are in parentheses.

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