

RESEARCH ARTICLE

WILEY

The effect of global volatility, uncertainty and geopolitical risk factors on international tourist arrivals in Asia

Buhari Doğan¹ | Sudeshna Ghosh²  | Aviral Kumar Tiwari^{3,4}  | Emmanuel Joel Aikins Abakah⁵

¹Department of Economics, Suleyman Demirel University, Isparta, Turkey

²Department of Economics, Scottish Church College, Kolkata, West Bengal, India

³Indian Institute of Management Bodh Gaya (IIM Bodh Gaya), Gaya, India

⁴University of Cambridge, Cambridge, UK

⁵University of Ghana Business School, Accra, Ghana

Correspondence

Sudeshna Ghosh, Department of Economics, Scottish Church College, West Bengal, India.
Email: sudeshna.ghoshsent@outlook.com

Abstract

The major tourist destinations in the Asian region are promoting and maintaining a conducive tourism environment. The susceptibility of the major tourist destinations in Asia to the uncertainties may encumber the arrival of international tourists. However, to the best of our understanding the research in this area is scant. Further though the tourism-uncertainty nexus has been widely explored in the literature, the deliberations in a time-varying and frequency-domain framework continue to be ignored. Thus, building upon the earlier deficiencies this study, investigates in a time and scale varying framework the tourism uncertainty/risk nexus for Singapore and Malaysia, two major tourist destinations in the Asian region. This article endeavors to investigate the role of world policy uncertainty, US Monetary Policy Uncertainty, geopolitical risk, Global Financial Stress Index and market volatility on international tourist arrivals in Malaysia and Singapore. To the best of our understanding, this study is the foremost to scrutinize the interrelatedness between these variables in a multivariate wavelet causality framework, from January 2000 to April 2020. Our results show that the global uncertainties manifested through different macro-based indicators affect international tourism demand for the destination countries. During the subprime crisis, Euro-crisis and the pandemics significant coherencies are perceptible. The major empirical findings of the impact of uncertainty indicators and geopolitical risk on international tourist arrivals over the recent period have important implications for policy makers and practitioners.

KEYWORDS

Asia, geopolitical risk, international tourists, monetary policy uncertainty, wavelets coherency

1 | INTRODUCTION

The occurrence of the pandemic COVID-19 underscores how shattering consequences of uncertainty, shocks and fear create negative attitudes among consumers as far as expenditure plans are concerned. During periods of uncertainty, consumers defer their consumption decisions and wait for the crisis period to be dissipated. Such implications of consumers decision making during periods of uncertainty is also found in the tourism related sector. The deliberations in the

literature demonstrate that tourists react adversely during periods of uncertainty. In the economic interpretation, human-beings would prefer to save as a precaution during uncertainty and adjourn their travel ideas.

While a sizeable empirical literature has explored the negative impacts of economic policy uncertainty on international tourist arrivals (Shahzad et al., 2022; Tiwari et al., 2019; Wu & Wu, 2021), the findings continue to be ambiguous. Another strand in the literature has explored how the Geopolitical Index influences the tourism

TABLE 1 Descriptive statistics

| Panel A: International tourist arrivals in Malaysia from January 2000 to March 2020 | | | | | | | |
|---|---------|---------|-----------|---------|-----------|--------------|--------------|
| | Mean | Median | Maximum | Minimum | Std. dev. | Sum | Observations |
| Australia | 31,559 | 30,115 | 70,801 | 6801 | 14,234 | 6,154,032 | 243 |
| Canada | 5217 | 5223 | 10,188 | 1147 | 2342 | 1,017,261 | 243 |
| China | 78,610 | 68,540 | 189,325 | 1930 | 46,457 | 15,328,872 | 243 |
| Finland | 1352 | 1164 | 4263 | 0 | 1022 | 263,679 | 243 |
| Germany | 8225 | 8658 | 16,958 | 1600 | 3559 | 1,603,954 | 243 |
| India | 37,089 | 38,394 | 93,162 | 5868 | 21,746 | 7,232,318 | 243 |
| Japan | 33,583 | 33,674 | 58,754 | 7242 | 9324 | 6,548,720 | 243 |
| Saudi Arabia | 5834 | 4255 | 24,456 | 355 | 5078 | 1,137,653 | 243 |
| Singapore | 880,060 | 877,694 | 1,543,174 | 205,065 | 250,181 | 172,000,000 | 243 |
| UK | 26,938 | 27,848 | 49,421 | 5051 | 9409 | 5,253,000 | 243 |
| UAE | 1764 | 1026 | 17,194 | 7 | 2584 | 344,046 | 243 |
| USA | 16,426 | 17,492 | 26,218 | 3426 | 4585 | 3,203,021 | 243 |
| Panel B: International tourists arrivals in Singapore from January 2000 to April 2020 | | | | | | | |
| | Mean | Median | Maximum | Minimum | Std. dev. | Sum | Observations |
| Canada | 7150 | 6814 | 15,968 | 0 | 2438 | 1,751,787 | 245 |
| Russia | 4323 | 4033 | 15,880 | 7 | 2910 | 1,059,021 | 245 |
| UAE | 4261 | 4179 | 11,862 | 1 | 2508 | 1,043,893 | 245 |
| UK | 39,586 | 39,718 | 68,106 | 17 | 9636 | 9,698,644 | 245 |
| USA | 36,631 | 34,968 | 76,119 | 13 | 11,104 | 8,974,677 | 245 |
| Panel C: Macroeconomic factors/uncertainties | | | | | | | |
| | Mean | Median | Maximum | Minimum | Std. dev. | Observations | |
| Global Economic Policy Uncertainty | 126.38 | 112.82 | 48.82 | 357.69 | 58.61 | 245 | |
| US Monetary Policy Uncertainty | 119.77 | 107.16 | 19.75 | 407.37 | 67.99 | 245 | |
| | 105.43 | 82.75 | 27.21 | 545.26 | 72.62 | 245 | |
| Market Volatility | 20.77 | 18.26 | 9.57 | 69.83 | 8.65 | 245 | |
| Global Financial Index | 99.47 | 99.47 | 98.46 | 101.00 | 0.44 | 245 | |

sector adversely (Balli et al., 2019; Lee, Olasehinde-Williams, et al., 2021). The explorations in the literature on utilizing both global economic uncertainty and Geopolitical Index in examining the tourism sector's vulnerability is scarce. This article intends to fill this lacuna in the literature by exploring the dynamic interactions amid international tourist arrivals (ITA) to two major Asian tourist destinations, that is, Singapore and Malaysia and a set of uncertainty-based macro indicators. The set of indicators include (i) global economic policy uncertainty (GEPU); (ii) US Monetary Policy Uncertainty Index (UMPU); (iii) the Volatility Index (VIX); (iv) Global Financial Stress Index (GFSI), and (v) the Geopolitical Index (GPR). These indicators measure the risk in money, fiscal, trade, levels of uncertainty in policy, fear among investors in decision making and fear associated with wars, internal strife and terrorism. It is probable these indicators impact the consumers' decision making and in particular the tourists. We utilized monthly data spanning from January 2000 to April 2020. The sample period was decided purely by data availability on the measure of tourism activities and the varying indicators on uncertainty.

1.1 | Objectives and contribution of the study

The uniqueness of the contribution of this study is three-fold. Firstly, it explores the dynamic nexus across tourism and major macro-based uncertainty indicators as mentioned earlier. No previous study has focused on how a group of key uncertainty indicators impact travel decision in a unified framework. GEPU encompasses dimensions of uncertainty related to monetary, trade, fiscal, and related policies. GPR comprises of features including the power relations across nations, stress, and tensions relating to natural resources and wars (Overland, 2019). It would be noteworthy to explore how uncertainty emanating from the varying sources impact tourism. In addition, we shall explore how the US Monetary Policy Uncertainty Index; the VIX and GFSI impact tourism for enhancing the comprehensive of the study. The UMPU is considered a major index in the extant literature which reflects the contemporaneous uncertainty on the financial state of the economy and how the perception of the public varies owing to the state of

uncertainty (Husted et al., 2020; Singh et al., 2019). The market Volatility Index or VIX is also referred to as the Fear Index, Akdağ et al. (2019) and the higher the VIX, greater the fear. There has been some research in the extant literature on the impacts of the VIX on tourism firms (Akdağ et al., 2019; Grechi et al., 2017).

Secondly, our study explores theoretical postulates with sophisticated empirical methodologies and thus is the uniqueness of the contribution in the extant literature. Our study has a theoretical underpinning in the sense it tests the theories on “prospect theory of risk” and “real options theory” on exploring the association between

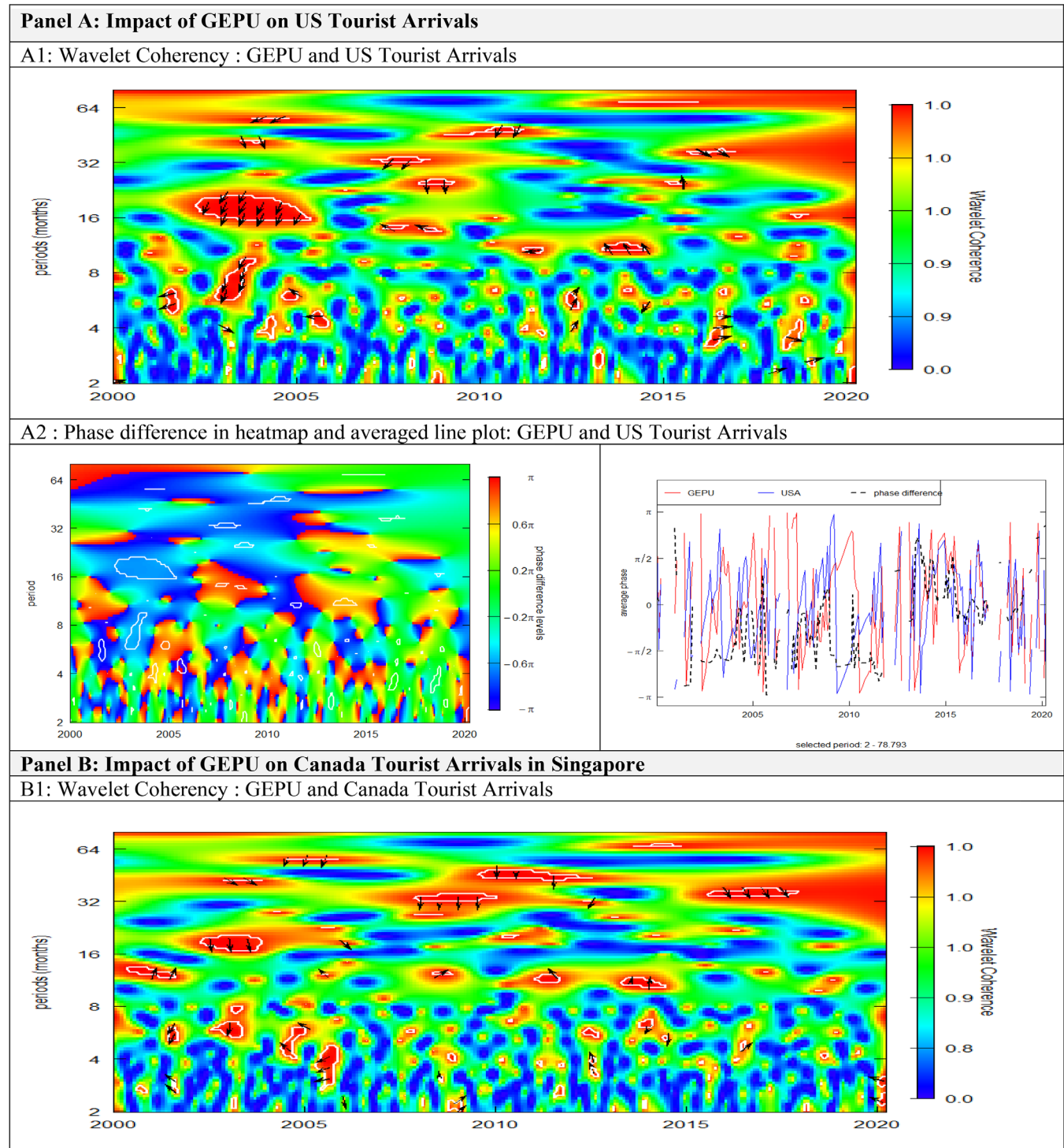


FIGURE 1 Wavelets coherence and phase difference between GEPU and tourist arrivals in Singapore [Colour figure can be viewed at wileyonlinelibrary.com]

uncertainty in economic policy, uncertainty in the political scenario and financial stress and tourism activity, an example of the real sector. Theoretically, the first concept associated with uncertainty relates to ‘Prospect Theory’. According to the “Prospect Theory” tourists are consumers whose choices are based on rationality. When tourists

perceive any risk in the travel, they become more careful to alter the travel plans and adopt methods that are not risk augmenting. Tourists are sensitive to threats emanating from terrorism/war, which may alter the choice of travel destinations, Seabra et al. (2020). The second concept relates to the “Real Options Theory”. According to the “Real

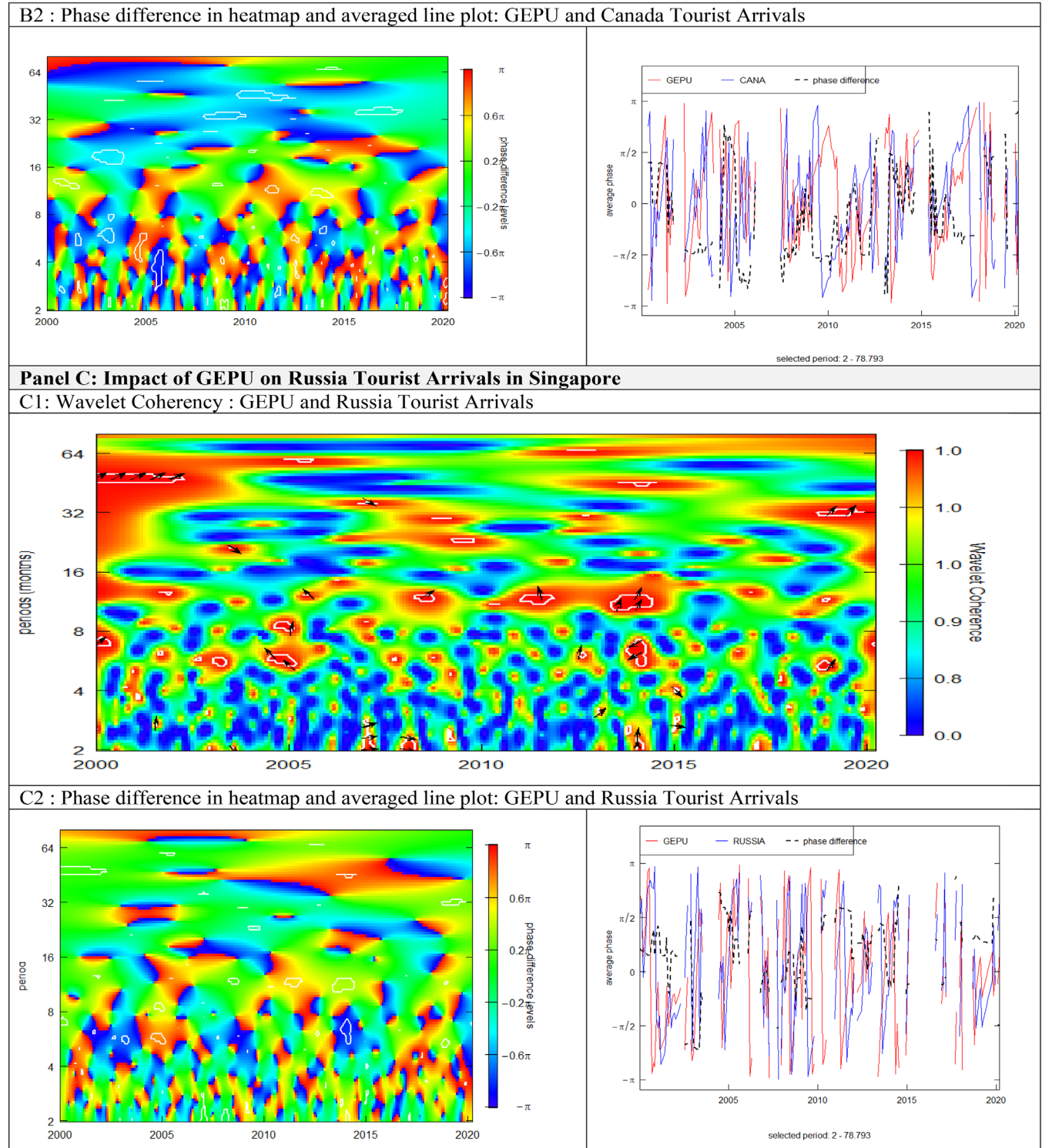


FIGURE 1 (Continued)

Options Theory” individuals take into account the situation of uncertainty while making important decisions in finance and wait for the climate of uncertainty to dissipate. Such postponement of decisions on investment impact the real sector adversely and affects consumers sentiments also. In a nutshell both the “Prospect Theory” and the

“Real Options Theory” deliberate how ebb in the travel plans can be a consequence of political risks and financial stress as reflected in aggravated uncertainty. As far as the empirical contribution of the study in the extant literature on tourism economics is concerned the contribution is twofold. Firstly, we base our study on a higher frequency

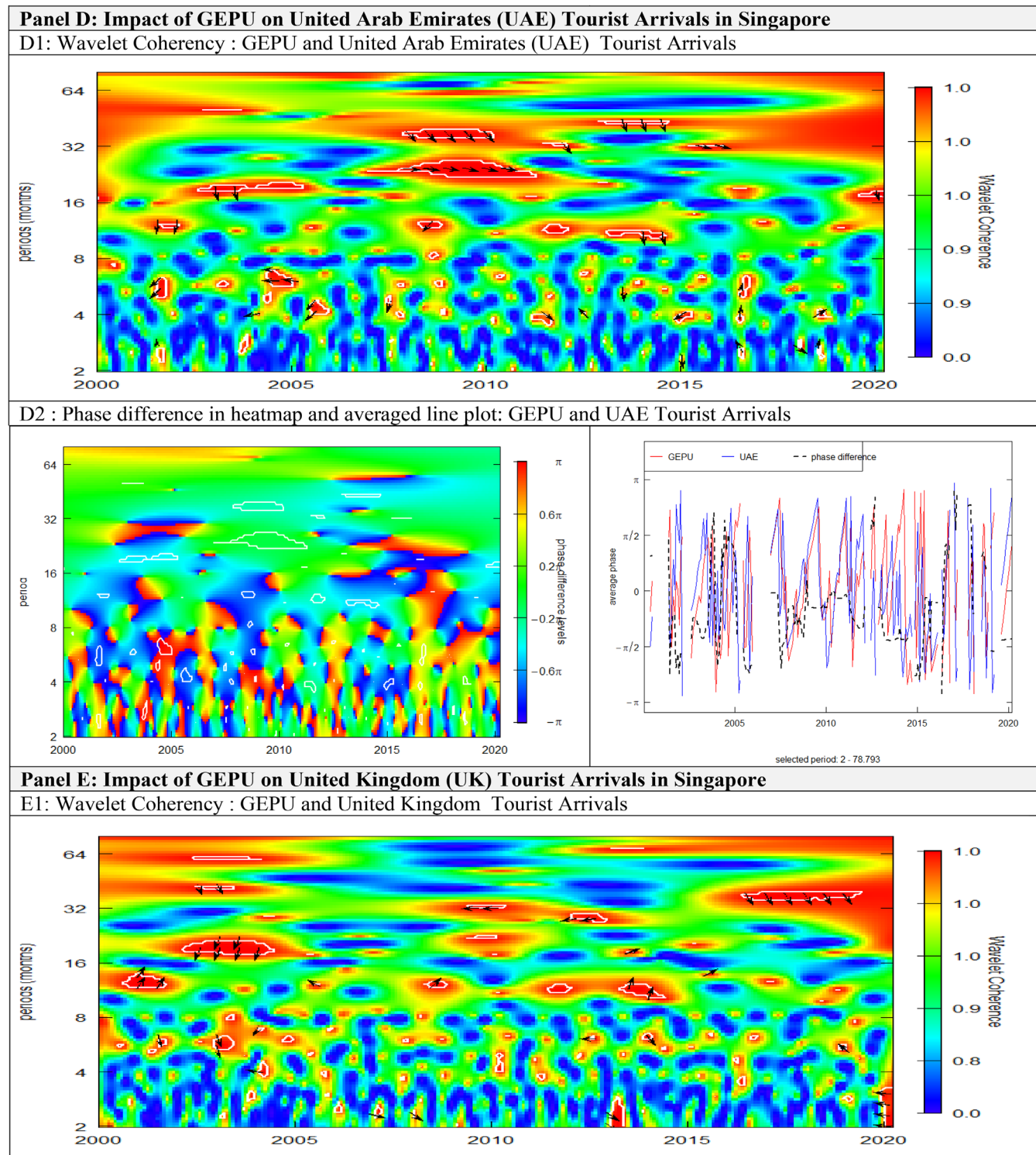


FIGURE 1 (Continued)

(monthly data sets) analogous to few recent studies (Balli et al., 2018; Tiwari et al., 2019). It is notable that the major indices on uncertainty is based on monthly data and is more suitable to capture precisely its impact on tourist arrivals. Secondly, to analyze the nexus between international tourist arrivals and uncertainty indicators we employ the wavelet-based methodology postulated by Rua (2010). The innovativeness of this methodology is that it allows very abundant and crucial insights about uncertainty of events as it generates the dynamism of the co-movements of the underlying variables in the time-frequency domain in a unified frame. Our prime motivation is to draw important insights into the economic policy uncertainty, VIX, financial stress and monetary uncertainty alongside geopolitical risk and international tourist arrivals–financial–political–real-world nexus. The utilization of the method is a unique contribution of the study.

Third diverse from the earlier studies which focus primarily on Western destinations (Yang & Ong, 2020) we focus our study on tourism destinations in two major countries in the East namely Singapore and Malaysia. The process of globalization has given inspiration to many Asian countries of the East to transform Asian culture meaningfully and have combined with Western contemporaneous aspects to encourage tourism and yet upholding the richness of cultural originality, Chon et al. (2020). According to the World Travel and Tourism Council Reports, Singapore is a major tourism destination in Asia. The travel and hospitality sector in Singapore creates employment opportunities, contributes to economic growth and foreign exchange. In 2017 Singapore tourism and travel industry accounted for a 10.4% share of global GDP and a 9.9% share in total employment. The Singapore government in the recent decade has taken important policy stances to promote tourism as a viable sector ranging from building the necessary infrastructure, focusing on the cultural and national heritage of the country, planning and execution in coordination with other agencies and multi-entry visa restrictions among others, Planning for Tourism (2015). Alternatively, Malaysia is the most visited tourist destination in Asia and tourism contributed to a 13.7% share in

GDP in 2016. Since the tenth plan period (2011–2015), Malaysia has diversified its tourism plan and projects to target high spending tourists. The tourism industry is the major element in Malaysia's Economic Transformation Program. The focus of tourism policy is to enhance quality services at competitive pricing. There are duty-free shopping destinations to promote intensified tourism. The country has also improved transport connectivity in key tourism areas which have increased international tourist arrivals rapidly. The country's progress in the tourism sector is attributed to fair exchange rate policy, climatic conditions, stable governments and cultural diversity. Yet, Malaysian tourism is grossly unresearched, Hussin and Buchmann (2019). In light of the foregoing discussion concerning the tourism activities in these two countries, exploring the tourism connection in the uncertainty framework across time sequence tools is not only appropriate but also has a momentous perspective.

We document several interesting findings. Our results show that the global uncertainties manifested through different macro-based indicators affect international tourism demand for the destination countries of Singapore and Malaysia for different time spans. However, the intensities of impact vary across countries. The next important indicator is the GEPU which depicts robust evidence of co-movements and causality with variation across frequencies and countries. During the subprime crisis, Euro-crisis and the pandemics significant coherencies are perceptible. In terms of the lead-lag association the GEPU and tourism display positive or negative association with significant co-movements. The other important uncertainty indicators namely the VIX and GFSI show important coherencies but the intensity is less considerable than the earlier mentioned indicators. Overall, the results demonstrate an intricate association between the various macro-indicators and tourism.

The remainder of this article is structured as: in the subsequent section the Literature Review is presented which develops the scientific underpinning of the current study followed by a discussion on the related works; subsequently the data, variables and the research

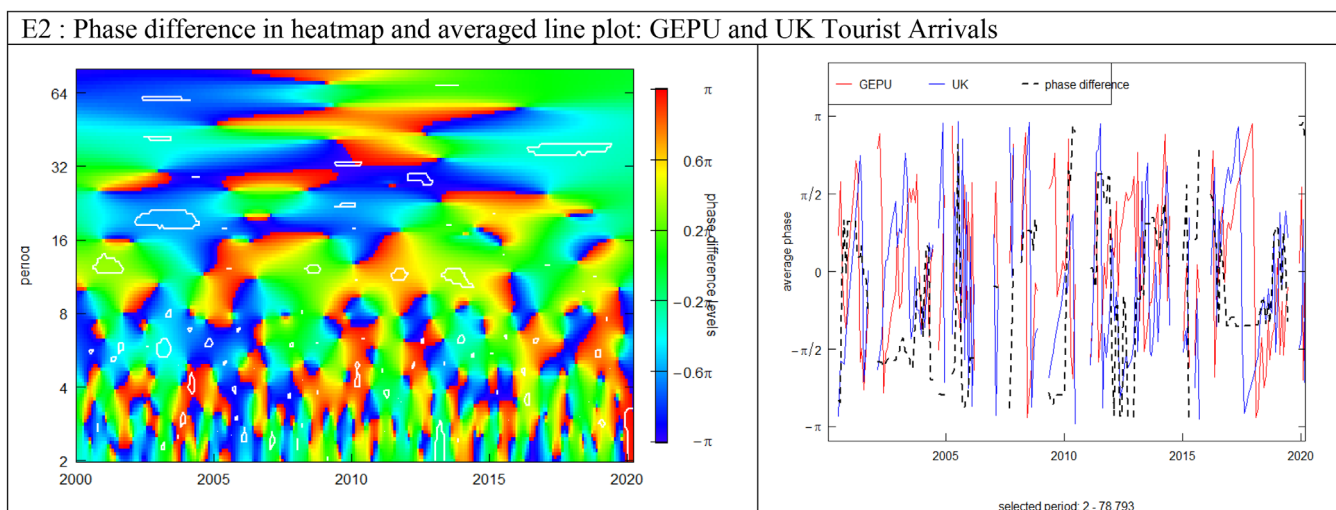


FIGURE 1 (Continued)

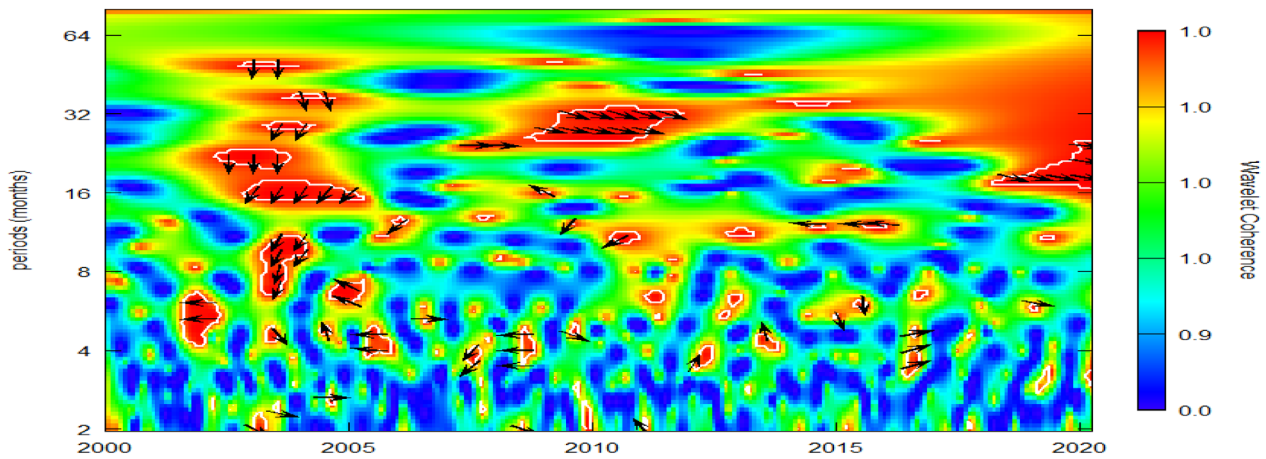
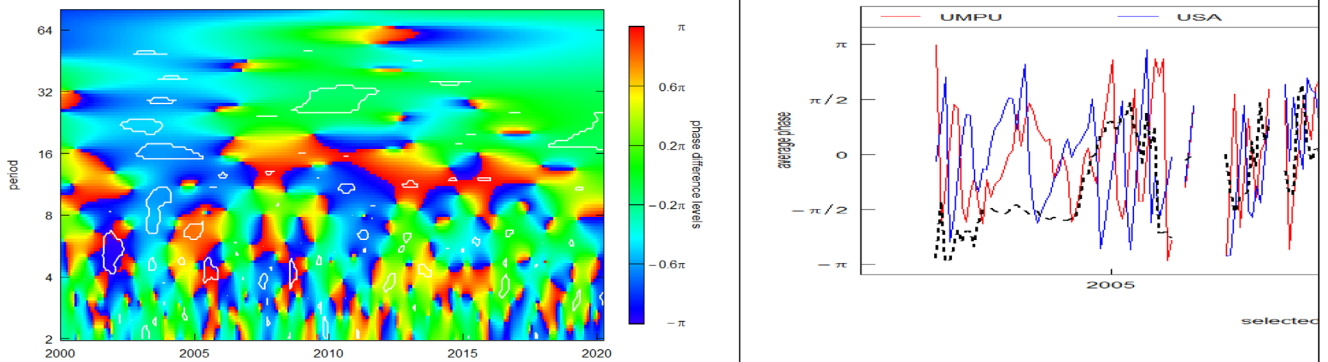
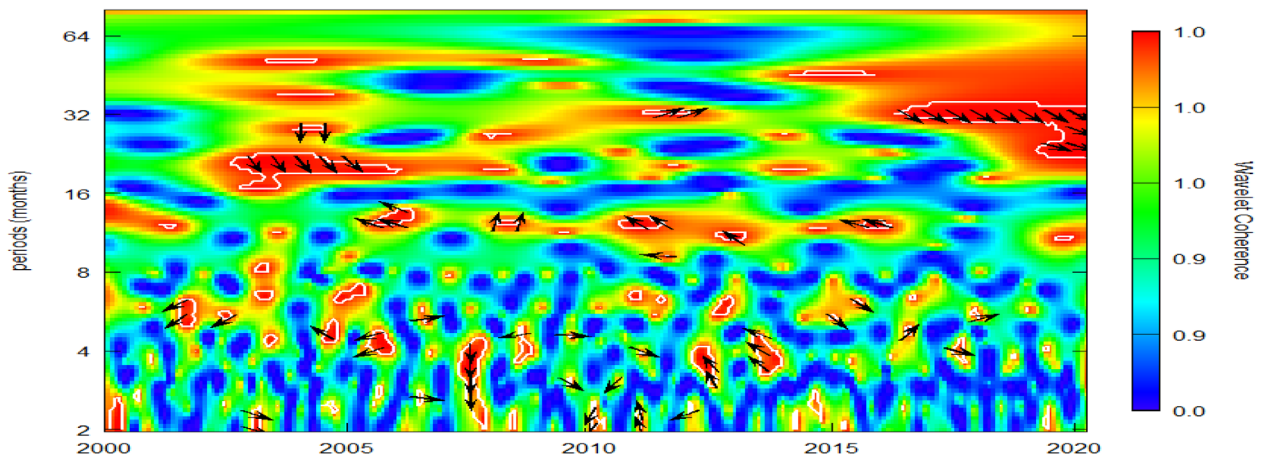
Panel A: Impact of UMPU on US Tourist Arrivals**A1: Wavelet Coherency : UMPU and US Tourist Arrivals****A2 : Phase difference in heatmap and averaged line plot: UMPU and US Tourist Arrivals in Singapore****Panel B: Impact of UMPU on Canada Tourist Arrivals in Singapore****B1: Wavelet Coherency : UMPU and Canada Tourist Arrivals**

FIGURE 2 Wavelets coherence and phase difference between UMPU and tourist arrivals in Singapore [Colour figure can be viewed at wileyonlinelibrary.com]

estimation methodology are explained. The Empirical Results and Discussion are in Section 4. The last section concludes with a summary on the probable inferences of the major findings.

2 | LITERATURE REVIEW

During the recent decade, the literature on tourism economics has made a meaningful pace onward in exploring the behavior of macro-economic uncertainty, political uncertainty and terrorist insurgency on

international inbound tourism demand. Careful scrutiny of the extant literature reveals that mostly the studies have deliberated on the linkages on global or local economic policy uncertainty (Singh et al., 2019; Wu & Wu, 2021; Sharma & Khanna, 2021; Lee & Chen, 2021; Lee, Olasehinde-Williams, & Ibikunle, et al., 2021) and Geopolitical Index (Balli et al., 2019; Lee, Olasehinde-Williams, & Akadiri, et al., 2021; Tiwari et al., 2019) and international tourism demand. Theoretically, there are two pertinent concepts that shed light on the nexus between financial stress/uncertainty, economic policy uncertainty and political uncertainty and impact on international tourism demand. The

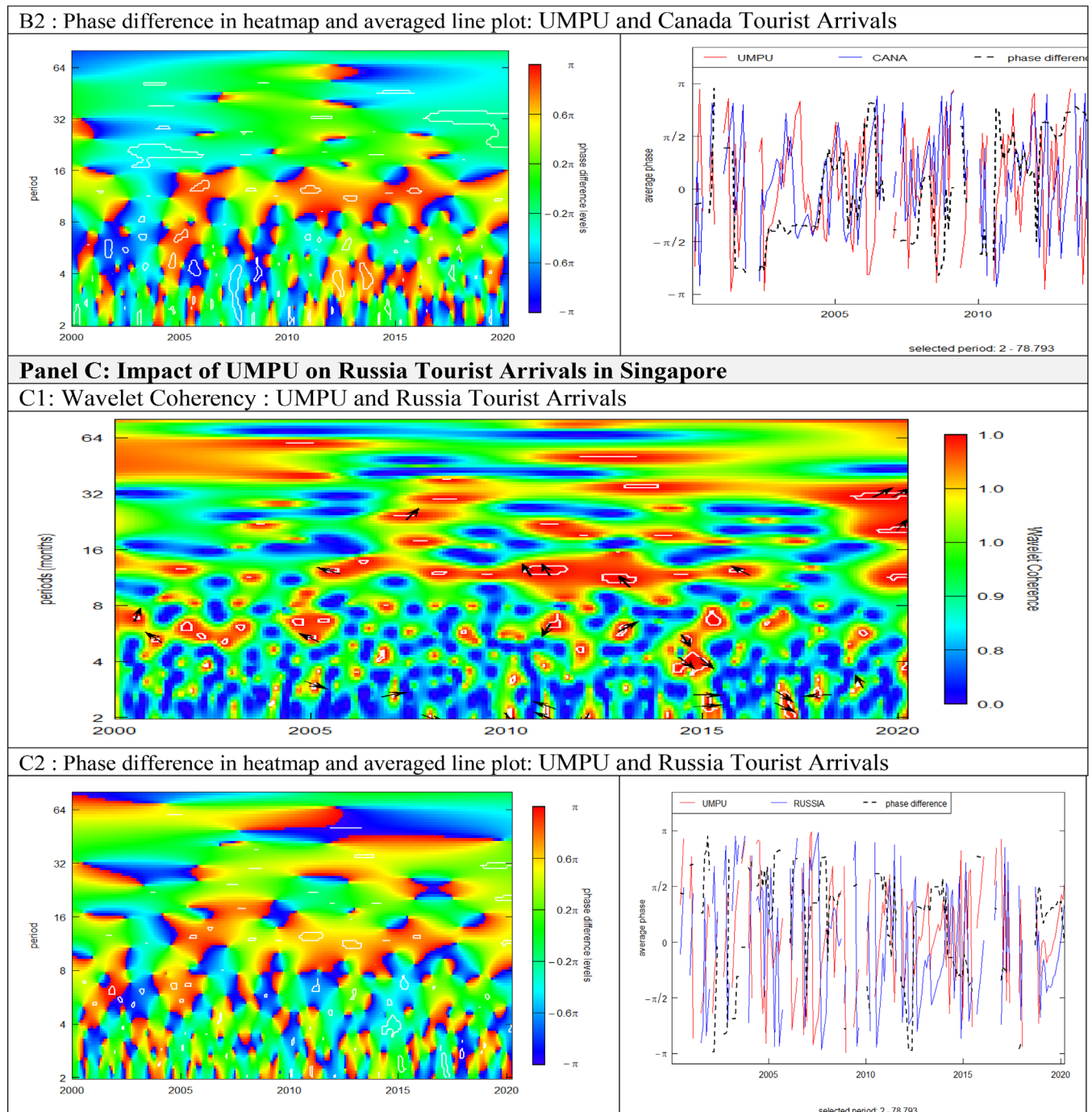


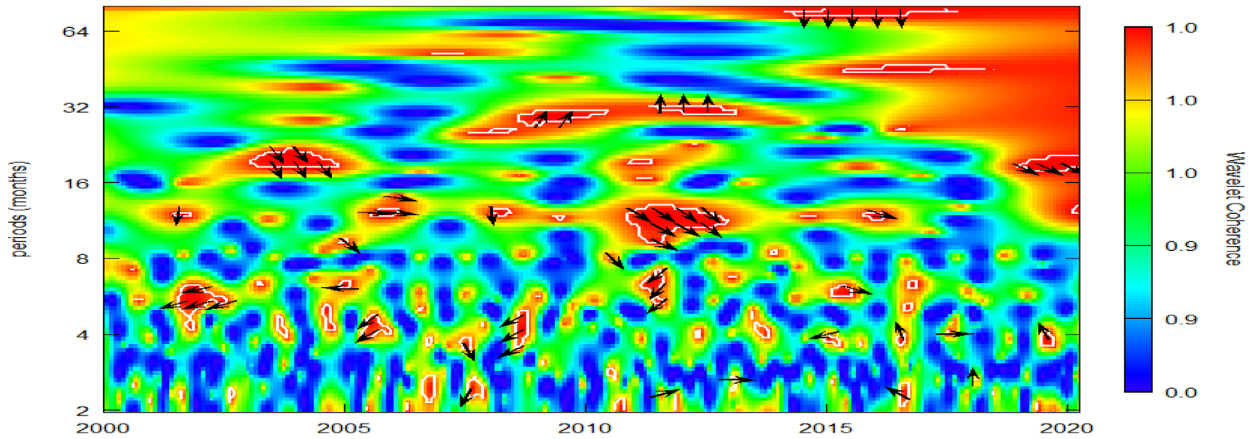
FIGURE 2 (Continued)

first concept is associated with the “Real Options Theory” that explains how uncertainty in financial markets lead to postponing of investment plans in the real sector until the wave of uncertainty is

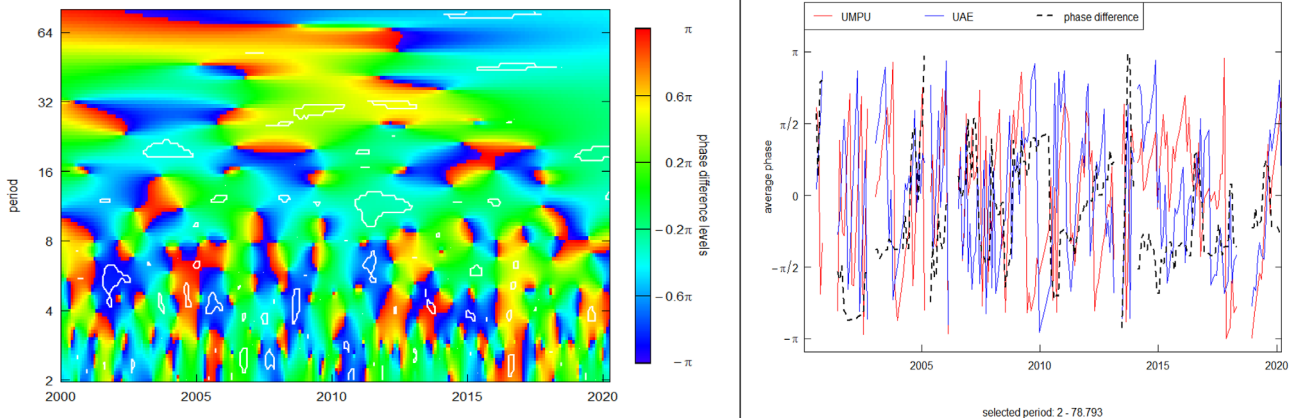
dissipated. The term real option was postulated by Myers (1977) to analyze opportunities related to growth. Since then, it has seen wide-ranging applications. In tourism economics in the context of financial

Panel D: Impact of UMPU on United Arab Emirates (UAE) Tourist Arrivals in Singapore

D1: Wavelet Coherency : UMPU and UAE Tourist Arrivals



D2 : Phase difference in heatmap and averaged line plot: UMPU and UAE Tourist Arrivals



Panel E: Impact of UMPU on United Kingdom (UK) Tourist Arrivals in Singapore

E1: Wavelet Coherency : UMPU and United Kingdom Tourist Arrivals

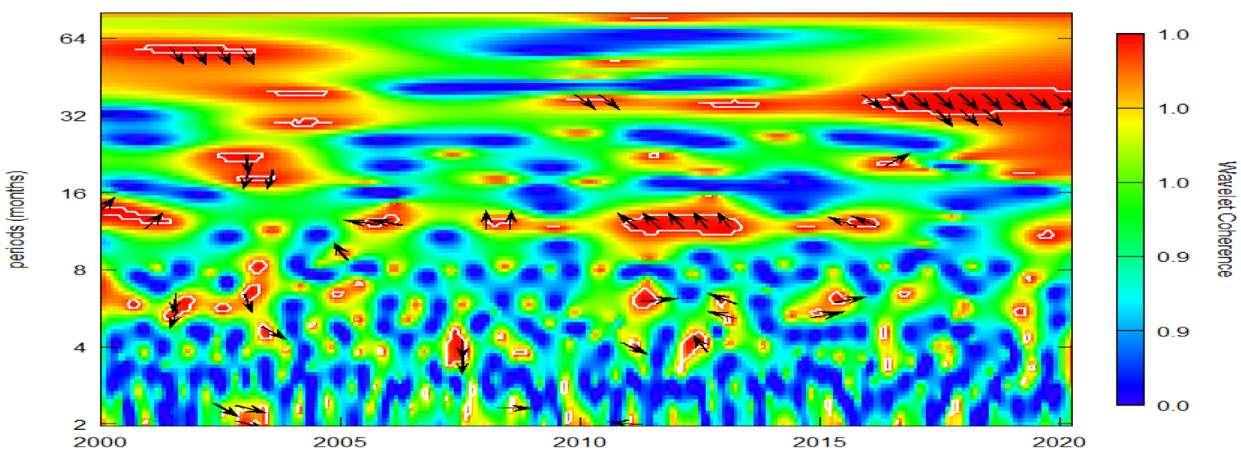


FIGURE 2 (Continued)

uncertainty/stress or fear the desire to travel will be significantly affected. Still, the scale and extent of postponement of travel would rest on the nature of goods if tourism were a luxury good then its demand would fall in times of uncertainty but if it is an inferior good then it may rise in times of uncertainty (Theuns, 2014; Singh et al., 2019). The second concept is associated with the 'Prospect Theory'. The tourists will tend to choose destinations that are potentially more gainful and have lower risks. Tourists' reaction to political threats and terrorism will make them avoid destinations connected to threats and may plan for alternative destinations Seabra et al. (2020). In contrast, the risk-loving tourists would prefer to travel during periods of political uncertainty and the risky environment by taking advantage of reduced prices of hotel rooms and travel costs (Tiwari et al., 2019; Singh et al., 2019).

A major strand in the literature has deliberated on the significance of financial stress, monetary policy uncertainty and VIX in impacting the real sector Husted., (2020). However, the literature in the context of tourism economics is relatively nascent (Akdağ et al., 2019; Grechi et al., 2017; Usman et al., 2021; Xia et al., 2021). In the empirical strand of literature, wide-ranging studies explore the negative effect of economic policy uncertainty on tourism, however, the conclusions continue to be ambiguous (Balli et al., 2018; Singh et al., 2019; Tiwari et al., 2019; Wu & Wu, 2021). The studies by Wu and Wu (2021) demonstrate the perceptible negative impact of economic policy uncertainty on tourism demand for the major countries of the European Union and the group of G7 countries, respectively. Sharma and Khanna (2021) employ pooled mean group estimation, dynamic ordinary least-squares and fully modified least-squares report for the panel of 19 tourism-driven economies the impact global economic policy uncertainty on international tourist arrivals. The findings obtain that in the short term the impact of global economic policy uncertainty on international tourism demand is significantly negative but in the long-run, it is significantly positive.

Another major strand in the literature focuses on the nexus between geopolitical risk, political instability and terrorism and demand for international tourism (Balli et al., 2019; Lee, Olasehinde-Williams, & Akadiri, et al., 2021; Seabra et al., 2020; Tiwari et al., 2019). Geopolitical tensions across and within countries create instability in the economy and society. Owing to global integration, regional or domestic geopolitical tensions may have repercussions across boundaries (Lee & Chen, 2021). The tourism sector is not immune from the shocks emanating from GPR tensions. Indeed, tourists may forego their decisions to travel or choose substitute destinations which are peaceful (Lee, Olasehinde-Williams, & Akadiri, et al., 2021; Tiwari et al., 2019). Furthermore, the recent COVID-19 pandemic crisis created major shocks which affected the geopolitical relations as well, thereby cumulating the levels of geopolitical tension, Choi (2020). Examples of how the health crisis cumulated into geopolitical tensions lie in the criticisms by the United States that China is responsible for the pandemic. Again, intolerant sentiments are raised toward people of Asian origin. The tourism sector is facing a multifaceted crisis owing to COVID-19 tensions and the geopolitical shocks associated with it, Lee, Olasehinde-Williams, and Akadiri, et al. (2021). Likewise, the study by Balli et al. (2019) using wavelet techniques close to our study report the impact of GPR on international-based tourism demand for major emerging economies. Analogous to our findings the impact of GPR on international tourism demand is heterogeneous. The study by Seabra et al. (2020) obtain the positive spillover impact of GPR on international tourism-related demand. The study reports that the rising incidence of terrorism has made international tourists choose Portugal as an alternative peaceful travel destination over 2002 and 2016. Precisely, like our study the study by Seabra et al. (2020) validates the "Prospect Theory," implying tourists as rational consumers at the backdrop of the terrorists' threats avoid risky destinations and choose relatively peaceful destinations.

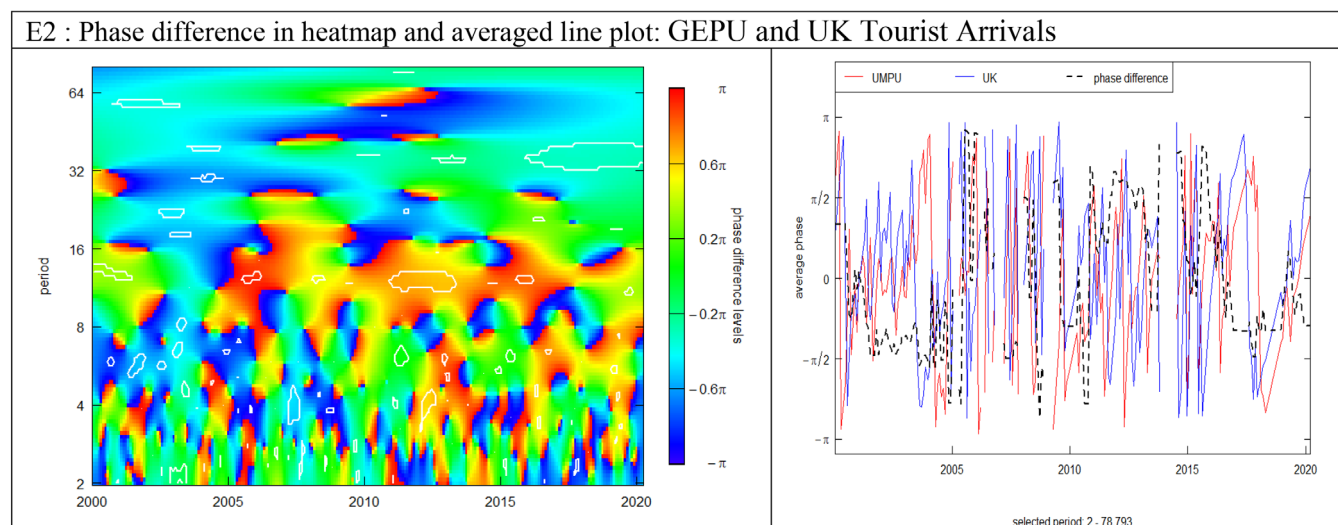


FIGURE 2 (Continued)

The aforesaid discussion has explored in-depth how indicators of uncertainty impact international tourism demand. However, these studies have left three main gaps in the extant literature. The first

gap is that the major research in the literature have focused on a single uncertainty indicator (Singh et al., 2019; Sharma & Khanna, 2021) and did not consider the importance of multiplicity of

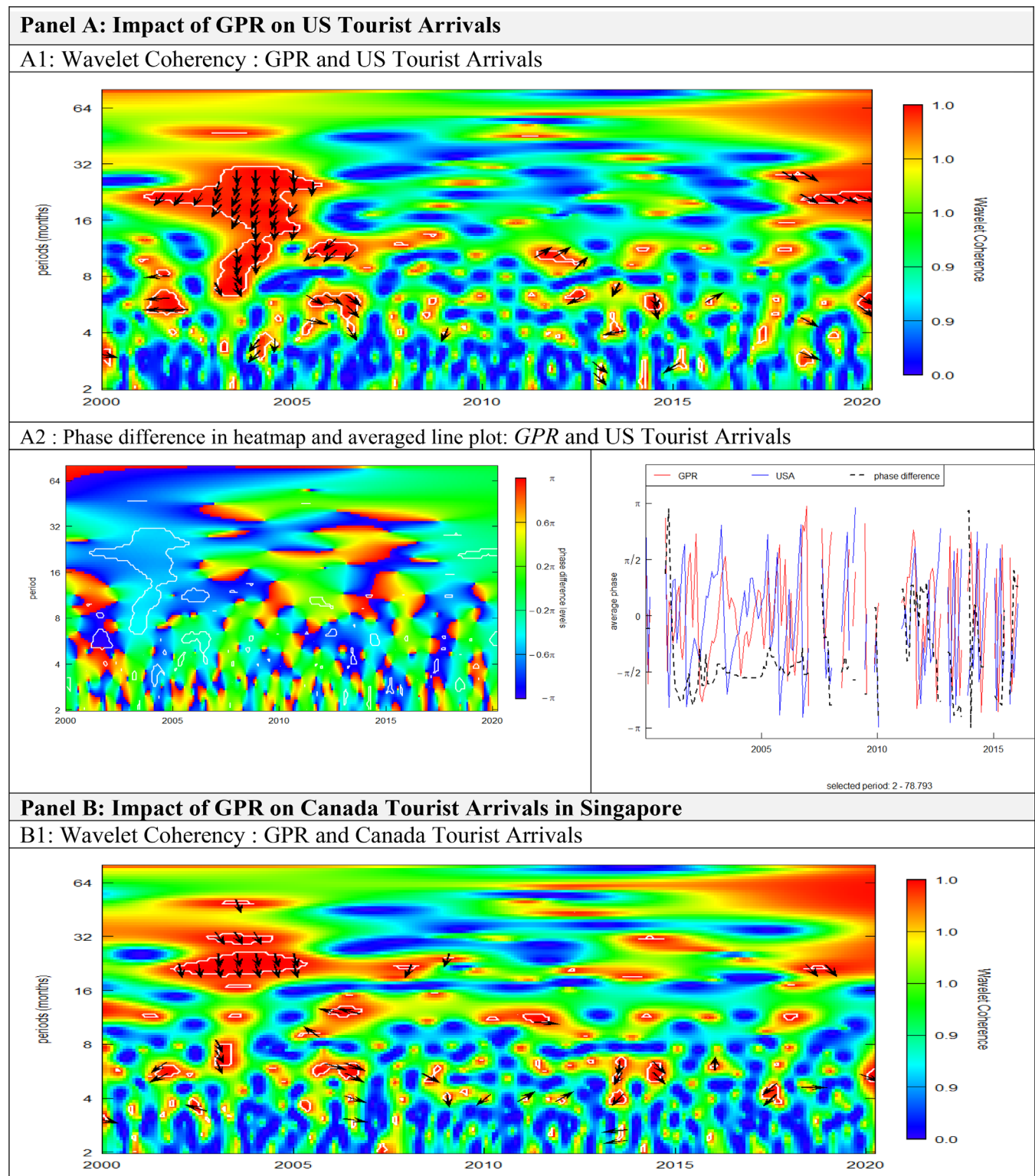


FIGURE 3 Wavelets coherence and phase difference between GPR and tourist arrivals in Singapore [Colour figure can be viewed at wileyonlinelibrary.com]

the uncertainty indicators that exist at the macro level and may have nexus with tourism. Our study addresses this first major gap. The second gap in the existing research on tourism economics is that plentiful research has explored the dynamics of uncertainty and tourism using conventional methods based on time-domain analysis for example causality and cointegrating techniques. However, the time-frequency and the variation in frequency in the causality may impact tourism demand. Existing research remains scant (Tiwari et al., 2019; Wu & Wu, 2021). It is essential to explore the time-

varying frequency impact of uncertainty for policy purposes and marketing decision making in tourism. This study addresses the second major gap by scrutinizing the association of the indices on uncertainty and international-based tourism demand in the broad framework of the wavelet methods. The third gap in the existing research, most of the earlier studies focused its discussion on the Western destinations and explorations on uncertainty-tourism nexus in the eastern major Asian destinations is rare. The current study addresses this major lacuna.

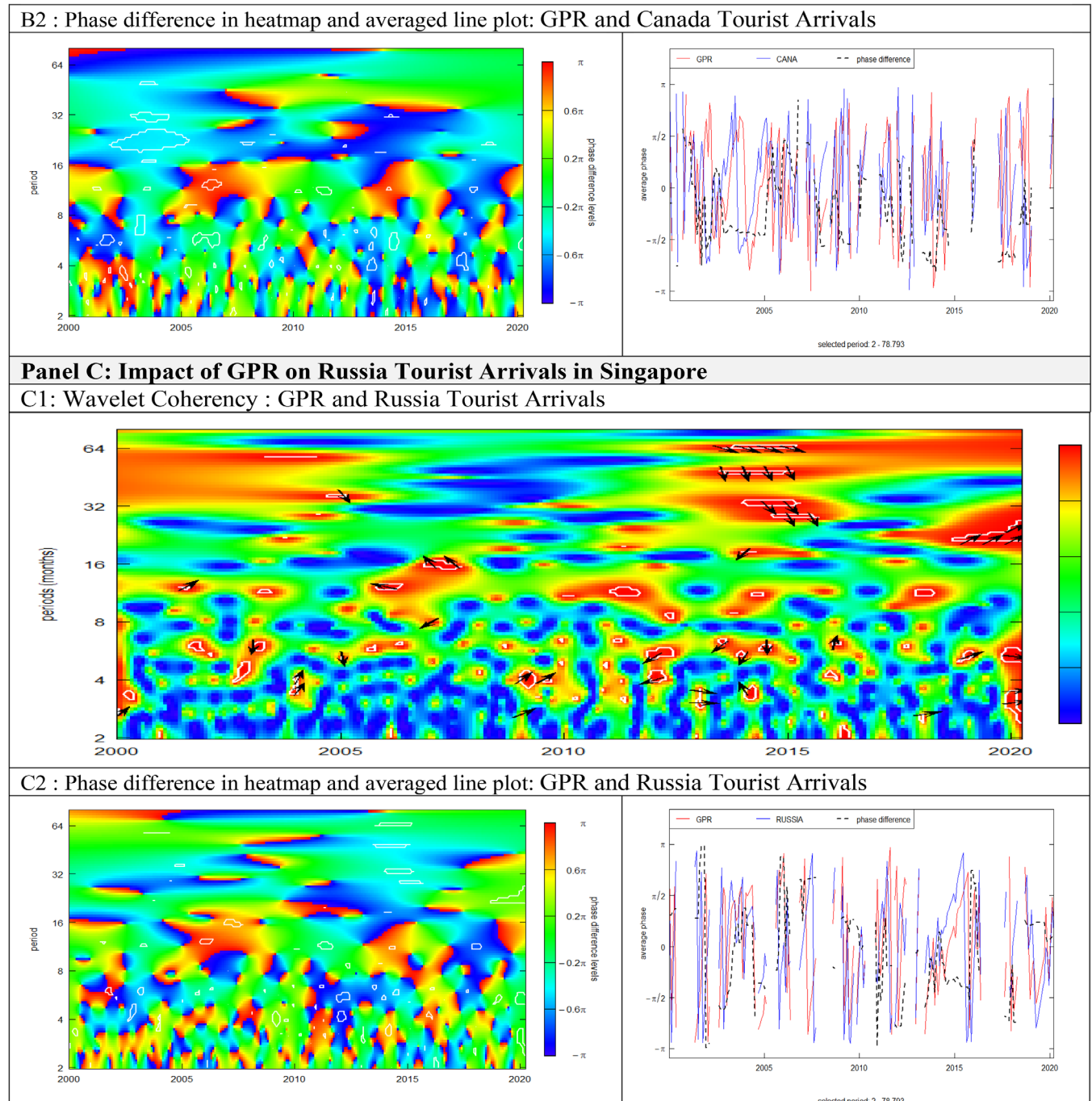
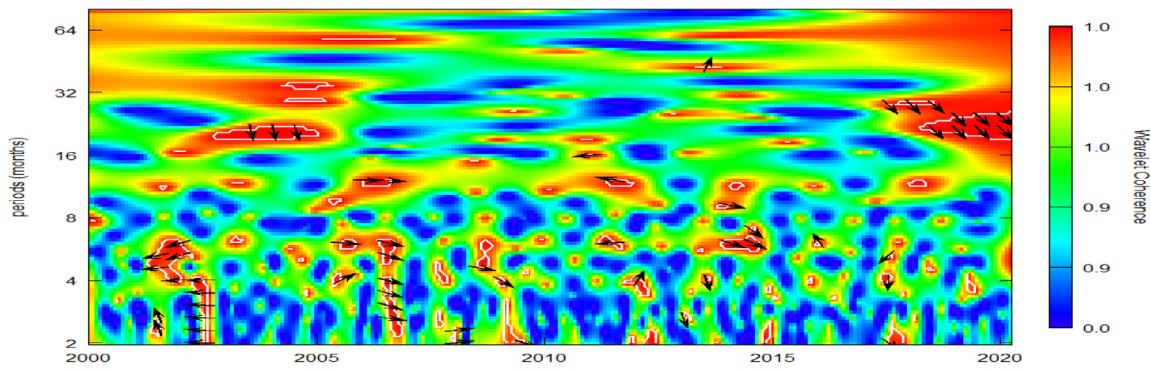


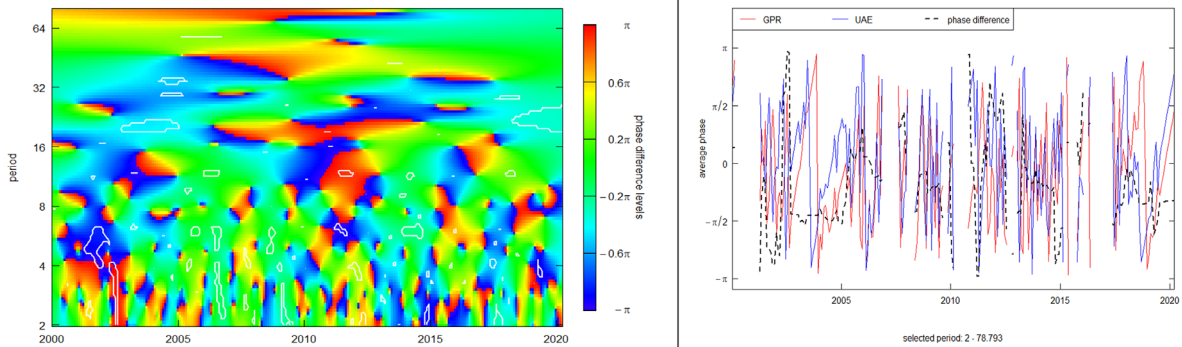
FIGURE 3 (Continued)

Panel D: Impact of GPR on United Arab Emirates (UAE) Tourist Arrivals in Singapore

D1: Wavelet Coherency : GPR and UAE Tourist Arrivals

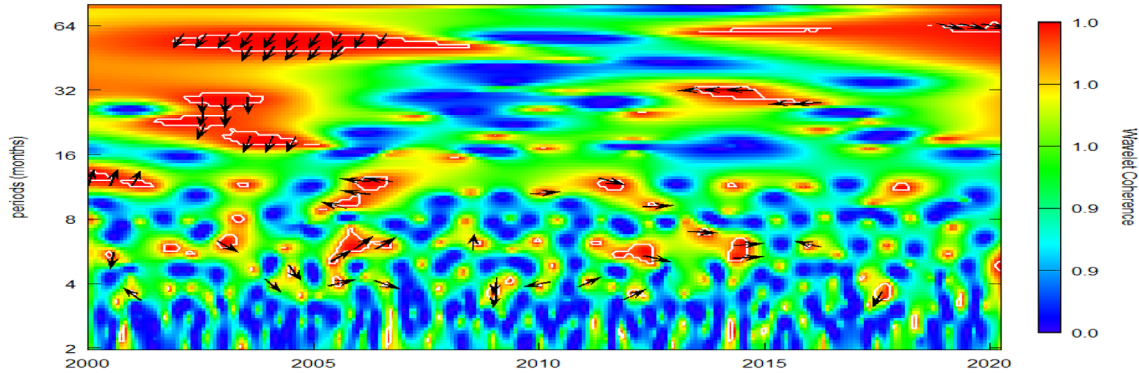


D2 : Phase difference in heatmap and averaged line plot: UMPU and UAE Tourist Arrivals



Panel E: Impact of GPR on United Kingdom (UK) Tourist Arrivals in Singapore

E1: Wavelet Coherency : GPR and United Kingdom Tourist Arrivals



E2 : Phase difference in heatmap and averaged line plot: GPR and UK Tourist Arrivals in Singapore

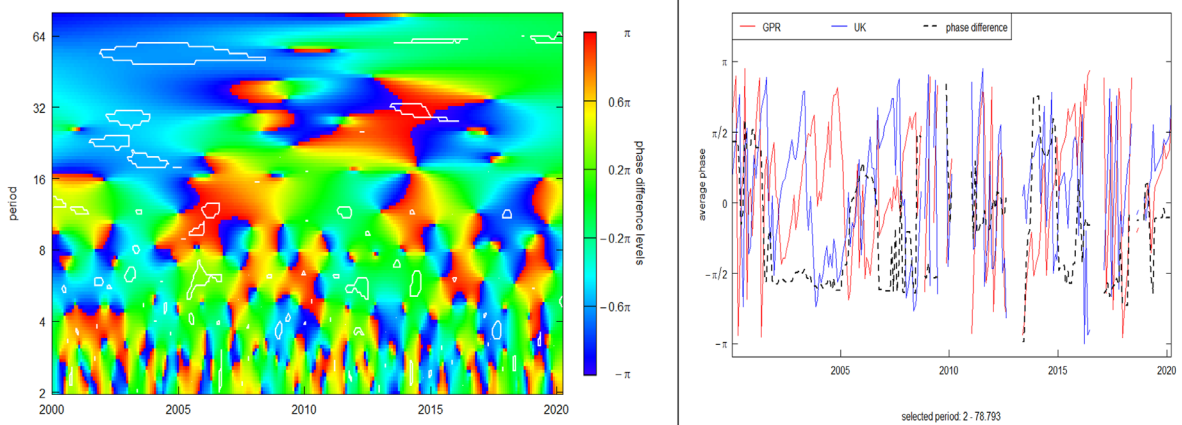


FIGURE 3 (Continued)

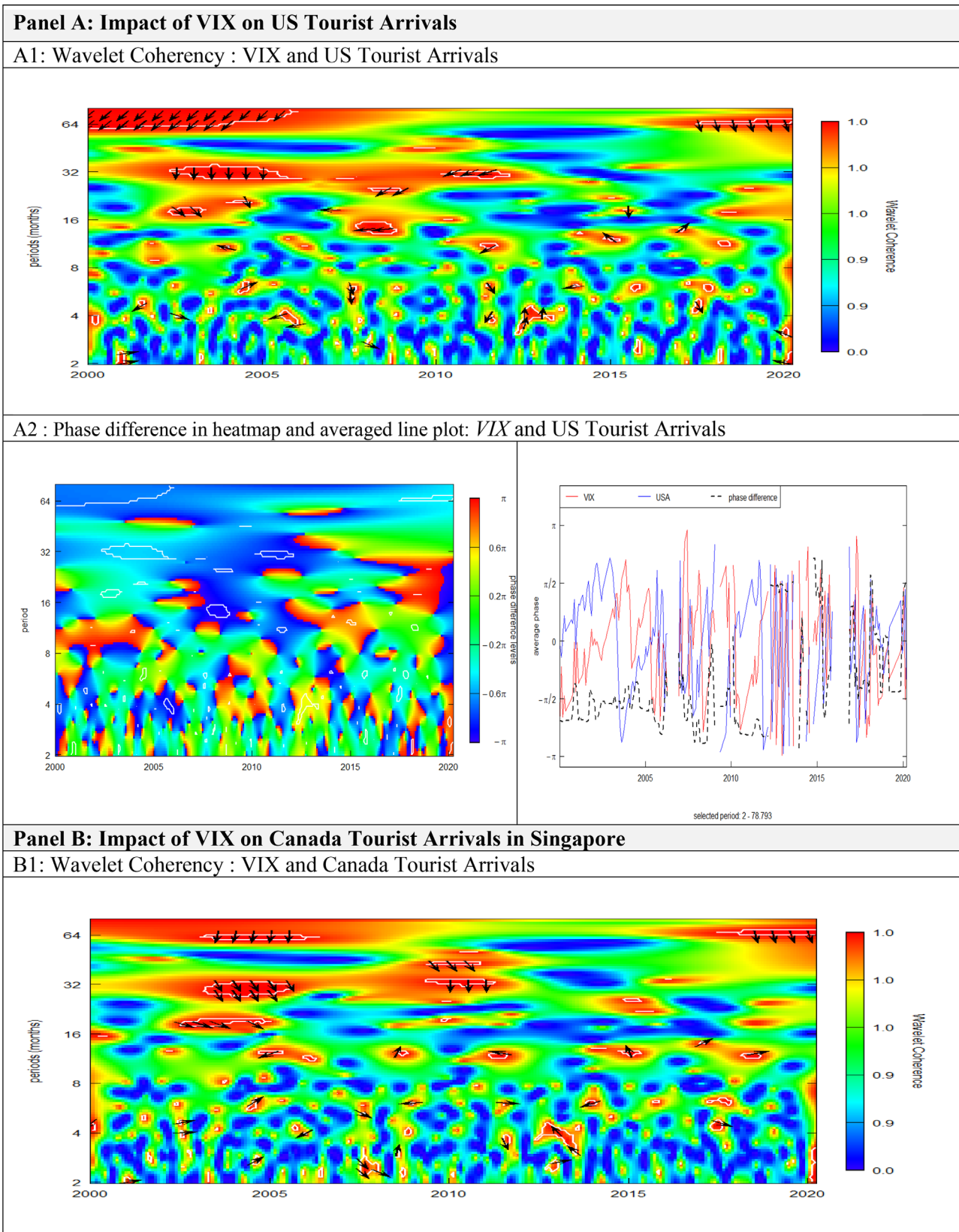


FIGURE 4 Wavelets coherence and phase difference between VIX and tourist arrivals in Singapore [Colour figure can be viewed at wileyonlinelibrary.com]

3 | EMPIRICAL METHODOLOGY

In this study, we adopt the continuous wavelets techniques to investigate the multi-time-horizon causality between economic and

monetary policy uncertainty, geopolitical risk, financial stress, Global Fear Index, and international tourist arrivals in Asia. The time varying nature of tourist arrivals permits the use of wavelet coherence and wavelet-based phase angle (Goupillaud et al., 1984) to explore the

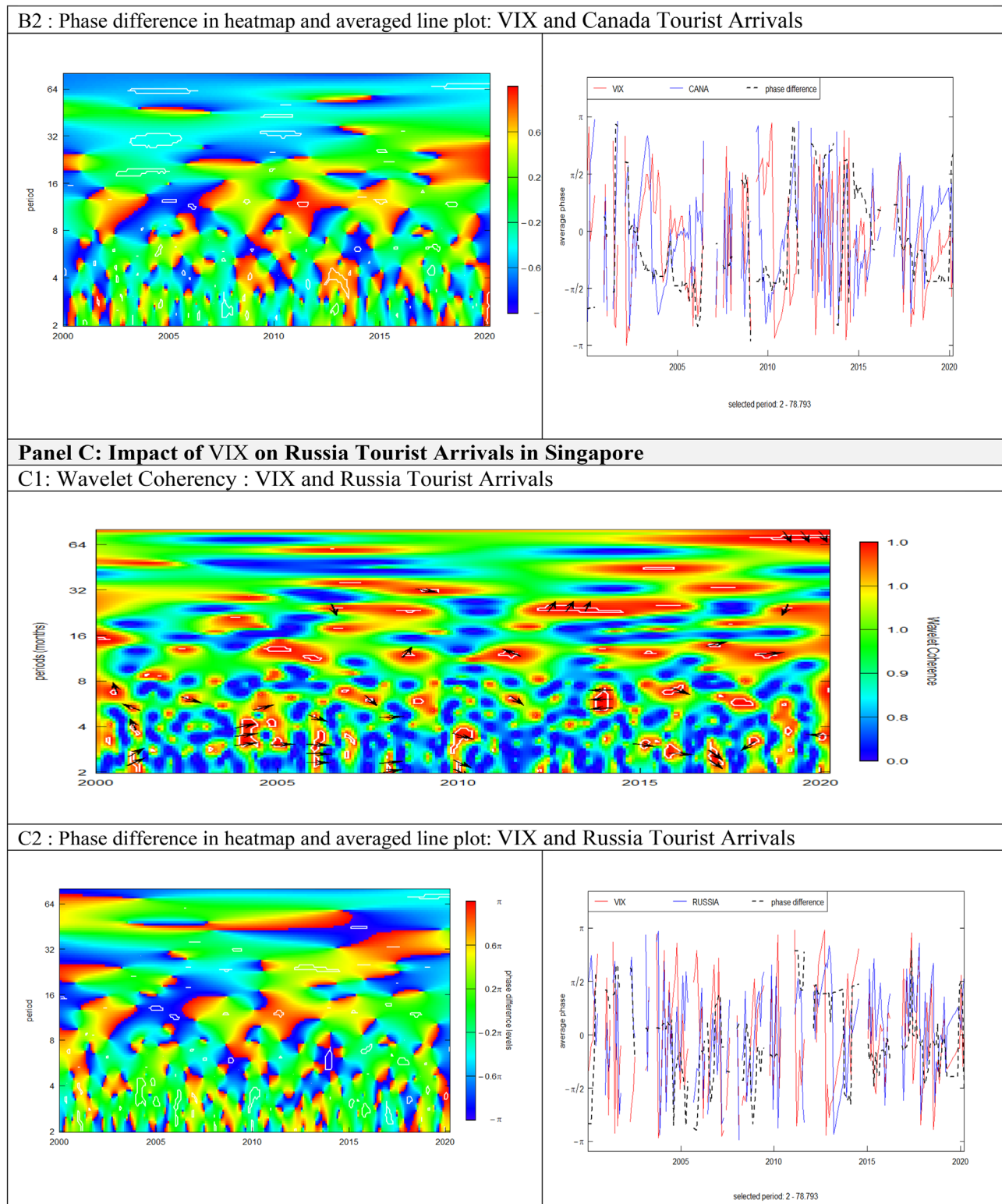


FIGURE 4 (Continued)

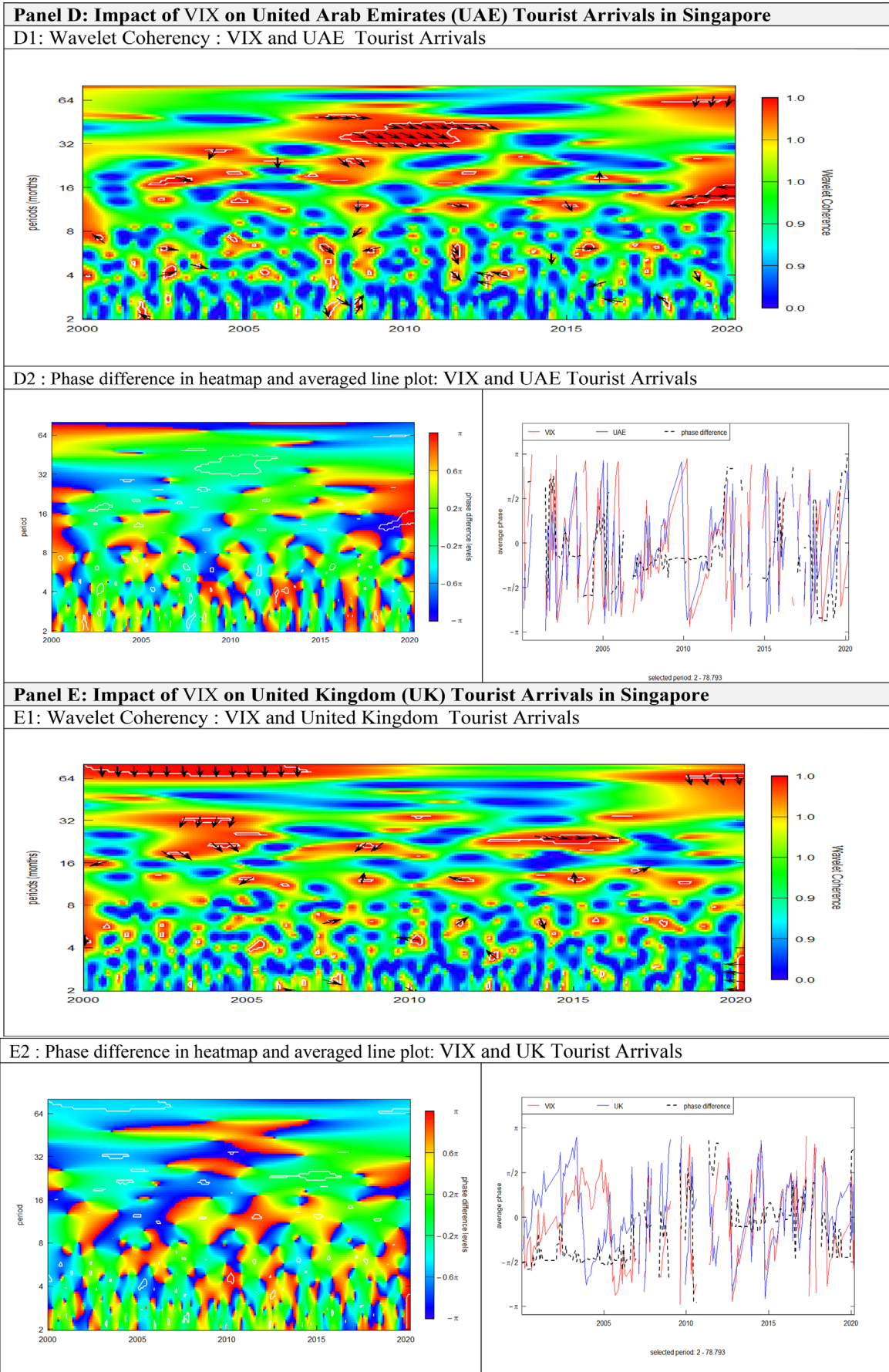


FIGURE 4 (Continued)

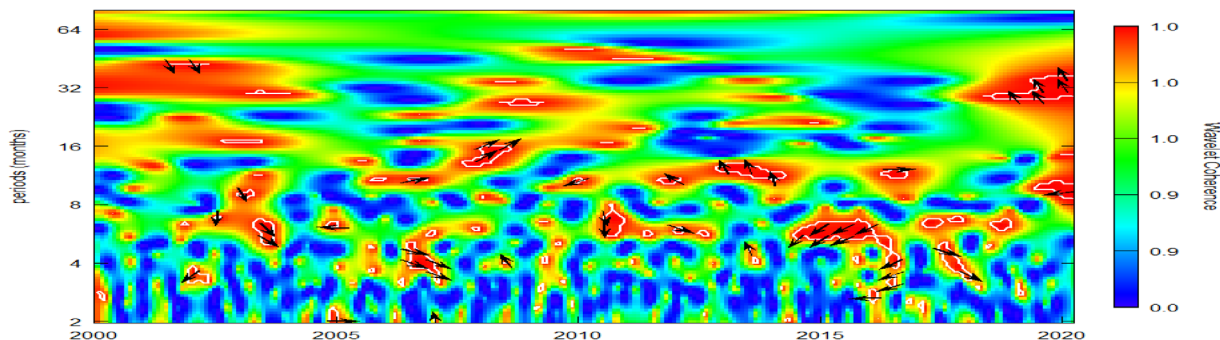
nature of causality under different time scales. Wavelet coherence (ratio of the cross-spectrum to the product of the spectrum of two time series) measures the strength of association between two variables over time as well as across frequencies. We

employ the wavelet cross spectrum and the wavelet coherence to compute the relation amid the two-time series that are non-stationary. The wavelet cross-spectrum employed in this study is given by

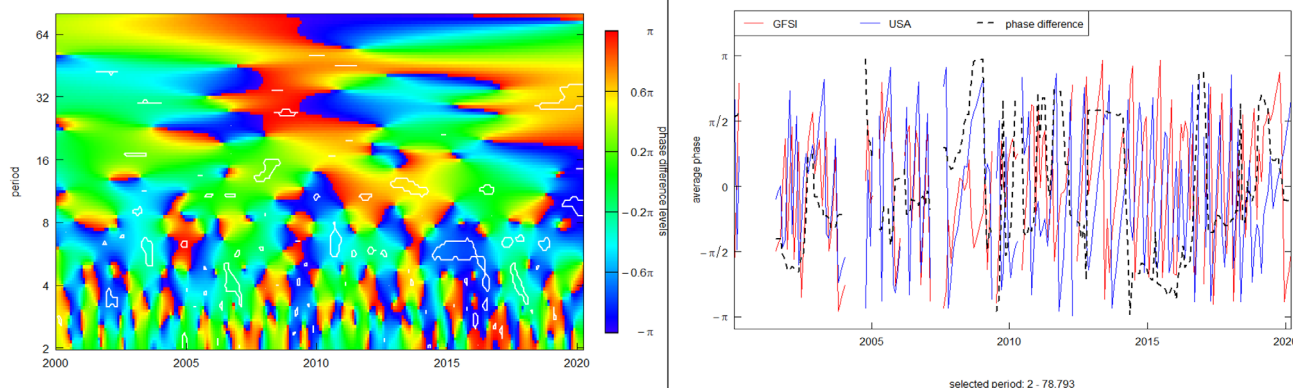
Fig 5 Wavelets Coherence and phase difference between GFSI and tourist arrivals in Singapore

Panel A: Impact of GFSI on US Tourist Arrivals

A1: Wavelet Coherency : GFSI and US Tourist Arrivals



A2 : Phase difference in heatmap and averaged line plot: GFSI and US Tourist Arrivals



Panel B: Impact of GFSI on Canada Tourist Arrivals

B1: Wavelet Coherency : GFSI and Canada Tourist Arrivals

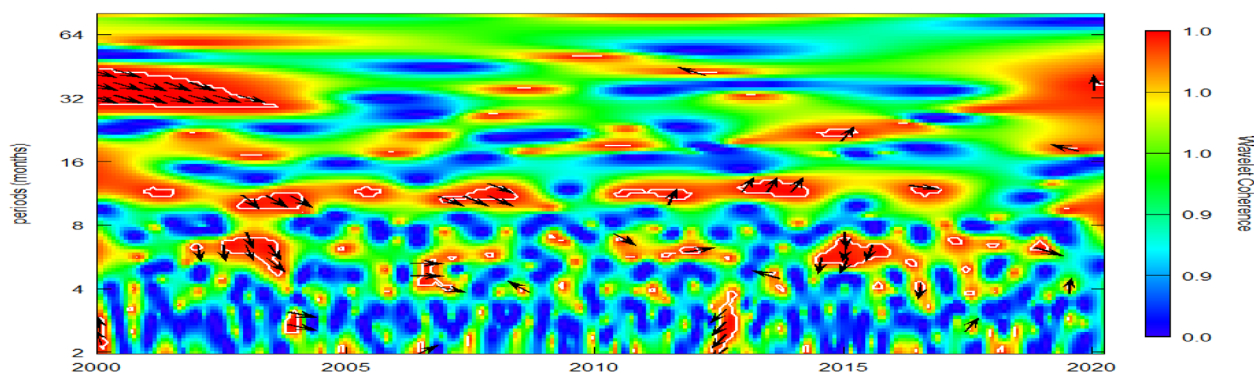
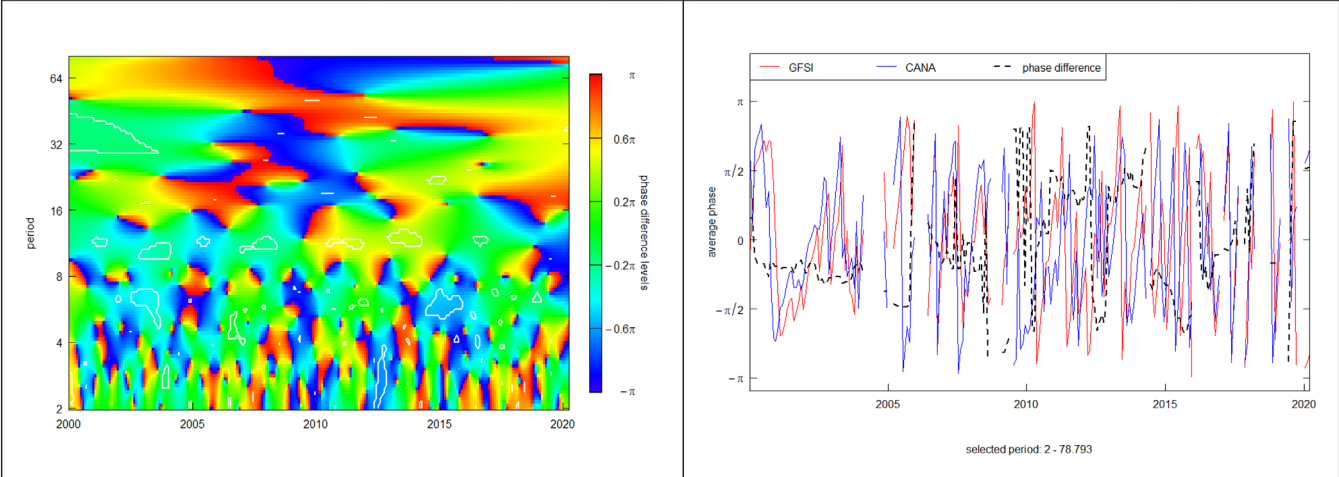


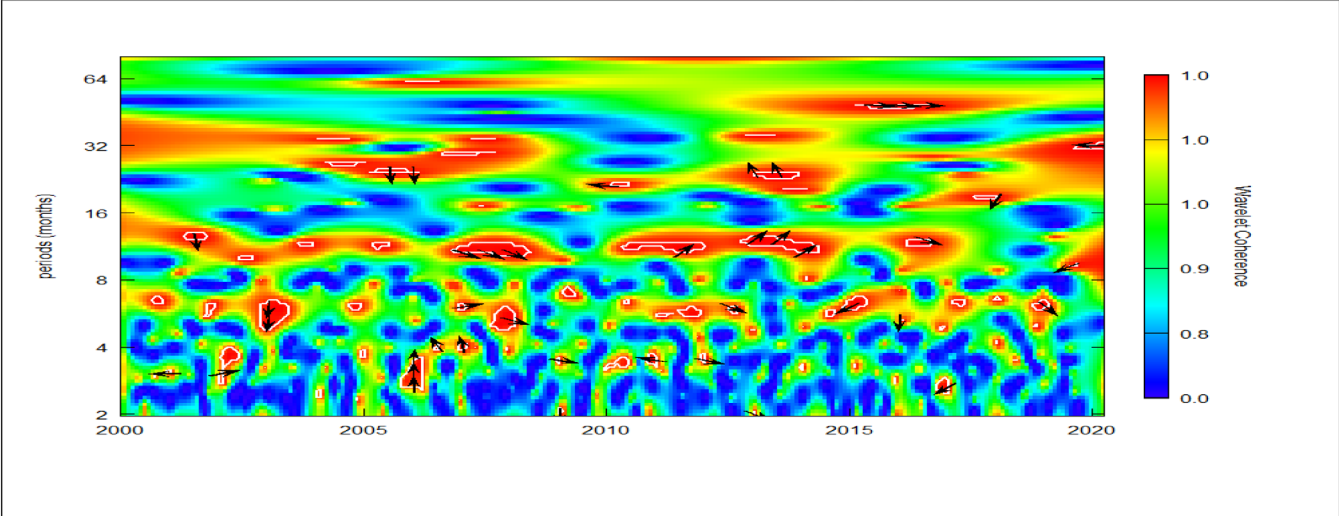
FIGURE 5 Wavelets coherence and phase difference between GFSI and tourist arrivals in Singapore [Colour figure can be viewed at wileyonlinelibrary.com]

B2 : Phase difference in heatmap and averaged line plot: GFSI and Canada Tourist Arrivals in Singapore



Panel C: Impact of GFSI on Russia Tourist Arrivals in Singapore

C1: Wavelet Coherency : GFSI and Russia Tourist Arrivals in Singapore



C2 : Phase difference in heatmap and averaged line plot: GFSI and Russia Tourist Arrivals in Singapore

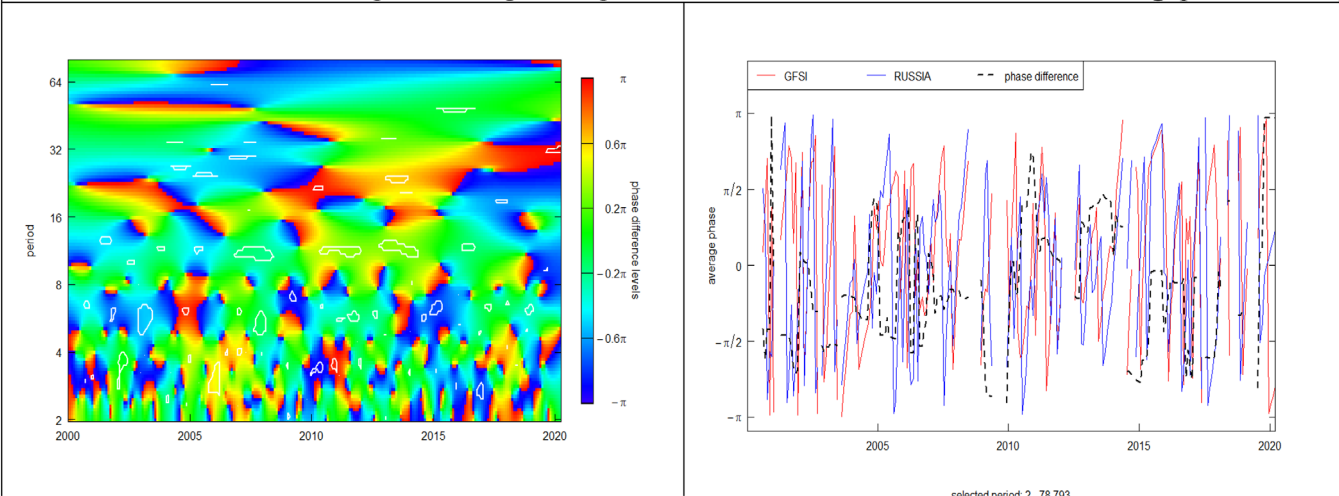


FIGURE 5 (Continued)

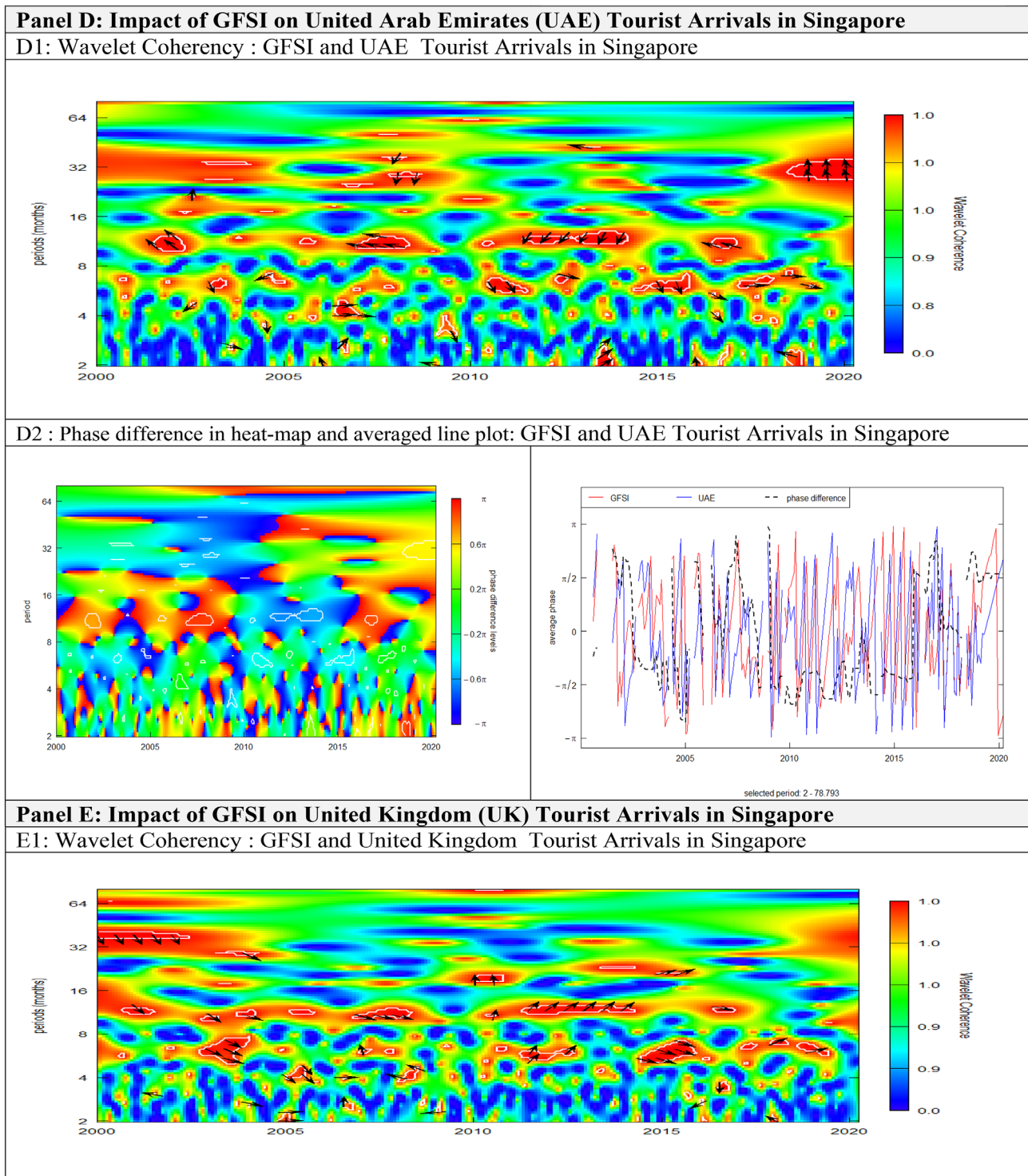


FIGURE 5 (Continued)

$$W_{x,y}(f, \tau) = W_x(f, \tau) W_y^*(f, \tau).$$

On the other hand, we denote the wavelet coherency as,

$$R_{x,y}(f, \tau) = \frac{\|\langle W_{x,y}(f, \tau) \rangle\|}{\|\langle W_{x,x}(f, \tau) \rangle\|^{1/2} \|\langle W_{y,y}(f, \tau) \rangle\|^{1/2}}, \quad (1)$$

where $\langle \rangle$ represents a smoothing operator in both scale and time. Based on this definition, $R_{x,y}(f, \tau)$ is restricted by $0 \leq R_{x,y}(f, \tau) \leq 1$. Following, Liu (1994), we see the benefits of wavelet coherency rests on its difference in time and, therefore its capacity to identify transitory relationship amid the two-time series. We compute the phase difference $\phi_{x,y}(f, \tau)$ as shown below:

$$\phi_{x,y}(f, \tau) \tan^{-1} \frac{\Im(\langle W_{x,y}(f, \tau) \rangle)}{\Re(\langle W_{x,y}(f, \tau) \rangle)}. \quad (2)$$

3.1 | Data specification

We utilized monthly data spanning from January 2000 to April 2020. We obtain data on international-based tourist arrivals in Malaysia and Singapore from DataStream. International tourist arrivals in Singapore include tourists from the United States, Canada, Russia, UAE, and United Kingdom. In the case of Malaysia, international tourists' arrivals considered, include tourists from Singapore, China, Japan, India, Saudi Arabia, UAE, Canada, the United States, Australia, United Kingdom, Finland and Germany. Additionally, we use world economic policy uncertainty,¹ US economic policy-based uncertainty,² Global Geopolitical Risk Index,³ Global Financial Stress Index⁴ and Global Fear Index (VIX).⁵ The appendix section provides in detail on the description of the variables and the source of data (Table A1).

4 | EMPIRICAL DISCUSSION

4.1 | Preliminary results

Table 1 explains the descriptive statistics of the underlying time series of observations based on a monthly frequency. Panel A reports the monthly frequency of observations, M1 2000 to M3 2020, for international tourist arrivals to Malaysia. The total observations are 243. The highest mean value of observations is for

tourists from Singapore (880,060) followed by China (78,610). Panel B reports the monthly frequency of observations, M1 2000 to M4 2020 for International Tourist Arrivals in Singapore. The total observations are 245. The total observations are 245.

4.2 | Wavelet coherence (WC) amid macro indicators on uncertainty and international tourists

In this section, we explain the empirical results based on the wavelet analysis. Figures 1–5 exhibit coherencies across international tourist arrivals from major countries like the United States (US), Canada, Russia, the United Arab Emirates (UAE) and the United Kingdom with the major uncertainty indicators to the tourist destination country Singapore. Further Figures 6–10 exhibit coherencies across international tourist arrivals from major countries such as Singapore, China, Japan, India, Saudi Arabia, UAE, Canada, the US, Australia, the UK, Australia, and Germany with the major uncertainty indicators to the tourist destination country Malaysia. The horizontal axis shows the timeline while the vertical axis defines the frequencies. The depth of the coherency is shown with red (high/strong) and blue (low/weak) colors. The direction of arrows indicates the phased difference amid the variables. When the arrows are pointed in the rightward direction and upward (downward) the first variable is the lead (lag). Again, when they are pointing leftward and upward (downward) the first variable is lag (lead). The phase-plot exhibited in the bottom part of Figures 1–10 demonstrate movements in the direction of $\pi/2$ and $-\pi/2$, indicating the positive- and negative-based relationships correspondingly.

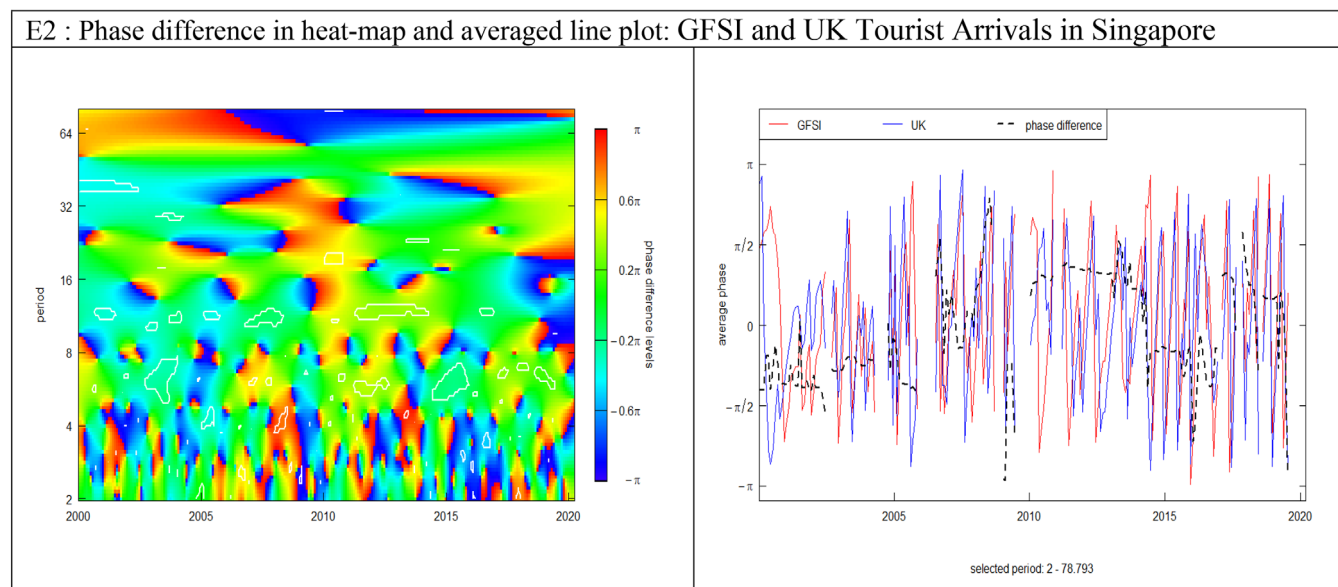


FIGURE 5 (Continued)

4.3 | Uncertainties and tourist arrivals in Singapore: Main findings

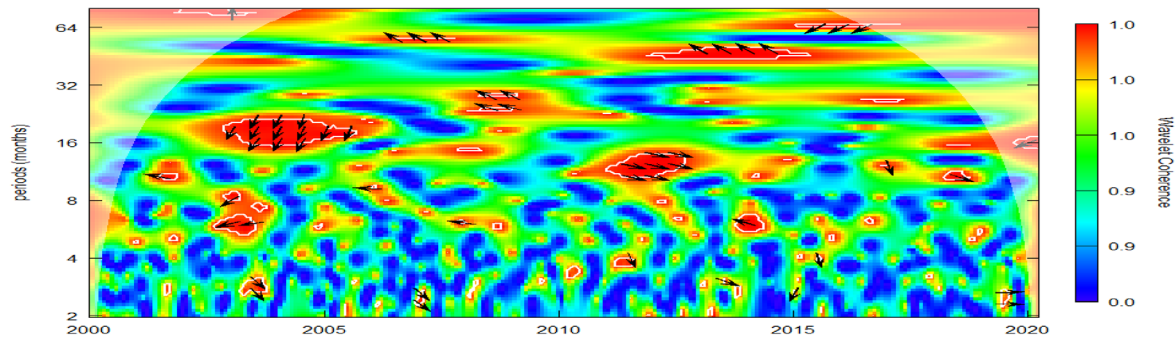
4.3.1 | GEPU and tourism

Figure 1 describes the wavelet coherence amid GEPU and international tourism in Singapore. Major coherencies are visible across

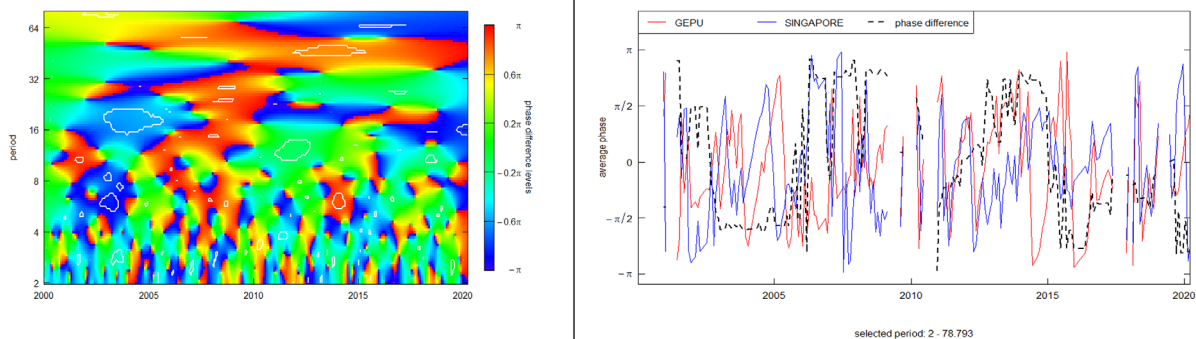
GEPU and tourism over medium-term (16–32) frequency band and the long-term (32–64) frequency band for the major inbound international tourist arrivals to Singapore. The periods of strong coherency are in the years 2002, 2004, 2007–2009 and further 2011–2015. The years 2002–2004 are associated with the technology bubble crisis. The period 2007–2009 were the years when the major economies experienced the adversaries of the subprime mortgage crisis. Again

Panel A: Impact of GEPU on Singapore Tourist Arrivals

A1: Wavelet Coherency : GEPU and Singapore Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GEPU and Singapore Tourist Arrivals



Panel B: Impact of GEPU on China Tourist Arrivals in Malaysia

B1: Wavelet Coherency : GEPU and China Tourist Arrivals

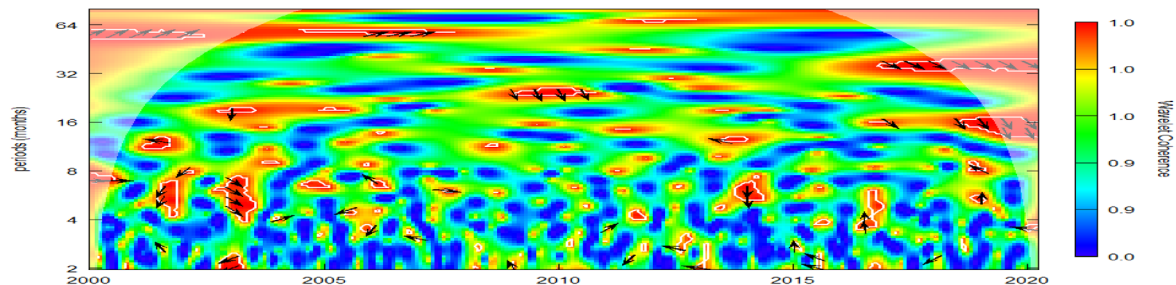


FIGURE 6 Wavelets coherence and phase difference between GEPU and tourist arrivals in Malaysia [Colour figure can be viewed at wileyonlinelibrary.com]

2011–2015 were the years when the globe was experiencing the European sovereign debt crisis. Last international tourist arrivals to Singapore are also affected in 2019–2020, the years of the pandemic COVID-19. The arrival of tourists from the concerned countries to

Singapore are impacted perceptibly in the long-run to the medium-run by the major global economic events. Some interesting findings on the GEPU has been summarized as: (i) Tourists' inflows in Singapore are impacted by GEPU during periods of global uncertainties.

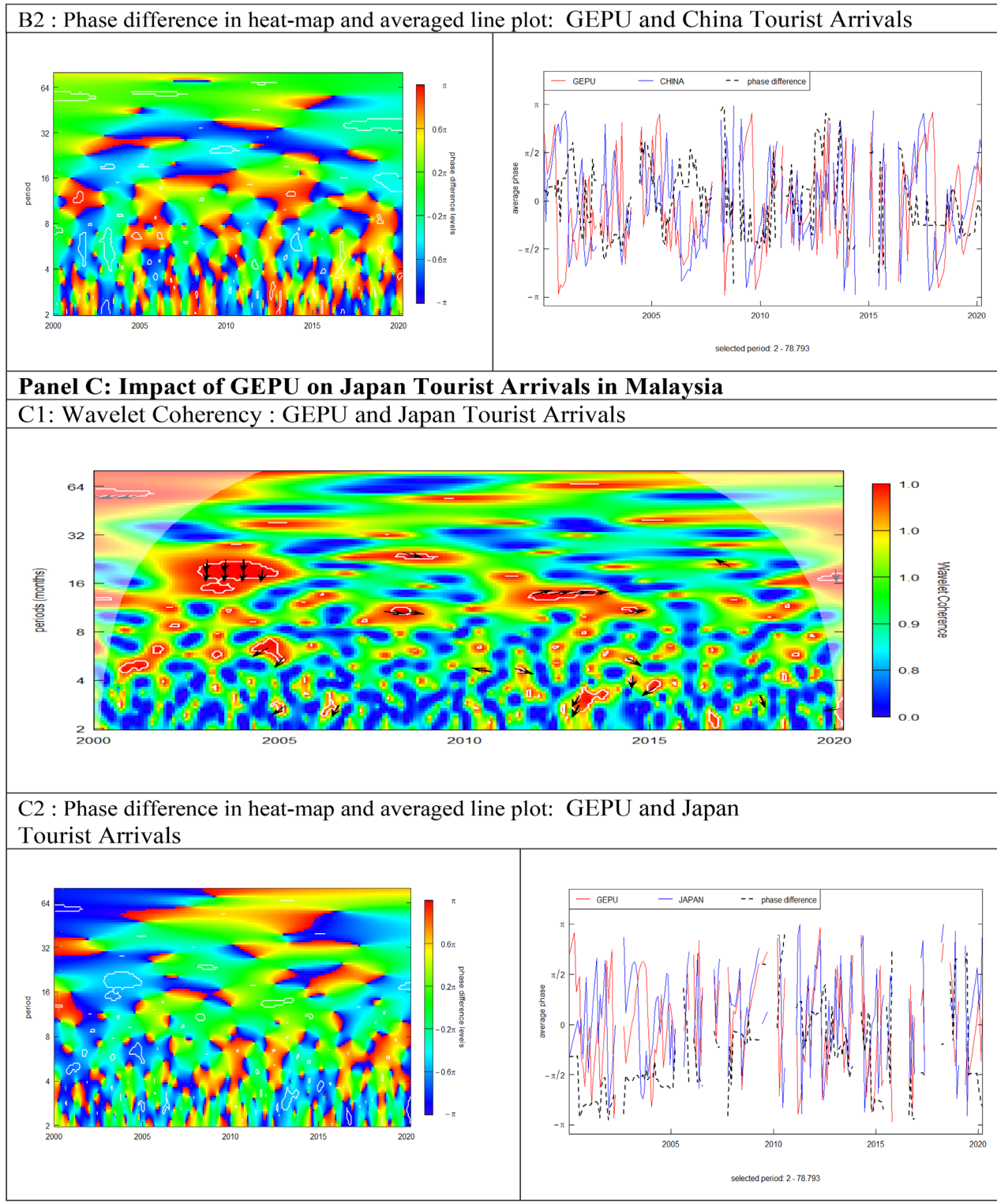


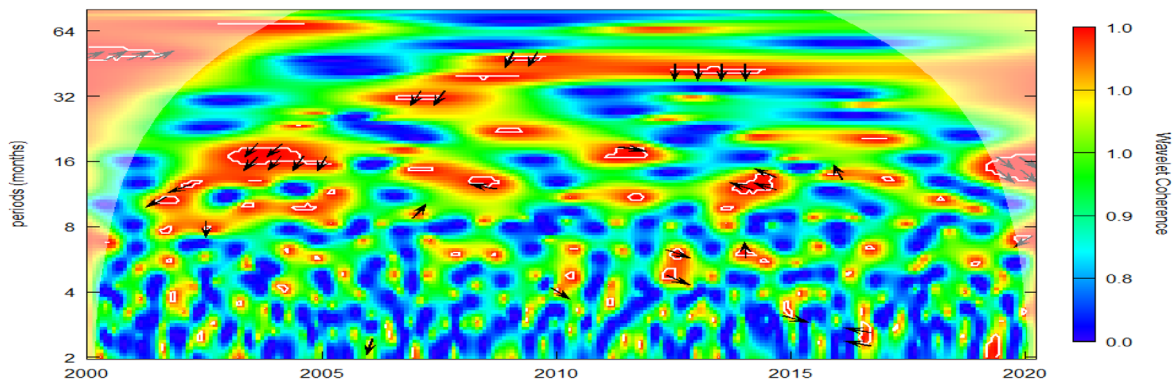
FIGURE 6 (Continued)

(ii) Arrows are mostly pointing to the right and in the downward direction signifying long-term in phase co-movements across the two variables. (iii) The phase plots for the coherencies maps negative relations.

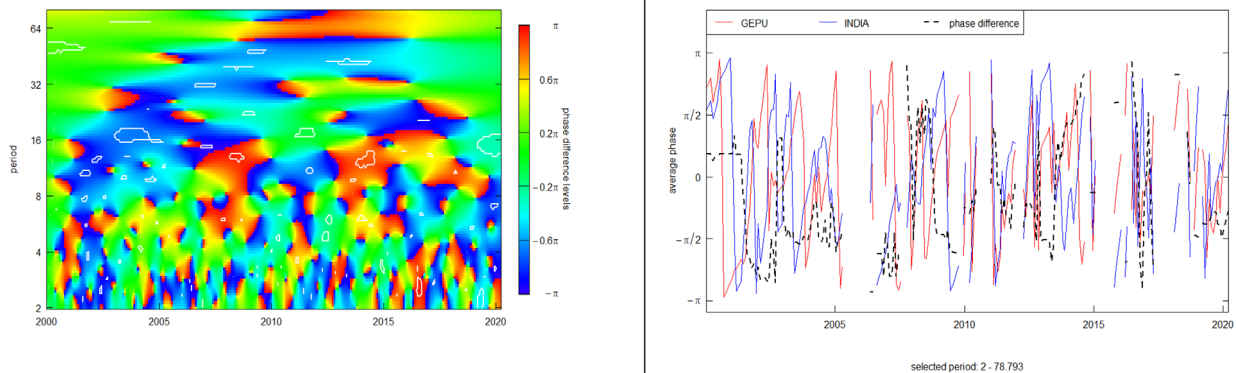
However, for some country experiences, for example, Canada and the United Kingdom there are positive correlations between GEPU and tourism. Such a phenomenon depicts the characteristic of risk-lover

Panel D: Impact of GEPU on India Tourist Arrivals in Malaysia

D1: Wavelet Coherency : GEPU and India Tourist Arrivals



D2 : Phase difference in heat-map and averaged line plot: GEPU and India Tourist Arrivals



Panel E: Impact of GEPU on Saudi Arabia Tourist Arrivals in Malaysia

E1: Wavelet Coherency : GEPU and Saudi Arabia Tourist Arrivals

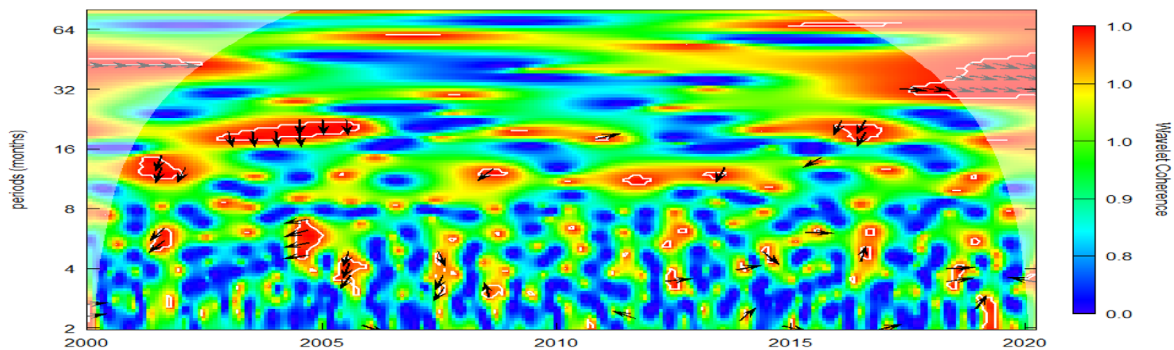


FIGURE 6 (Continued)

tourists. These tourists take the advantage of the low turn in the markets because in periods of uncertainty room rates and air prices may be reduced (Singh et al., 2019). (iv) Some tourists from Europe, for example, the UK often substitute the cheaper Asian locations during periods of economic downswings.

4.3.2 | UMPU and tourism

Figure 2 Panel A to Panel E describe the impact of UMPU on international tourist arrivals in Singapore. Except for the Russian tourist arrivals to Singapore, a uniform pattern of WC is observed

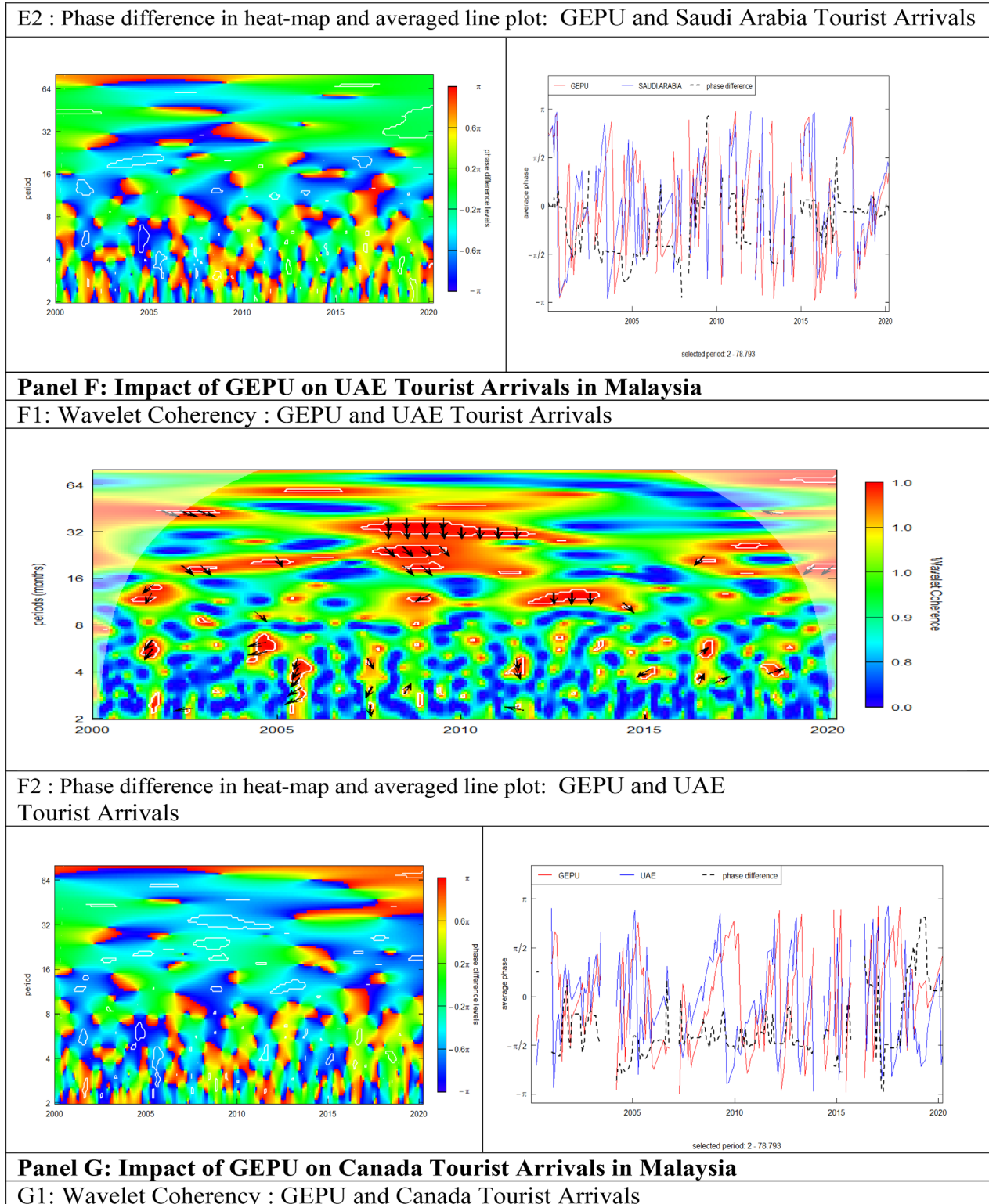
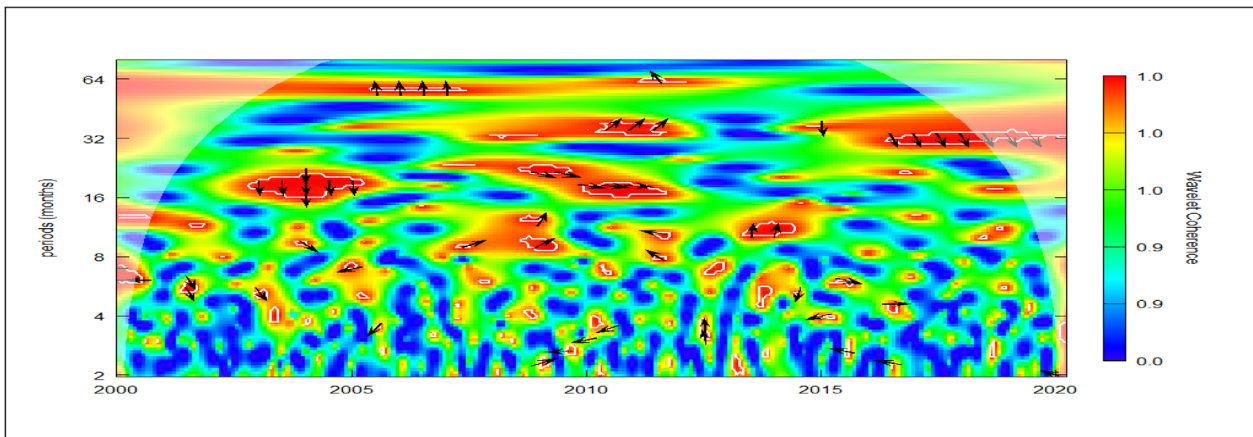


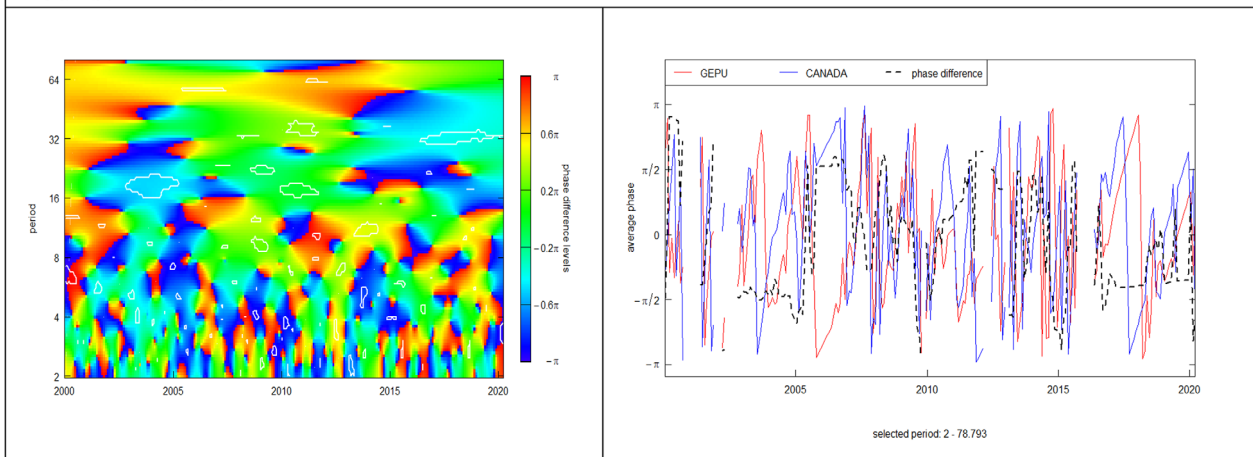
FIGURE 6 (Continued)

(Panels A–E). A profound medium-term to long-term coherence is observed (16–32) frequency band and (32–64) frequency band between UEMPU and tourist arrivals. The periods are around 2000–2001 and 2019–2020. The first period coincides with the

9/11 terrorist attack in the USA and the second period is associated with the COVID-19 pandemic. In the period around 2000–2001, the direction of arrows pointed downward and toward the left demonstrating the lead originates from UMPU. In the period

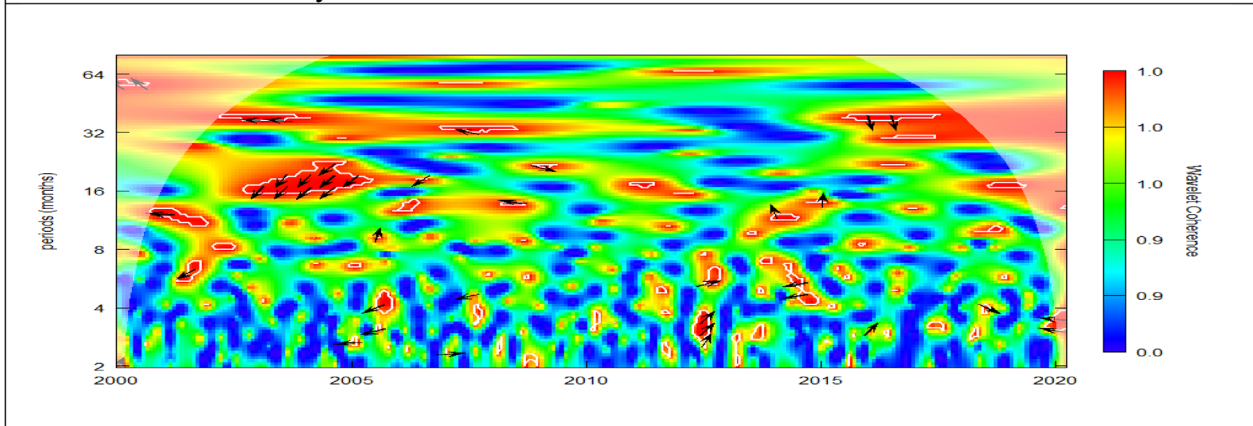


G2 : Phase difference in heat-map and averaged line plot: GEPU and Canada Tourist Arrivals



Panel H: Impact of GEPU on USA Tourist Arrivals in Malaysia

H1: Wavelet Coherency : GEPU and USA Tourist Arrivals



H2 : Phase difference in heat-map and averaged line plot: GEPU and USA Tourist Arrivals

FIGURE 6 (Continued)

2019–2020, the direction of the arrow moves downward but toward the right indicating the lead from tourist arrivals. So bidirectional causality exists between UMPU and international tourist arrivals to Singapore.

4.3.3 | GPR and tourism

Figure 3 demonstrates the WC between GPR and international tourist arrivals in Singapore. Major short-term to medium and long-term

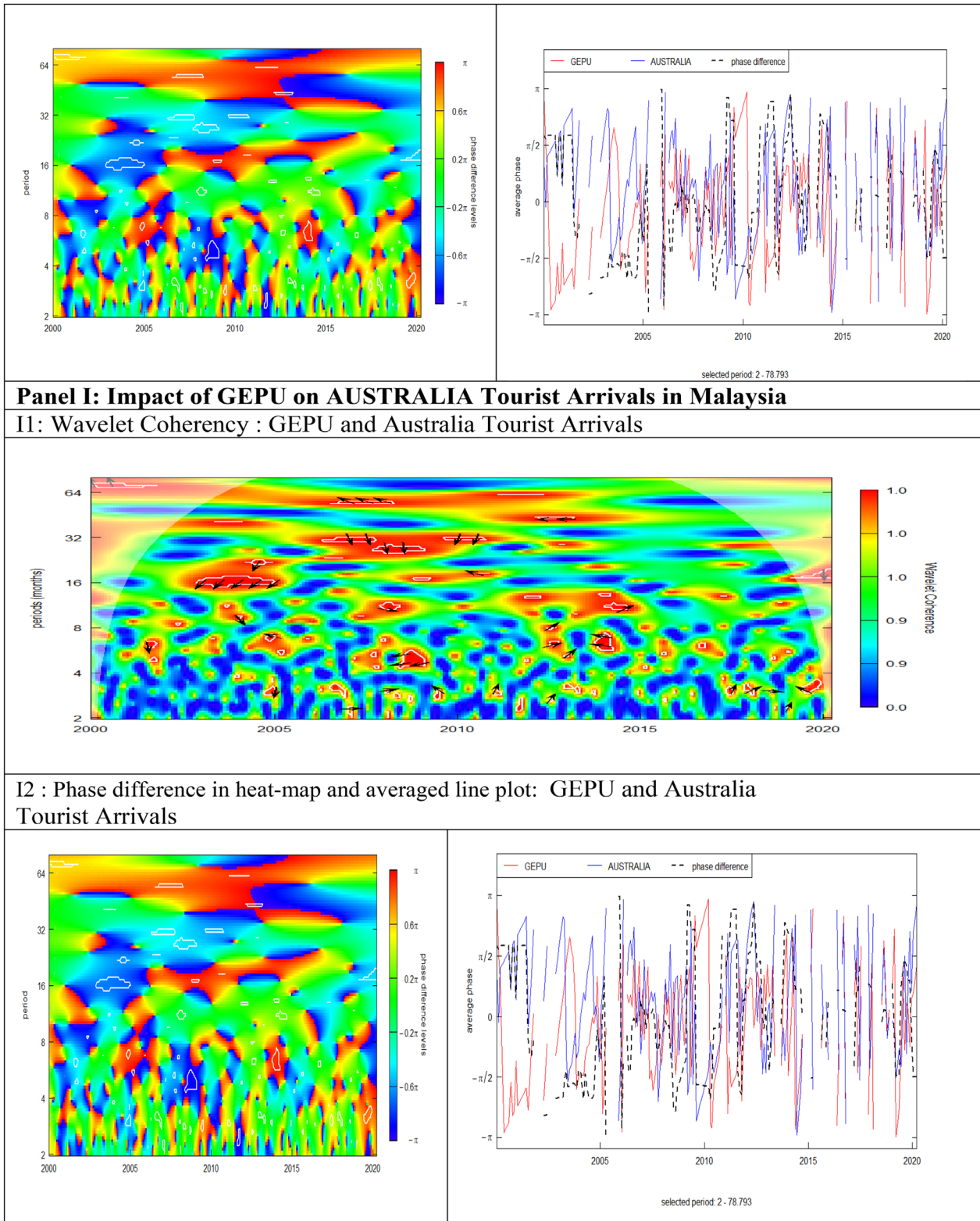


FIGURE 6 (Continued)

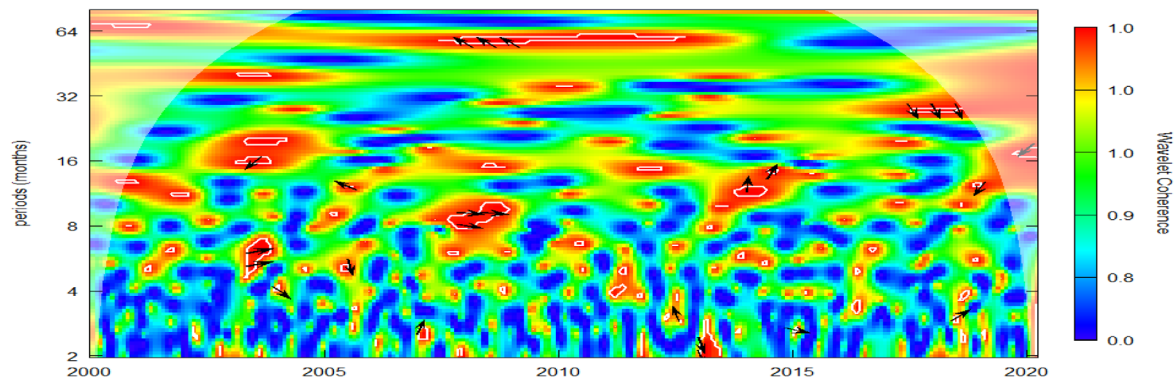
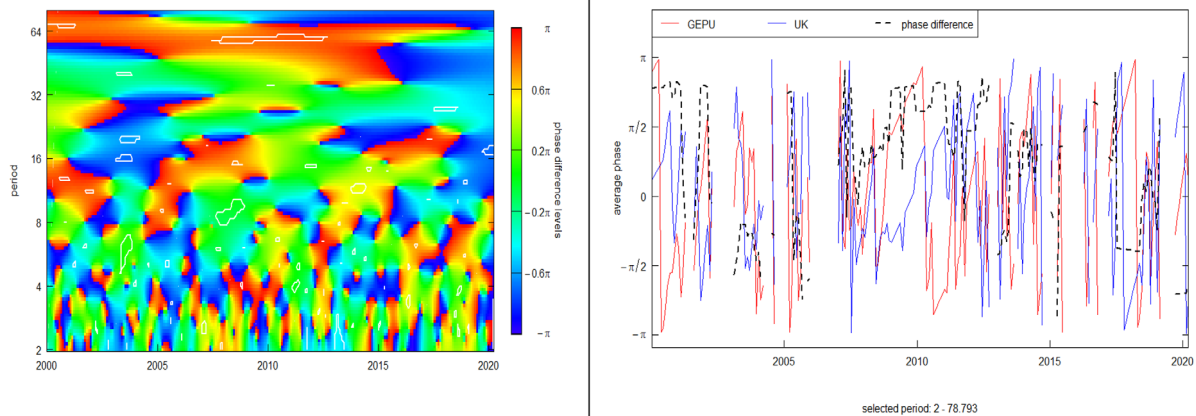
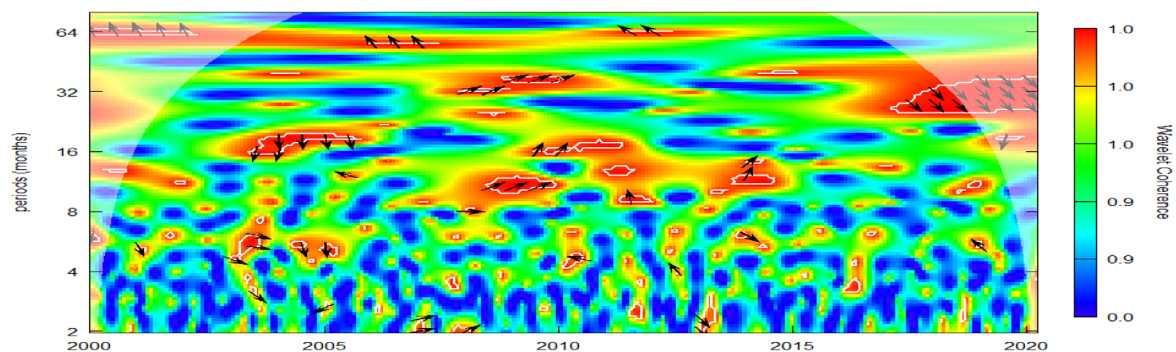
Panel J: Impact of GEPU on UK Tourist Arrivals in Malaysia**J1: Wavelet Coherency : GEPU and UK Tourist Arrivals****J2 : Phase difference in heat-map and averaged line plot: GEPU and UK Tourist Arrivals****Panel K: Impact of GEPU on GERMANY Tourist Arrivals in Malaysia****K1: Wavelet Coherency : GEPU and Germany Tourist Arrivals**

FIGURE 6 (Continued)

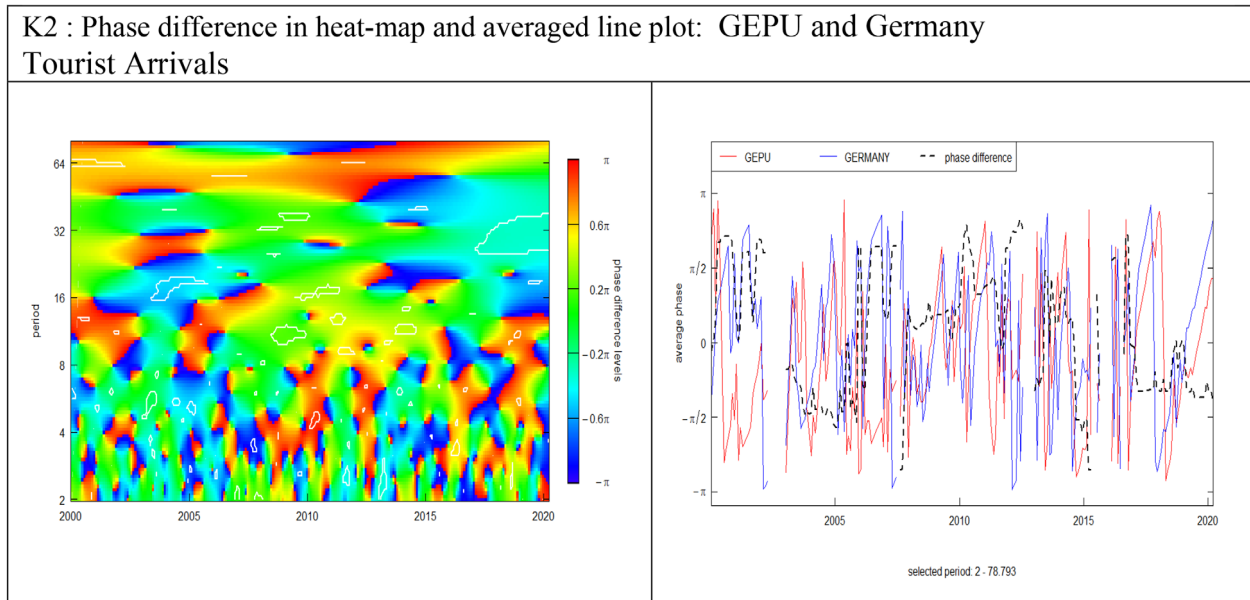


FIGURE 6 (Continued)

coherencies is exhibited amid GPR and international tourism. The major findings from the visual implications: (i) The impact of GPR is strengthened during 2001–2004, the years associated with the 9/11 attacks and technological bubble crisis. (ii) Furthermore, a short-term WC is associated between GPR and tourists arriving from the countries such as the US (the epicenter of the crisis), Canada during the periods of the global financial crisis with the lead from the tourism sector. (iii) A prominent red island is noticeable over the frequency band (32–64) in 2015 for some countries like the United Kingdom and Russia thereby explaining the long-term causality. Further, the phase diagrams denote positive associations in the said period. This period is associated with the Paris attacks so the predictive scope of the GPR is toward substitution on Asian destinations. Such findings are in conformity with the earlier studies in the literature Choi (2020) which explains a positive spill over from uncertainty owing to geopolitical tensions, the tourist chooses alternative destinations. Such findings confirm the studies in the literature (Choi, 2020; Tiwari et al., 2019).

4.3.4 | VIX and tourism

Figure 4 describe the wavelet coherence across VIX and international tourist arrivals from the countries of the US, Canada, Russia, UAE and the United Kingdom respectively. In the recent times, the VIX is considered the most popularly utilized Volatility Index of the Financial index. Alternatively, it is also referred to as the Fear Index affecting globally many indicators across countries. (i) Major long-term to medium-term coherencies is noticeable across the VIX and tourism. The direction of the arrow is

downward and toward the left in the 64-frequency band and toward right in the 16–32 frequency bands. This implies that in the long-run there is alternate behavior in tourist arrivals and the rise and fall in the VIX. However, in the medium and short-run we find co-movements across the VIX and tourist arrivals. The prominence of coherence is significant during 2001–2004 and 2011. (ii) Another red island is visible in the frequency band 64 (indicating long-term WC) amid VIX and tourist arrivals to Singapore. The period is around 2019–2020, this may be attributed to the pandemic COVID-19 which had brought disruptions in the real and financial sector and tourism and hospitality is major sector that suffered the shocks of disruption. The rightward pointing arrows are considered in phase co-movements across the two variables. Thus, the adverse dependencies are explained across VIX and tourism as indicated in the extant literature (Akdağ et al., 2019; Usman et al., 2021). (iii) The behavior of the VIX on tourist arrivals from Russia to Singapore may appear diverse to other country case studies. This is because there is stability in the Russian financial markets and the Russian stock markets are not cointegrated with the US (Caporale et al., 2020). (iv) A medium- to long-term wavelet coherence is found during 2007–2011 with the arrows pointing downward and toward the right in the context of tourist arrivals from the UAE to Singapore. This explains significant in-phase co-movements across VIX and the tourist arrivals from the UAE. The period coincides with the post-Iraqi war and global financial crisis. Thus, the impact of VIX may have a long-last impact as far as the emotional stress of the travelers is concerned. It is important to mention that the motivation for travel for outbound tourists from the UAE distinct from outbound tourist behavior from the West needs further exploration (Prayag and Hosany, 2014). The travel

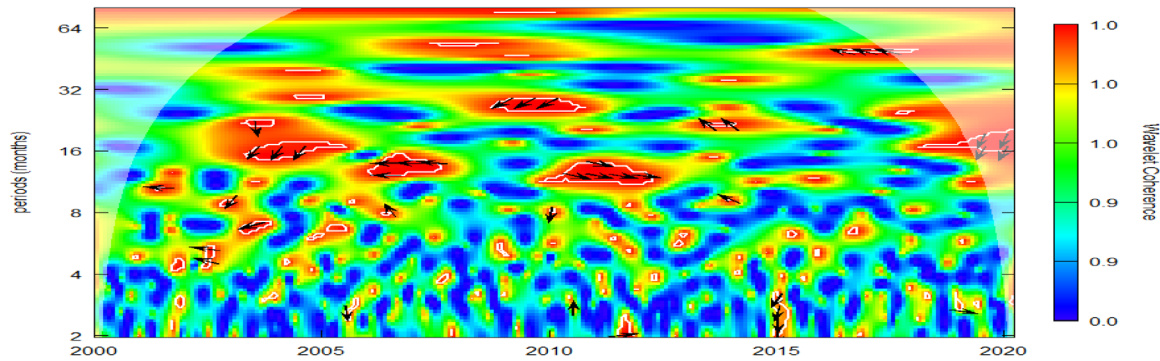
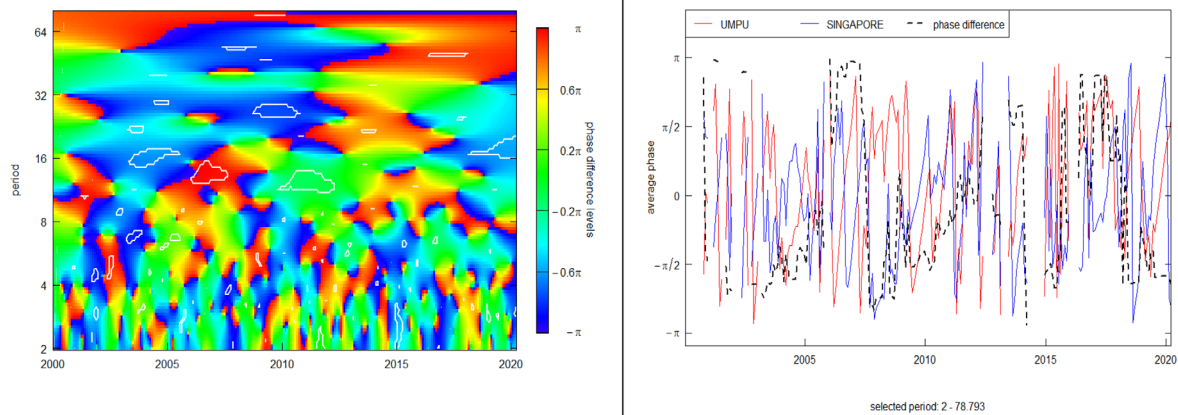
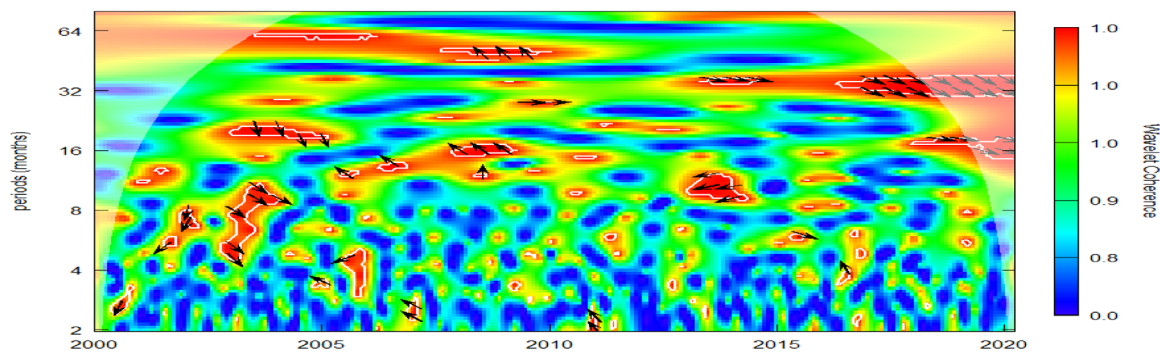
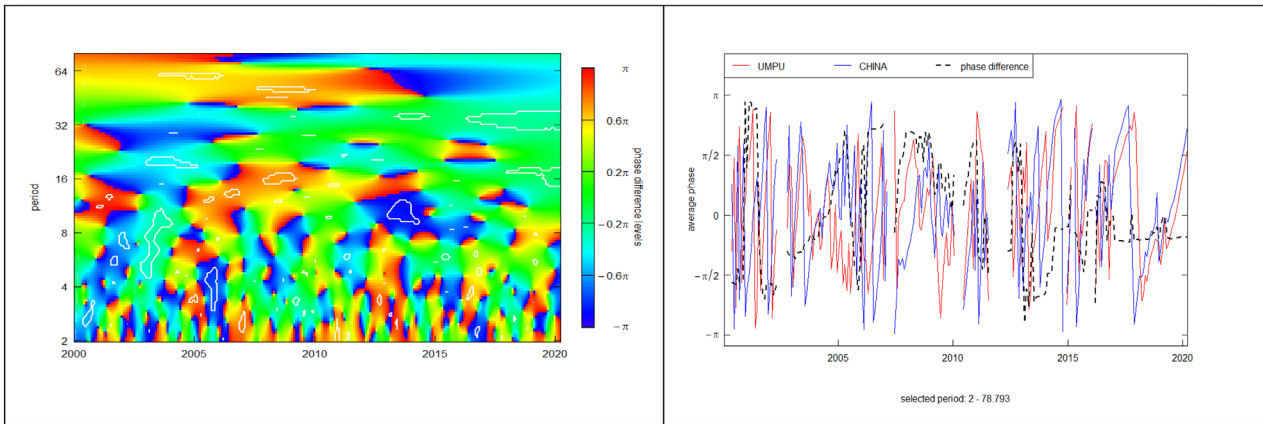
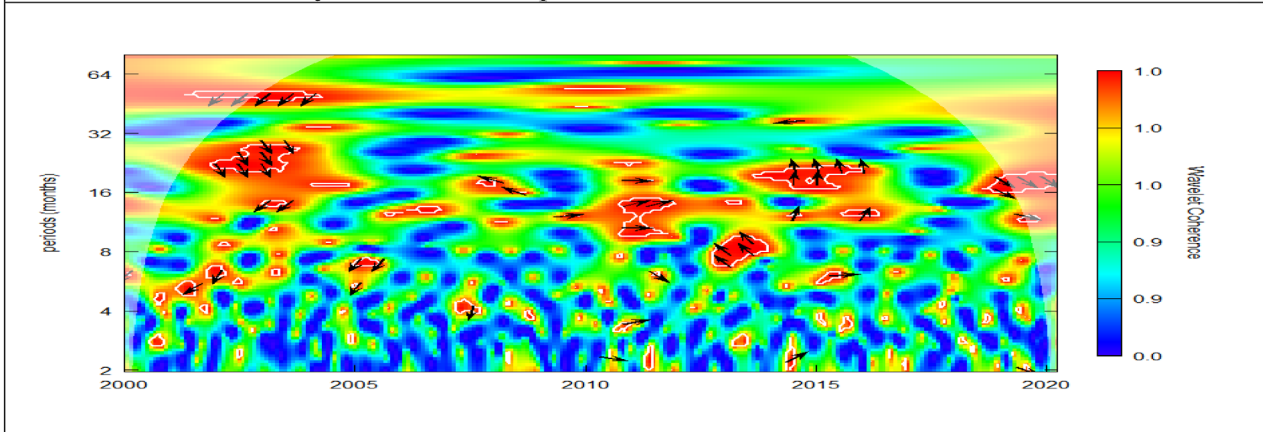
Panel A: Impact of UMPU on Singapore Tourist Arrivals**A1: Wavelet Coherency : UMPU and Singapore Tourist Arrivals****A2 : Phase difference in heat-map and averaged line plot: UMPU and Singapore Tourist Arrivals****Panel B: Impact of UMPU on China Tourist Arrivals in Malaysia****B1: Wavelet Coherency : UMPU and China Tourist Arrivals****B2 : Phase difference in heat-map and averaged line plot: UMPU and China Tourist Arrivals**

FIGURE 7 Wavelets coherence and phase difference between UMPU and tourist arrivals in Malaysia [Colour figure can be viewed at wileyonlinelibrary.com]

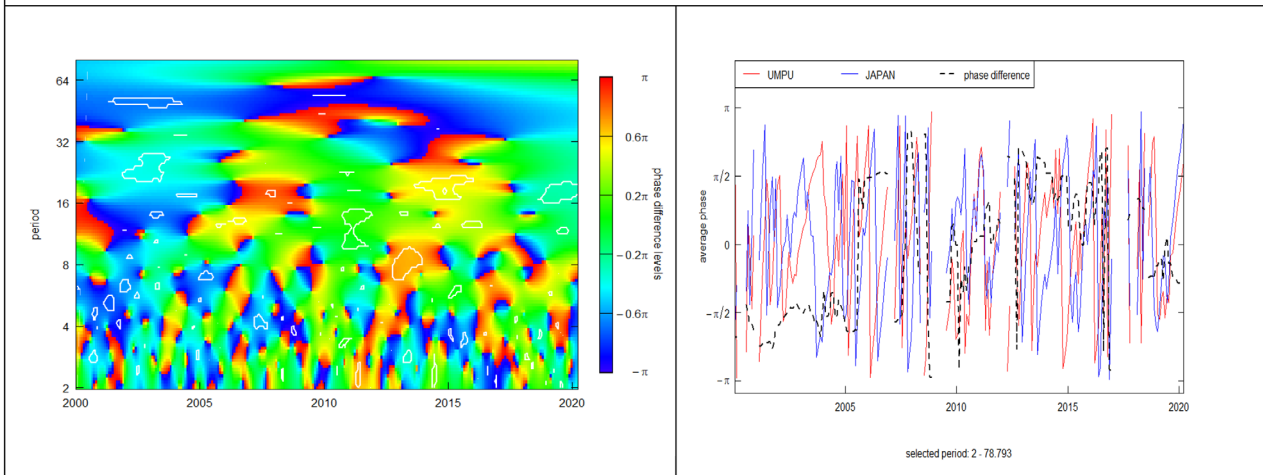


Panel C: Impact of UMPU on Japan Tourist Arrivals in Malaysia

C1: Wavelet Coherency : UMPU and Japan Tourist Arrivals



C2 : Phase difference in heat-map and averaged line plot: UMPU and Japan Tourist Arrivals



Panel D: Impact of UMPU on India Tourist Arrivals in Malaysia

D1: Wavelet Coherency : UMPU and India Tourist Arrivals

FIGURE 7 (Continued)

motives and perception of tourists (Lee et al., 2022) from the UAE to other countries is still under-researched so our results based on the wavelet methods may show interesting ramifications that needs further research.

4.3.5 | GFSI and tourism

Figure 5 describes the wavelet coherence across GFSI and tourist arrivals to Singapore. In sum, the global financial-based crisis (2007–2009); the

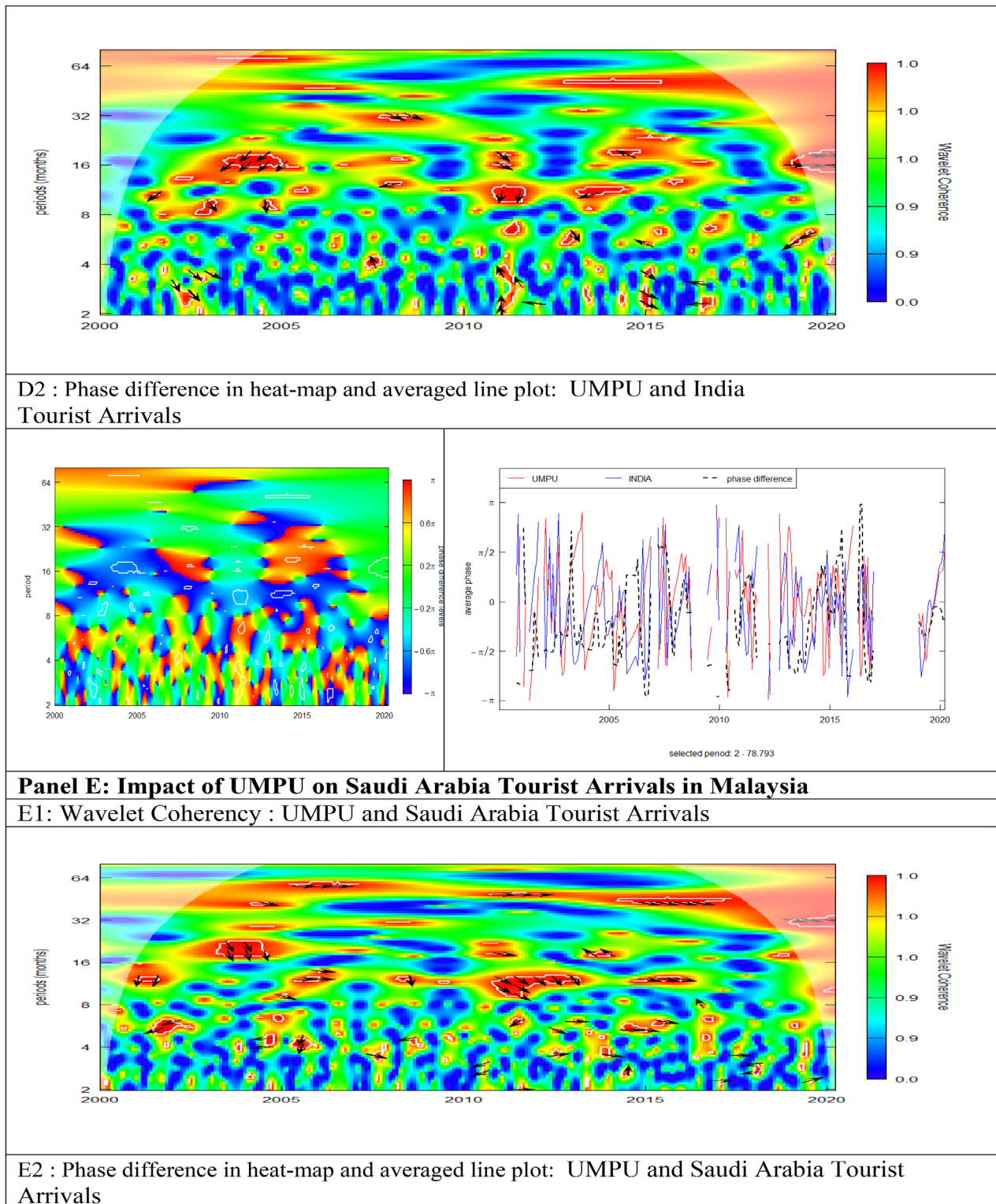
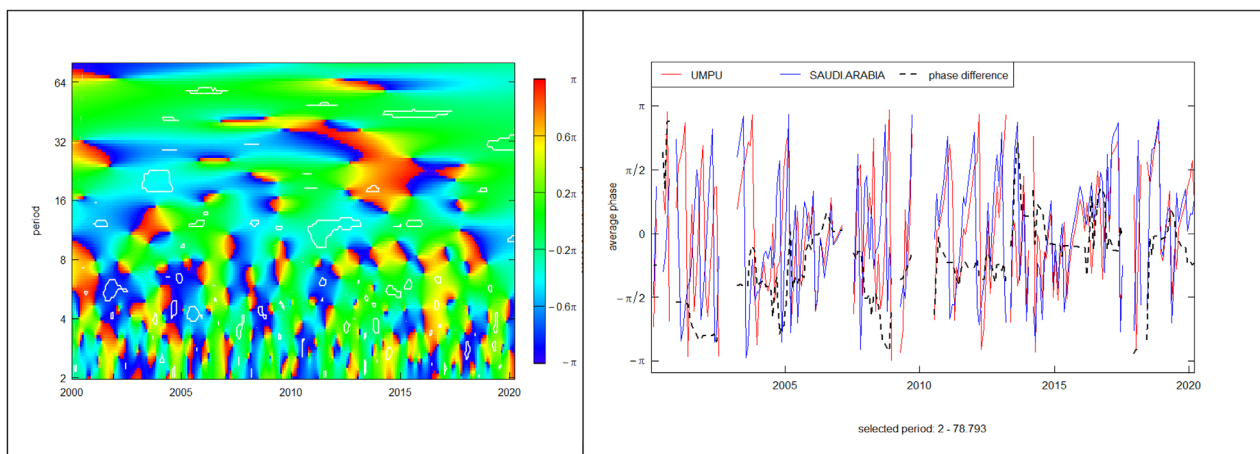


FIGURE 7 (Continued)

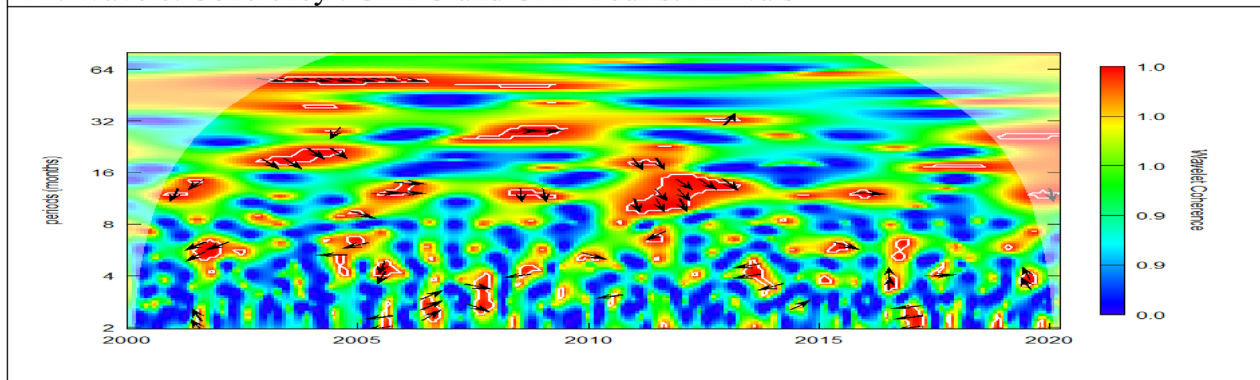
European sovereign related debt crisis (2011–2015) and the pandemic COVID-19 (2019–2020) have demonstrated the rationale of the monitoring and the measuring of extreme financial instability (as illustrated in GFSI). We have explored its potential and dramatic effects on the tourism sector, an illustration of the real sector. In times of a rise in GFSI due

to extreme financial stress, households become more risk-averse so they tend to halt their consumption until the periods of uncertainty is dissipated. Thus, travelers postpone their decisions to travel to overcome the crisis. Our results from the empirical exercise demonstrate that the links between GFSI and tourism vary over time.

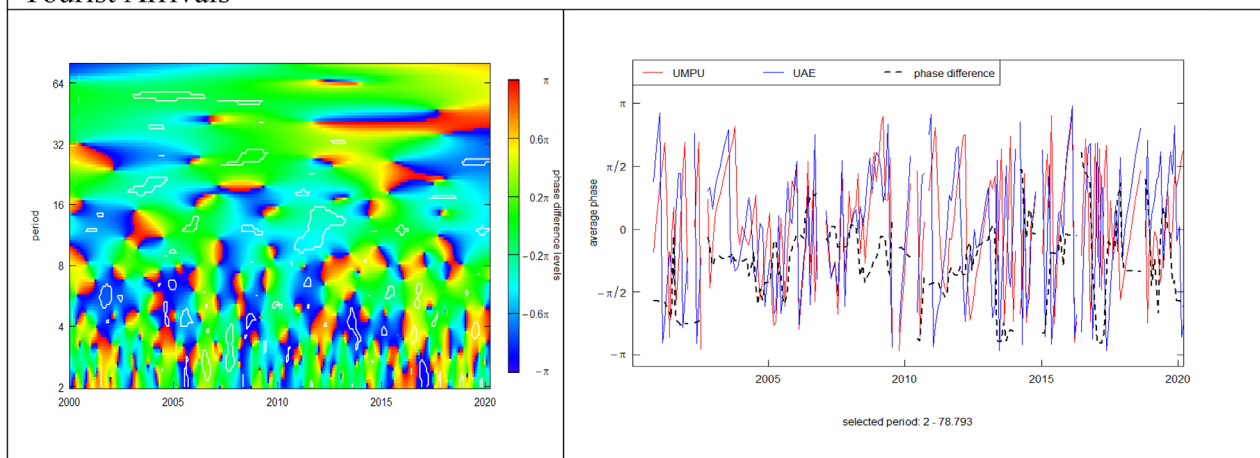


Panel F: Impact of UMPU on UAE Tourist Arrivals in Malaysia

F1: Wavelet Coherency : UMPU and UAE Tourist Arrivals



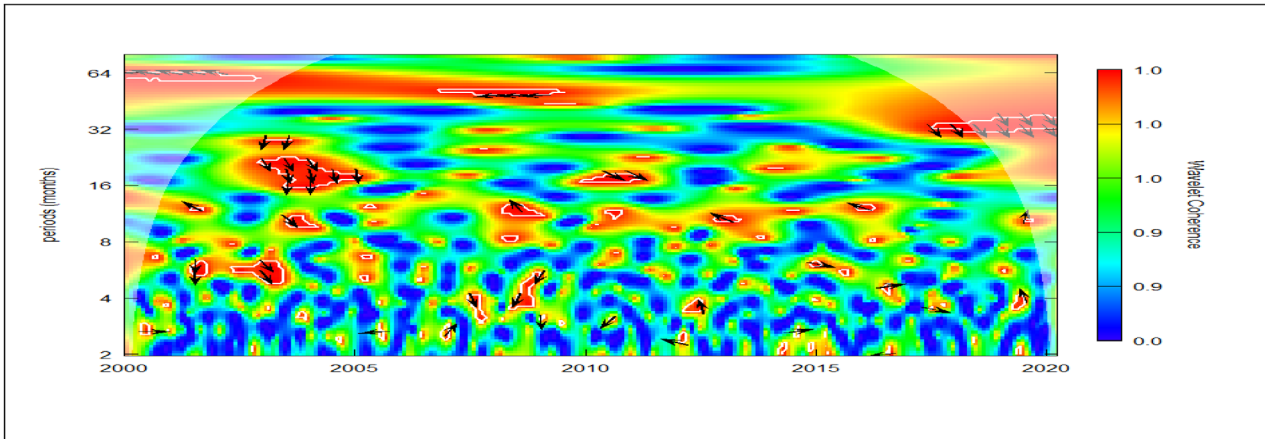
F2 : Phase difference in heat-map and averaged line plot: UMPU and UAE Tourist Arrivals



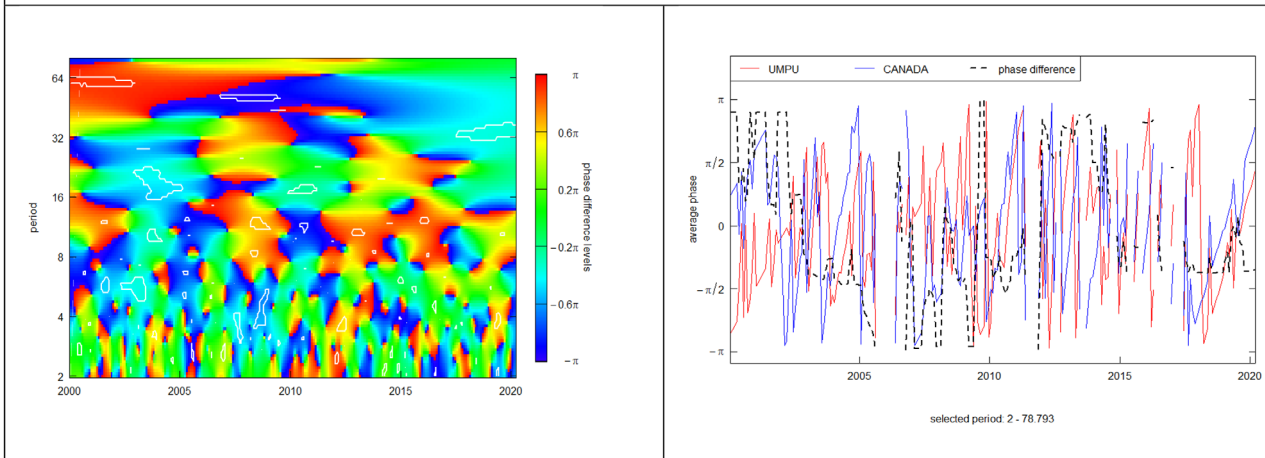
Panel G: Impact of UMPU on Canada Tourist Arrivals in Malaysia

G1: Wavelet Coherency : UMPU and Canada Tourist Arrivals

FIGURE 7 (Continued)

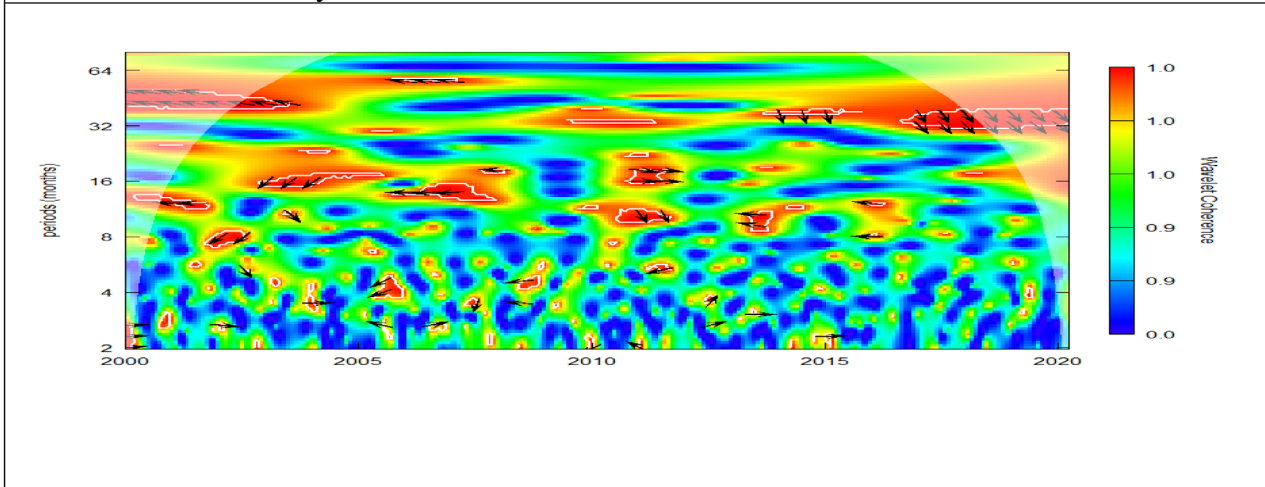


G2 : Phase difference in heat-map and averaged line plot: UMPU and Canada Tourist Arrivals



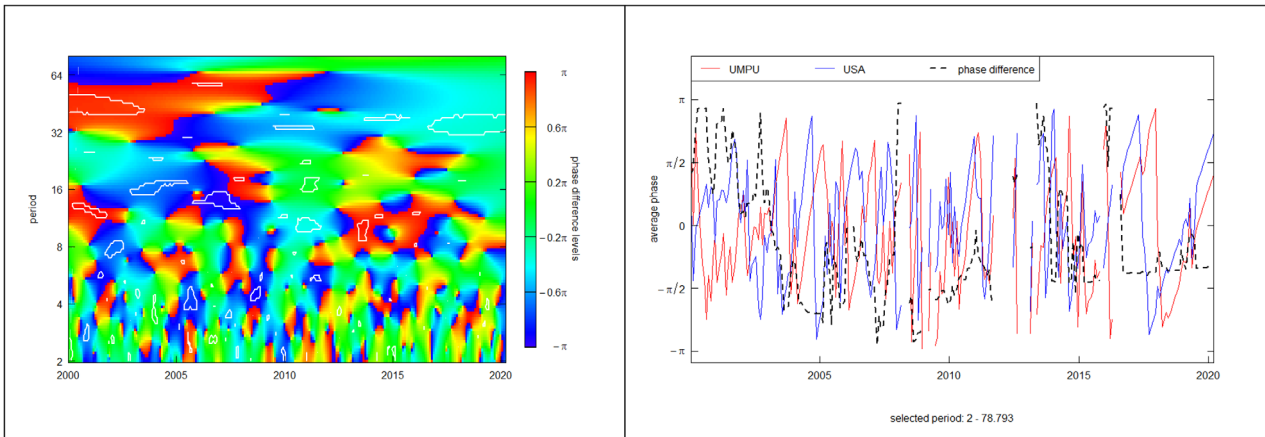
Panel H: Impact of UMPU on USA Tourist Arrivals in Malaysia

H1: Wavelet Coherency : UMPU and USA Tourist Arrivals



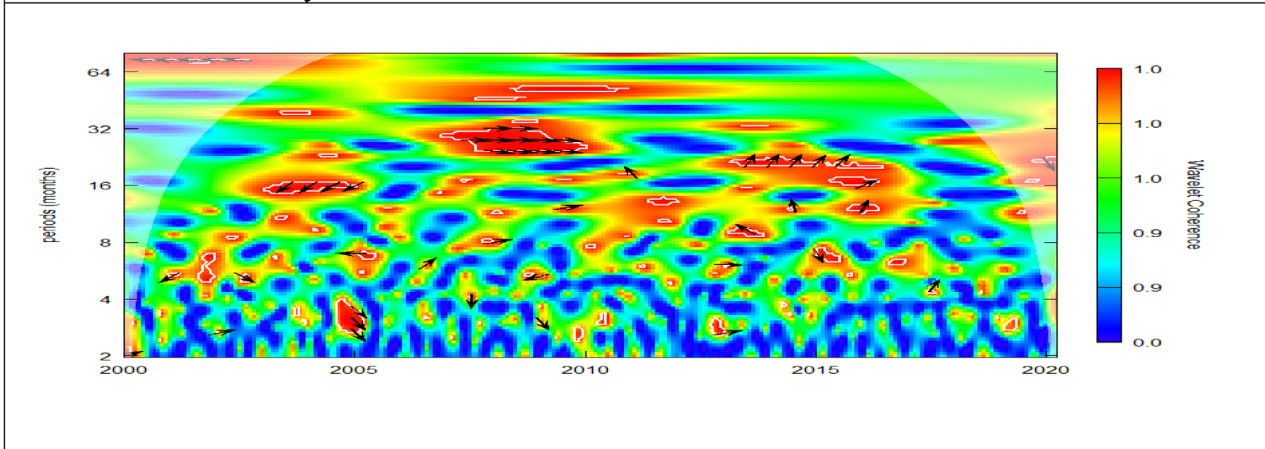
H2 : Phase difference in heat-map and averaged line plot: UMPU and USA Tourist Arrivals

FIGURE 7 (Continued)

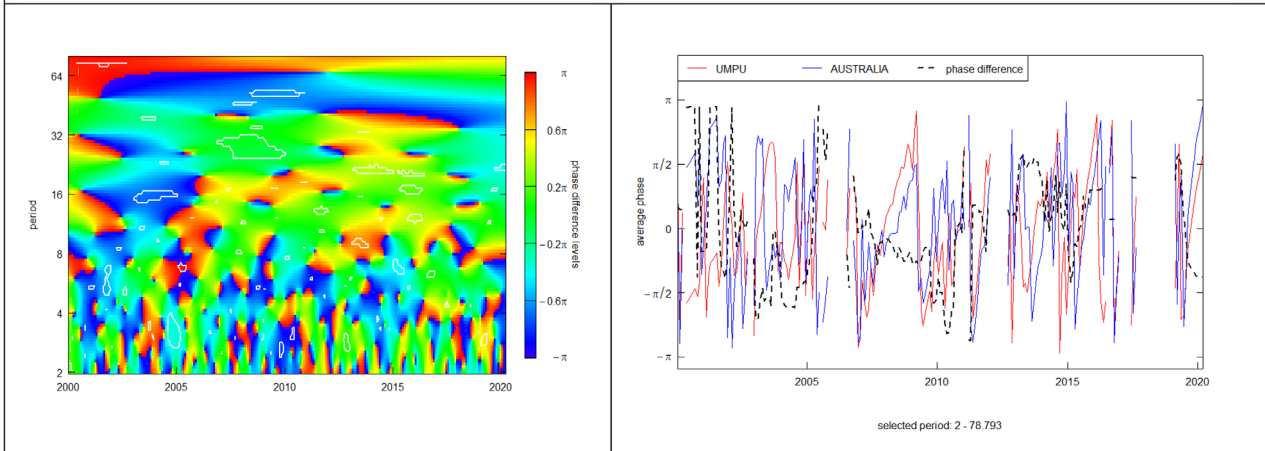


Panel I: Impact of UMPU on AUSTRALIA Tourist Arrivals in Malaysia

I1: Wavelet Coherency : UMPU and Australia Tourist Arrivals



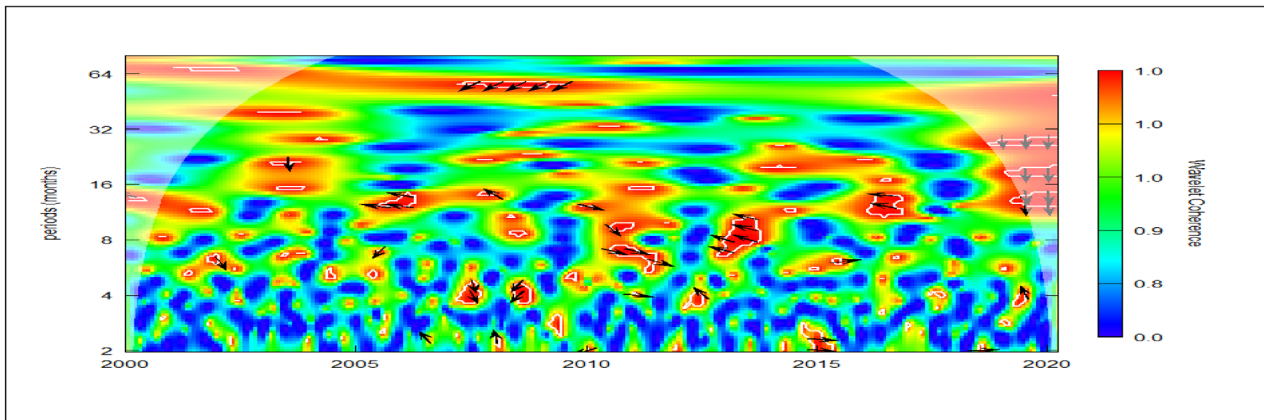
I2 : Phase difference in heat-map and averaged line plot: UMPU and Australia Tourist Arrivals



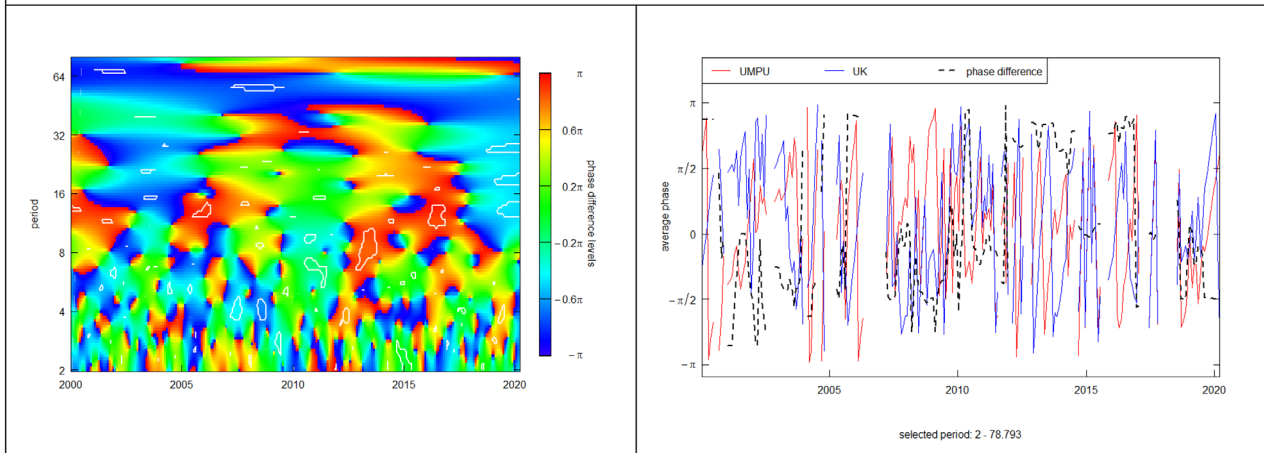
Panel J: Impact of UMPU on UK Tourist Arrivals in Malaysia

J1: Wavelet Coherency : UMPU and UK Tourist Arrivals

FIGURE 7 (Continued)

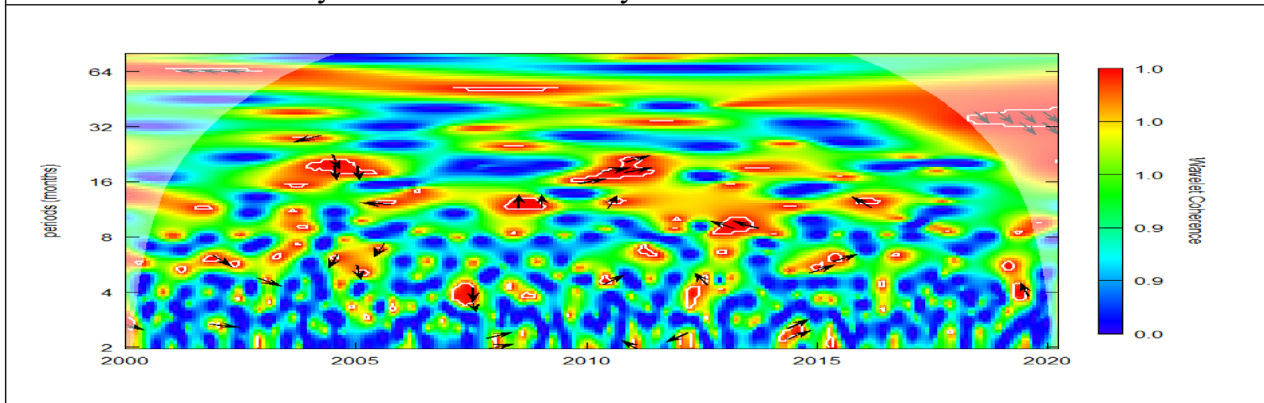


J2 : Phase difference in heat-map and averaged line plot: UMPU and UK Tourist Arrivals



Panel K: Impact of UMPU on GERMANY Tourist Arrivals in Malaysia

K1: Wavelet Coherency : UMPU and Germany Tourist Arrivals



K2 : Phase difference in heat-map and averaged line plot: UMPU and Germany Tourist Arrivals

FIGURE 7 (Continued)

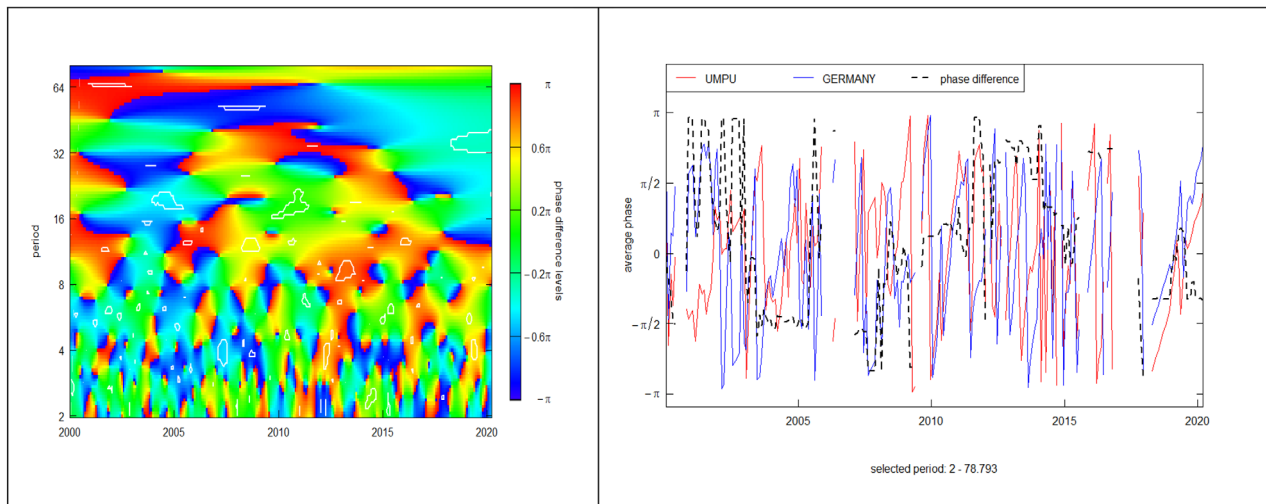


FIGURE 7 (Continued)

4.4 | Uncertainties and tourist arrivals in Malaysia: Main findings

4.4.1 | GEPU and tourism

Figure 6 exhibits the impact of GEPU on tourism in Malaysia. As far as the impact of GEPU on tourism in Malaysia from Singapore and the UAE the effect is more profound in the medium-term to the long-term for the technological bubble crisis and it stretches to the Euro-crisis. The remaining countries find short-run coherence during global financial crisis and also during the period of the Euro-crisis. However, the regions of significance are smaller and are mostly found in the short-term to medium-term. The pandemics also demonstrate major islands of significance in the context of the tourists from China, Saudi Arabia, Canada, and Germany to Malaysia over the short-term to medium term. In most cases, the arrows point downward and right signifying in-phase co-movements.

4.4.2 | UMPU and tourism

Figure 7 explains the impact of UMPU on tourism in Malaysia. The regions of high wavelet coherence remain scarce for inbound tourism to Malaysia from most of the countries. The profound association is obtained in the context of China, the UAE, and Canada in the short-term to the medium-term for the years 2004, 2007, and 2011. However significant red islands are perceptible during 2019–2020 for the countries China, Canada, the US, the United Kingdom, and Germany and the association is over medium to the long-term. The direction of arrows is mostly pointing to the right and downward thus depicting in-phase co-movements. Precisely, the findings throw interesting insights on the nexus between UMPU and tourism in Malaysia, a prominent example of an upper middle-income country with global openness: (i) Sensitivity of the high-income countries to UMPU is

directly associated with the country-specific income levels and therefore the demand in cheaper countries for outbound international tourism destinations. (ii) Tourists from richer countries like the US, the United Kingdom, and Australia in times of high uncertainty allocate destinations to specific locations as substitutes but the number of travelers may reduce.

4.4.3 | GPR and tourism

Figure 8 depicts the coherencies amid GPR and international tourist arrivals to Malaysia. The regions of high wavelet coherence remain scarce except for China, Japan, the UAE, Singapore, Australia, the US, and India. For the countries, such as China, the UAE, Singapore, Australia, the US, and India significant island of coherencies is perceptible in the medium to long-term periods during the 9/11 attacks, technology bubble crisis and further the Euro-crisis. The pandemics have high intensity of long-term coherence for these concerned countries. For some countries direction of arrows mostly point upward and left which means greater GPR reduces international travel. The notable examples are India, the US, and Germany. Overall, our findings in conformity with the earlier studies (Balli et al., 2019; Wu & Wu, 2019; Choi, 2020; Lee & Chen, 2021) demonstrate that in periods of political uncertainty the tourists' perception of the destination country is related to safety, risks and reputation determine the major decisions to travel.

4.4.4 | VIX and tourism

Figure 9 describes the wavelet coherencies across VIX and international tourist arrivals in Malaysia. As evident the regions of wavelet coherence remain scarce except for the following countries: (i) Singapore (long-term coherence in 2015 and beyond and 2019–

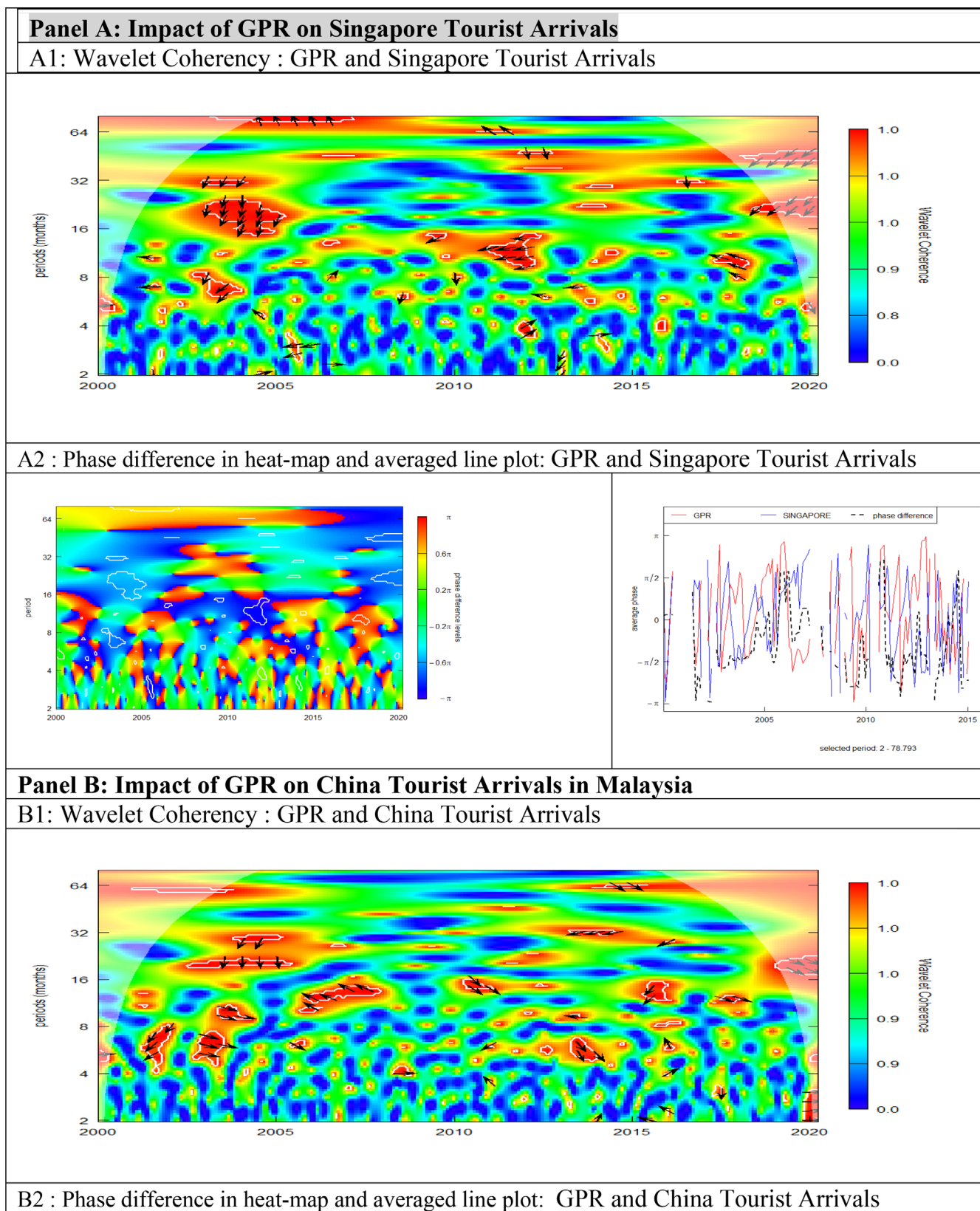
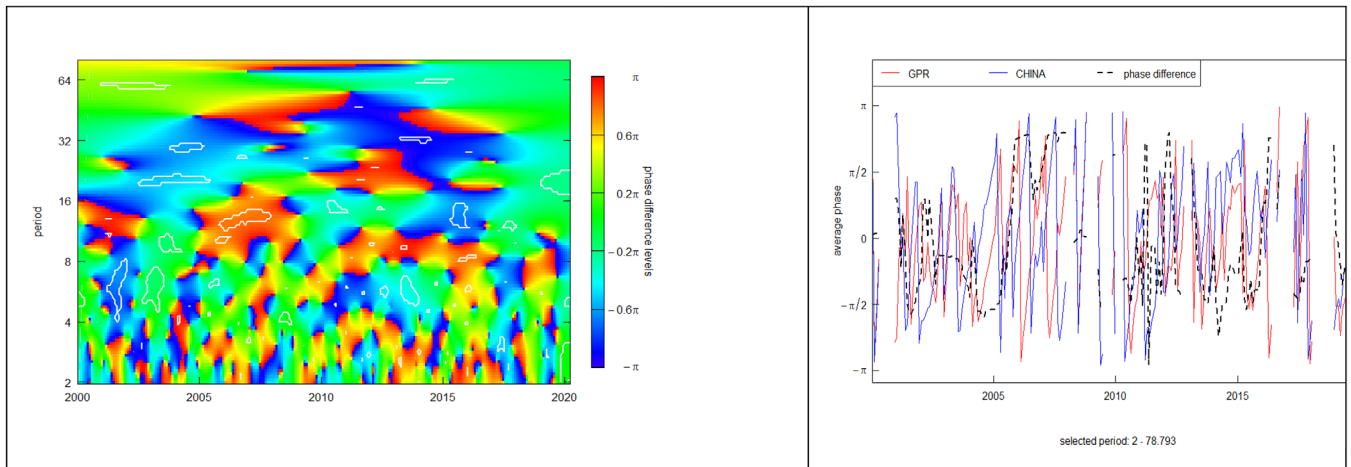
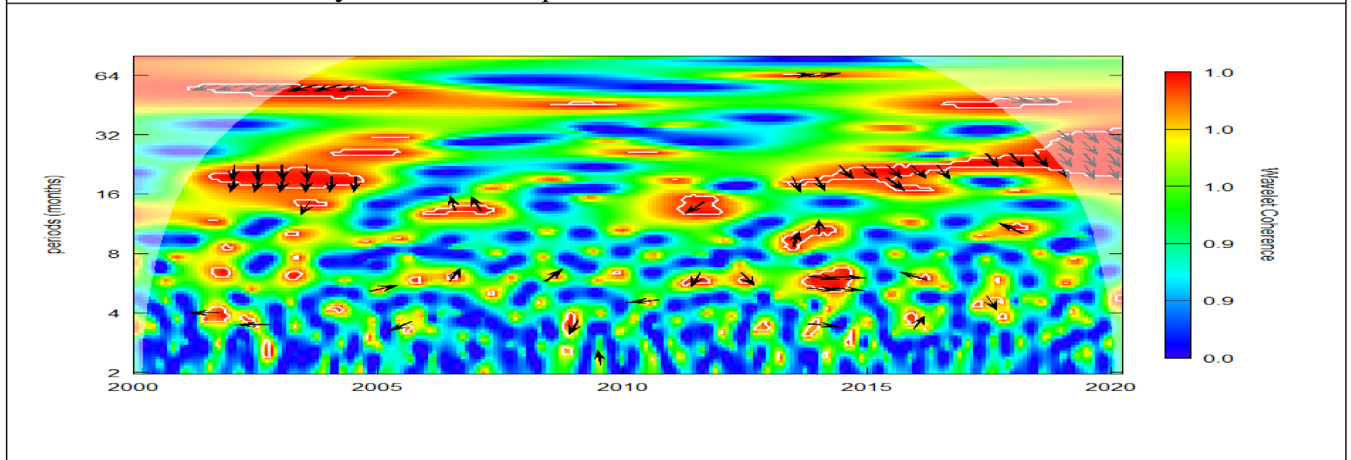


FIGURE 8 Wavelets coherence and phase difference between GPR and tourist arrivals in Malaysia [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

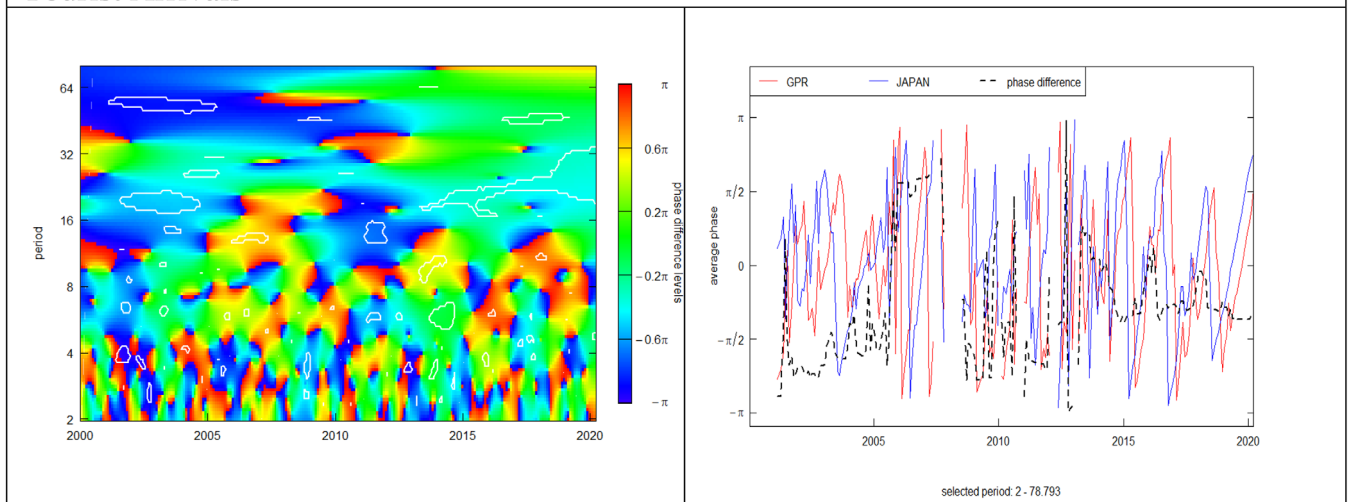


Panel C: Impact of GPR on Japan Tourist Arrivals in Malaysia

C1: Wavelet Coherency : GPR and Japan Tourist Arrivals



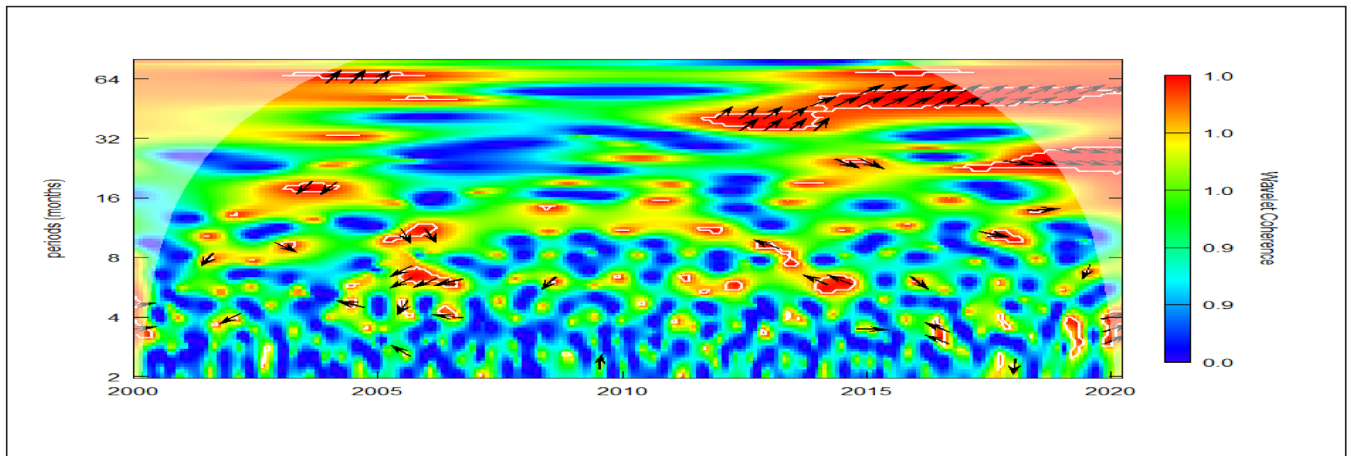
C2 : Phase difference in heat-map and averaged line plot: GPR and Japan Tourist Arrivals



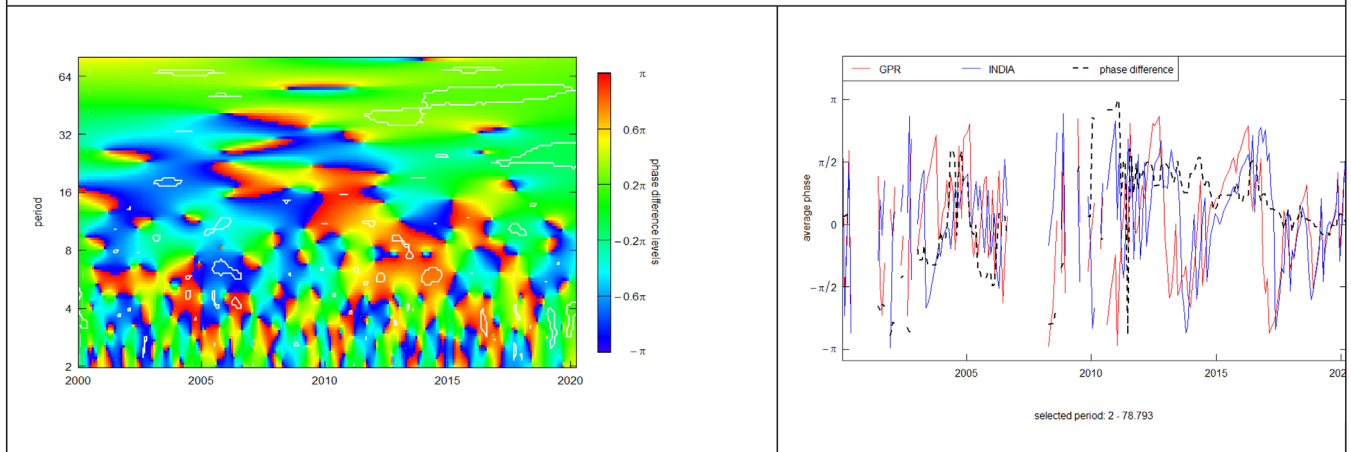
Panel D: Impact of GPR on India Tourist Arrivals in Malaysia

D1: Wavelet Coherency : GPR and India Tourist Arrivals

FIGURE 8 (Continued)

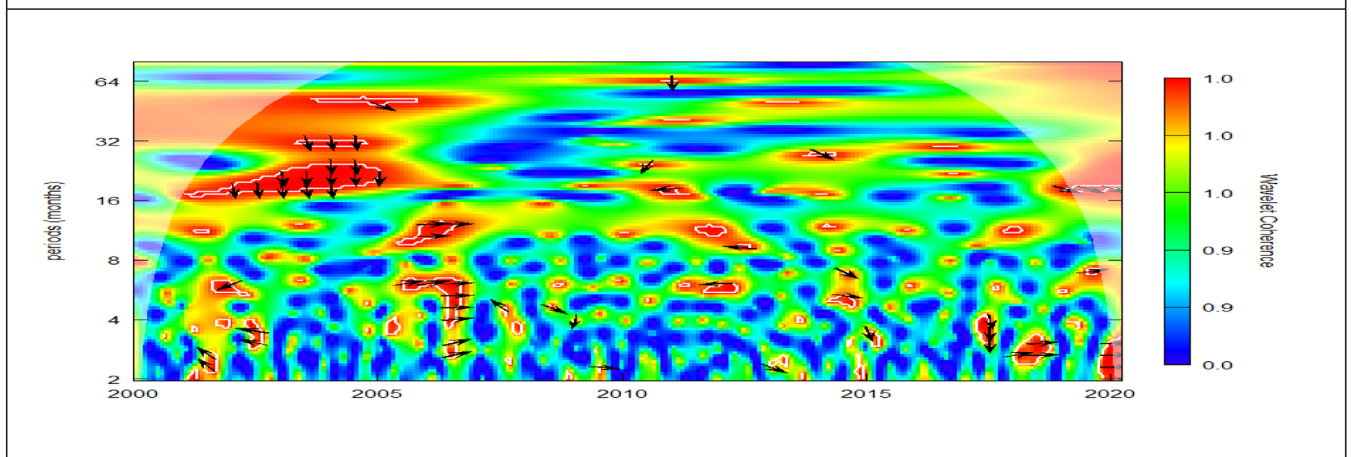


D2 : Phase difference in heat-map and averaged line plot: GPR and India Tourist Arrivals



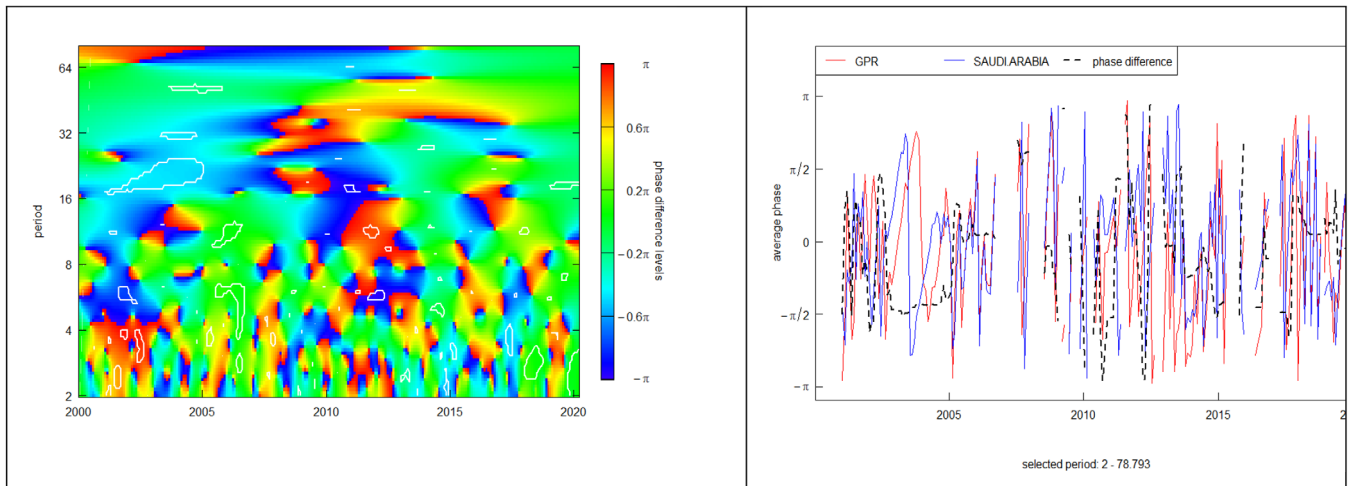
Panel E: Impact of GPR on Saudi Arabia Tourist Arrivals in Malaysia

E1: Wavelet Coherency : GPR and Saudi Arabia Tourist Arrivals



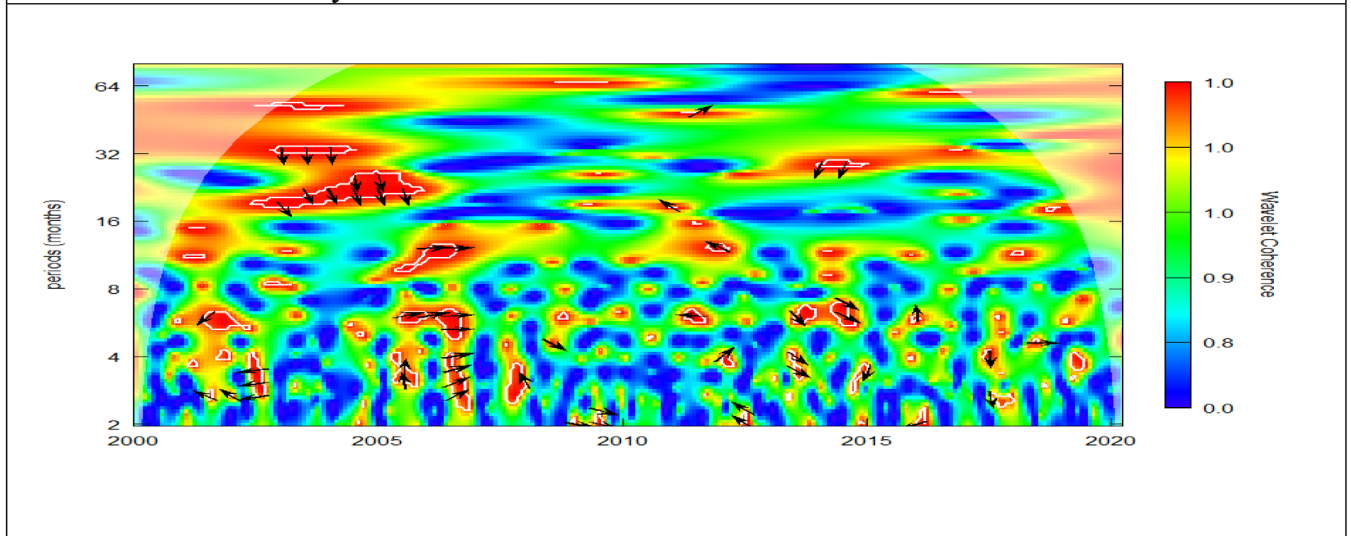
E2 : Phase difference in heat-map and averaged line plot: GPR and Saudi Arabia Tourist Arrivals

FIGURE 8 (Continued)



Panel F: Impact of GPR on UAE Tourist Arrivals in Malaysia

F1: Wavelet Coherency : GPR and UAE Tourist Arrivals



F2 : Phase difference in heat-map and averaged line plot: GPR and UAE Tourist Arrivals

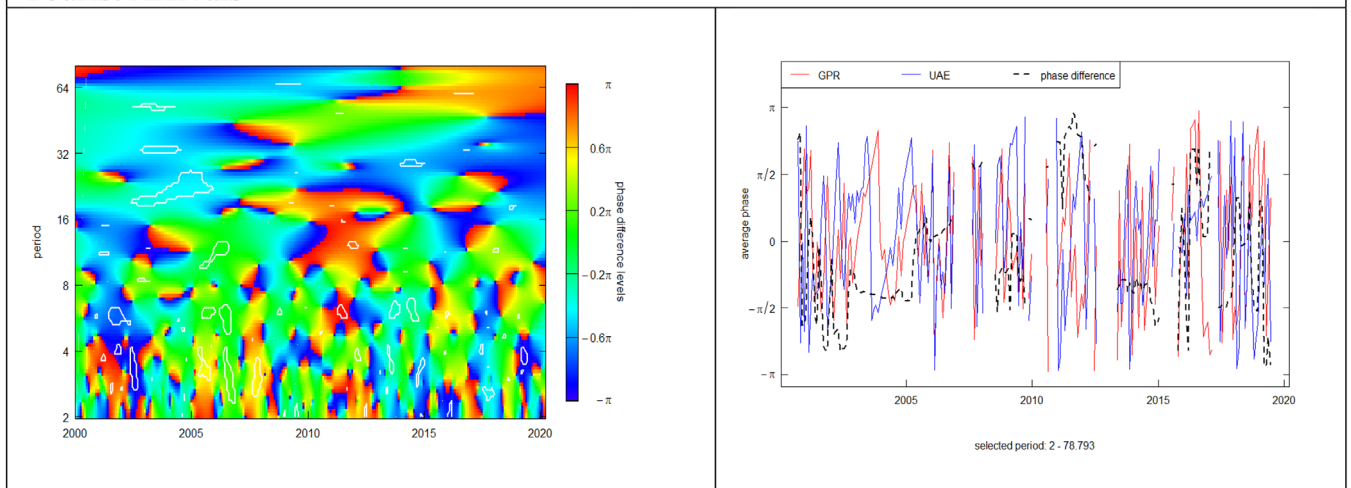
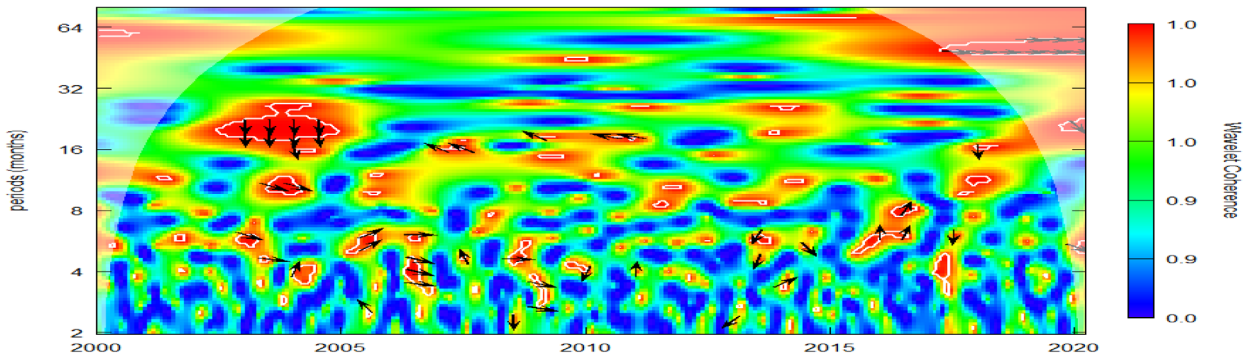


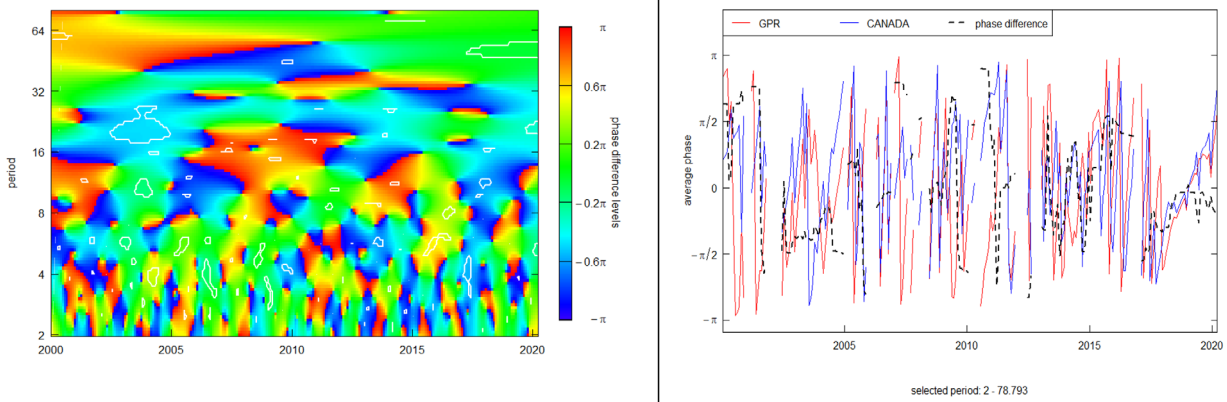
FIGURE 8 (Continued)

Panel G: Impact of GPR on Canada Tourist Arrivals in Malaysia

G1: Wavelet Coherency : GPR and Canada Tourist Arrivals

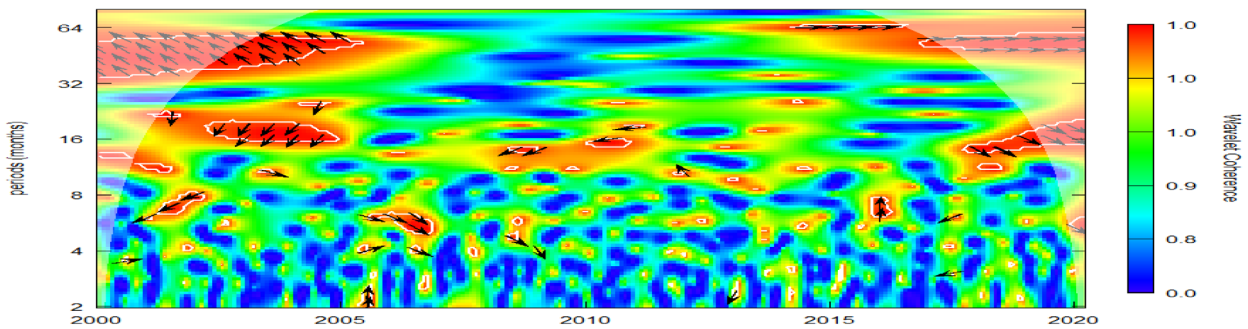


G2 : Phase difference in heat-map and averaged line plot: GPR and Canada Tourist Arrivals



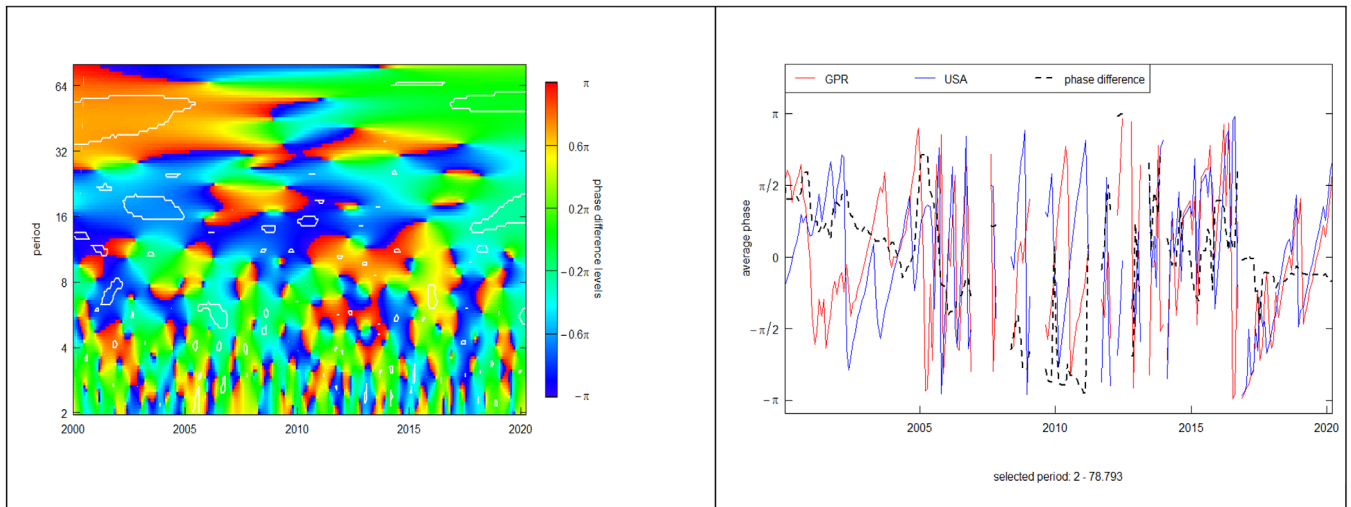
Panel H: Impact of GPR on USA Tourist Arrivals in Malaysia

H1: Wavelet Coherency : UMPU and USA Tourist Arrivals



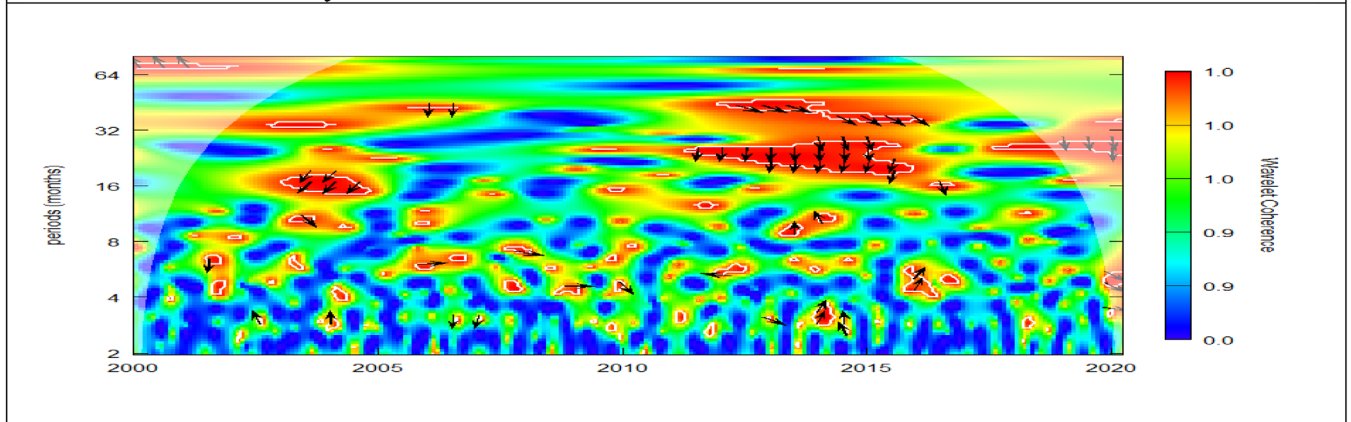
H2 : Phase difference in heat-map and averaged line plot: GPR and USA Tourist Arrivals

FIGURE 8 (Continued)

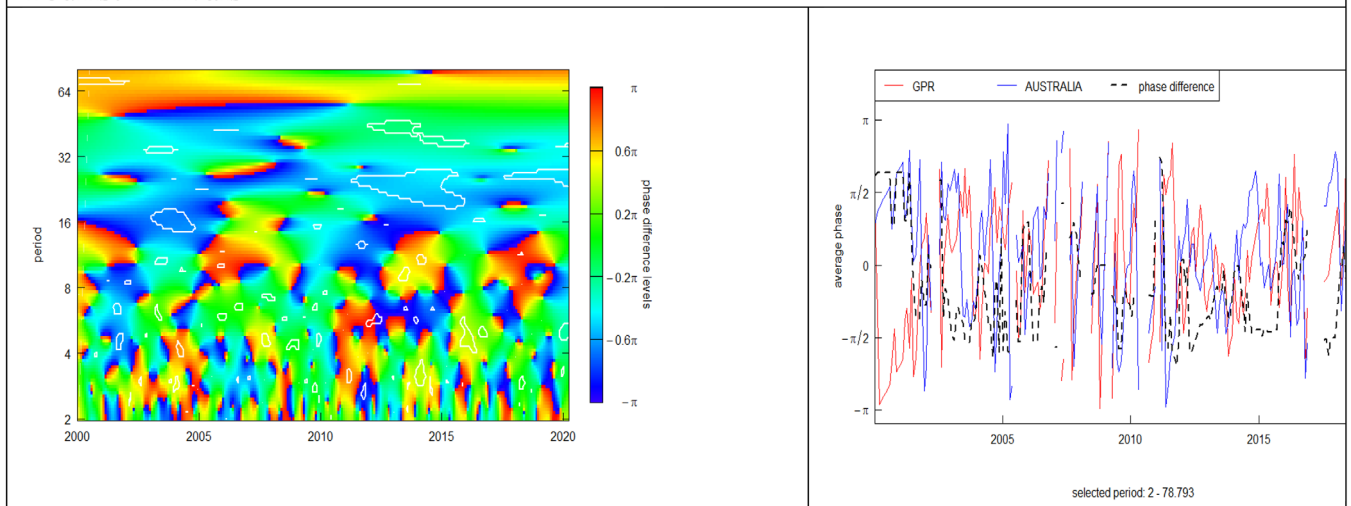


Panel I: Impact of GPR on AUSTRALIA Tourist Arrivals in Malaysia

I1: Wavelet Coherency : GPR and Australia Tourist Arrivals



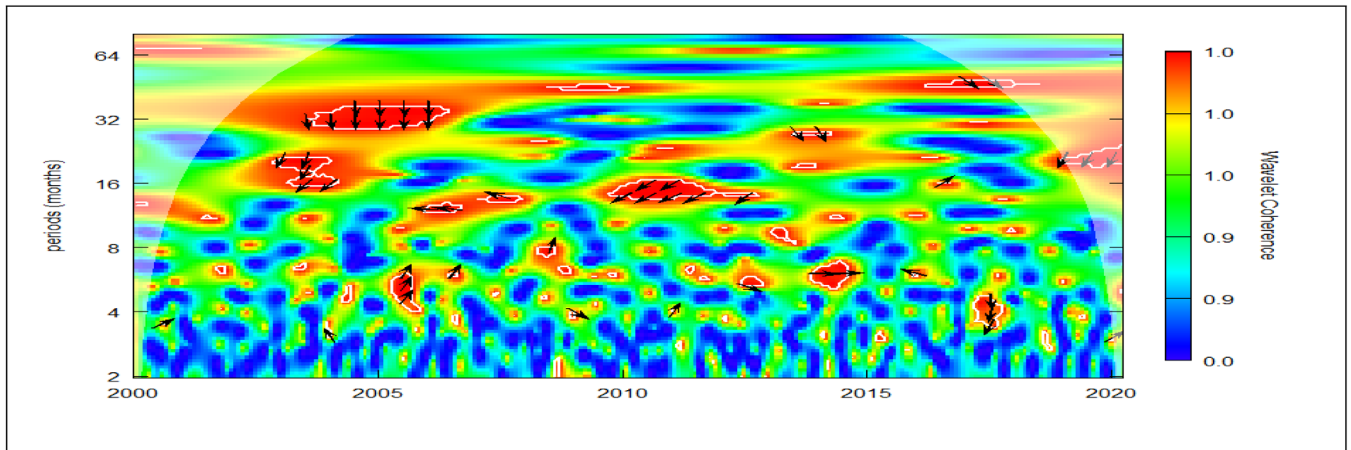
I2 : Phase difference in heat-map and averaged line plot: GPR and Australia Tourist Arrivals



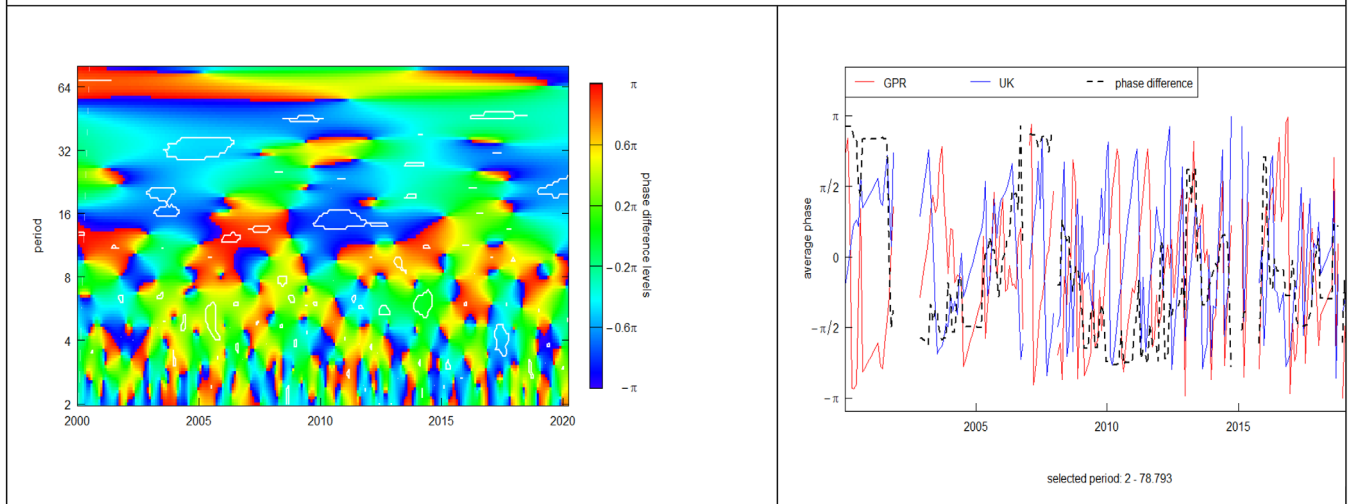
Panel J: Impact of GPR on UK Tourist Arrivals in Malaysia

J1: Wavelet Coherency : GPR and UK Tourist Arrivals

FIGURE 8 (Continued)

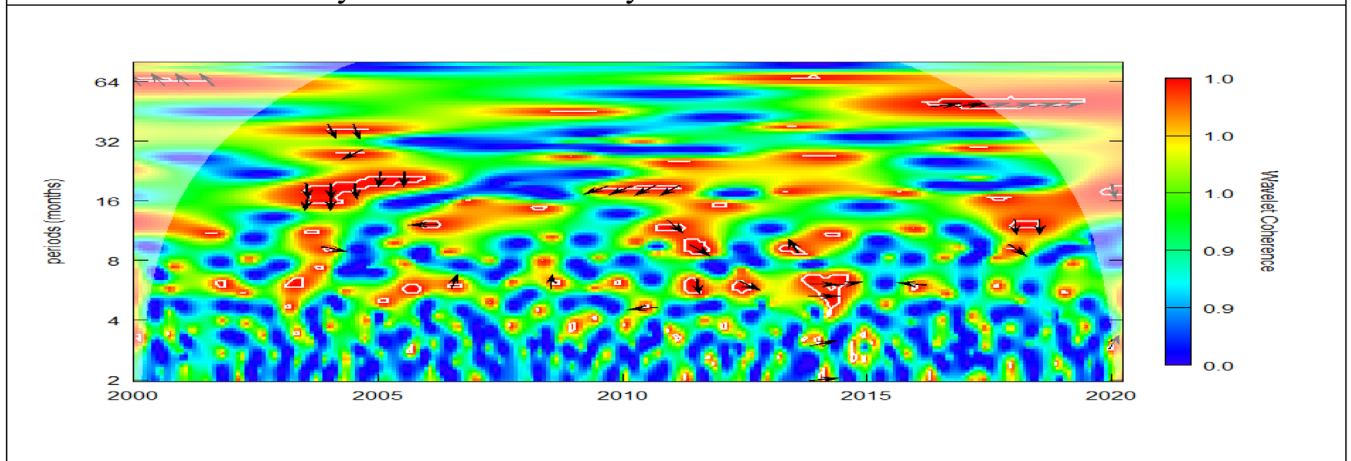


J2 : Phase difference in heat-map and averaged line plot: GPR and UK Tourist Arrivals



Panel K: Impact of GPR on GERMANY Tourist Arrivals in Malaysia

K1: Wavelet Coherency : GPR and Germany Tourist Arrivals



K2 : Phase difference in heat-map and averaged line plot: GPR and Germany Tourist Arrivals

FIGURE 8 (Continued)

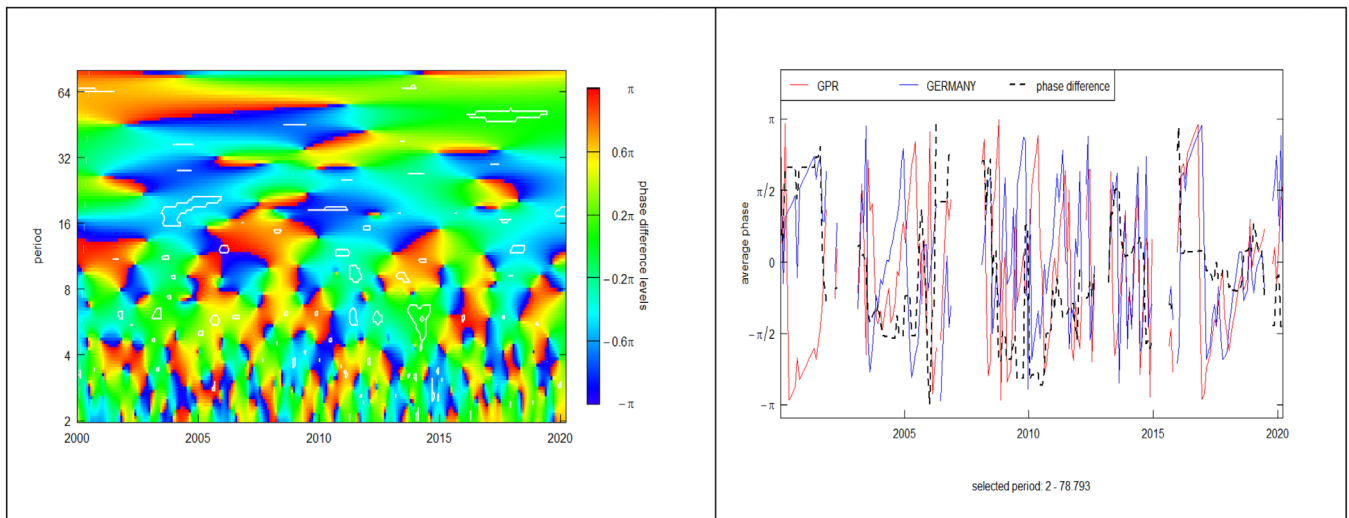


FIGURE 8 (Continued)

2020 with the directions of arrows upward and left). (ii) In Japan there is perceptible coherence in the mid-term during 2007 and the direction of arrows point toward the right and downward. (iii) Likewise for Saudi Arabia significant middle-term coherencies during 2015 and 2020. (iv) Again, for the UAE long-run coherence during 2007–2010 with the arrows pointing downward and left.

Figure 10 describes the wavelet coherencies amid GFSI and tourism in Malaysia. Precisely the 9/11 crisis, the subprime mortgage crisis and the Euro crisis depict severe short-run to medium and long-run coherencies between GFSI and tourist arrivals in Malaysia. However similar to the VIX coherency the direction of arrows is varying across countries and frequency. It is clear from the wavelet coherencies that global uncertainty owing to GFSI impacts the consumers' decision to travel than in normal times.

4.5 | Discussion

Our results show that the global uncertainties manifested through different macro-based indicators affect international-based tourism demand for the destination countries of Singapore and Malaysia for different time spans. However, the intensities of impact vary across countries. Further in conformity with the earlier studies the influence of the GPR is strong and has a long-standing impact (Tiwari et al., 2019). The next important indicator is the GEPU which depicts robust evidence of co-movements and causality with variation across frequencies and countries. During the subprime crisis, Euro-crisis and the pandemics significant coherencies are perceptible. In terms of the lead-lag association the GEPU and tourism display positively or negatively based association with significant co-movements. These

findings are analogous to the studies by (Balli et al., 2018; Wu & Wu, 2021). The other important uncertainty indicators namely the VIX and GFSI show important coherencies but the intensity is less considerable than the earlier mentioned indicators. The findings from the study are intuitively elegant. Tourism demand is grossly negatively correlated with uncertainties. However, there are indications of risk-lovers where tourist movements are positively associated with uncertainty. Our empirical findings lend support to the “Prospect Theory” and the “Real Options Theory.” The decision to travel is postponed during the financial crisis for precautionary motive of savings. However, in the instances of inferior good behavior of international tourism we find occurrences of co-movement of tourism with GFSI and VIX. Our study throws surprising insights analogous to the study by Sharma and Khanna (2021) where we explore the behavior of tourism as an inferior good in certain country contexts. Tourism may be an inferior commodity whose demand is higher in times of uncertainty. Overall, the results demonstrate an intricate association between the various macro-indicators and tourism.

5 | CONCLUSION AND POLICY IMPLICATIONS AND RESEARCH LIMITATIONS

This paper using wavelets approaches examines the effects of world policy uncertainty (GEPU), US Monetary Policy Uncertainty (UMPU), geopolitical risk (GPR), Financial Stress Index (FSI) and market volatility (VIX) on international-based tourist arrivals in Malaysia and Singapore from China, Japan, India, Saudi Arabia, UAE, Canada, the US, Australia, United Kingdom, Finland, and Germany. We use

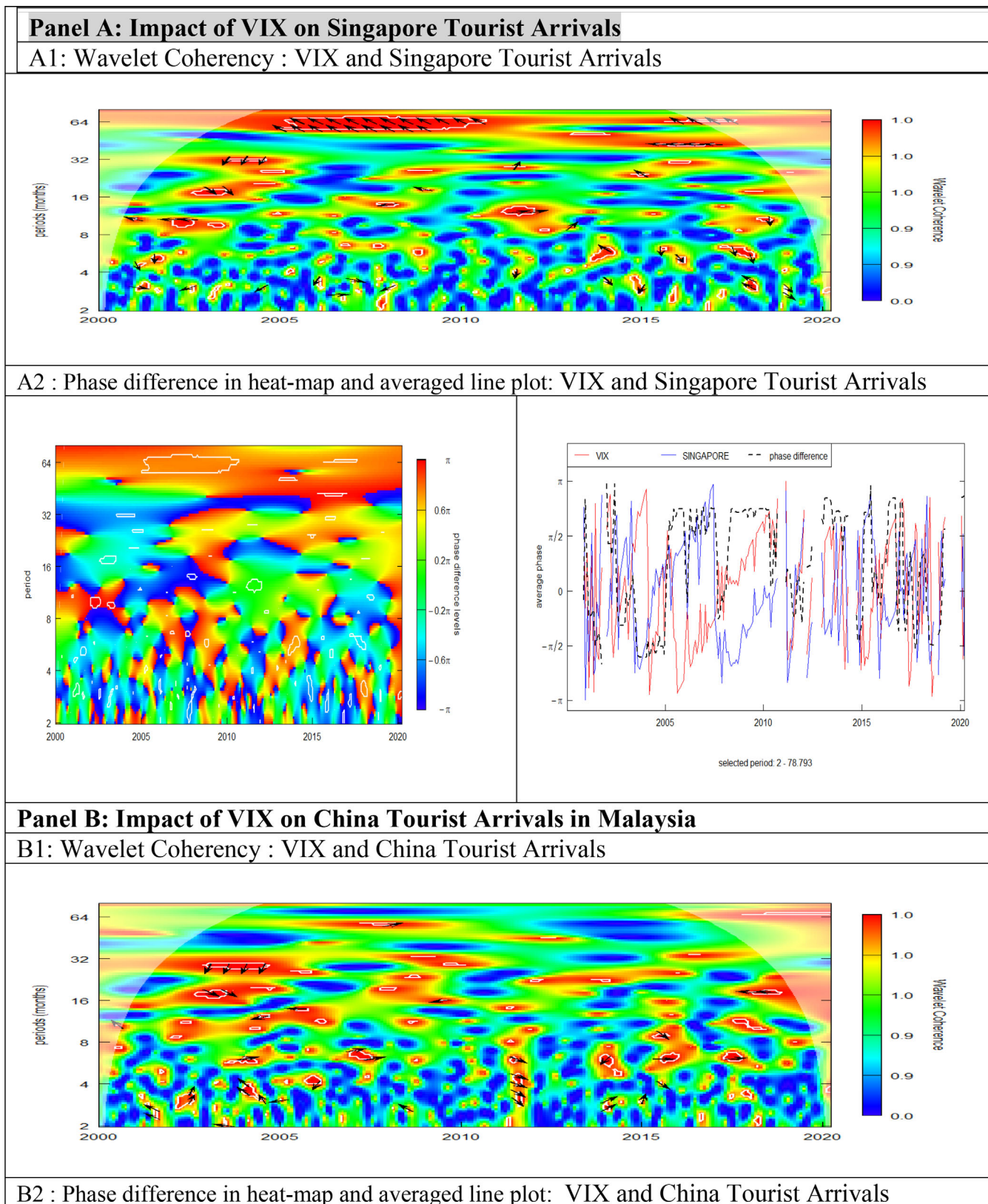
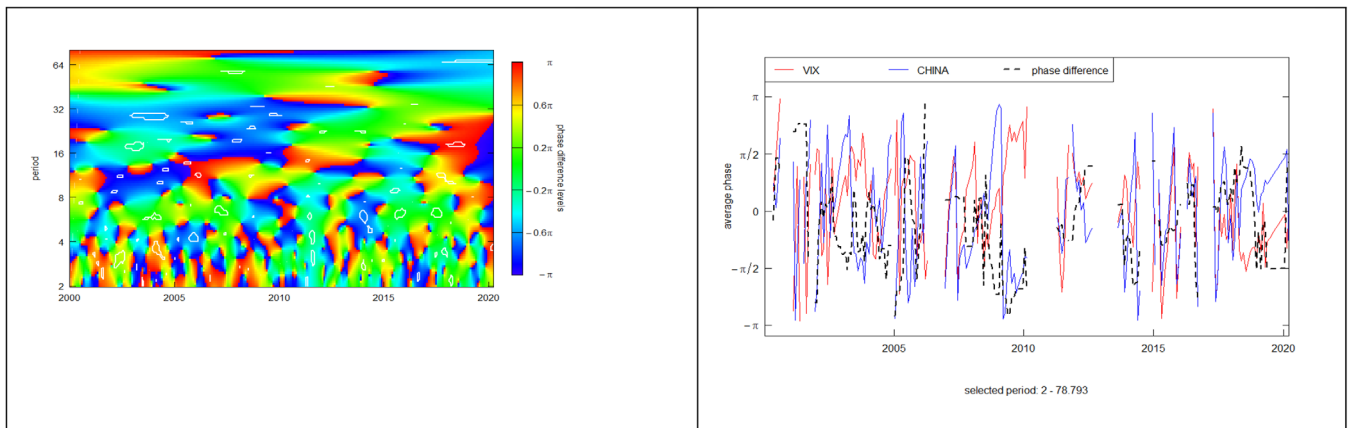
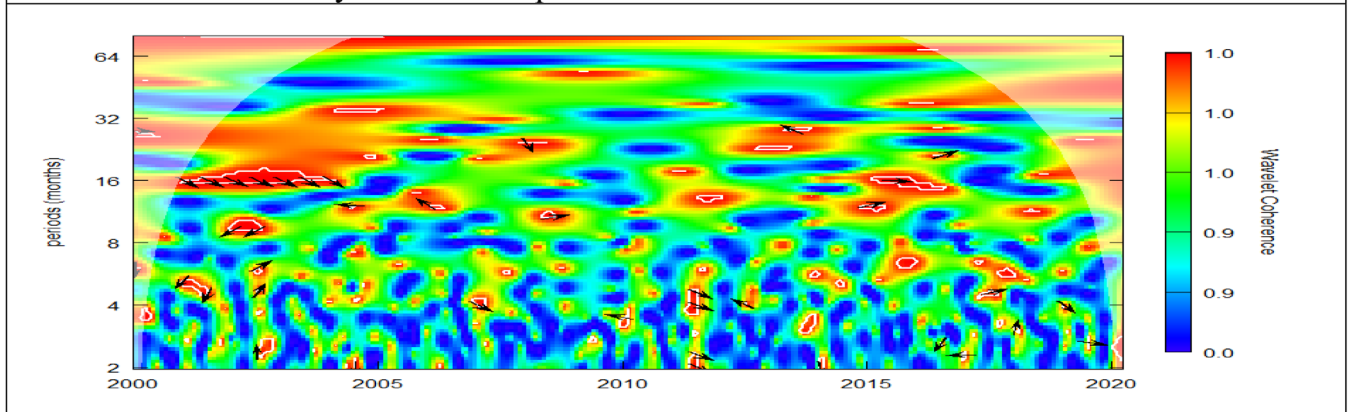


FIGURE 9 Wavelets coherence and phase difference between VIX and tourist arrivals in Malaysia [Colour figure can be viewed at wileyonlinelibrary.com]



Panel C: Impact of VIX on Japan Tourist Arrivals in Malaysia

C1: Wavelet Coherency : VIX and Japan Tourist Arrivals



C2 : Phase difference in heat-map and averaged line plot: VIX and Japan Tourist Arrivals

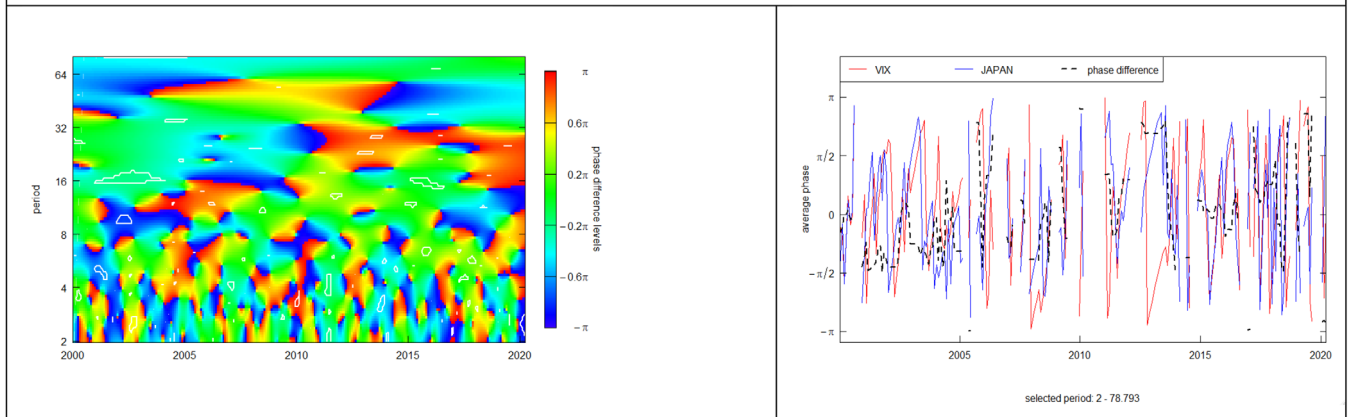


FIGURE 9 (Continued)

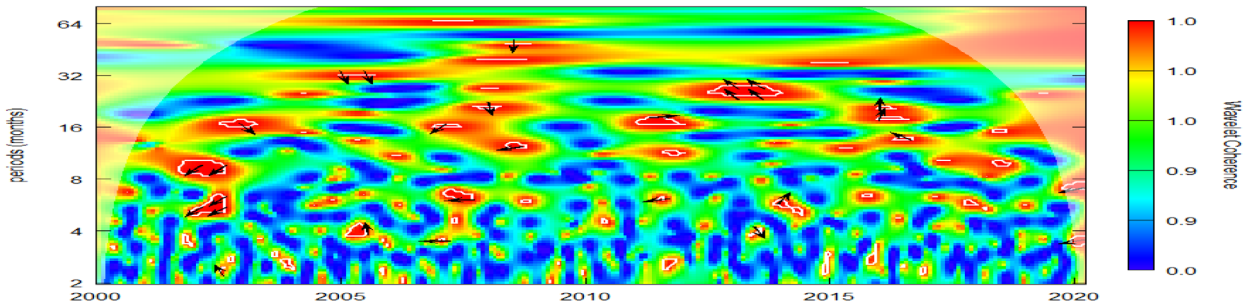
monthly data from January 2000 to April 2020. Our results show that the global uncertainties manifested through different macro-based indicators affect international-based tourism demand for the destination countries of Singapore and Malaysia for different time spans. However, the intensities of impact vary across countries. The GEPU depicts robust evidence of co-movements and causality with variation across frequencies and countries. During the subprime crisis, Euro-crisis and the pandemics significant coherencies are perceptible. In

terms of the lead-lag association the GEPU and tourism show positively or negatively based association with significant co-movements.

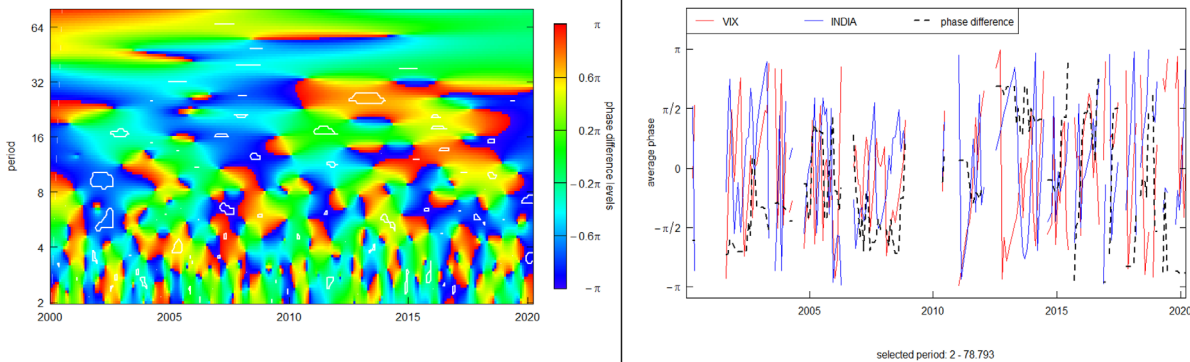
Our findings offer several policy prescriptions. Given that policy uncertainty, geopolitical threat and war defined by geopolitical risk, financial stress and market volatility impacts the tourists' arrivals from emerging and developed economies in Asia, we suggest that policy-makers need to adopt and implement operational policies to curtail unsure events that can increase uncertainty and political tensions

Panel D: Impact of VIX on India Tourist Arrivals in Malaysia

D1: Wavelet Coherency : VIX and India Tourist Arrivals

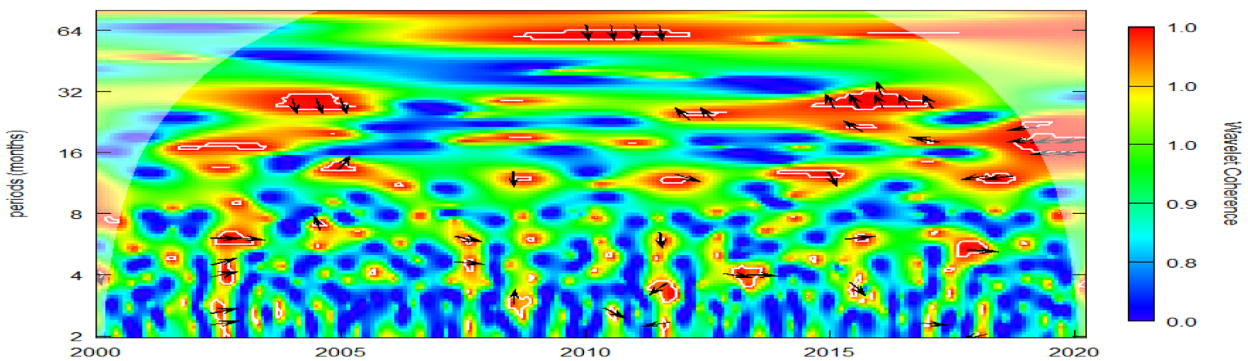


D2 : Phase difference in heat-map and averaged line plot: VIX and India Tourist Arrivals



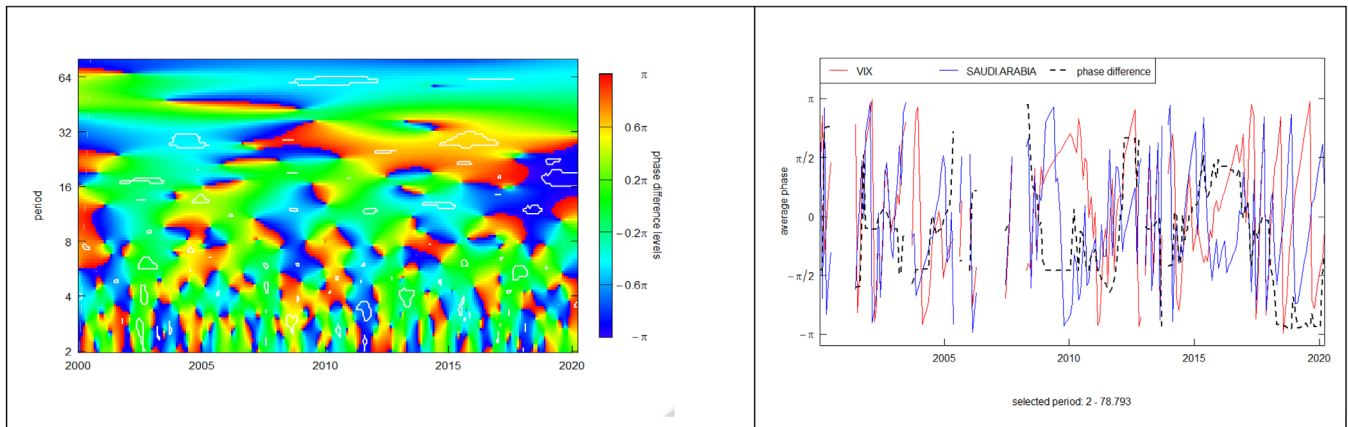
Panel E: Impact of VIX on Saudi Arabia Tourist Arrivals in Malaysia

E1: Wavelet Coherency : VIX and Saudi Arabia Tourist Arrivals



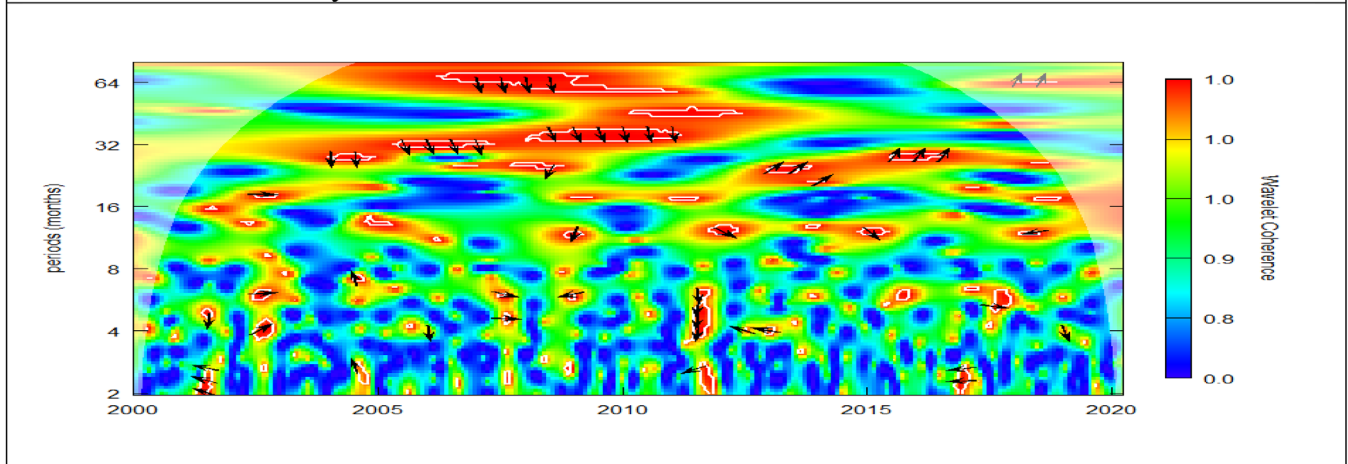
E2 : Phase difference in heat-map and averaged line plot: VIX and Saudi Arabia Tourist Arrivals

FIGURE 9 (Continued)

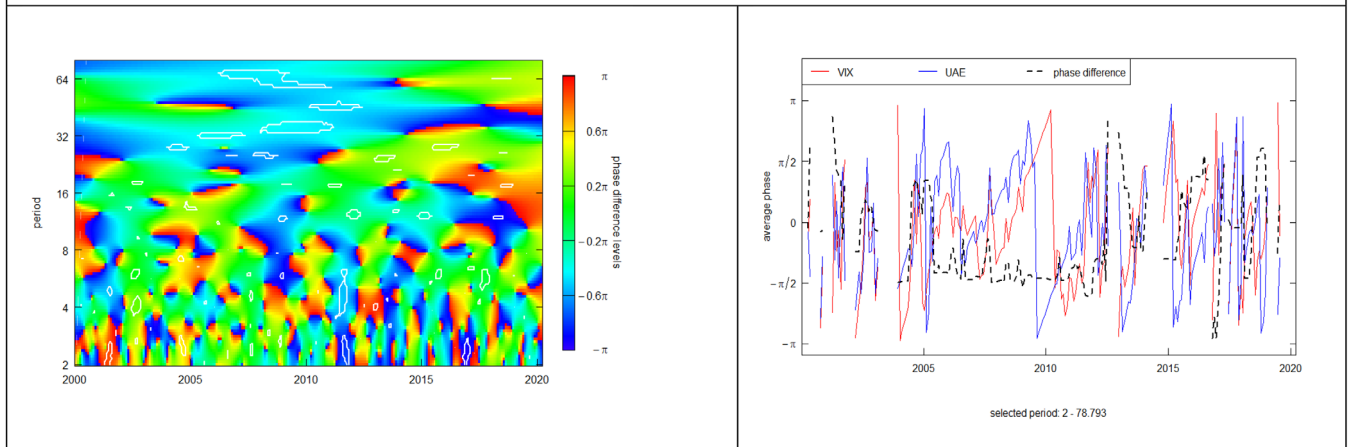


Panel F: Impact of VIX on UAE Tourist Arrivals in Malaysia

F1: Wavelet Coherency : VIX and UAE Tourist Arrivals



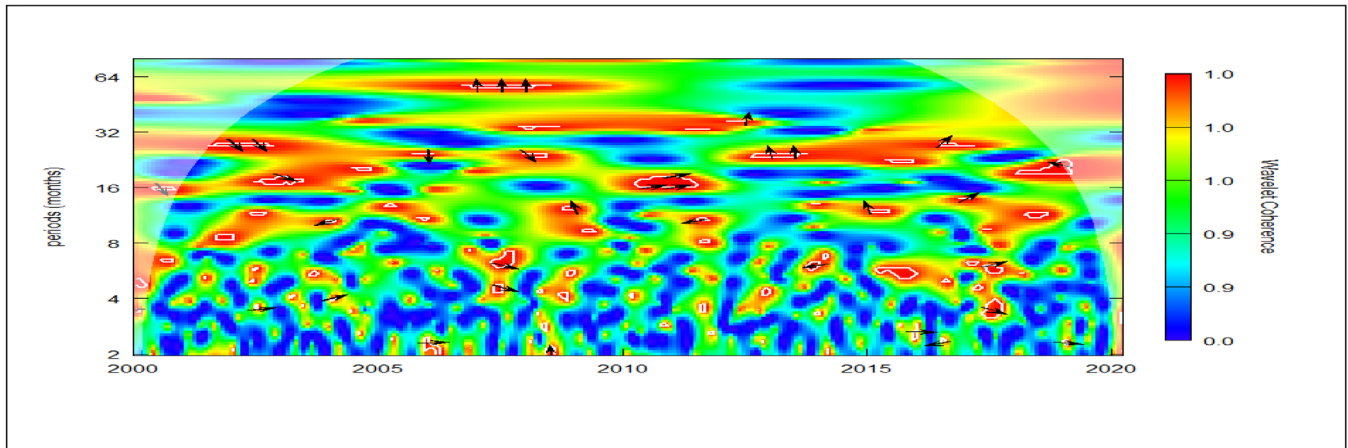
F2 : Phase difference in heat-map and averaged line plot: VIX and UAE Tourist Arrivals



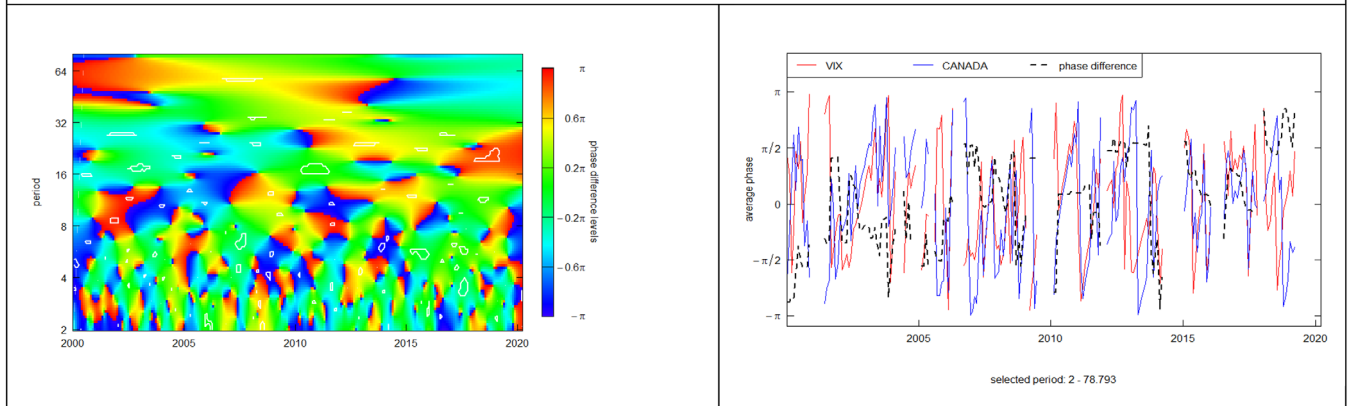
Panel G: Impact of VIX on Canada Tourist Arrivals in Malaysia

G1: Wavelet Coherency : VIX and Canada Tourist Arrivals

FIGURE 9 (Continued)

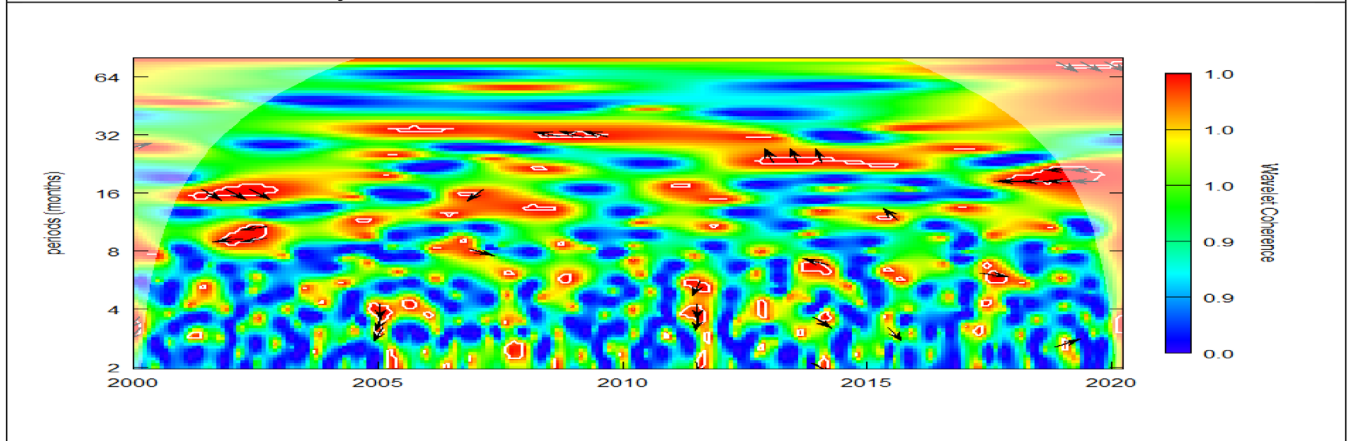


G2 : Phase difference in heat-map and averaged line plot: VIX and Canada Tourist Arrivals



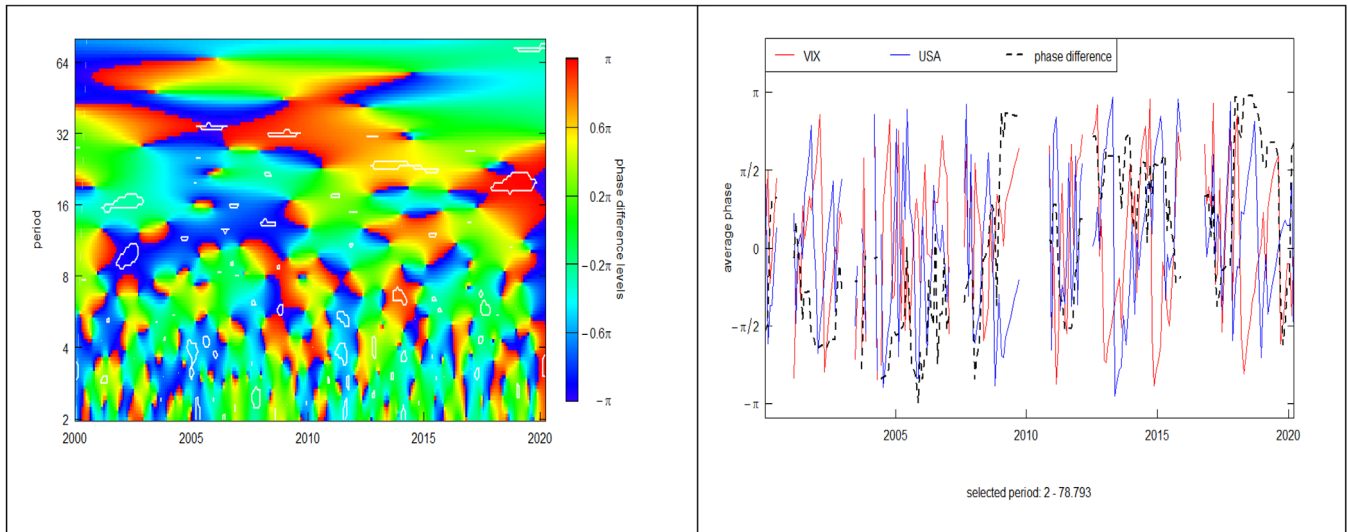
Panel H: Impact of VIX on USA Tourist Arrivals in Malaysia

H1: Wavelet Coherency : VIX and USA Tourist Arrivals



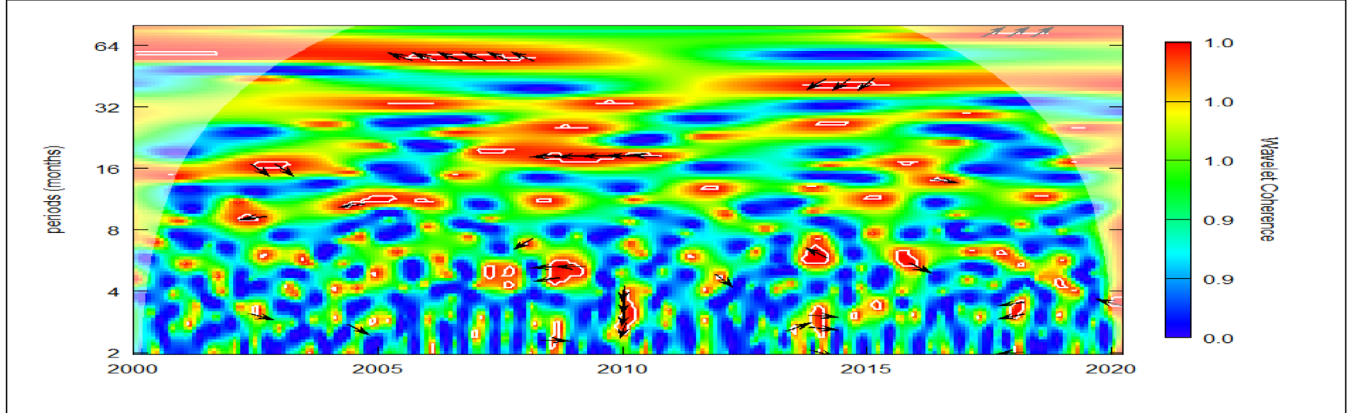
H2 : Phase difference in heat-map and averaged line plot: VIX and USA Tourist Arrivals

FIGURE 9 (Continued)



Panel I: Impact of VIX on AUSTRALIA Tourist Arrivals in Malaysia

II: Wavelet Coherency : VIX and Australia Tourist Arrivals



I2 : Phase difference in heat-map and averaged line plot: VIX and Australia Tourist Arrivals

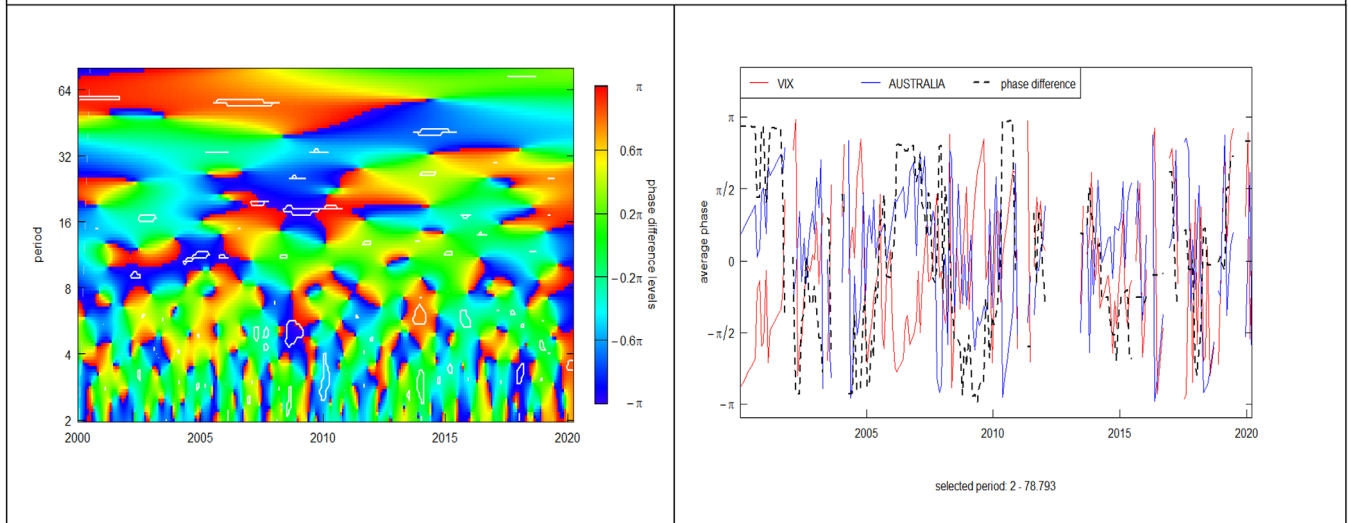


FIGURE 9 (Continued)

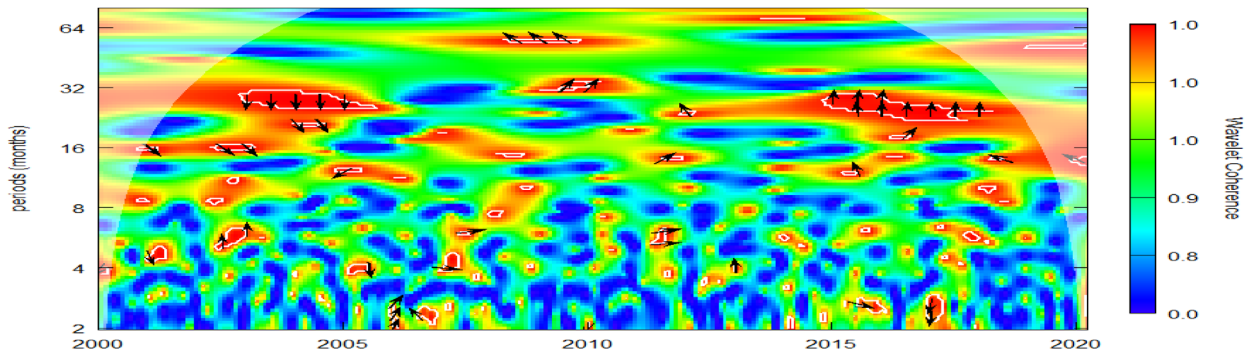
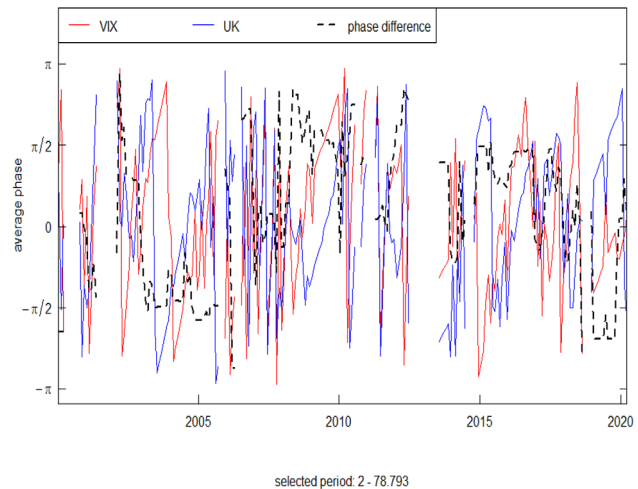
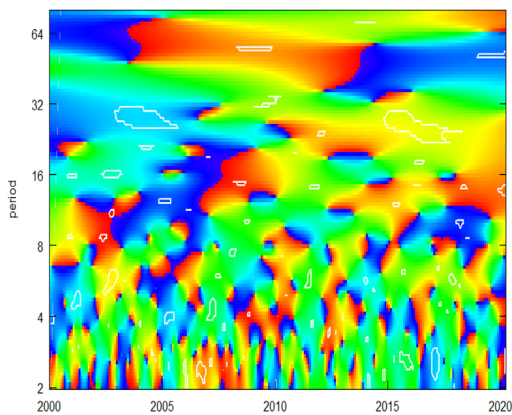
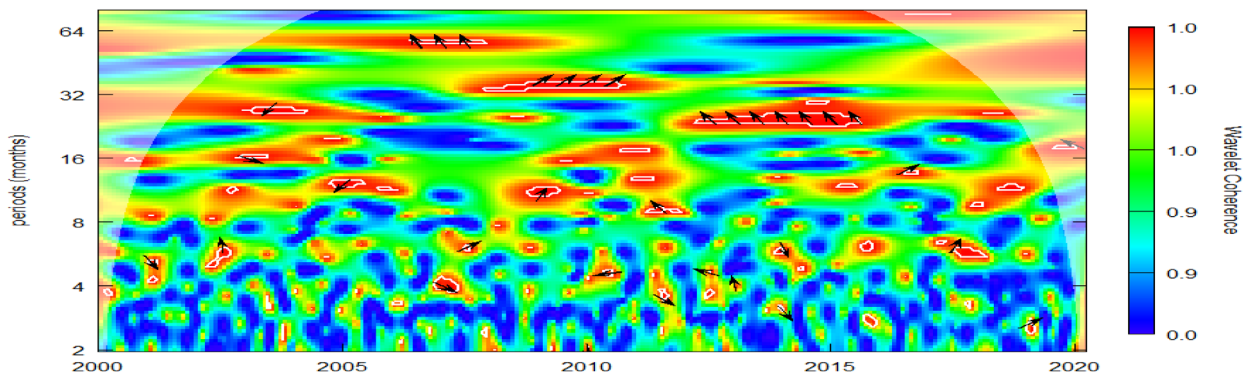
Panel J: Impact of VIX on UK Tourist Arrivals in Malaysia**J1: Wavelet Coherency : VIX and UK Tourist Arrivals****J2 : Phase difference in heat-map and averaged line plot: VIX and UK Tourist Arrivals****Panel K: Impact of VIX on GERMANY Tourist Arrivals in Malaysia****K1: Wavelet Coherency : VIX and Germany Tourist Arrivals**

FIGURE 9 (Continued)

A2 : Phase difference in heat-map and averaged line plot: VIX and Germany Tourist Arrivals

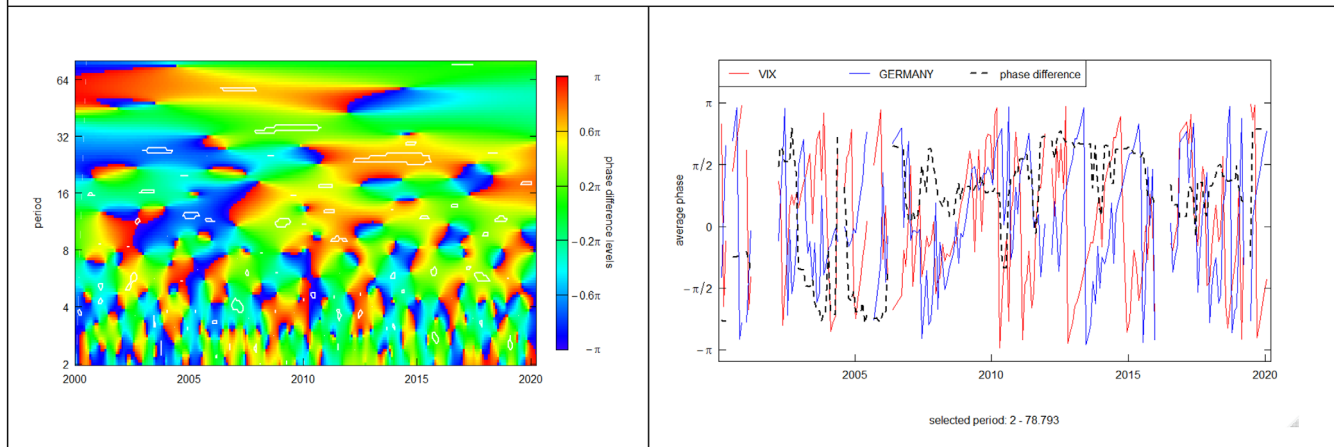


FIGURE 9 (Continued)

across the economies of Asian countries including Malaysia and Singapore. Tourism firms could be encouraged by implementing policies such as tax inducements and back up their capital requirement to facilitate stability in the investments in the tourism industry, especially when there are unstable and volatile political and economic occurrences in their particular economies. Policy authorities in addition need to support tourism infrastructure by implementing PPP investments in the tourism sector. It is probable that; all these procedures would contribute toward the tourism sector in sustaining even in condition when there is a momentous uncertainty in the concerned economies. If the policymakers do not take indispensable initiatives to thwart the growing process of uncertainty, then this could lead to having an acute unfavorable impact on the tourism-based industry of Malaysia and Singapore.

From the perspective of policy implications, international tourists as rational consumers postpone their travel plans in the event of uncertainty or risks. As uncertainty in the macroeconomic perspective reduces the levels of consumer preference and satisfaction via slow-down of income, alongside the geopolitical risks, it raises the travel costs. Against such backdrop tourists, may either postpone the travel plans or tend to choose alternative peaceful tourist destinations. The choice of alternative tourist destinations renders huge losses in terms of foregone revenue from tourism in the country against which the destination substitution is made. We thus advocate that during the precrisis situation, the tourism sector in the concerned countries should develop all-encompassing policies to develop crisis management strategies. Such crisis management strategies should involve the private tourism houses, government sector and major institutions involved with the law-and-order situation. The concerned tourism houses may develop strategies through rigorous training to gauge the intensity of crisis and create adequate back up plans thereof. From the perspective of the government, there should be task force with representations from tourism industry, police force and local

population who can enable the international tourists to combat the crisis. We advocate that the task force should be thoroughly trained to guide the stakeholders to overcome the panics of crisis and ensure the pathway toward recovery.

As the situation resumes normalcy the tourist destinations should evolve marketing strategies on recovery of the tourism sector to attract the tourists. Particularly, the recent pandemic has taught that the hospitality sector increasingly needs to create an image of safety, hygiene and cleanliness to ensure competitiveness in the tourism sector. Further as geopolitical risks create adverse perception of the tourism destination country, strategic marketing practices can be evolved to attract the risk lovers who take advantage of the turn in the market movements in the events of risks. During periods of recovery, since tourists as rational consumers are more sensitive to price variations, risk adverse travelers can be encouraged to travel by practicing significant price cutting. Succinctly, the government of the destination country should maintain international security relations, and maintain the domestic law and order situation. Such decisive steps are major paces to invigorate tourism from the long-run perspective.

Finally, some limitations of the research have to be underlined. A caveat of the present study is that monthly data on Economic Policy Uncertainty are available only from 1997. Although monthly frequency of observations provides robust estimations, we are constrained in our analysis to use dense historical data sets to cover various occurrences on uncertainty and geopolitical risks as available in the periods in history. Next, the characteristic features of vacation and visiting friends and relatives in the context of tourism can show significant variations across countries and therefore it may display seasonality patterns even if the data are adjusted for seasonality.

Future direction of studies can be undertaken to explore with further disaggregated data the impact of uncertainty on tourism as the availability of datasets grows and further expansion of the sample size. Moreover, from the contextual perspective, the scope of the

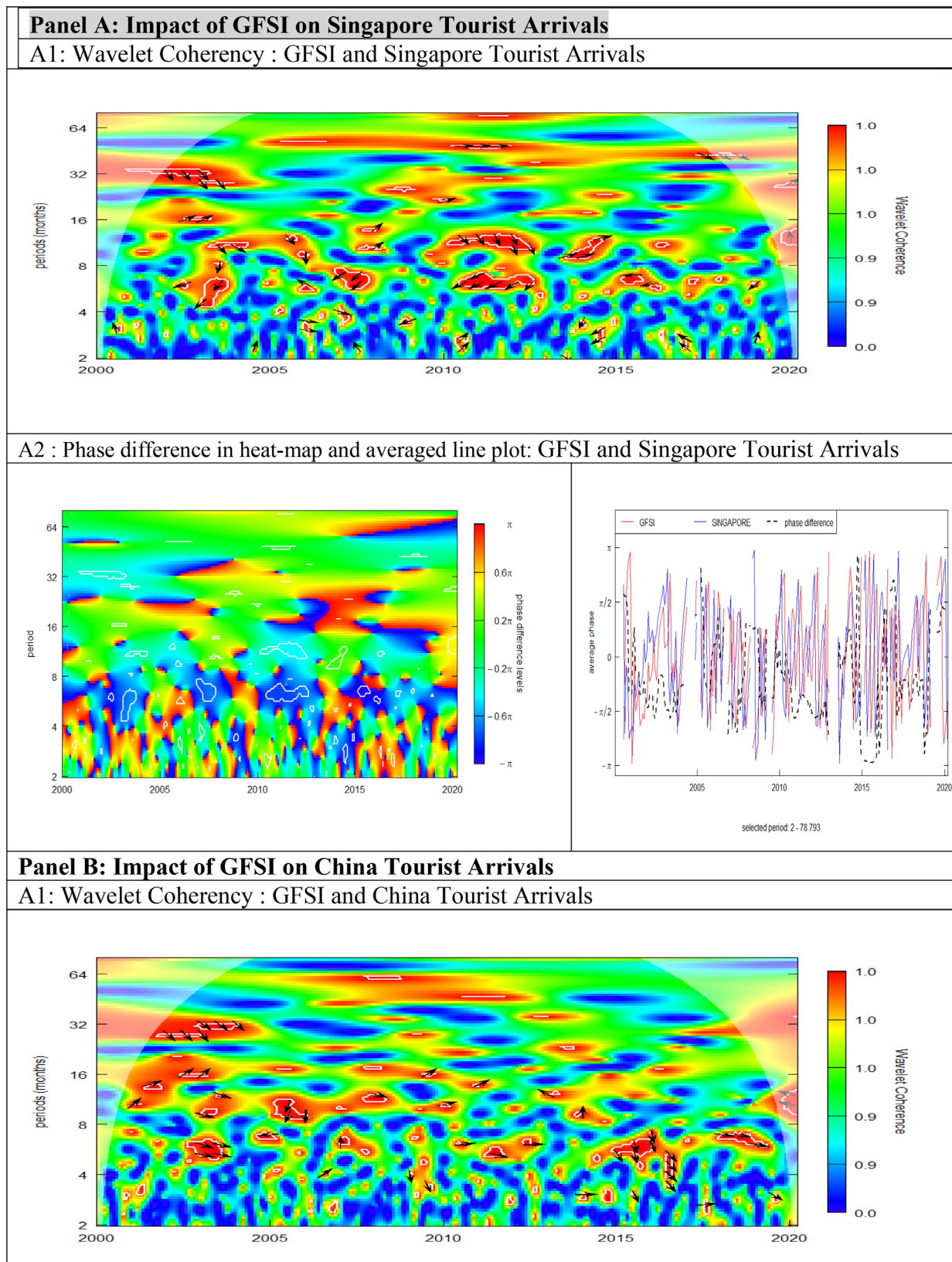
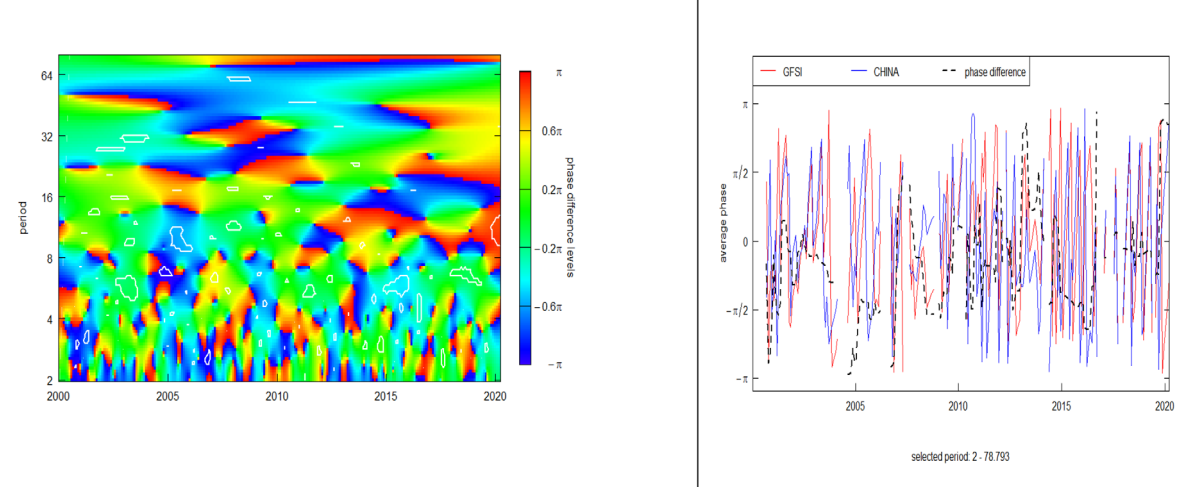


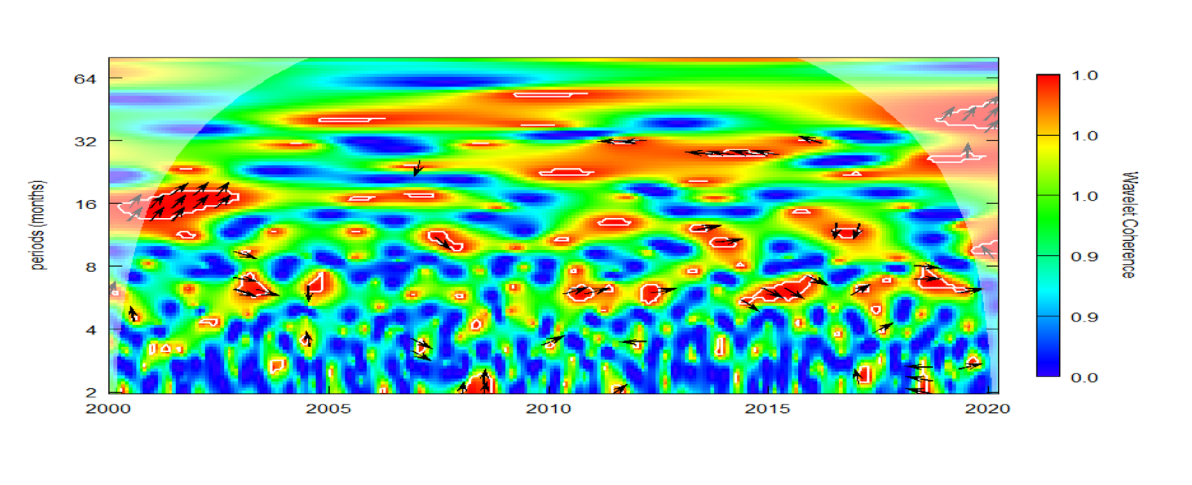
FIGURE 10 Wavelets coherence and phase difference between GFSI and tourist arrivals in Malaysia [Colour figure can be viewed at wileyonlinelibrary.com]

A2 : Phase difference in heat-map and averaged line plot: GFSI and China Tourist Arrivals



Panel C: Impact of GFSI on Japan Tourist Arrivals in Malaysia

A1: Wavelet Coherency : GFSI and Japan Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GFSI and Japan Tourist Arrivals

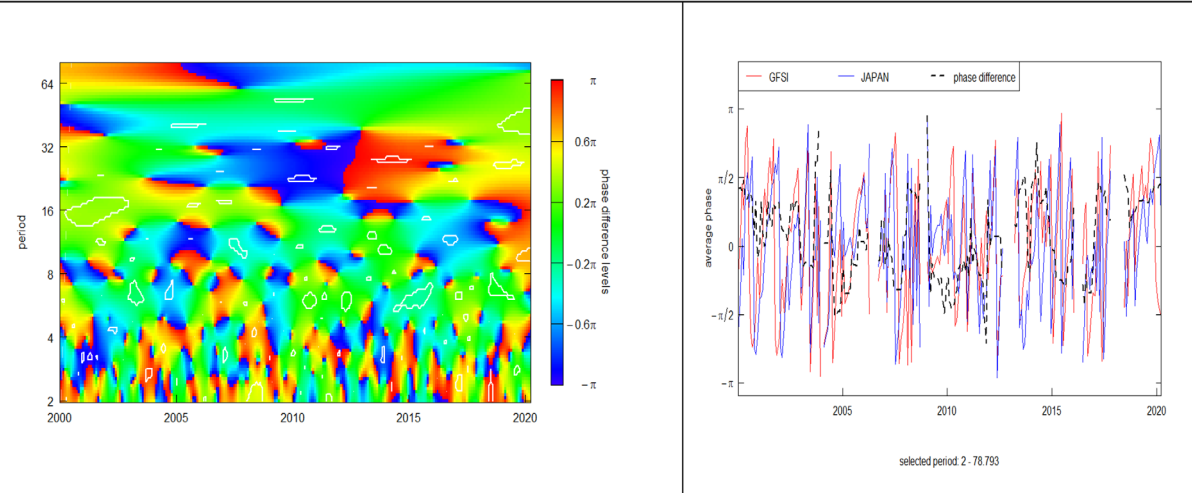
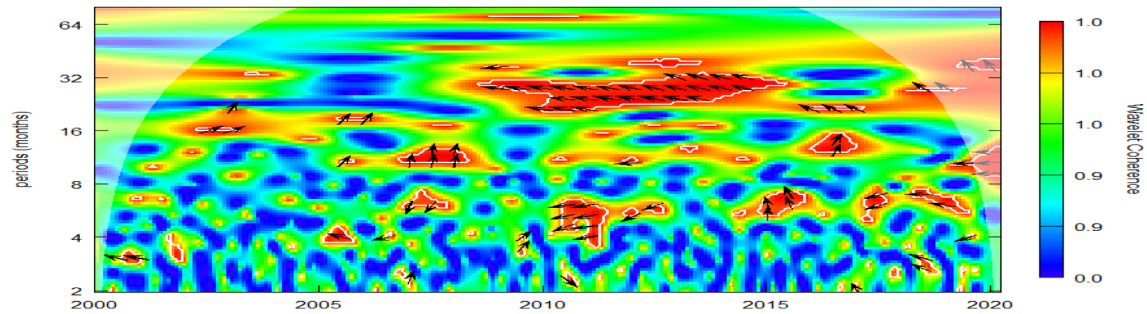


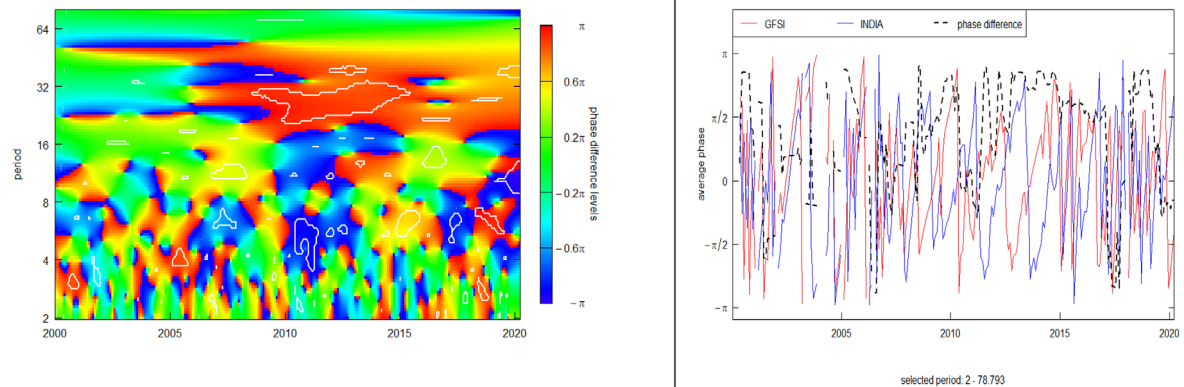
FIGURE 10 (Continued)

Panel D: Impact of GFSI on India Tourist Arrivals

A1: Wavelet Coherency : GFSI and India Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GFSI and India Tourist Arrivals

**Panel E: Impact of GFSI on Saudi Arabia Tourist Arrivals in Malaysia**

A1: Wavelet Coherency : GFSI and Saudi Arabia Tourist Arrivals

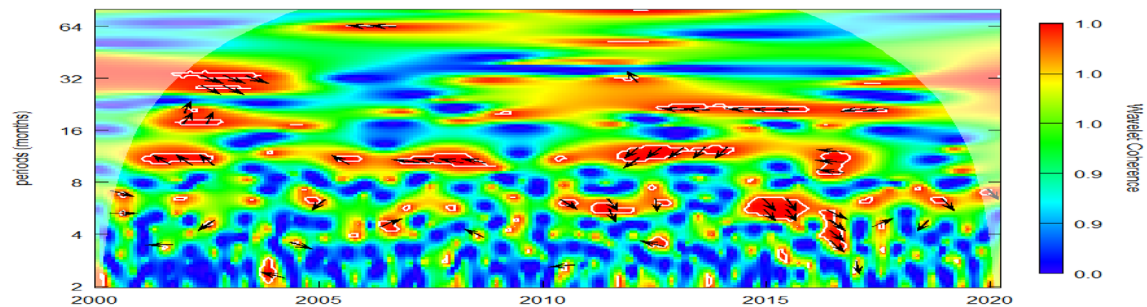
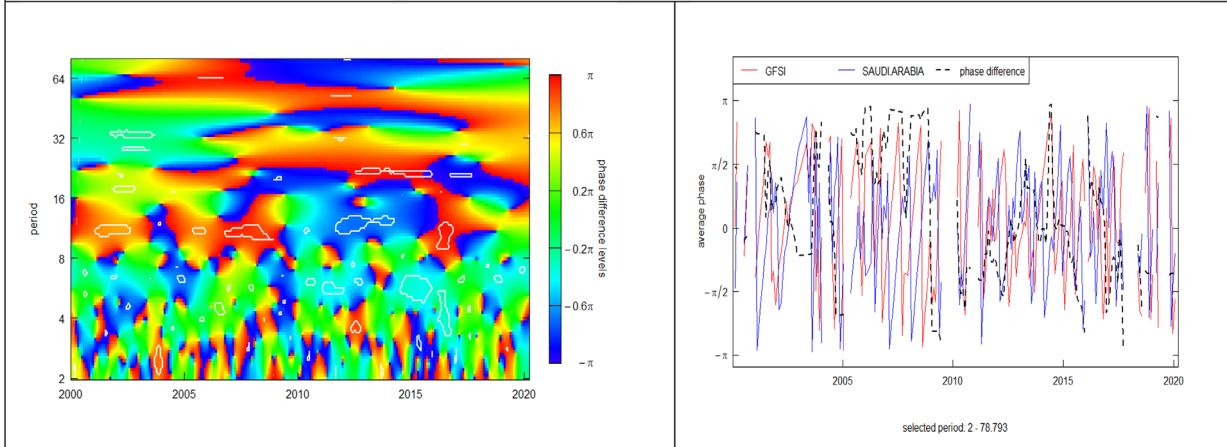


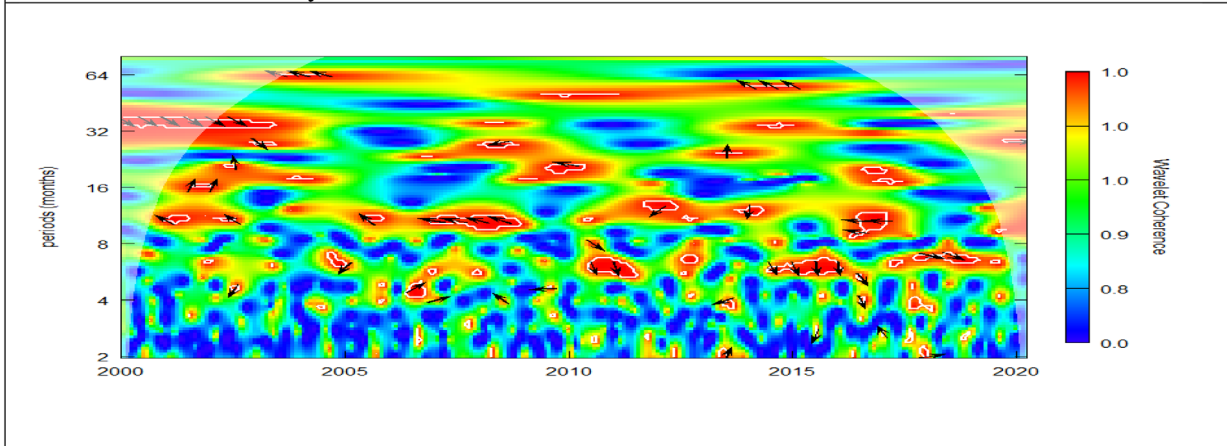
FIGURE 10 (Continued)

A2 : Phase difference in heat-map and averaged line plot: GFSI and Saudi Arabia Tourist Arrivals



Panel F: Impact of GFSI on UAE Tourist Arrivals in Malaysia

A1: Wavelet Coherency : GFSI and UAE Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GFSI and UAE Tourist Arrivals

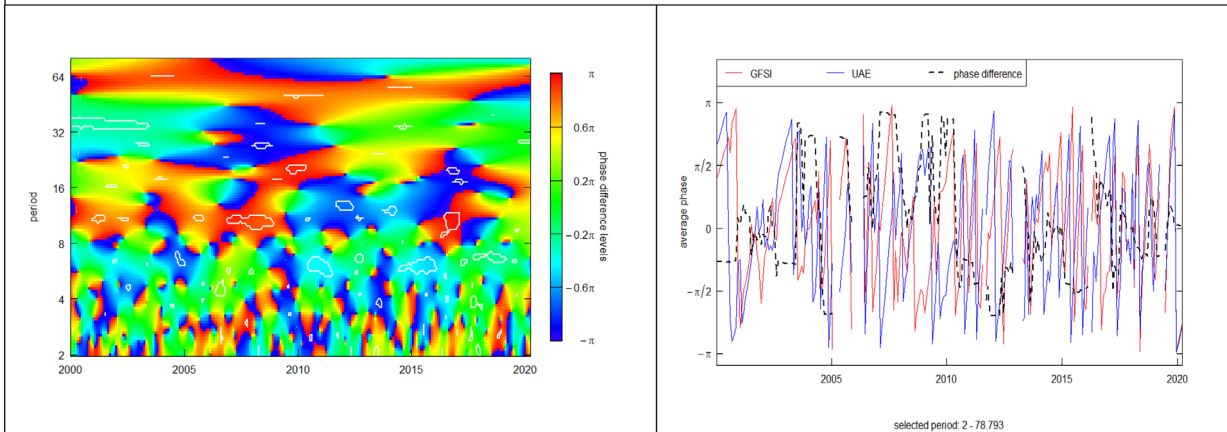
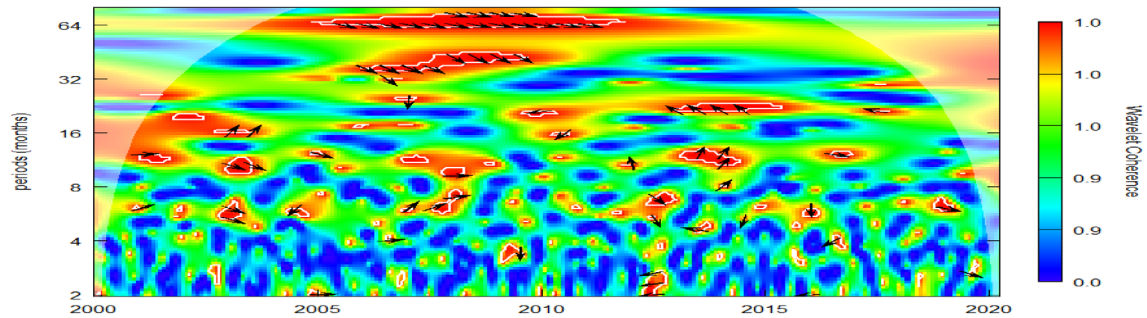


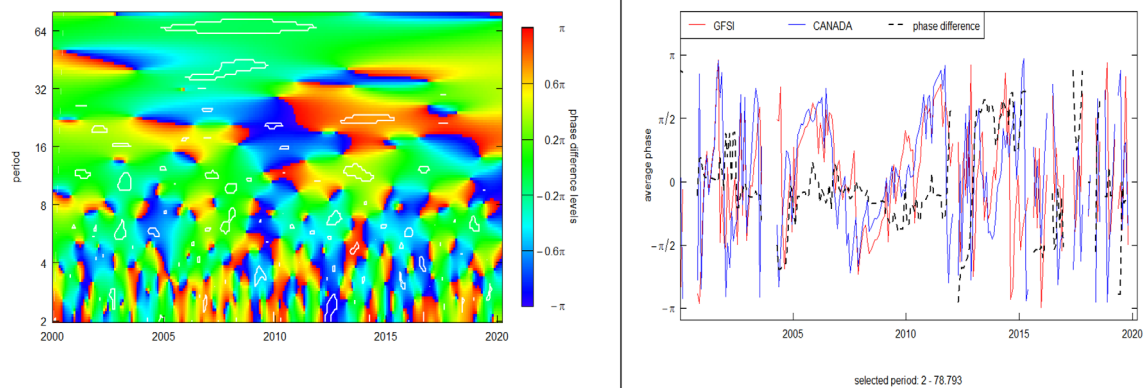
FIGURE 10 (Continued)

Panel G: Impact of GFSI on Canada Tourist Arrivals in Malaysia

A1: Wavelet Coherency : GFSI and Canada Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GFSI and Canada Tourist Arrivals

**Panel H: Impact of GFSI on USA Tourist Arrivals in Malaysia**

A1: Wavelet Coherency : GFSI and USA Tourist Arrivals

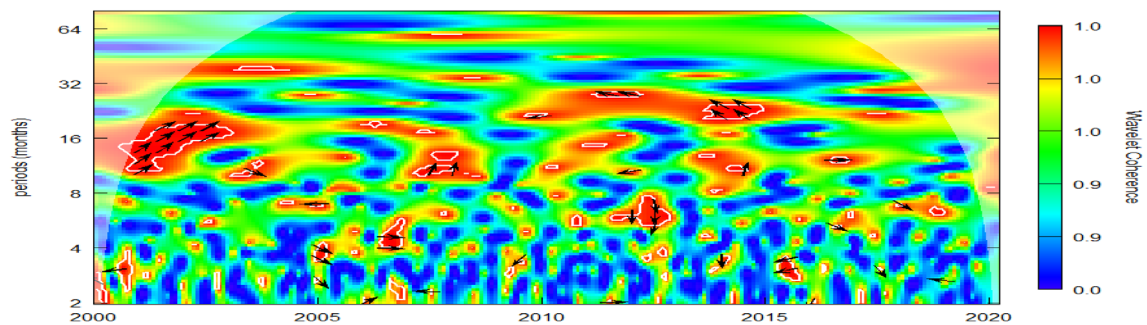
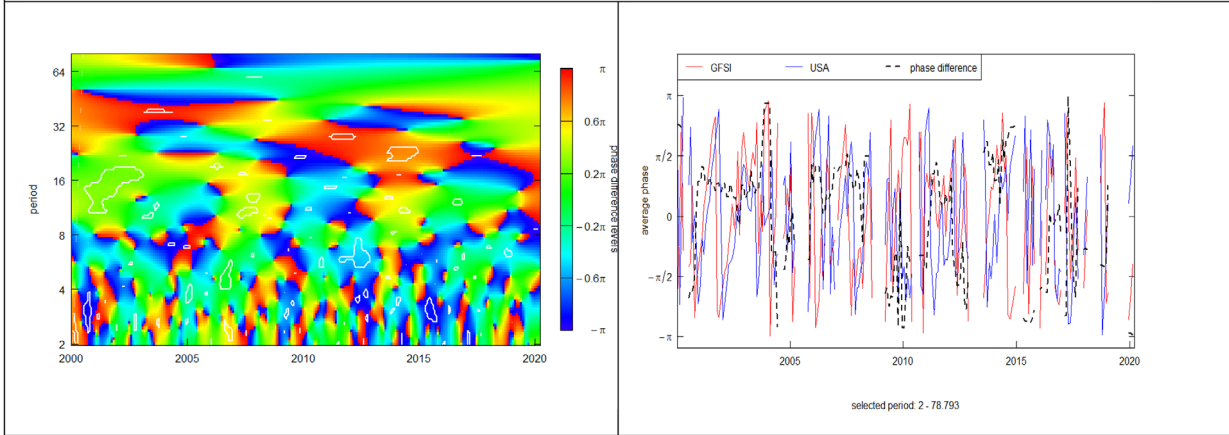


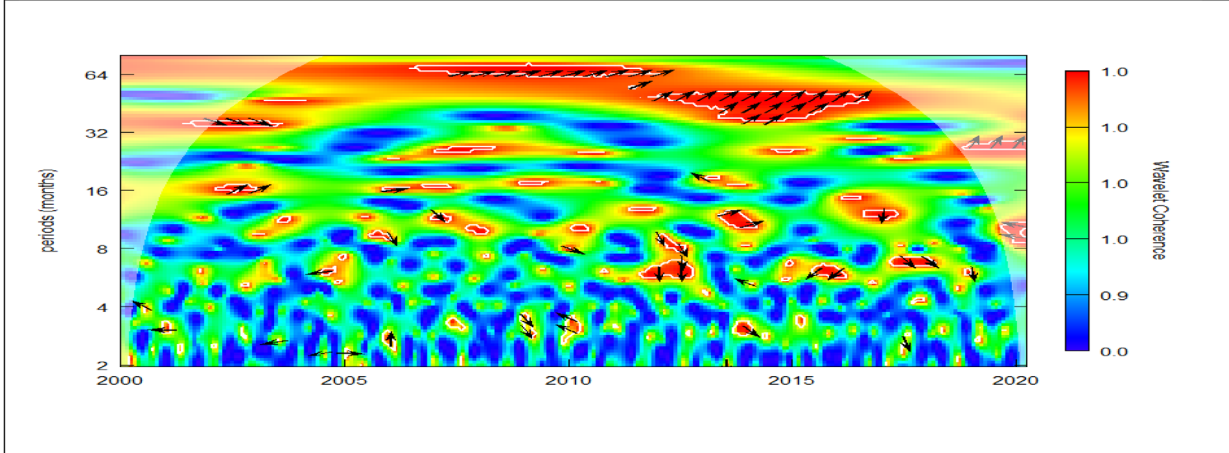
FIGURE 10 (Continued)

A2 : Phase difference in heat-map and averaged line plot: GFSI and USA Tourist Arrivals



Panel I: Impact of GFSI on AUSTRALIA Tourist Arrivals in Malaysia

A1: Wavelet Coherency : GFSI and Australia Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GFSI and Australia Tourist Arrivals

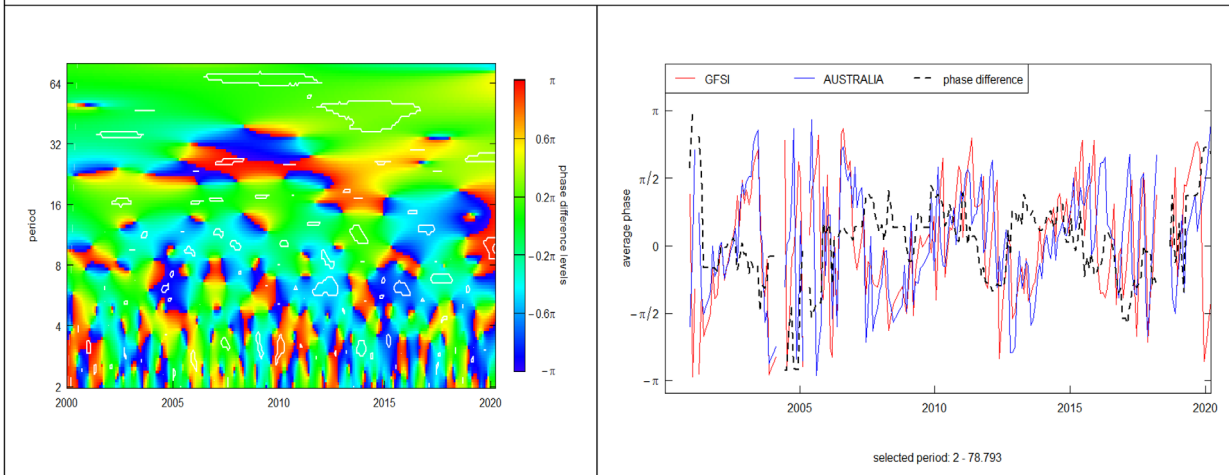
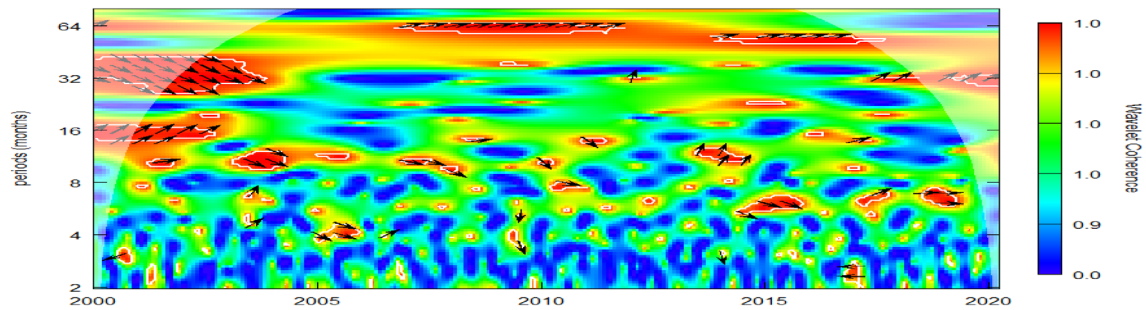


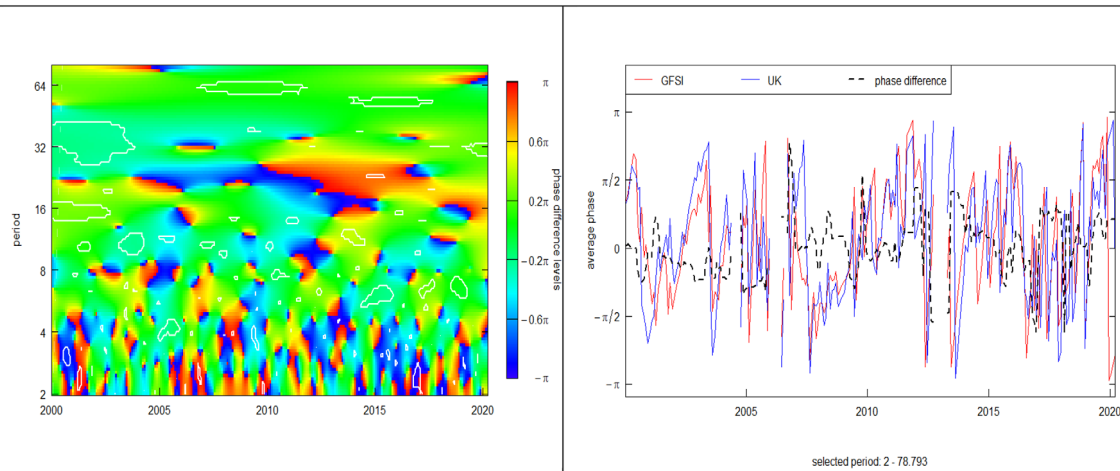
FIGURE 10 (Continued)

Panel J: Impact of GFSI on UK Tourist Arrivals in Malaysia

A1: Wavelet Coherency : GFSI and UK Tourist Arrivals



A2 : Phase difference in heat-map and averaged line plot: GFSI and UK Tourist Arrivals

**Panel K: Impact of GFSI on GERMANY Tourist Arrivals in Malaysia**

A1: Wavelet Coherency : GFSI and Germany Tourist Arrivals

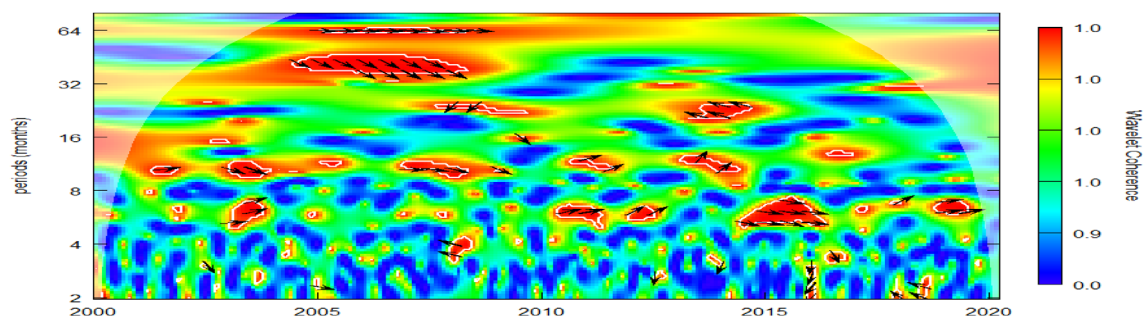


FIGURE 10 (Continued)

A2 : Phase difference in heat-map and averaged line plot: GFSI and Germany

Tourist Arrivals

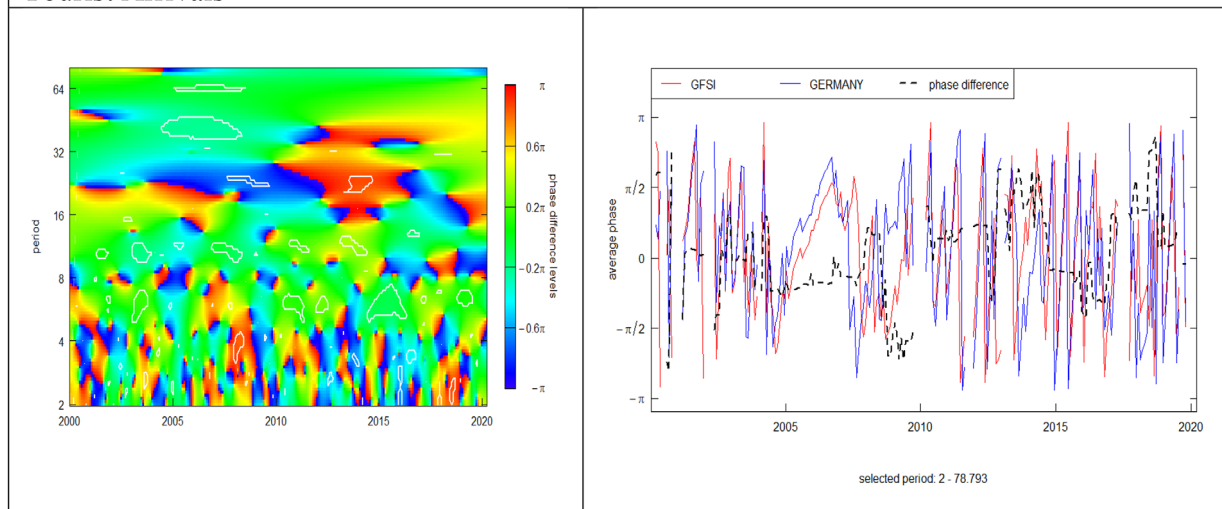


FIGURE 10 (Continued)

study could be furthermore extended to include other top destination countries in the Asian region, for example, Thailand, Cambodia, India, Vietnam, etc. Finally, we recommend further studies on this topic by using other robust time-series approaches (Jahanger et al., 2022; Jena et al., 2021; Jiang et al., 2022; Usman & Balsalobre-Lorente, 2022) or nonlinear Granger causality models (Doğan et al., 2021; Balsalobre-Lorente, Driha, et al., 2022; Balsalobre-Lorente, Ibáñez-Luzón, et al., 2022; Doğan et al., 2022) or decomposition models (Abakah et al., 2021; Khalfaoui & Ben Jabeur, 2022; Lee, Chen, et al., 2021; Sinha et al., 2022; Tiwari et al., 2021) to further explore the impact of uncertainty shocks on tourist arrivals from other regions of the world.

ACKNOWLEDGMENTS

The Editor and the anonymous reviewers are gratefully acknowledged for their valuable comments and suggestions.

CONFLICT OF INTERESTS

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

Data are available from the corresponding author on reasonable request.

ORCID

Sudeshna Ghosh  <https://orcid.org/0000-0002-2026-1676>

Aviral Kumar Tiwari  <https://orcid.org/0000-0002-1822-9263>

ENDNOTES

¹ Source https://www.policyuncertainty.com/global_monthly.html

² Source <https://www.policyuncertainty.com/monetary.html>

³ Source <https://www.policyuncertainty.com/gpr.html>

⁴ Source https://www.policyuncertainty.com/financial_stress.html

⁵ Source <https://fred.stlouisfed.org/series/VIXCLS>

REFERENCES

- Abakah, E. J. A., Caporale, G. M., & Gil-Alana, L. A. (2021). Economic policy uncertainty: Persistence and cross-country linkages. *Research in International Business and Finance*, 58, 101442.
- Akdağ, S., Kiliç, İ., & Yildirim, H. (2019). Does VIX scare stocks of tourism companies? *Letters in Spatial and Resource Sciences*, 12(3), 215–232.
- Balli, F., Shahzad, S. J. H., & Uddin, G. S. (2018). A tale of two shocks: What do we learn from the impacts of economic policy uncertainties on tourism? *Tourism Management*, 68, 470–475.
- Balli, F., Uddin, G. S., & Shahzad, S. J. H. (2019). Geopolitical risk and tourism demand in emerging economies. *Tourism Economics*, 25(6), 997–1005.
- Balsalobre-Lorente, D., Driha, O. M., Halkos, G., & Mishra, S. (2022). Influence of growth and urbanization on CO₂ emissions: The moderating effect of foreign direct investment on energy use in BRICS. *Sustainable Development*, 30(1), 227–240. <https://doi.org/10.1002/sd.2240>
- Balsalobre-Lorente, D., Ibáñez-Luzón, L., Usman, M., & Shahbaz, M. (2022). The environmental Kuznets curve, based on the economic complexity, and the pollution haven hypothesis in PIIGS countries. *Renewable Energy*, 185(2), 1441–1455. <https://doi.org/10.1016/j.renene.2021.10.059>
- Caporale, G. M., Gil-Alana, L. A., & Tripathy, T. (2020). Volatility persistence in the Russian stock market. *Finance Research Letters*, 32, 101216.
- Choi, S. Y. (2020). Industry volatility and economic uncertainty due to the COVID-19 pandemic: Evidence from wavelet coherence analysis. *Finance Research Letters*, 37, 101783.
- Chon, K., Park, E., & Zoltan, J. (2020). The Asian paradigm in hospitality and tourism. *Journal of Hospitality & Tourism Research*, 44(8), 1183–1202.
- Doğan, B., Chu, L. K., Ghosh, S., Truong, H. H. D., & Balsalobre-Lorente, D. (2022). How environmental taxes and carbon emissions are related in the G7 economies?. *Renewable Energy*, 187 (3), 645–656. <https://doi.org/10.1016/j.renene.2022.01.077>.

- Doğan, B., Driha, O. M., Balsalobre Lorente, D., & Shahzad, U. (2021). Mitigating the effects of economic complexity and renewable energy on carbon emissions in developed countries. *Sustainable Development*, 29, 1–12.
- Goupillaud, P., Grossmann, A., & Morlet, J. (1984). Cycle-octave and related transforms in seismic signal analysis. *Geoexploration*, 23(1), 85–102.
- Grechi, D., Ossola, P., & Tanda, A. (2017). The European tourism industry in crisis: A stock market perspective. *Tourism Analysis*, 22(2), 139–148.
- Hussin, N. Z. I., & Buchmann, A. (2019). Understanding tourism development policies in Malaysia. *Journal of Policy Research in Tourism, Leisure and Events*, 11(2), 333–353.
- Husted, L., Rogers, J., & Sun, B. (2020). Monetary policy uncertainty. *Journal of Monetary Economics*, 115, 20–36.
- Jahanger, A., Usman, M., Murshed, M., Mahmood, H., & Balsalobre-Lorente, D. (2022). The linkages between natural resources, human capital, globalization, economic growth, financial development, and ecological footprint: The moderating role of technological innovations. *Resources Policy*, 76(June), 102569. <https://doi.org/10.1016/j.resourpol.2022.102569>
- Jena, S. K., Tiwari, A. K., Abakah, E. J. A., & Hammoudeh, S. (2021). The connectedness in the world petroleum futures markets using a quantile VAR approach. *Journal of Commodity Markets*, 27, 100222.
- Jiang, T., Yu, Y., Jahanger, A., & Balsalobre-Lorente, D. (2022). Structural emissions reduction of China's power and heating industry under the goal of "double carbon": A perspective from input-output analysis. *Sustainable Production and Consumption*, 31(5), 346–356. <https://doi.org/10.1016/j.spc.2022.03.003>
- Khalfaoui, R. S., & Ben Jabeur, B. D. (2022). The spillover effects and connectedness among green commodities, bitcoins, and US stock markets: Evidence from the quantile VAR network. *Journal of Environmental Management*, 306, 114493. <https://doi.org/10.1016/j.jenvman.2022.114493>
- Lee, C. C., & Chen, M. P. (2021). Do country risks matter for tourism development? International evidence. *Journal of Travel Research*, 60(7), 1445–1468. <https://doi.org/10.1177/2F0047287520954539>
- Lee, C. C., Chen, M. P., Wu, W., & Xing, W. (2021). The impacts of ICTs on tourism development: International evidence based on a panel quantile approach. *Information Technology & Tourism*, 23(4), 509–547. <https://doi.org/10.1007/s40558-021-00215-4>
- Lee, C. C., Chen, M. P., & Xing, W. (2022). Do national cultures matter for tourism development? Some international evidence. *Economic Analysis and Policy*, 74(June), 666–686. <https://doi.org/10.1016/j.eap.2022.03.021>
- Lee, C. C., Olasehinde-Williams, G., & Akadiri, S. S. (2021). Geopolitical risk and tourism: Evidence from dynamic heterogeneous panel models. *International Journal of Tourism Research*, 23(1), 26–38.
- Lee, C. C., Olasehinde-Williams, G. O., & Ibikunle, J. A. (2021). An asymmetric examination of the environmental effect of tourism in China. *Tourism Economics*, 22(10), 1–16. <https://doi.org/10.1177/2F13548166211021173>
- Liu, P. C. (1994). Wavelet spectrum analysis and ocean wind waves. In Foufoula et al., (Eds.), *Wavelet analysis and its applications* (Vol. 4, pp. 151–166) Academic Press.
- Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), 147–175.
- Overland, I. (2019). The geopolitics of renewable energy: Debunking four emerging myths. *Energy Research & Social Science*, 49, 36–40.
- Planning for Tourism: Creating a Vibrant Singapore (2015). <https://www.clc.gov.sg/docs/default-source/urban-systems-studies/plan-for-tourism.pdf>
- Prayag, G., & Hosany, S. (2014). When Middle East meets west: Understanding the motives and perceptions of young tourists from United Arab Emirates. *Tourism Management*, 40, 35–45.
- Rua, A. (2010). Measuring comovement in the time–frequency space. *Journal of Macroeconomics*, 32(2), 685–691.
- Seabra, C., Reis, P., & Abrantes, J. L. (2020). The influence of terrorism in tourism arrivals: A longitudinal approach in a Mediterranean country. *Annals of Tourism Research*, 80, 102811.
- Shahzad, U., Ramzan, M., Shah, M. I., Doğan, B., & Ajmi, A. N. (2022). Analyzing the nexus between geopolitical risk, policy uncertainty, and tourist arrivals: Evidence from the United States. *Evaluation Review*, 46(3), 266–295. <https://doi.org/10.1177/0193841X221085355>
- Sharma, C., & Khanna, R. (2021). Does global economic policy uncertainty drive tourism demand? A cross-country analysis. *Journal of Policy Research in Tourism, Leisure and Events*, 1–8.
- Singh, R., Das, D., Jana, R. K., & Tiwari, A. K. (2019). A wavelet analysis for exploring the relationship between economic policy uncertainty and tourist footfalls in the USA. *Current Issues in Tourism*, 22(15), 1789–1796.
- Sinha, A., Balsalobre-Lorente, D., Zafar, M. W., & Saleem, M. M. (2022). Analyzing global inequality in access to energy: Developing policy framework by inequality decomposition. *Journal of Environmental Management*, 304(2), 114299. <https://doi.org/10.1016/j.jenvman.2021.114299>
- Theuns, H. L. (2014). Is tourism a luxury: Can we do without? *Tourism Recreation Research*, 39(2), 221–233.
- Tiwari, A. K., Abakah, E. J. A., Le, T. L., & Leyva-de la Hiz, D. I. (2021). Markov-switching dependence between artificial intelligence and carbon price: The role of policy uncertainty in the era of the 4th industrial revolution and the effect of COVID-19 pandemic. *Technological Forecasting and Social Change*, 163, 120434.
- Tiwari, A. K., Das, D., & Dutta, A. (2019). Geopolitical risk, economic policy uncertainty and tourist arrivals: Evidence from a developing country. *Tourism Management*, 75, 323–327.
- Usman, M., & Balsalobre-Lorente, D. (2022). Environmental concern in the era of industrialization: Can financial development, renewable energy and natural resources alleviate some load? *Energy Policy*, 162(3), 112780. <https://doi.org/10.1016/j.enpol.2022.112780>
- Usman, O., Iorember, P. T., & Jelilov, G. (2021). Exchange rate pass-through to restaurant and hotel prices in the United States: The role of energy prices and tourism development. *Journal of Public Affairs*, 21(2), e2214.
- Wu, T. P., & Wu, H. C. (2021). Global economic policy uncertainty and tourism of fragile five countries: Evidence from time and frequency approaches. *Journal of Travel Research*, 60(5), 1061–1073.
- Wu, T. P., & Wu, H. C. (2019). Causality between European economic policy uncertainty and tourism using wavelet-based approaches. *Journal of Travel Research*, 58(8), 1347–1356.
- Xia, W. B., Doğan, U., Shahzad, F. F., Adedoyin, A. P., & Bashir, M. A. (2021). An empirical investigation of tourism-led growth hypothesis in the European countries: Evidence from augmented mean group estimator. *Portuguese Economic Journal*, 21, 239–266. <https://doi.org/10.1007/s10258-021-00193-9>
- Yang, E. C. L., & Ong, F. (2020). Redefining Asian tourism. *Tourism Management Perspectives*, 34, 100667.

How to cite this article: Doğan, B., Ghosh, S., Tiwari, A. K., & Abakah, E. J. A. (2023). The effect of global volatility, uncertainty and geopolitical risk factors on international tourist arrivals in Asia. *International Journal of Tourism Research*, 25(1), 1–62. <https://doi.org/10.1002/jtr.2550>

APPENDIX A

TABLE A1 Variables' description and data source

| Variable | Symbol | Description | Source |
|---|--------|---|--|
| International Tourist Arrivals | ITA | Number of visitors from a different country who spends at least one night in collective or private accommodation in the destination country. | DataStream |
| World Economic Policy Uncertainty Index | GEPU | The GEPU Index calculated as a GDP-weighted average of national Economic Policy Uncertainty index for 21 countries. | Economic Policy Uncertainty Data Portal— https://www.policyuncertainty.com/global_monthly.html |
| US Monetary Policy Uncertainty Index | UMPU | UMPU impacts the transmission of monetary policy shocks to long-term nominal and real sector returns | Economic Policy Uncertainty Data Portal Monetary Policy Uncertainty Indices— https://www.policyuncertainty.com/monetary.html |
| Global Geopolitical Risk Index | GPR | GPR measures the adverse geopolitical events based on a tally of newspaper articles encompassing the geopolitical tensions, and examine its evolution | Geopolitical Risk Index Data Portal — https://www.policyuncertainty.com/gpr.html |
| Global Financial Stress Index | GFSI | GFSI measures the stress level in the financial system as whole or major parts of it by compressing a number of indicators measuring stress in individual market segments into a comprehensive index. | Financial Stress Indicator Data Portal— https://www.policyuncertainty.com/financial_stress.html |
| Global Fear Index | VIX | VIX measures market expectation of near term volatility conveyed by stock index option prices. A VIX of greater than 20% denotes rising uncertainty and fear in the market and describes an environment of high-riskiness | FRED Economic Data— https://fred.stlouisfed.org/series/VIXCLS |