PECC International Virtual Seminar:
"Connectivity and Tourism Recovery from Covid-19"

FORECASTING TOURISM FLOWS POST-COVID IN ASIA-PACIFIC

May 30, 2021

Vincent DROPSY & Sylvain PETIT

Professor & Associate Professor of Economics

University of French Polynesia

1

Forecasting Tourism Flows

- Quantitative and qualitative approaches

  "No model can universally outperform all others in terms of forecasting accuracy."

  - Song, Qiu, and Park (2019, p. 355)

- Large scale tourism demand forecasts
  - *Asia Pacific Visitor Forecasts* by PATA (1400+ O-D pairs)
  - *Tourism Towards 2030 – Global overview* by UNWTO (220 flows)
  - *Tourism, insularity, and remoteness: A gravity-based approach* by Vincent Dropsy, Christian Montet, and Bernard Poirine, Tourism Economics, 2020, vol 26(3), 792-808 (O-D pairs between 32 small islands and 142 other countries = 7000+ observations)

Song, H., Qiu, R.T.R., & Park, J. (2019). A review of research on tourism demand forecasting: Launching the *Annals of Tourism Research* Curated Collection on tourism demand forecasting. *Annals of Tourism Research*, 75, 338-362. DOI: 10.1016/j.annals.2018.12.001.

Contents lists available at ScienceDirect

Annals of Tourism Research

journal homepage: https://www.journals.elsevier.com/annals-of-tourism-research

ELSEVIER

Visitor arrivals forecasts amid COVID-19: A perspective from the Asia and Pacific team

Richard T.R. Qiu [a,*], Doris Chenguang Wu [b,*], Vincent Dropsy [c], Sylvain Petit [c,d,e], Stephen Pratt [f], Yasuo Ohe [g]

Visitor arrivals forecasts amid COVID-19: A perspective from the Africa team

Nikolaos Kourentzes [a], Andrea Saayman [b,*], Philippe Jean-Pierre [c], Davide Provenzano [d], Mondher Sahli [e], Neelu Seetaram [f], Serena Volo [g]

Visitor arrivals forecasts amid COVID-19: A perspective from the Europe team☆

Anyu Liu [a], Laura Vici [b], Vicente Ramos [c], Sauveur Giannoni [d], Adam Blake [e,*]

3

Richard T. R. Qiu is an Assistant Professor in Integrated Resort and Tourism Management at in the Faculty of Business Administration of the University of Macau, Macao, China.

Doris Chenguang Wu is a professor of tourism forecasting in the Business School at the Sun Yat-sen University, China.

Vincent Dropsy is a professor of economics at the University of French Polynesia, and the co-director of the Center for Research on Tourism in Oceania Pacific (CETOP) within the Governance and Insular Development (GDI) research center.

Sylvain Petit is an associate professor in economics at the Polytechnic University of Hauts de France and is a visiting professor and head of the Law, Economics and Management Department at the University of French Polynesia.

Stephen Pratt is a professor and Head of School of Tourism & Hospitality Management at the University of the South Pacific, Fiji.


Yasuo Ohe is a professor at the Department of Agribusiness Management, Faculty of International Agriculture and Food Studies, Tokyo University of Agriculture, Japan.

4

Tourism Forecasting in the Time of COVID-19

- Organisation of the competition (forecasting deadline : October 15, 2020)
  - Organisers: Haiyan Song and Gang Li (Professors of Tourism, The Hong Kong Polytechnic University & University of Surrey)
  - Participants: 3 regional teams (Asia and Pacific, Europe, and Africa)
- Scope of the competition : 2 forecasting stages for 2 purposes
  - <u>First stage— "ex post" forecasting of tourist arrivals before COVID-19</u>
    - Based on data up to the end of 2018
    - Ex post prediction of tourist arrivals in the 20 destinations across all regions throughout 2019
    - Identification of the most accurate forecasting method(s) in "normal" times
  - <u>Second stage—"ex ante" forecasting of tourist arrivals during and after COVID-19</u>
    - Based on the latest available data (2019-2020…)
    - Ex ante forecast of tourist arrivals in the 20 destinations up to the end of 2021
    - Identification of the most accurate forecasting method(s) and procedures in a crisis situation
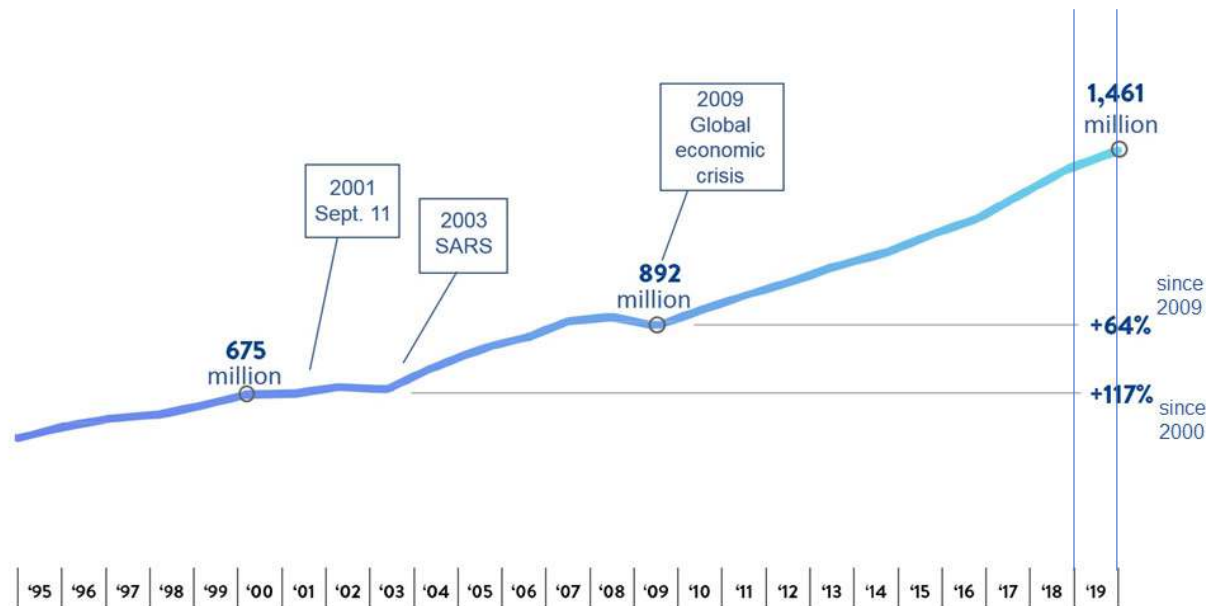
Tourism Forecasting in the Time of COVID-19
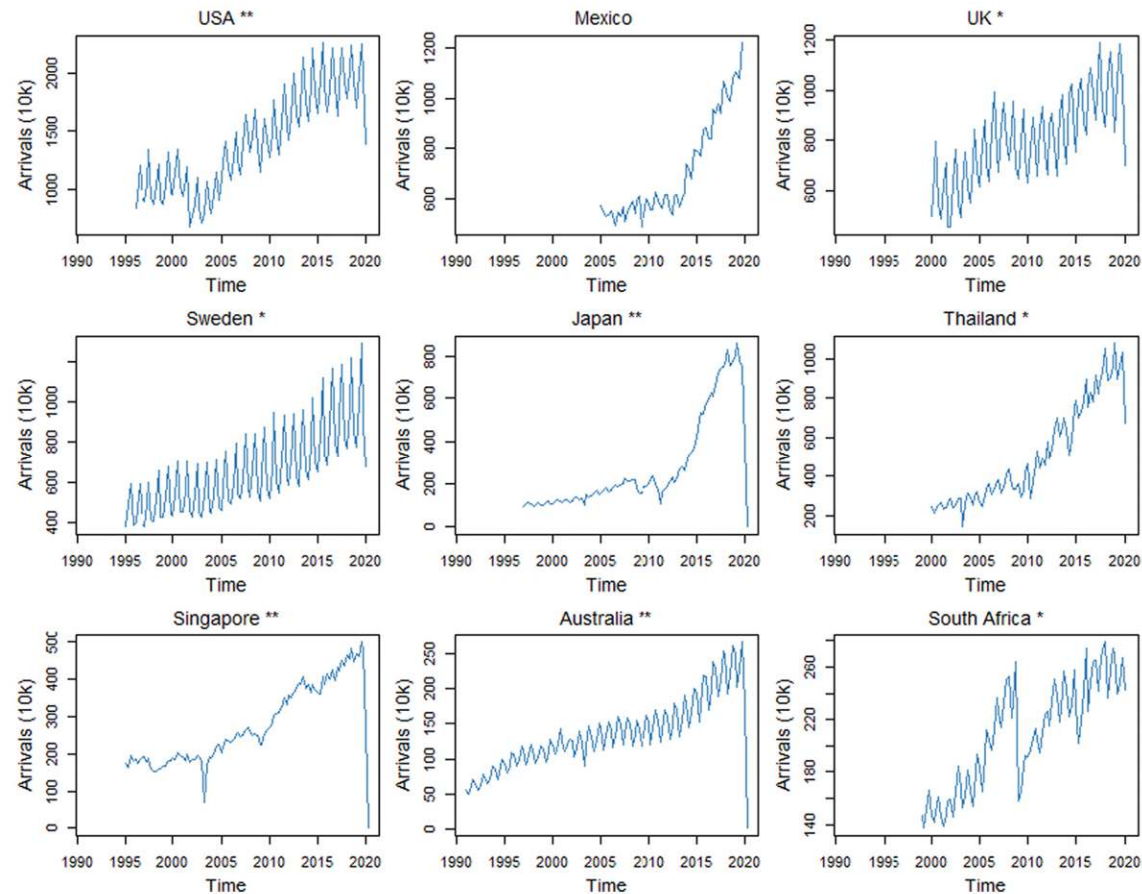
"Tourist Visitor Arrival Forecast amid COVID-19: A Perspective from the Africa team", with Nikolaos Kourentzes, Andrea Saayman, Philippe Jean-Pierre, Davide Provenzano, Neelu Seetaram, Serena Volo, *Annals of Tourism Research*, 88:103-197. (2021). doi.org/10.1016/j.annals.2021.103197

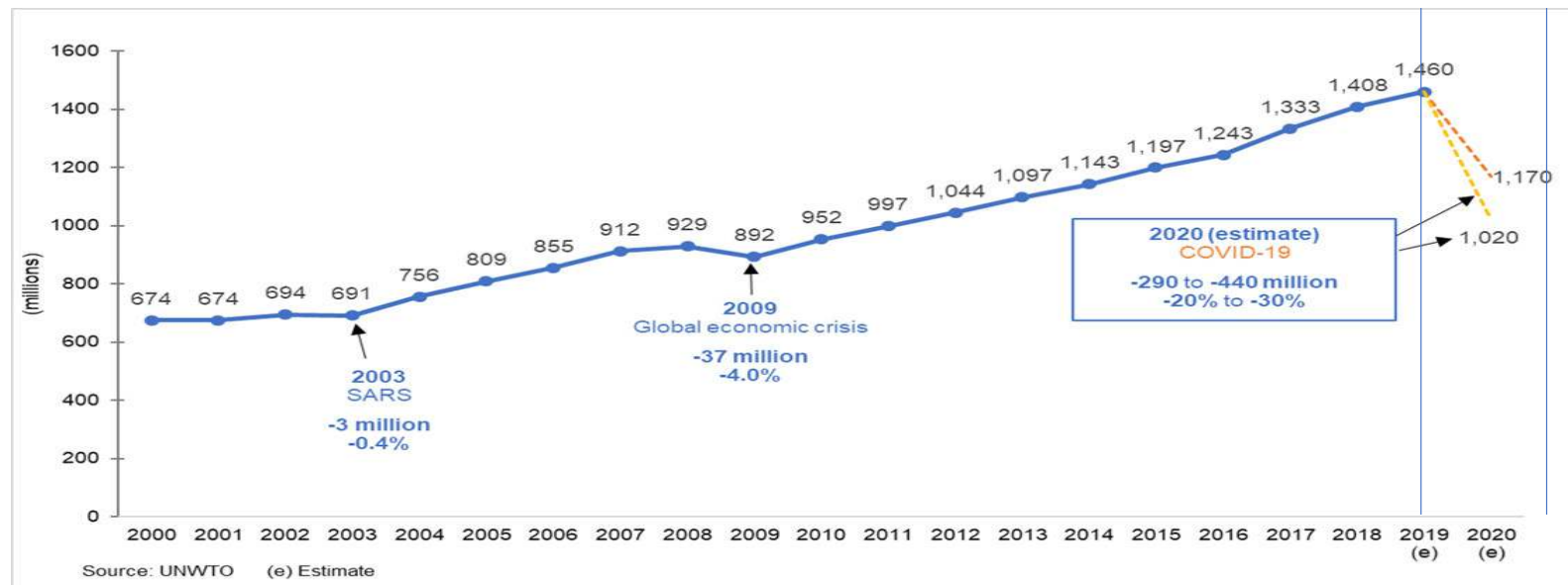# Tourism Forecasting in the Time of COVID-19

- First stage— "ex post" forecasting of tourist arrivals before COVID-19
  - Based on data up to the end of 2018 => **ex post prediction throughout 2019**
  - Identification of the most accurate forecasting method(s) in "normal" times

UNWTO, Impact assessment of the COVID-19 outbreak on international tourism (2020-03-27)
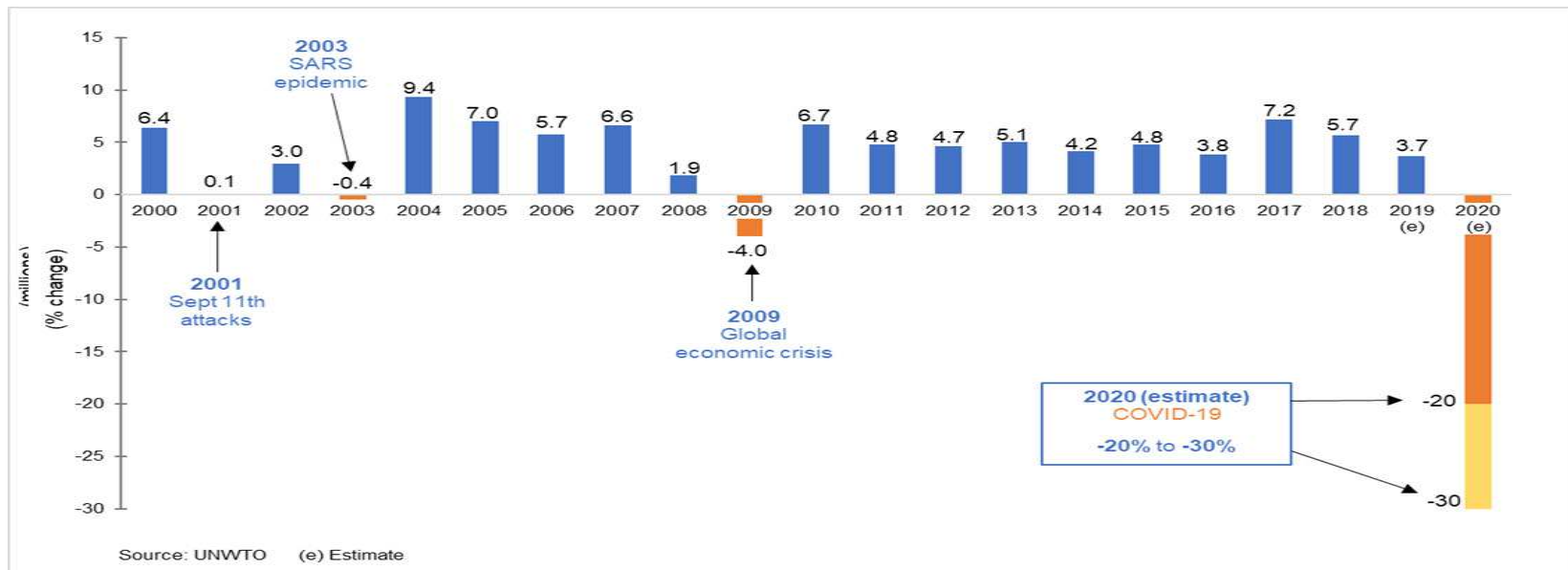
Tourism Forecasting in the Time of COVID-19

- Second stage—"ex ante" forecasting of tourist arrivals during and after COVID-19
  - Based on the latest available data (2019-2020…) => **ex-ante forecasts of 2020 & 2021**
  - Identification of the most accurate forecasting method(s) and procedures in a crisis situation

UNWTO, Impact assessment of the COVID-19 outbreak on international tourism (2020-03-27)
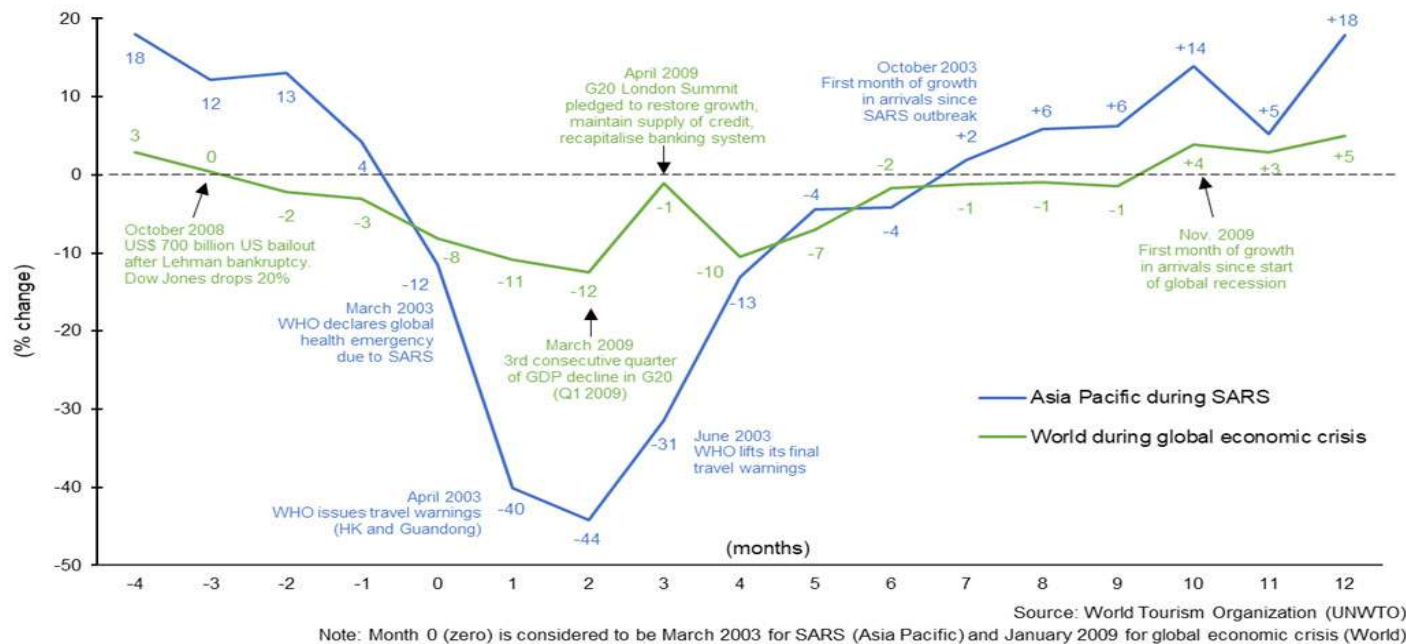
Tourism Forecasting in the Time of COVID-19

- Second stage—"ex ante" forecasting of tourist arrivals during and after COVID-19
  - This graph (and the previous one) were prepared by the UNWTO on March 27, 2020, at the beginning of the COVID-19 crisis (start of containment). The UNWTO forecast of tourist arrivals greatly underestimated the actual collapse in 2020 (-70%).

UNWTO, Impact assessment of the COVID-19 outbreak on international tourism (2020-03-27)
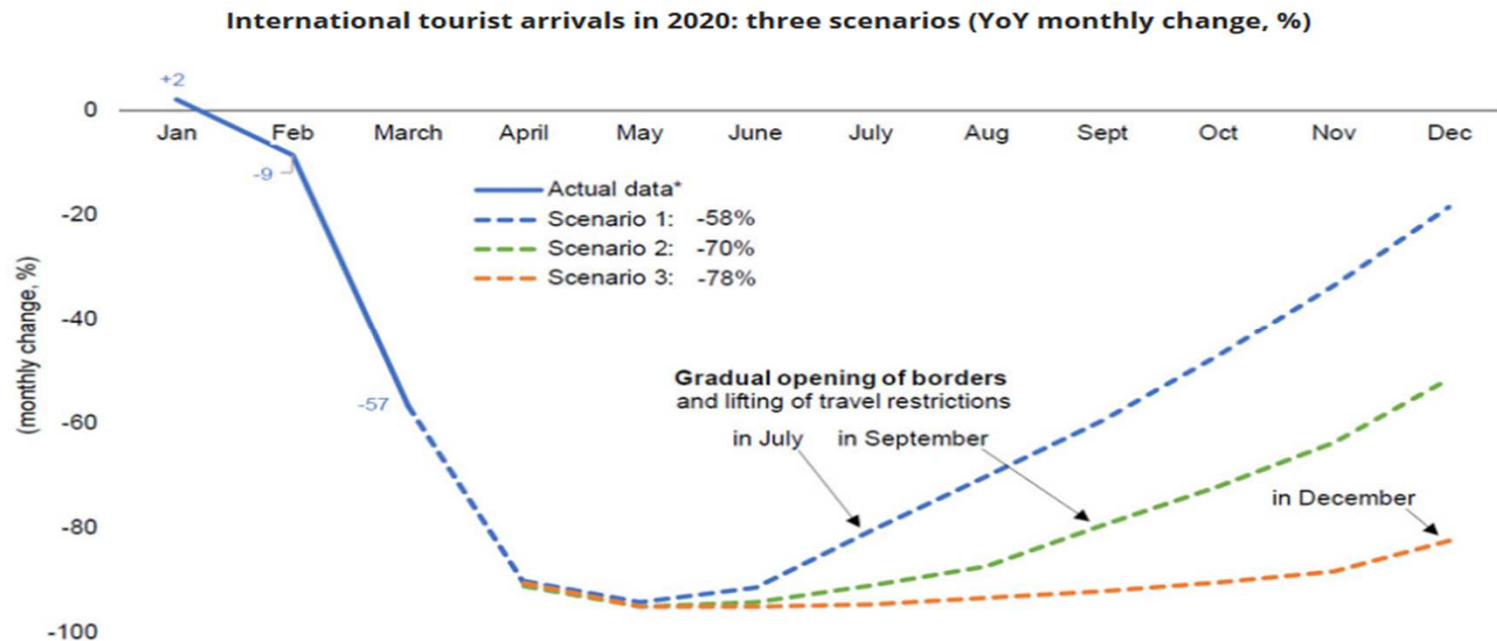
Tourism Forecasting in the Time of COVID-19

- <u>Dynamics of tourist arrivals during previous crises (SARS 2003, GEC 2009)</u>
  - Tourism recovery from the two major previous crises was relatively rapid, but will it be the case for tourism post-COVID?

Source: World Tourism Organization (UNWTO)

Note: Month 0 (zero) is considered to be March 2003 for SARS (Asia Pacific) and January 2009 for global economic crisis (World)

UNWTO, Impact assessment of the COVID-19 outbreak on international tourism (2020-03-27)

10

Tourism Forecasting in the Time of COVID-19

- Second stage—"ex ante" forecasting of tourist arrivals during and after COVID-19
  - Rapidly (in May 2020), three UNWTO scenarios concerning tourist arrivals emerged with a better sense of the magnitude of the collapse of tourism in 2020, but with a great uncertainty.

International tourist arrivals in 2020: three scenarios (YoY monthly change, %)

- Actual data*
- Scenario 1: -58%
- Scenario 2: -70%
- Scenario 3: -78%

Gradual opening of borders and lifting of travel restrictions
- in July
- in September
- in December

UNWTO, International tourist arrivals in 2020: three scenarios (YoY monthly % change) (2020-05-07)

11

Tourism Forecasting in the Time of COVID-19

- <u>Second stage—"ex ante" forecasting of tourist arrivals during and after COVID-19</u>
  - Tourism recovery is also expected to last much longer than for previous crises

International tourist arrivals: Future scenarios (millions)

Source: UNWTO

11 **UNWTO** World Tourism Barometer   Source : https://www.unwto.org/fr/unwto-tourism-dashboard   12

Tourism Forecasting in the Time of COVID-19

Challenges

- Stage 1 - Large scale forecasts
  20 destinations × 6 origins × 4 horizons = 480 series
  ➤ Need an automatic model selection and optimization system

- Stage 2 - COVID-19 pandemic impact
  Statistical forecasts provide very limited insights
  ➤ Need an adjustment mechanism to factor in the influences of the pandemic

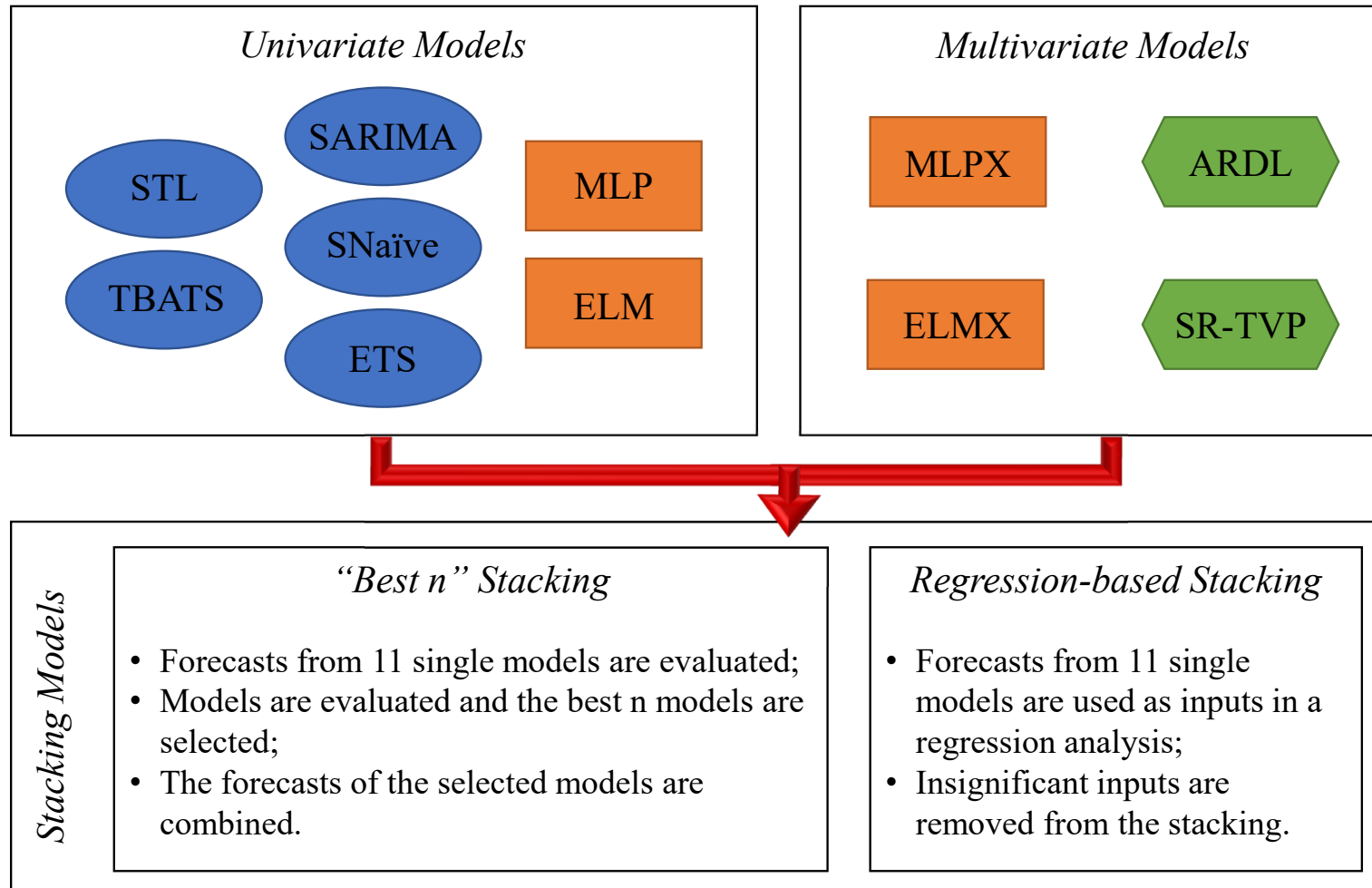# Tourism Forecasting in the Time of COVID-19
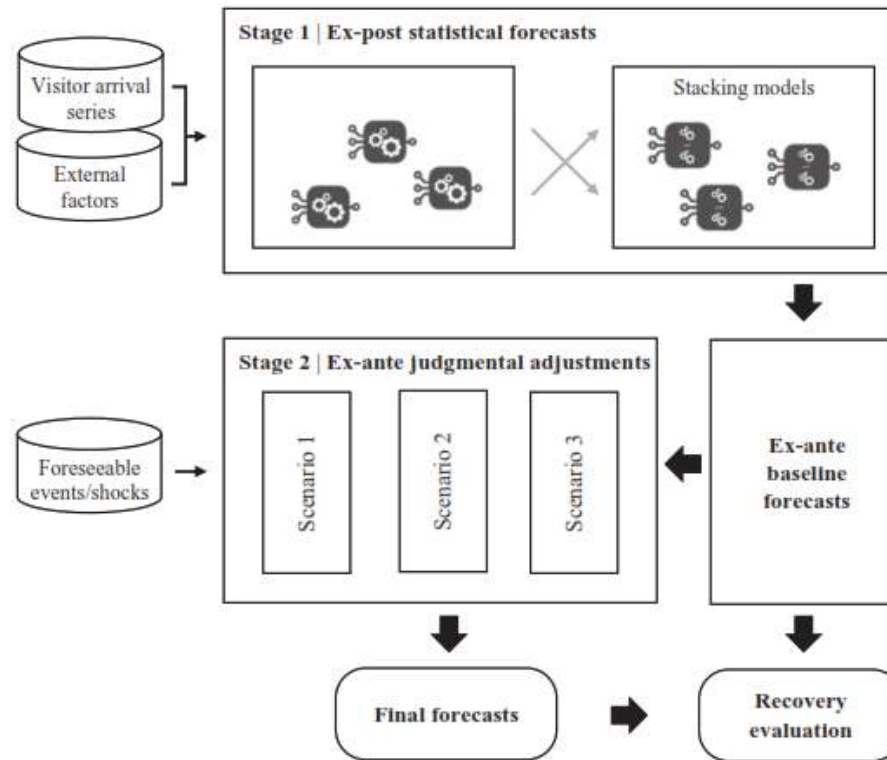
Fig. 1. Framework of the study.

Stage 1 - Tourism Demand Model

- Variable to explain : number of tourist arrivals from i to j

where i denotes the tourist's country of residence, j denotes his/her destination country

- External factors (from a gravity model)
  - D_{ij}: distance between i and j (resistance to travel)
  - $Dm_{i\ or\ j}$: multilateral distance of country i or j (multilateral resistances)
  - GDP_i : GDP of country i (purchasing power of tourists)
  - GDP_j : GDP of country j (proxy for level of supply & infrastructure, …)
  and
  - P_i/P_j : price ratio (real exchange rate)
  - Monetary, Cultural and Institutional proximity (common currency, common language, common religion, common historical past, …)

Stage 1 - Automatic model selection and optimization system

Univariate Models

- STL
- TBATS
- SARIMA
- SNaïve
- ETS
- MLP
- ELM

Multivariate Models

- MLPX
- ELMX
- ARDL
- SR-TVP

Stacking Models

"Best n" Stacking

- Forecasts from 11 single models are evaluated;
- Models are evaluated and the best n models are selected;
- The forecasts of the selected models are combined.

Regression-based Stacking

- Forecasts from 11 single models are used as inputs in a regression analysis;
- Insignificant inputs are removed from the stacking.

Stage 1 – Pre-COVID (2019) Forecast Results

Best *ex post* Forecasting Performance of Stage 1

UNIVERSITY OF SURREY

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

10

Stage 2 - Tourism Demand Models

- Variable to explain : number of tourist arrivals from i to j

  where i denotes the tourist's country of residence, j denotes his/her destination country

- Which other external factors to add to the model?
  - International Travel Controls (=> number of quarters with borders closed)
  - Vaccination Gap

- Which adjustment mechanism to use in order to factor in the influences of the pandemic?

Stage 2 - COVID-19 and Tourism

As of 29 May 2021
- 170 million confirmed cases
- 3.5 million deaths
- 1.8 vaccine doses administered

Global Impact
Severe damage to global economy:
+2.9% (in 2019) vs. **-3.3%** (in 2020)

Source: *World Economic Outlook, April 2021: Managing Divergent Recoveries,* by the IMF
https://www.imf.org/en/Publications/WEO/Issues/2021/03/23/world-economic-outlook-april-2021

Tourism industry has been severely affected
- Global travel bans: 76 countries/regions
- Non-global restrictions: 41 countries/regions
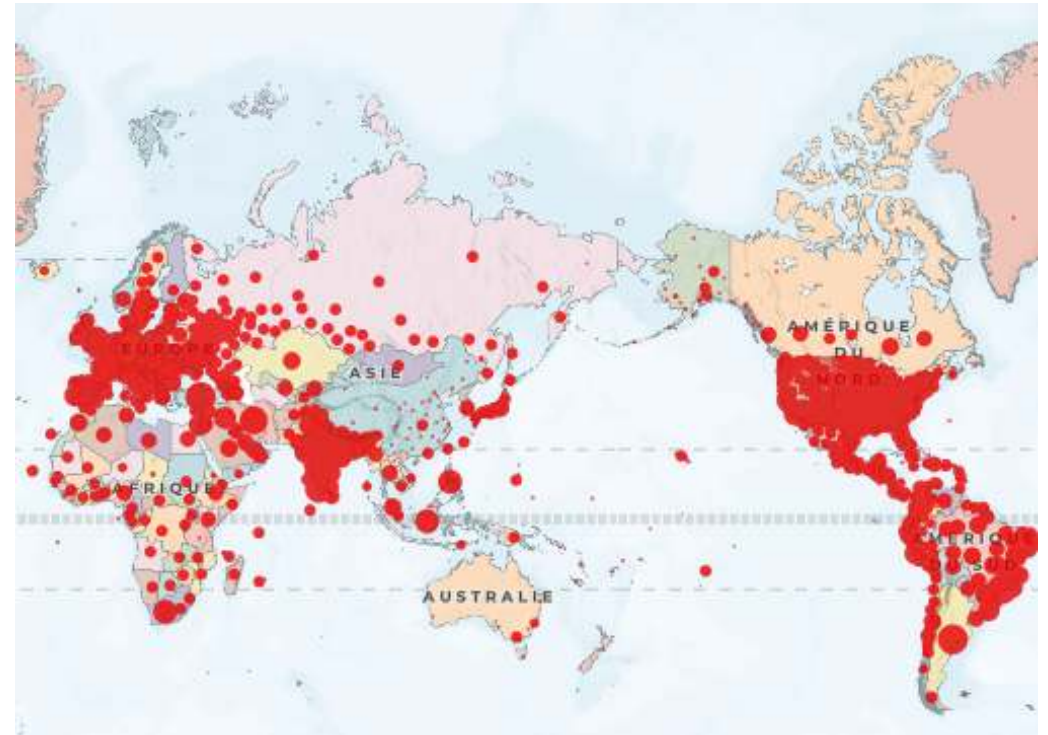
Cumulative Confirmed Cases as of 29 May 2021

Source: *COVID-19 Dashboard* by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU) https://coronavirus.jhu.edu/map.html. Accessed 29 May 2021

COVID-19 and International Travel Controls
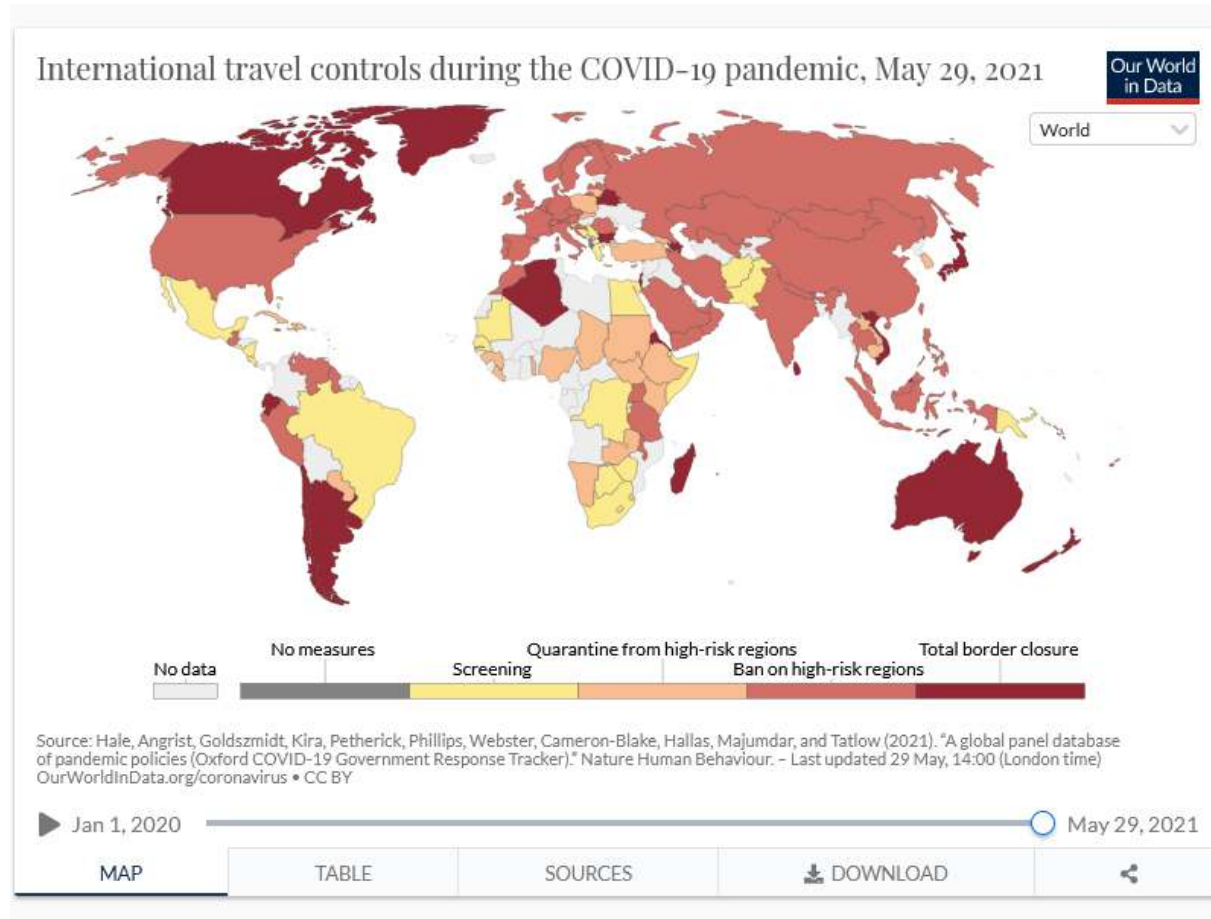
International travel controls as of 29 May 2021

COVID-19 and the Vaccination Gap

The vaccination gap
- 1.8 vaccine doses administered
- Current capacity of vaccine production < demand worldwide
- 14.2 billion doses (2 per person) required to inoculate 90 percent of the world's 7.9 billion people and achieve herd immunity.
- The vaccines that are available are not distributed equitably—85 percent of global doses thus far were administered in richer and upper-middle-income economies.
- The APEC region produces most of the world's COVID-19 vaccines.

The vaccination gap
(share vaccinated as of end-April 2021, % of total population, at least one dose)

No data   0   10   20   30   40   50+
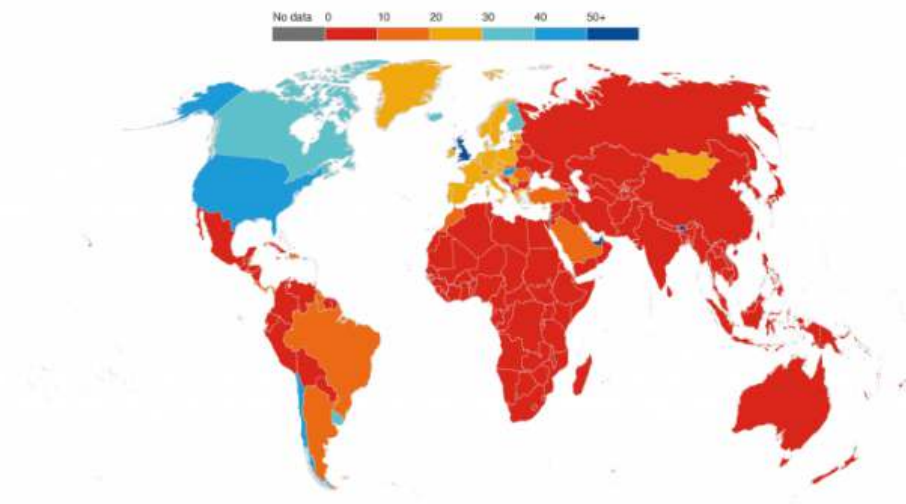
Source: Authors' calculations. See IMF Staff Discussion Note 21/4, May 2021.
Note: Country borders or names do not necessarily reflect the IMF's official position.

INTERNATIONAL MONETARY FUND

Source: *Promoting Trade in Vaccines and Related Supplies and Equipment 2021, APEC*
https://www.apec.org/Publications/2021/05/Promoting-Trade-in-Vaccines-and-Related-Supplies-and-Equipment

Source: *A Proposal to End the COVID-19 Pandemic, 2021, IMF*
https://blogs.imf.org/2021/05/21/a-proposal-to-end-the-covid-19-pandemic/
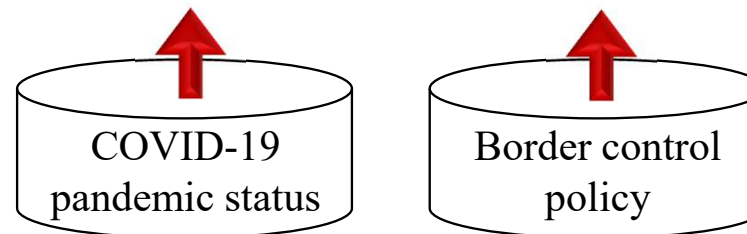
Stage 2 - Ex Ante Forecasting Method: Judgmental Adjustment

Steps 1 to 3
Determine important dates and levels:
  Start of the COVID-19,
  bottom of the COVID-19,
  Start of the recovery.

2020 Q2:
Bottom of COVID-19

Baseline

2020 Q1:
Start of COVID-19

2020 Q3:
Start of recovery

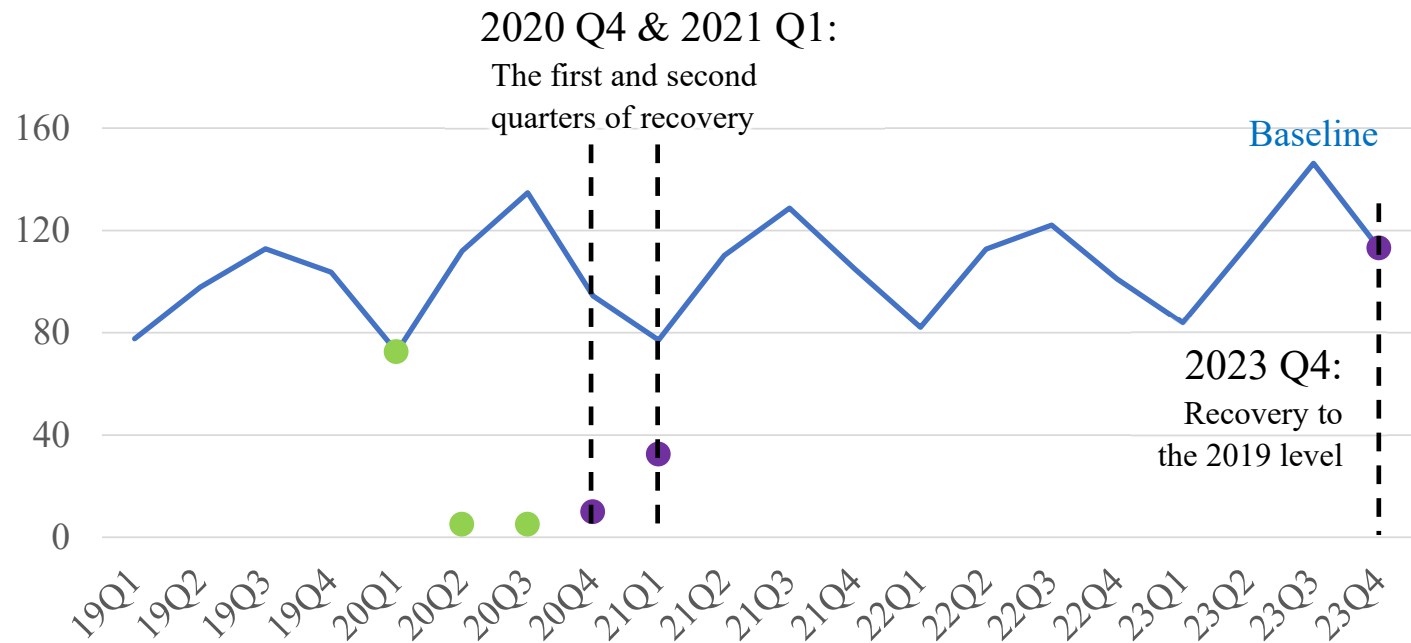Note: Dates and magnitudes are for illustration only; only one scenario is illustrated in the figure.

COVID-19 pandemic status

Border control policy

Step 4

Determine the number of arrivals during the first two quarters of recovery.

Step 5

Determine the date (quarter) that visitor arrivals recover to its 2019 level.

2020 Q4 & 2021 Q1:
The first and second quarters of recovery

Baseline

2023 Q4:
Recovery to the 2019 level

Note: Dates and magnitudes are for illustration only; only one scenario is illustrated in the figure.

COVID-19 pandemic status

Border control policy
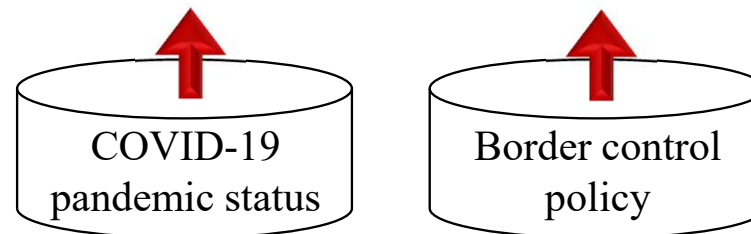
Stage 2 - Ex Ante Forecasting Method: Judgmental Adjustment

Step 6

Determine the number of arrivals during the period of recovery.

Linear trend is assumed after the second quarter of the recovery.
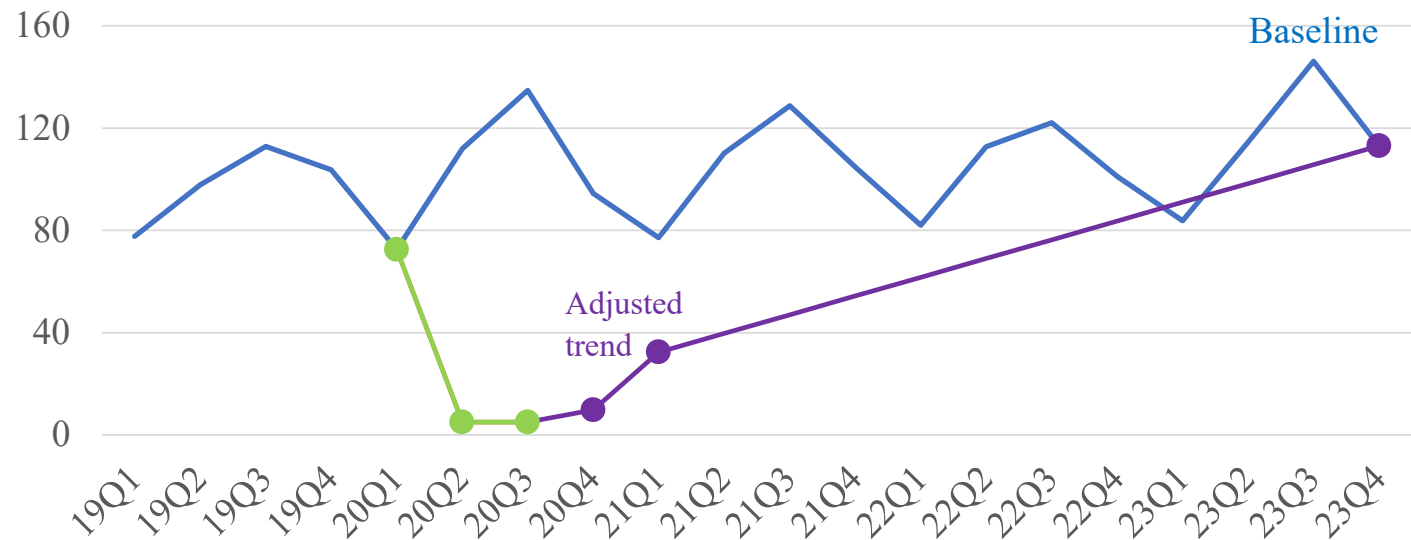
Note: Dates and magnitudes are for illustration only; only one scenario is illustrated in the figure.

Stage 2 - Ex Ante Forecasting Method: Judgmental Adjustment

Step 7
Adjust for seasonality on the trend line produced in step 6.
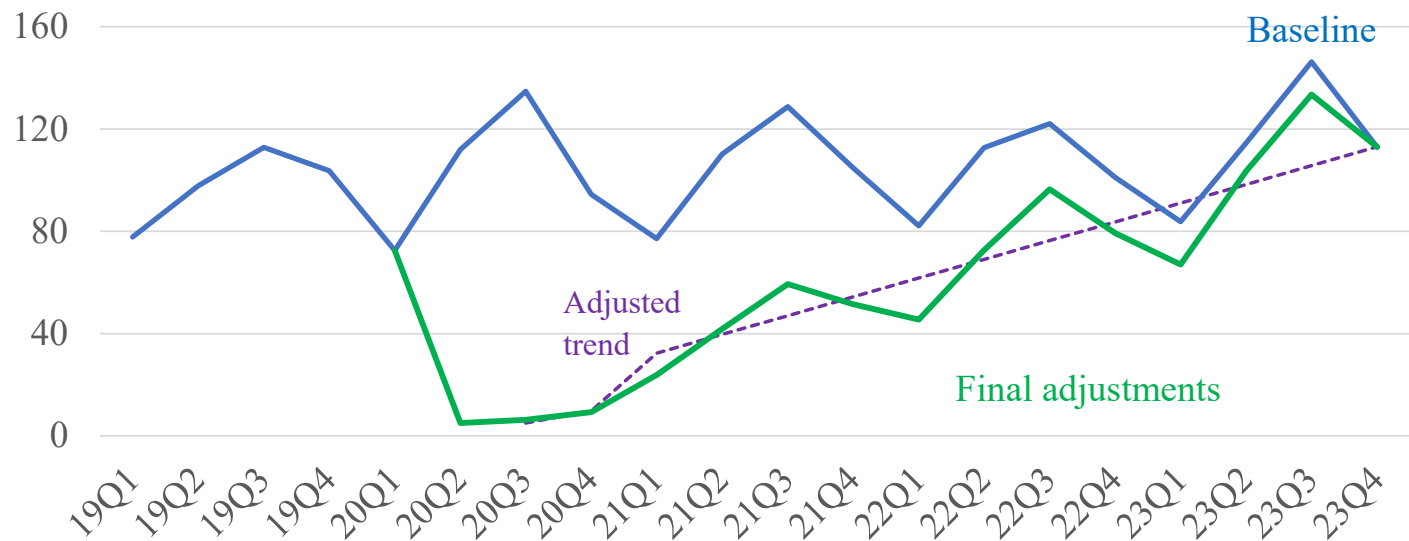
Note: Dates and magnitudes are for illustration only; only one scenario is illustrated in the figure.

The seasonal factor is extracted from the two years of data pre-COVID-19 pandemic (i.e., 2018 and 2019).
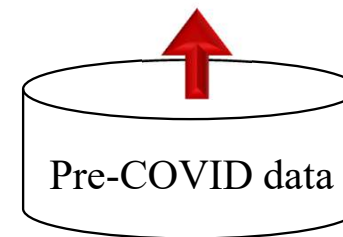
Stage 2 - Ex Ante Forecasting Method: Judgmental Adjustment

Scenario 1:
Mild (a V-shaped pattern)

Scenario 2:
Medium (a deep V/U-shaped pattern)

Scenario 3:
Severe (an L-shaped pattern)
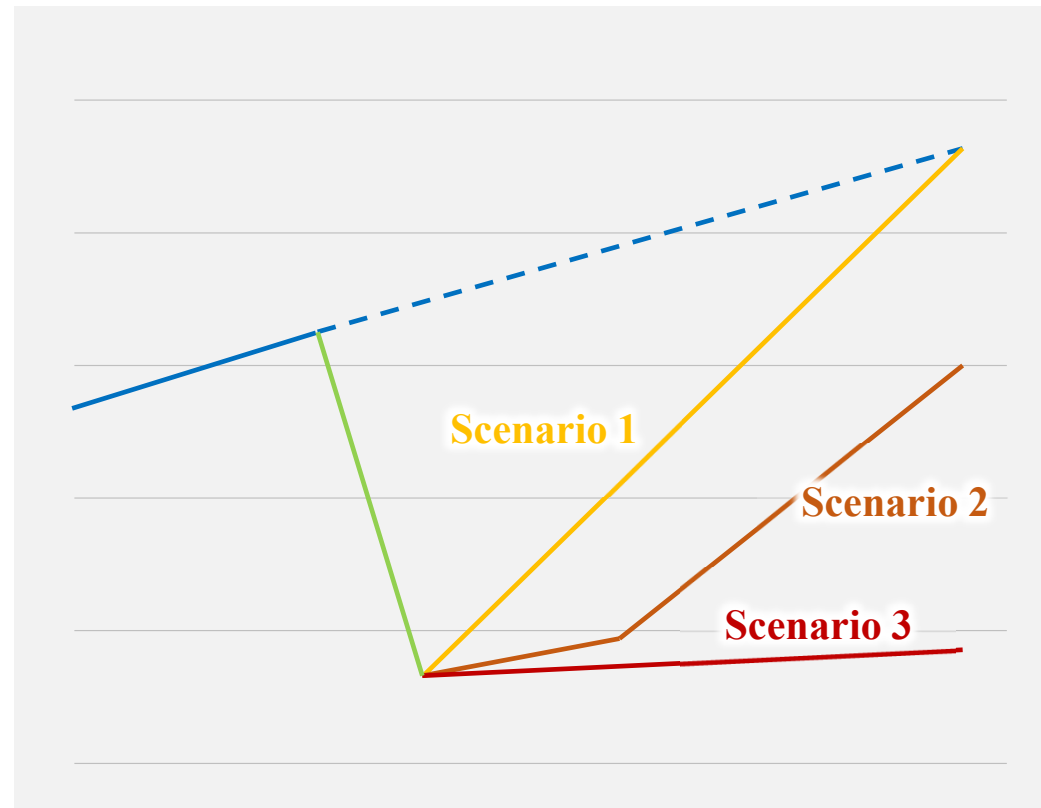
Stage 2 - COVID (2020-2021) Forecast Results from the Asia-Pacific Team
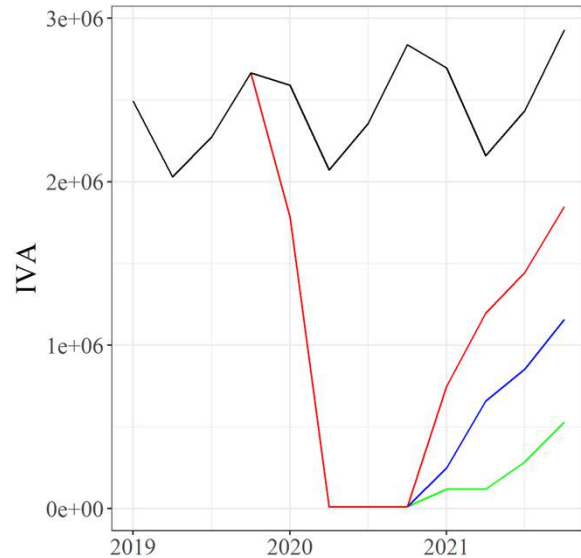

World to Australia

World to Sweden

- Australia has implemented a continuous ban of international visitor arrivals since March 2020.

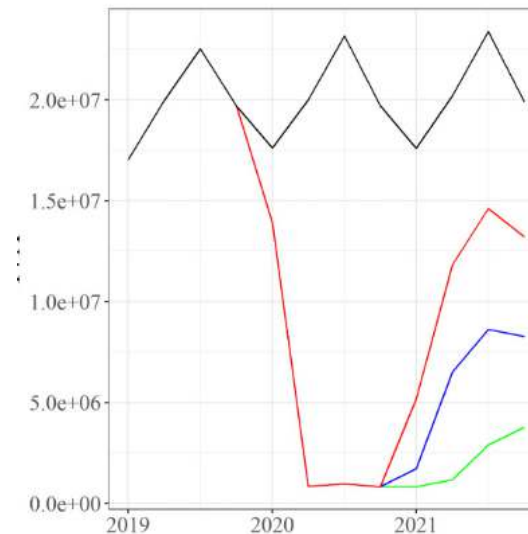- Recoveries of 55%, 31%, and 11% in three scenarios by the end of 2021.
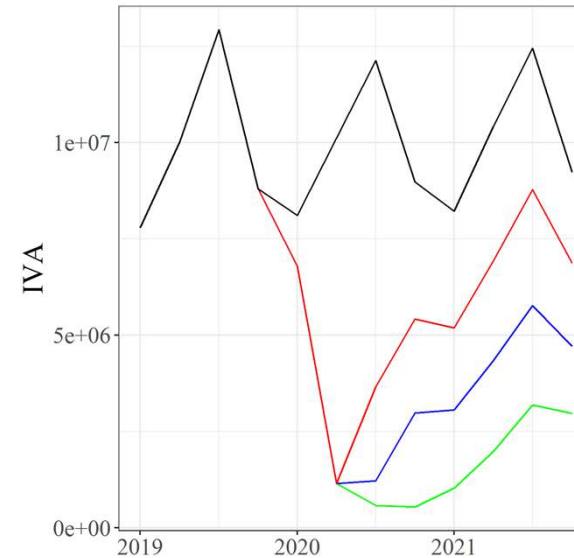
- Sweden pursued herd immunity without lockdown or strict sanitary measures, and experienced an early wave of infection in June and July 2020.

- Recoveries of 70%, 45%, and 23% in three scenarios by the end of 2021.

Stage 2 - COVID (2020-2021) Forecast Results from the Asia-Pacific Team
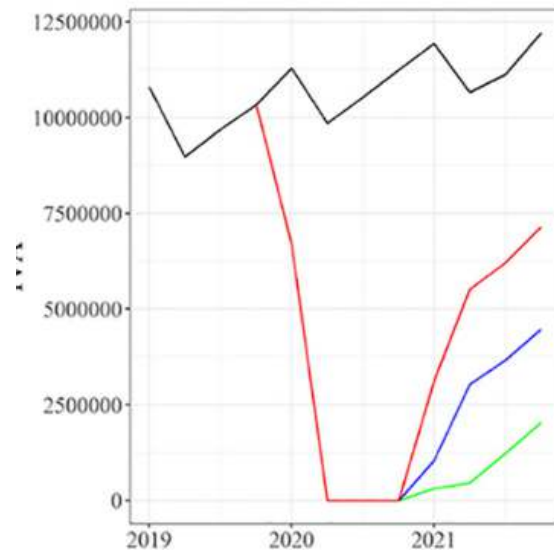

World to Thailand

World to USA

- Thailand is on the hardest-hit economies due to its dependence on tourism revenues. It is slowly easing restrictions since April 1, 2021.

- Recoveries of 58%, 33%, and 11% in three scenarios by the end of 2021.

- The U.S. pursues herd immunity through a massive vaccination campaign in 2021. This may fastened the recovery. Yet, it is closing its borders to some countries (China, EU, UK, Brazil, India).

- Recoveries of 56%, 32%, and 23% in three scenarios by the end of 2021.

28

Stage 2 - COVID (2020-2021) Forecast Results from the Europe Team
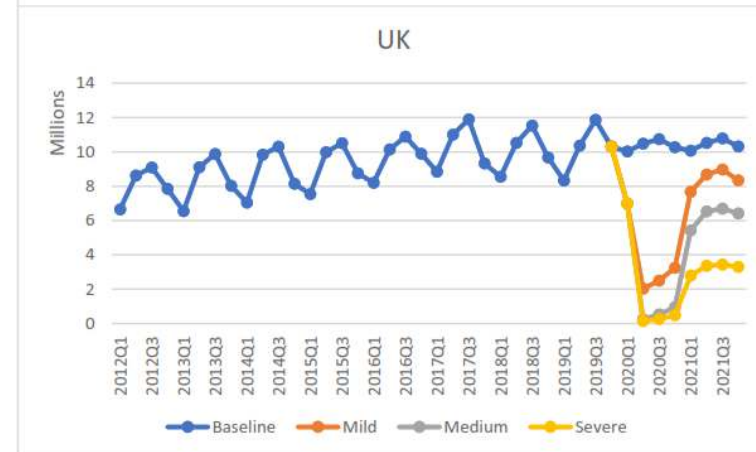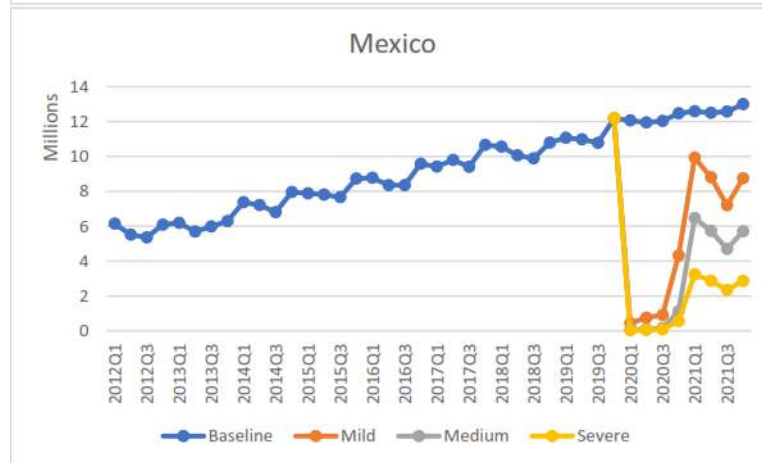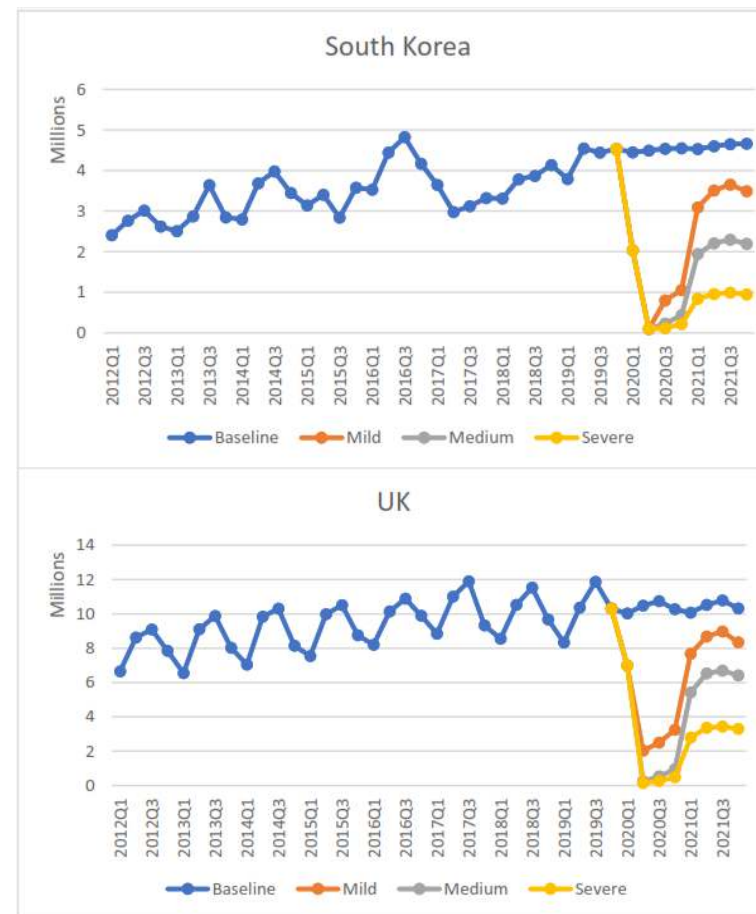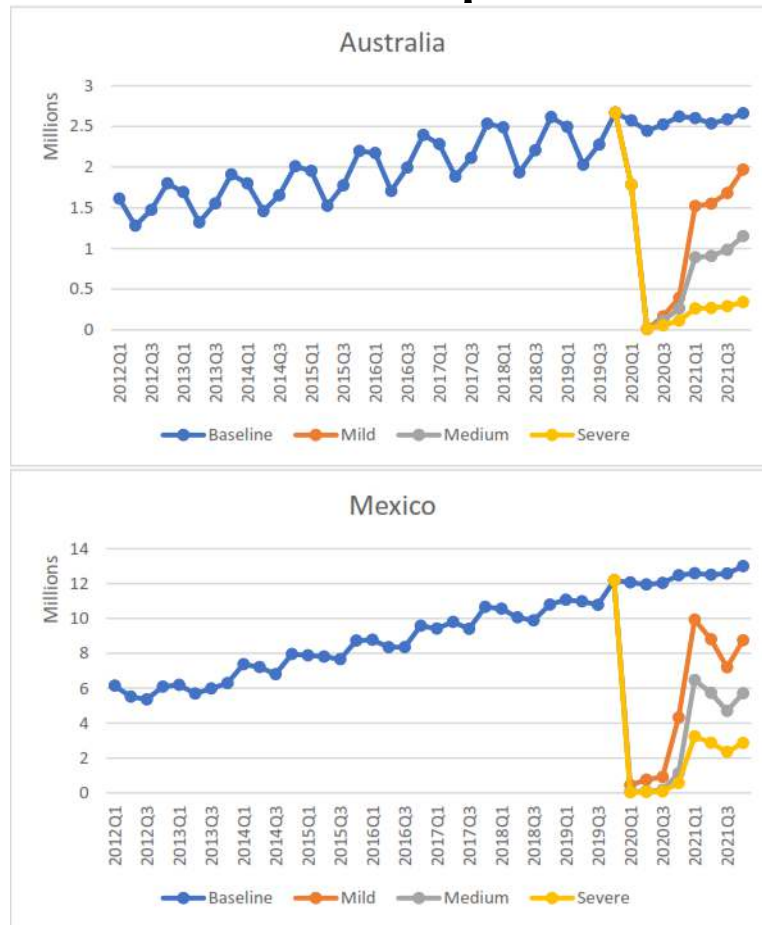
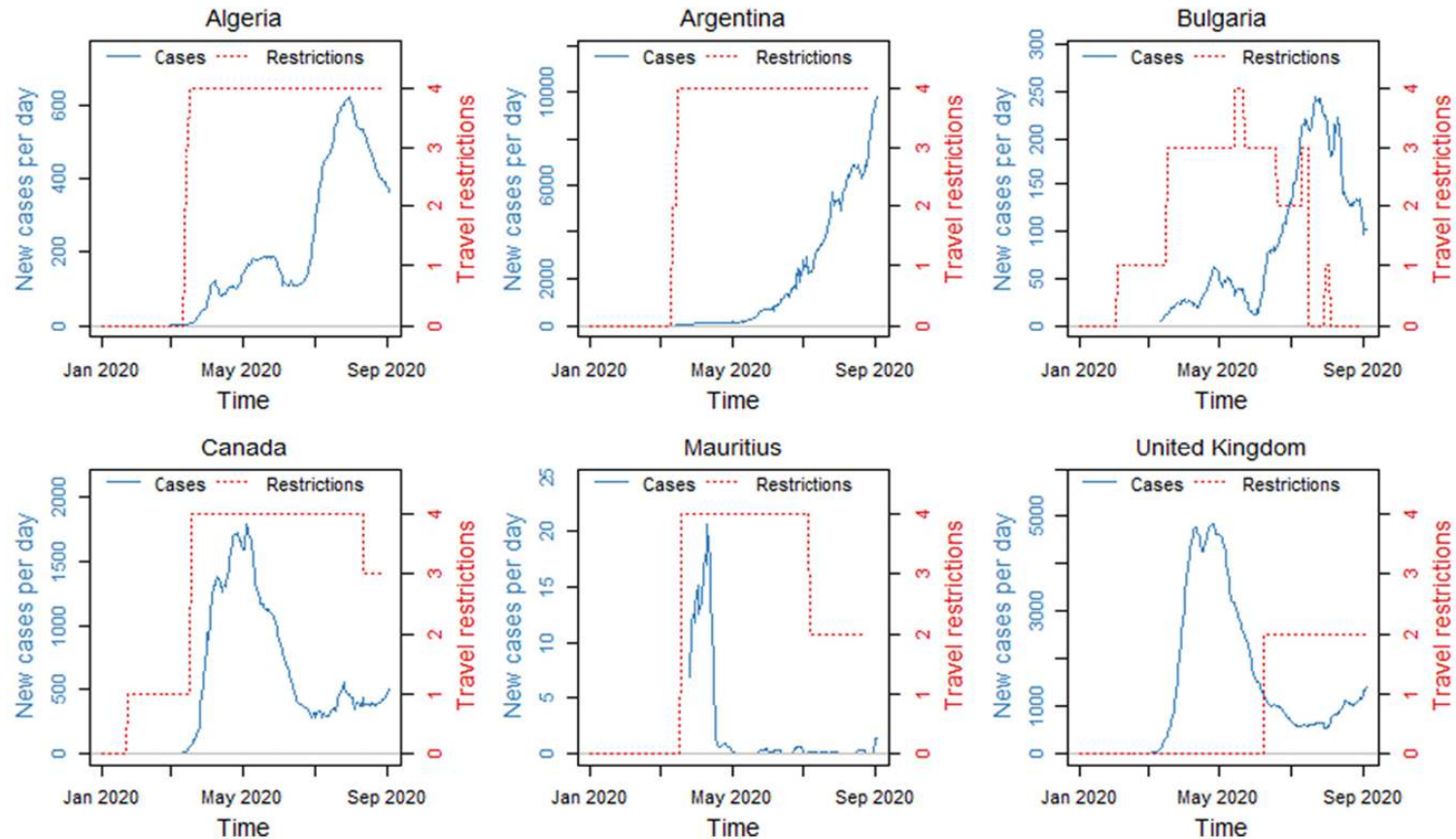# Stage 2 - COVID (2020-2021) Forecast Results from the Africa Team

Fig. 3. Visualisation of COVD-19 progression and travel restrictions imposed for selected countries (Source of Data: Ritchie, 2020).

"Tourist Visitor Arrival Forecast amid COVID-19: A Perspective from the Africa team", with Nikolaos Kourentzes, Andrea Saayman, Philippe Jean-Pierre, Davide Provenzano, Neelu Seetaram, Serena Volo, *Annals of Tourism Research*, 88:103-197. (2021). doi.org/10.1016/j.annals.2021.103197

30

Conclusions and Reflections

- Before the COVID-19 crisis, combination and ensemble techniques benefited the forecasting accuracy improvement and the forecast robustness, especially under large scale forecasting task.

- Since the COVID-19 crisis, judgmental forecasting is more effective, given the huge volatility and uncertainty. Other big data analytics such as text mining and picture mining from different sources (government news, industry documents and tourist online behavior) may yield improvements in forecasting in these conditions.

- New external factors need to be added to the forecasting models (international travel controls, vaccination gap, …) to take into account a new environment for travel and tourism.

PECC International Virtual Seminar:
"Connectivity and Tourism Recovery from Covid-19"

FORECASTING TOURISM FLOWS POST-COVID IN ASIA-PACIFIC

Thank you for your comments and questions!

Vincent DROPSY & Sylvain PETIT