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TOURISM FORECASTING AND TACKLING FLUCTUATING PATTERNS: A COMPOSITE LEADING INDICATOR APPROACH

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Abstract:

A growing interest is surfacing toward the non-linearities in tourism demand forecasting. This paper aims to construct a tourism composite indicator to anticipate the cyclical movement for the tourism demand in Fiji. The time duration tackled in the current study is under the span of approximately two decades from 2000 to 2017. Apart from an indicator construction approach and turning point dating algorithm, we proposed a two regime Markov switching model to analyse the Fijian tourism cycle. The empirical results revealed the composite leading indicator accorded a signalling approach for Fijian tourism demand with an average lead time of 2.75 months. Furthermore, the prior-recognition of the tourism economic transition with adequate dating evaluation of the tourism cycle is obtained from the filtered probabilities through the Markov switching models.

Key words: *Fijian tourism demand forecasting, composite leading indicator approach, turning point dating, near-term forecasting, non-parametric approach*

1. Introduction

According to the statistical evidence from the World Tourism Organisation (UNWTO) in 2017, the total contribution of tourism (including broader impacts from investment, supply chain, and induced income impact) to world income was USD 7,631.3 billion (10.2% of world GDP) for the year 2016. Nonetheless, the tourism industry generated 108,741,000 jobs (3.6% of total employment) and the trend is speculated to be upward in nature. Apart from the momentous attribute by the world GDP and employment

rate, the tourism industry also attracted USD 806.5 billion of capital investment in 2016. After one decade, the total contribution of tourism to the global GDP is expected to rise by 3.9% to USD 11,512.9 billion (11.4% of world GDP); the tourism industry will account for 138,086,000 jobs (20% of total employment); the expected capital investment attracted by the tourism sector will increase by 4.5% (USD 1,307.1 billion). Thus, for those countries that heavily rely on tourism, it is essential to construct a cyclical study on the tourism market to ensure the continuous prosperity, while minimising the burden of external shocks.

The Fiji Bureau of Statistics declared that the tourism industry is one of the major contributors to the Fijian economy, as it contributed 40.4% to the GDP in 2016 and has been providing both direct and indirect employment opportunities to one third of Fijians. This proves that tourism remains as the largest foreign exchange earner in Fiji. Fiji is an island located in the heart of the South Pacific Ocean with a total population of 860,000 people and is blessed with 33 tropical islands. Fiji is famous for its luxurious private islands, resorts, spas, culinary delights and unique culture, as well as outdoor adventures. The economic performance in Fiji is adversely affected by the nation's vulnerability to internal and external shocks such as political unrest, natural disasters (cyclones and floods), global financial crises, and international oil and food price shocks. However, Ooi, Hooy and Puad (2013) argued that some might gain positive impacts from the tourism crises. To provide better insights into future trends of Fiji tourism, a set of comprehensive economic variables with forecasting ability can be used to supplement their internal information. Thus, this can empower governments and policy makers to develop better policies and programmes.

Moreover, a chronology of key events can be identified throughout the research progress. With monitoring tourism progress over time, the emerging risks for the tourism industry can be identified early. As the constructed tourism cycle indicator possesses leading characteristics in the risk management of tourism value chain, it can grasp more effective and efficient public spending in resources allocation. The principle aim of this study is to trace and monitor the movement in the Fijian tourism cycle by constructing a tourism cycle indicator (TCI). Evidence of predictive content can be offered from a comprehensive series of leading components and their co-movement with the tourist arrivals in Fiji. The turning point analysis is studied to gauge the foretelling power of the constructed TCI.

2. Literature review

Government and numerous tourism industry players acquire prior knowledge of the commencement or finale of turning points in tourism demand. These packets of information are mainly contributing to the industry players' upcoming investment and planning in the tourism sector. Past scrutiny mostly focused on trends of changes in annual tourism demand. Witt, Song, and Louvieris (2003) revealed that econometric models outperformed time series models from the perspective of directional change forecasting. However, there are limitations such as non-linearity, dynamic modelling issues, or the data availability and relevancy when constructing these models. In the

business context, the leading indicator approach is commonly applied to detect the turning points and cyclical patterns for the business cycle. The chronology calendar for when events happen can be established throughout the study as an enhancement for the reliability of this study.

A recent study by Tule, Ajilore, and Ebuh (2016) focused on the composite index of leading indicators to predict unemployment in Nigeria following the methodology of the Organization for Economic Co-operation and Development (OECD) system. Multiple series of variables that covered diverse aspects of economic activities has been utilised in the study to track and anticipate the turning points of Nigeria over the time span of 7 years. Recently, Tang, King, and Pratt (2017) implemented the OECD system and the OECD composite indicators in conducting their study on forecasting the unemployment and hotel occupancies rate. Apart from convincing results produced using an approach on the business context similar to Puah et al. (2016), it can also extend further to the housing market analysis studied by Puah, Kuek, Arip, and Wong (2016). Other than business and property studies, Chong et al. (2018) also employed the complementary approach in oil price forecasting. Therefore, it is believed that the leading indicator approach can be applicable in the tourism context as it is generally accepted as a convenient and speedy tool for the purpose of optimising information.

With regards to the composite leading indicator approach in the tourism context, Kulendran and Wong (2011) foretold the turning points of the Hong Kong inbound tourism growth cycle to minimise the risks and crisis burden. The tourism demand determinants were comprised of oil price, income, business confidence indicator, price at the destination and price at substitute destination using the estimation by the logistic and probit regression model. Apart from Kulendran and Wong (2011), Yap and Allen (2011) also investigated the leading components for Australian local tourism demand. The study found out that the consumer sentiment index was only sensitive towards friends and relatives visiting but not influential towards holiday tourism. Moreover, the business confidence index was also less influential on business tourism demand.

Moving further into a recurring research approach, regime switching studies have been widely applied in different contexts which include the tourism context and are getting popularised. Although Huarng, Yu and Parellada (2011) confessed that there is a high difficulty in foretelling the non-linear data with regime switches for the tourism demand in Taiwan, Ozcan and Ucak (2016) argued that this approach can furnish a more robust result. Nevertheless, Chang and Lee (2016) utilised the Markov-switching model to investigate the growth stage and tendency to shift from one stage to another for Taiwan tourism. The empirical results found that the macroeconomic factors can consistently have an impact on the foreign-exchange earnings from tourism. Throughout the growing importance on tourism studies, this approach can be further developed in other countries.

3. Research Methodology

The inadequate number of studies that furnish a broad sense of the tourism market involvement has led to the aspiration in constructing a tourism cycle indicator for the country. The tourism sector is vulnerable towards the changes in society, economics

and politics in either the generating or host countries. Apart from the conventional supply and demand influences, external shocks and national economic indicators are needed to assist in the forecasting performance of the tourism market. To trace the movement of the tourism industry in Fiji, a profound framework is utilised to summarize the periodic evolution from different viewpoints. The ideology of indicator establishment was first introduced by the U.S. National Bureau of Economic Research (NBER) and employed by Moore and Zarnowitz (1986) in creating a composite leading indicator. Thus, this study aims to construct a composite leading indicator to gauge the cyclical movements for the Fijian tourism market.

The initial part of the procedure is construction of the tourism composite index as actuated by the NBER. The composite index construction steps are referred as The Conference Board (2000). First and foremost, figure the month-to-month changes ($y_{i,t}$) for the corresponding component of ($Z_{i,t}$), where $i = 1, \dots, n$. Simple arithmetic differences are computed as $y_{i,t} = (Z_{i,t}) - (Z_{i,t-1})$ where the variable itself originally is in percent form. For other cases, the formulation of symmetric percent change is summarised as $y_{i,t} = 200 * (Z_{i,t} - Z_{i,t-1}) / (Z_{i,t} + Z_{i,t-1})$. The step is then followed by the modification of the month-to-month changes for each of the component series by multiplying each of them by the standardization factor of the component (a_i). Monthly contributions of each component series can be accessed via $B_{i,t} = (a_i) * (y_{i,t})$. Next, sum up the adjustment month-to-month changes by adding all the component series for every month via the formulae of $S_t = \sum_{i=1}^n B_{i,t}$. The computation of preliminary levels of the index comes immediately after summation for the series using the symmetric percent change formula. The preliminary value of the index during the first month is denoted as $L_1 = 100$ and the subsequent month will be interpreted as $L_2 = 100 * (200 + S_2) / (200 - S_2)$. Then, the initial index value for the following month will be computed accordingly $L_3 = L_2 * (200 + S_3) / (200 - S_3)$. The final stage for indicator construction is to rebase the initial index to average 100 in the base year. The initial indexes computed from the previous step are multiplied by 100, then followed by the division of the preliminary levels' mean in the base year.

Before proceeding to examine the turning points of the tourism cycle, it is important to undergo seasonal adjustment using census X-12 and followed by the filtering process. The Christiano-Fitzgerald (CF) random walk filter by Christiano and Fitzgerald (2003) is utilised as a tool in macroeconomics such as the real business cycle theory to de-trend the cyclical movement and formulate the smoothing problem in the frequency domain. There is always a trade-off among varieties of filtering methodologies. In this study, Christiano-Fitzgerald random walk filter has been selected due to its way of calculation by including each filtered data point using the full sample size (Gomez, 2014). Moreover, another advantage of the Christiano-Fitzgerald random walk filter is the fact that it is well-designed for a larger class of time series and it converges in the long run to the

optimal filter (Nilsson & Gyomai, 2011). This is also to ensure the smoothed series can be attained for further forecasting processes. In the study of Voon, Puah and Wong (2016), they engaged a CF filter to inhibit the incompatibility and inconsistency of the data series. Estimation and approximation of the smoothed series can be implemented as

$$F_t = A_0 x_t + A_1 x_{t-1} + \dots + A_{T-1-t} x_{T-1} + \tilde{A}_{T-t} x_T + A_1 x_{t-1} + \dots + A_{t-2} x_2 + \tilde{A}_{t-1} x_1, \quad \text{where}$$

$$A_j = \frac{\sin(jb) - \sin(ja)}{\pi j}, \quad j \geq 1; \quad A_0 = \frac{b-a}{\pi}, \quad a = \frac{2\pi}{P_u}, \quad b = \frac{2\pi}{P_i}; \quad \text{and} \quad \tilde{A}_{T-1} = -\frac{1}{2}A_0 - \sum_{j=1}^{T-t-1} A_j,$$

$t = 3, 4, \dots, T-2$. The estimated parameters P_u and P_i in the approximation equation above denoted the cut-off cycle length on a monthly basis. In other words, cycles that are shorter than P_u and longer than P_i are sustained in the cyclical term, F_t . The filter type selected is a full sample asymmetric and the stationary assumption chosen is random walk.

The step is continued closely with the Bry-Boschan dating algorithm to predict the peaks and troughs of the construction indicator. The comparison between the reference series and the constructed indicator can be achieved via the method proposed by Bry and Boschan (1971). After the extreme values and substitution values are successfully identified, the highest among the alternative peaks and lowest of multiple troughs are selected. Final turning points of the cycle are produced as a statement after the elimination and identification using the Bry-Boschan dating algorithm. The aggregated unique series that possess leading attributes can significantly anticipate the future roadmap of tourism development for the Fijian economy. Instead of only observing these shifts directly, this study also proposed a tractable approach to draw probabilistic inference about the occurrence on the observed behavior of the component and reference series.

For each point in time, tranquil when $S_t = 0$ or speculative when $S_t = 1$ characterized the economy regime. This paper adopted a variant of Hamilton's model (Hamilton, 1990) developed by Diebold et al. (1994) in which transition probabilities can be time-varying. The mechanics underlying shifts from tranquil to speculative regimes can be studied by allowing transition probabilities to vary over time.

$$P_t^{00} = P(s_t = 0/s_{t-1} = 0, x_{t-1}; \beta_0) = \frac{\exp(x'_{t-1}\beta_0)}{1 + \exp(x'_{t-1}\beta_0)} \quad (1)$$

$$P_t^{11} = P(s_t = 1/s_{t-1} = 1, x_{t-1}; \beta_1) = \frac{\exp(x'_{t-1}\beta_1)}{1 + \exp(x'_{t-1}\beta_1)} \quad (2)$$

$$P_t^{01} = (1 - P_t^{00}) = P(s_t = 1/s_{t-1} = 0, x_{t-1}; \beta_0) = 1 - \frac{\exp(x'_{t-1}\beta_0)}{1 + \exp(x'_{t-1}\beta_0)} \quad (3)$$

$$P_t^{10} = (1 - P_t^{11}) = P(s_t = 0/s_{t-1} = 1, x_{t-1}; \beta_1) = 1 - \frac{\exp(x'_{t-1}\beta_1)}{1 + \exp(x'_{t-1}\beta_1)} \quad (4)$$

Given that the economy was in a tranquil (speculative) state for the previous period, shown as $P_t^{00}(P_t^{11})$. This is followed by the probability of switching from a tranquil (speculative) state on date $t-1$ to a speculative state (tranquil) in period t indicated as $P_t^{01}(P_t^{10})$.

4. Empirical findings and discussion

Studies on early warning indicators often craved a benchmark that could portray the current state of the market development and an array of variables that possess the predictive ability towards the market development. International tourist arrivals are generally seen as a significant contributory sign to reveal the development of the Fijian tourism market and therefore it is privileged as the benchmark that provides the reference chronology for the market evolution. A bulk of variables selected are undergone an interpolation technique proposed by Chow-Lin (1971) to acquire higher frequency of data which is in monthly attributes. This study employed monthly data under the span of nearly two decades from 2000 to 2017. The sources of data are from the CEIC database, U.S. Energy Information Administration, World Travel and Tourism Council and The World Bank.

Among three approaches used in the literature by other studies, which include leading, coincident and lagging indicators, the potential leading indicators should be elected in determining the selected database. Previous published research has been scrutinized for relevant leading indicators in tourism cycle forecasting. An extensive data set that tackles the Fijian tourism market development and might carry the pragmatic information for future expansion of the sector is preferred. We rely on systematic literature study to reveal the probable data set to be embodied in the component series for indicator construction. A single dependent variable, which is also the reference series for the cycle, is determined according to the past scrutiny in tourism demand forecasting where it is commonly applied. For the sake of emphasizing the difference between indicator-based and the casual tourism demand forecasting methodology, the current methodology used is to construct an indicator that can have a co-movement with the Fijian tourism sector. A reference of chronological events can be detected throughout this study where turning points are dated. When we have sufficient information to anticipate the movement of the tourism industry, the policy makers, industry players, or even the community itself can do some decision making to smooth the cycle fluctuation. This is also to ensure the resources can be allocated efficiently from different aspects such as financial, investment, or facilities development to ensure sustainable tourism development.

Figure 1 portrays the visualisation of the constructed indicator, named the tourism cycle indicator (TCI), and the reference series is international tourist arrivals to Fiji (TA). Most of the former tourism studies promoted the notion that measuring international tourist arrivals was a succinct way of measuring the tourism development for a country. Jovicic (2014) also emphasized the importance of globe support from broad political to ensure the sustainable tourism development. In this study, for clarity and conciseness, the component series of the TCI includes foreign direct investment, political stability index, crude oil price, shanghai stock composite index and visitor exports, whereby causing the financial data, economic and political aspects to be all inclusive in the constructed TCI. As illustrated in Figure 1, the constructed TCI has consistently featured the signalling effect of the reference series. At the same time, the main transitions of the TCI from one turning point to another turning point have signalled the approaching shift of the TA. Thus, the empirical

analysis proves that the constructed TCI can tackle the general movement of the Fijian tourism industry in a well-timed manner.

Figure 1. Visualisation of the Constructed Tourism Cycle Indicator and International Tourist Arrival, 2000-2017

Table 1. Results from Turning Point Analysis

Cycle Condition	TCI	TA	Number of Early Signal(s)		Major Events
Peak	2001M10	2002M01	3	✓	Elections
Trough	2003M05	2003M07	2		
Peak	2004M08	2004M11	3	✓	Oil price hikes
Trough	2006M11	2007M05	6	✓	Fijian political crisis
Peak	2008M03	2008M06	3	✓	Constitution repealed
Trough	2009M06	2009M06	0	✓	Sub-prime mortgage crisis
Peak	2010M10	2010M12	2	✓	Suspension from
Trough	2013M10	2014M01	3		Commonwealth
Average			2.75 months		

The troughs often brought the meaning that there were some impactful events that led to a spill over effect on the number of international tourist arrivals. The momentous slumps occurred during 2003, 2006, 2009 and 2013 for the Fijian tourism market. Political instability has afflicted Fiji since 1970 where four coups and two constitutional crises have negatively impacting Fiji's economy. Brodien Hapairai, Walters and Li (2018) emphasised that the political crises have a long-term detrimental impact on tourism dependent economies as it affects tourists' risk perceptions. This is due to the tourists' propensity to ensure that the travel destination or neighbouring regions are perceived to be safe. In the midst of significant political crises, it is vital to minimise the political instability to ensure a sustainable growth on the tourism sector in Fiji. Nonetheless, the sudden increment of world oil prices has led to inflation in both production and transportation sectors which

affect the Fijian tourism industry, for instance in terms of flight fares or travel costs. Moreover, the sudden withdrawal of worldwide foreign direct investment induced by the sub-prime mortgage crisis also led to shrinkage in the number of tourists. Thus, the aggregate demand for commodities weakened the consumers' purchasing power parity and caused a drastic effect on the Fijian tourism sector.

From the graphic illustration, we noticed that there are four complete cycles detected indicated by 4 peaks and 4 troughs for the Fijian tourism sector. Taking into consideration the financial influence, political instability concern, security concern, world economic prestige and other outstanding travel issues, the constructed TCI was able to trace the Fijian tourism demand growth cycle with a short-term lead period of 2.75 months on average. Possible alternative decisions can be made by tourism policy makers with the critical information provided by the constructed TCI. Accompanied with this information, it can provide early warning symptoms for the related parties such as tourism industry players to tackle the tourism marketing promotion and enhance the effectiveness of resources allocation to ensure the growth of Fijian tourism is consistent and sustainable. In this situation, the fluctuation of the tourism cycle can be smoother, and the tourism demand can be captured in an informative way.

Table 2. Matrix of Transition Probabilities

	Regime 1	Regime 2
Regime 1	0.977	0.023
Regime 2	0.022	0.976

A great concern of the techniques on the non-linear specification analysis has been growing in importance as the linear models lack the capability of capturing the cyclical asymmetries for different cycle characteristics. Therefore, this paper introduces an alternative way to introduce a significant distinction between the expansion and the recession phases for the Fijian tourism cycle. Table 2 portrays the probabilities of regime transition results from the Markov regime switching model. As regard to the empirical statistics, the probability to remain at the first regime again is 97.7% while the tourism economy is in the first regime. The subsequent move from the first regime to the second regime is 2.3%. Whilst the tourism economy is in the second regime, the probability to stay at the same regime is 97.6%. Similarly, the probability of the tourism economy to shift from the second regime to the first regime is 2.2%. A Markov switching vector autoregressive approach was applied in the study of Ozcan and Ucak (2016) to obtain a more robust result in determining the outbound tourism demand.

In the current research, we applied the constructed indicator (TCI) to the Fijian tourism context to analyse the expansion and recession phases as well as dating the turning points. As far as Hamilton (1990) is concerned, the researcher believed that there is always an existence of two phases for the economic cycle, which are the negative growth rate phase and the positive side. Moreover, he presumed that a "latent variable" can govern the economic activity when it is shifting from one process to another. As regard to Figure 2, the filtered and smoothed probabilities for both regimes are shown. Following a trough which was in a recession phase, the tourism activity output shifted to a growth phase again. Moving on to consider another recession period which occurred

during 2009 when the constitution was repealed in Fiji and the sub-prime mortgage crisis happened. However, the “bounce back” effect took place in the following year in 2015. The tourism demand is modelled as a switching process over the expansions and recessions to capture the asymmetrical behaviour. With respect to such a situation where the output succeeds to meet a recovery regaining phase after the trough, Medhioub (2015) emphasised that this is considered a “peak reversion” or “bounce back” effect when the series approaches its usual trend. This case happened for the Fijian tourism economic impact as well. Although the impacts of the recession phases are considered permanent, this study has aimed to anticipate the further movement of the Fijian tourism cycle to ensure a more sustainable growth of the tourism sector with a smoother cycle.

Notes: 50 = “2004M02”, 100 = “2008M04”, 150 = “2012M06”, 200 = “2016M08”

Figure 2. Filtered and Smoothed Probabilities for Both Regimes in the Markov Regime Switching Model

The following part of this paper moves on to describe in greater detail the estimation results empirically. It is statistically significant for both regimes. The residual standard error and multiple R-squared obtained are statistical terms to measure the goodness-of-fit for the model. The measurement of how well the data points align with the actual model can be acquired. The smaller the residual standard error, the closer it fit to the actual data. With regards to the results shown, both regime with residual standard error 0.026 and 0.028 respectively determined a relatively closer for its goodness-of-fit.

Table 3. Estimation Results

Summary Results of Markov Regime Switching (MsM)

$$TA_t = \alpha_i + \beta_i \sum_{i=1}^n TCI + \varepsilon_t$$

Regime 1			
Variable	Coefficient	Standard Error	p-value
C	-0.050	0.003	0.000***
TCI	0.380	0.044	0.000***
Residual standard error: 0.026 Multiple R-squared: 0.488			
Regime 2			
Variable	Coefficient	Standard Error	p-value
C	0.035	0.003	0.000***
TCI	0.564	0.081	0.000***
Residual standard error: 0.028 Multiple R-squared: 0.337			

Notes: C=constant; Significant codes: 0 "****", 0.001 "***", and 0.01 "**".

As illustrated in Figure 3, the residuals are considerably fitted against the values. Follow closely to the normal distribution graph, the residuals are to be like white noise, and they are moving towards the normal distribution.

Figure 3. Diagnostics for Markov Switching

Notes: Left side denotes the plot of residuals against fitted values while right side represents the normal Q-Q plot to diagnose whether the error terms are normally distributed.

5. Conclusion

This section presents the principal findings of the current investigation of the Fijian tourism sector development and tourism demand forecasting. The tourism cycle is a

fundamental yet elusive concept in the national economy, especially when the tourism sector is one of the main contributors of economic growth. Fiji is honoured as one of the tourism-dependent countries. As a concern, various world trending variables, an assortment of macroeconomic series, country development indicators, financial implications as well as tourism-related data were employed to examine the significant leading characteristics to anticipate Fijian tourism growth. This is to evaluate the role of variables that can act as a proxy from different perspectives including travel cost, consumer behaviours, investment prosperity, tourism-related influences and even political authority. As indicated in the discussion earlier on, the movement of the constructed TCI is consistent in advance as compared to the selected reference series with an average lead time of 2.75 months.

Fiji is a sovereign island nation located in the South Pacific Ocean and embraces tourism as one of the major development privileges. Tourism contributes mainly to potential involvement in employment opportunities, income and foreign exchange. Effective and efficient public-sector management is crucial in tackling the pragmatic issues and crises in Fiji to further enhance the establishment of tourism growth. With the involvement of foreign investors, the benefits can be maximised while the adverse impacts of the tourism growth can be minimised. Furthermore, political disturbances are the main concern facing by Fijian economy. Political stability with good policies that intensify good governance are critical to affect the overall performance and development of the nation. The ripple effect of instability can cause the loss of vast numbers of tourists and investors due to the risk of averse perceptions.

Fiji tourism can be embodied by the dominance of foreign capital as the foreign investors play an influential role in the Fijian tourism development. Therefore, a conducive business environment needs to be consistently existing to ensure investment is sustainable and continuous. The willingness of the tourism industry players to be involved in the formation of a private-public partnership can provide a useful forum for addressing the issues. For instance, land problems and disputes or other factors related to the sustainable tourism growth could be discussed at such forums. A socio-political and economic environment that is conducive to attract quality investment is evidently important for a small island with limited resources like Fiji. Forecasting the tourism demand for Fiji and establishing the reference chronology for the crises which happened can provide an early warning signal for the future tourism development in Fiji. The constructed cycle can portray clearer insights and trends for the Fijian tourism cycle. It would be interesting to explore more on the relevant studies with varieties of approaches to obtain a robust result and to ensure sustainable tourism growth.

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