Editorial: Tourism forecasting competition in the time of COVID-19

A R T I C L E I N F O

Background

The ongoing COVID-19 pandemic has had a profound effect on the tourism industry. When the tourist market will recover remains unknown. Accurate forecasting of the full scale of the impact on the tourism industry and market recovery is critical for strategic planning by tourist destinations and tourism-related businesses. Against this background, the Curated Collection of *Annals of Tourism Research* on Tourism Forecasting called for a tourism forecasting competition in July 2020. Nineteen tourism researchers from around the world expressed interest and formed three competing teams: Asia and Pacific, Europe, and Africa. Their reports on the forecasting results are included in this special collection. This editorial summarizes the aims, rules, and preliminary results of the competition.

It should be noted that there had only been one organized tourism forecasting competition before the present call (Athanasopoulos et al., 2011). Only two teams participated in that competition, one of which focused on econometric methods and the other on time series forecasting. No forecasting competition had focused on tourism recovery from a global crisis. The present competition thus filled a gap in the tourism forecasting literature.

Aims and rules of the competition

The competition had two main aims: (1) to advance the methodology of tourism forecasting and contribute to the development of this field of research; and (2) to inform the tourism industry and destination management and marketing organizations about good forecasting practice and the predicted impact of the COVID-19 pandemic on tourism.

There were two stages of forecasting in relation to these two purposes.

Stage 1: *ex post* forecasting of tourism demand before COVID-19. Based on data up to the end of 2018, each participating team predicted tourism demand in 20 given destinations across all regions throughout 2019. The purpose of Stage 1 forecasting was to identify the most accurate forecasting method(s) in "normal" times.

Stage 2: *ex ante* forecasting of tourism demand during and after COVID-19. Based on the latest available data, each team predicted tourism demand in the 20 destinations to the end of 2021. The purpose of Stage 2 forecasting was to identify the most accurate forecasting method(s) and procedures in a crisis situation.

Tourism demand was measured by quarterly visitor or tourist arrivals (or hotel nights where arrivals data were not available). For each destination, total tourism demand and the demand from five key source markets (120 series in total) were forecast.

The competition rules were as follows. (1) The competition focused on point forecasts only. The mean absolute scaled error (MASE) proposed by Hyndman and Koehler (2006) was used as the forecast error measure for this competition. A weighting scheme of 40%:60% was applied to the results of the Stage 1 and Stage 2 forecasting, respectively. (2) For Stage 1 *ex post* forecasting prior to COVID-19, any forecasting methods were permitted. Rolling forecasts of one, two, three, and four quarters ahead for 2019 were produced. The best performing model had to be used to produce baseline forecasts (2020Q1–2021Q4) for Stage 2 forecasting. (3) For Stage 2 *ex ante* forecasting during and after COVID-19, the teams had to set up a baseline model and three scenarios. Any models and techniques were allowed for scenario forecasting. The evaluation was based on the most accurate set of scenario forecasts among the three over the forecasting period of Quarter 1 to Quarter 4, 2021 and the results of the ex ante forecasts will be announced at the 8th Conference of the International Association for Tourism Economics to be held in Perpignan, France in 2022.

Comments on the competition results

Compared with the first tourism forecasting competition a decade ago, a larger number, more diversified, and more advanced forecasting methods were presented in the current competition. In the first competition, only five non-causal time-series forecasting methods and three types of causal econometric models were included; in the present competition, in addition to the above time-series and econometric models, all three teams included artificial intelligence methods, such as neural network, random forest, support vector machine, extreme learning machine, and multilayer perceptron methods. Furthermore, the Europe team included some hybrid models that integrated the merits of time-series and artificial intelligence methods, and they also implemented combination forecasting; the Africa team used hierarchical forecasting considering both cross-sectional and temporal aggregations; the Asia and Pacific team introduced a combination-based stacking method. Table 1 summarizes the best *ex post* forecasting performance presented by each team, using the data of 2019Q1-Q4 for forecast accuracy evaluation.

Among the wide range of forecasting methods used for Stage 1 forecasting, the stacking model based on five time-series methods from the Asia and Pacific team provided the most accurate *ex post* forecasts overall, so the Asia and Pacific team won the Stage 1 competition. Compared with the benchmark seasonal naïve model, the stacking model of the Asia and Pacific team was approximately 22% more accurate overall based on MASE values across all forecasting horizons and all origin–destination pairs. The performance of the stacking model was especially superior to the other best-performing models from the other teams in one-quarter-ahead forecasting, and the performance among the three best methods tended to converge as the forecasting horizon extended further, as shown in Table 1. Overall, the results of this forecasting competition show that more advanced hybrid models and combination methods tend to outperform traditional single time-series models.

For Stage 2 *ex ante* forecasts of tourism recovery in 2021, each of the competing teams presented some innovative ideas on scenario forecasting and judgmental adjustments for tourism forecasting amid a crisis. For example, the Europe team introduced a COVID-19 Risk Exposure index to assist scenario forecasting. The three teams presented slightly different paces of tourism recovery in 2021 among the 20 destinations compared to the level in 2019. For example, under the most likely (medium) scenario, the Africa team forecast an average recovery rate of 58%, whereas the Asia Pacific team predicted a less optimistic picture with recovery rates between 29% and 45%; the Europe team predicted the widest range of recovery rates, from 36% to 77%.

Although Stage 2 forecast accuracy has yet to be evaluated and the overall winner of this competition is undetermined, all participating teams have made valuable contributions to the tourism forecasting literature and practice by recommending innovative frameworks for tourism forecasting amid a crisis.

Table 1
Best *ex post* forecasting performance from each team (2019Q1–Q4).

Team	Best-performing method	Relative MASE against seasonal naïve model				
		1-Step ahead	2-Step ahead	3-Step ahead	4-Step ahead	Overall
Asia and Pacific	Stacking of 5 time-series models	0.668	0.722	0.835	0.760	0.784
Europe	Combination of 4 time-series models	0.791	0.917	0.984	0.969	0.915
Africa	ARIMA model with temporal hierarchy	0.810	0.896	0.992	1.006	0.929

References

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