

## ORIGINAL ARTICLE OPEN ACCESS

# Time-Varying Interactions Between US–China Political Relation, Flight Frequency, and Inbound Tourism

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## ABSTRACT

This study investigates the dynamics among US–China political relations, flight frequency, and inbound tourism through the utilization of a time-varying parameter vector autoregression model. As political relations warm, there is a notable uptick in flight frequency between the two nations. Moreover, the rising flight frequency would further increase inbound tourists. Interestingly, our analysis reveals no substantial evidence supporting a significant impact of inbound tourists on either political relations or flight frequency. The study concludes with insightful policy implications drawn from these findings.

## 1 | Introduction

International tourism is prone to be affected by political, economic, diplomatic, and security factors (Kim and Prideaux 2012; Timothy and Kim 2015). Chu et al. (2021) found that a political relation shock, particularly a negative one, can immediately impact Chinese outbound tourism. They pointed out that a travel warning issued by the government plays a key role in influencing Chinese passengers' outbound travel intentions and destination choices. The authors argue a two-way relationship between political relationship and tourism activities: understanding the political disputes between two countries can help the tourism sector prepare for possible fluctuations in inbound and outbound travels; however, tourism can help improve and influence bilateral political relationships through mutual understanding and communication.

International arrivals to China plummeted during the COVID-19 period due to the restrictive border control measures implemented. However, the recovery of inbound tourism has

proven to be slow. In 2023, China recorded 35.5 million border entries and exits by foreign citizens, about 36% of the 2019 figure. This is largely due to the slow recovery of the number of international flights and the ongoing geopolitical tensions between China and the US and its allies. By the end of 2023, there were only 66 direct flights each week between China and the US, less than 20% of the weekly frequency in 2019. The lack of sufficient direct flights and geopolitical issues have deterred international travel and have had a significant impact on the inbound tourism from the US to China, although some other factor may also at play such as unfriendly payment environment and awkward visa process, which have drawn the attention of the Chinese government and are being addressed by the authorities.

The relationship between China and the US is one of the most important and sophisticated in the world. For more than two decades since 1949, the relationship between the two nations has been hostile and bitter. Tourism and trade activities between the two countries were virtually zero. The 1970s saw the gradual

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warming up of the bilateral relationship, and the formal diplomatic relations were established in 1979. 1979 was also the start of China's implementation of the "open door" policy, marking the beginning of the modern tourism in China. The 1979–1989 period was commonly seen as the most stable period, and the two countries were "more friends than foes" (Yan 2010, 269). There were large and frequent fluctuations in the bilateral relationship between the two nations from 1989 to 2000, after which the relationship was relatively stable until 2017, when the Trump government came into power. Unwilling to see the rise of China as an economic superpower due to the disagreements on many issues, the Trump government set significant trade barriers, which resulted in trade wars between the two countries. The trade disputes did not get resolved in the Biden Administration, and tensions and instability continued to exist. Despite the disagreements between the two countries on a range of matters, the economic and trade ties have become stronger and deeper today. In the last decade or so, the US and China have been the largest and second-largest economies in the world, respectively, and the second and third largest international tourist recipients, respectively. In January 1990, the number of inbound tourists from the US to China was 15,275, and this number increased by more than 10 times before the COVID-19 pandemic.

Air transport is an inherent part of the tourism supply chain, supporting and facilitating the cross-border movement of more than 1.2 billion tourists worldwide before the COVID-19 pandemic (Uniting Aviation 2018). As with many other bilateral air services agreements (ASAs). The ASA between China and the US was very restrictive with the number of airlines and destinations as well as the frequency being tightly regulated. In 2004 and 2007, China and the US reached significant milestone deals to increase frequency and remove the limit on the number of destinations. This has improved the financial performance of Chinese carriers in the following years (Lei et al. 2016). Chinese carriers commanded a market share of 38% in the China–US market in 2011, 50% in 2014, and more than 60% before COVID-19. Two decades ago, it was the US carriers that wanted a more liberal ASA arrangement between the two countries, while since 2019, it was Chinese carriers that pushed hard for a more relaxed bilateral agreement. Tourism activities came to a halt during COVID-19, and the difficulty in restoring sufficient direct flights between China and the US has directly contributed to the slow recovery of inbound tourism to China.

Political relationships, air transport, and international tourism are closely linked and have a significant impact on one another. When countries have positive diplomatic relations, they are more likely to create agreements that expand flight routes and reduce travel restrictions. This increased accessibility makes air travel easier and more affordable, promoting the growth of international tourism as more travelers can reach their desired destinations. On the other hand, worsening political relations can lead to negative consequences for air transport and tourism. For instance, when tensions rise, countries may impose travel bans, cancel flights, or introduce strict visa requirements, making it difficult for tourists to visit. These actions can decrease tourism levels, affecting economies that depend on visitor spending. Additionally, concerns about safety and security may deter travelers from going to countries with strained political relations.

Air transport also directly influences tourism. Improved air connectivity, characterized by more frequent flights and better service options, encourages people to travel to new destinations. Conversely, limited or expensive flights can discourage travel, as potential tourists may find it challenging or costly to visit certain locations. In conclusion, the relationship between political ties, air transport, and international tourism is complex and important. Positive diplomatic relations can enhance air connectivity and boost tourism, while negative political dynamics can create barriers to travel. Understanding these connections is crucial for policymakers and industry stakeholders aiming to support a thriving tourism sector that benefits from strong international relationships and effective air transport networks.

Hence, this paper undertakes a comprehensive investigation into the intricate interplay between the political relations of China and the US and their effects on both flight frequency and inbound tourism from the US to China, covering the period from February 1996 to December 2017. The findings reveal a compelling link between improved political relations and heightened flight frequency, suggesting a significant increase in flights between the two nations as diplomatic ties warm. However, intriguingly, our analysis uncovers no direct evidence supporting the notion that political relations directly impact inbound tourism from the US to China. Nevertheless, a notable revelation emerges as the analysis demonstrates a clear correlation: as flight frequency rises, so does the influx of inbound tourists. This underscores the pivotal role of transportation accessibility in driving tourism. Surprisingly, our study finds no conclusive evidence to suggest that an increase in inbound tourists contributes to improvements in political relations or flight frequency between the US and China, highlighting the complexities inherent in the relationship dynamics between these two global powers. Understanding the relationships between these variables will help the airline and tourism industries make more informed decisions when facing political instabilities. This study will also generate insights for decision-makers in designing proper industry policies to boost inbound tourism.

The subsequent sections are structured as follows: Section 2 provides a review of existing literature. Section 3 outlines the data set and presents descriptive statistics. Section 4 elucidates the research methodology employed in this study. Section 5 unveils the empirical results obtained. Finally, the concluding remarks are presented in the last section of the paper.

## 2 | Literature Review

Zhang and Findlay (2014) and Zhang (2015) reported that air transport policy, bilateral trade, disposable income, distance, common language, and immigration are key factors influencing the number of inbound tourists. Chow and Tsui (2019) found that real GDP, export volumes, and transportation infrastructure were the main determinants of the number of visitors from Russia to China. Shan and Wilson (2001) identified a two-way Granger causal relationship between inbound tourism to China from the US, Japan, Australia and the UK and China's bilateral trade with these countries. Qu et al. (2018) clustered

**TABLE 1** | Unit root tests.

|      | PRI       |             | Frequency |             | Inbounds |             |
|------|-----------|-------------|-----------|-------------|----------|-------------|
|      | <i>c</i>  | <i>c, t</i> | <i>c</i>  | <i>c, t</i> | <i>c</i> | <i>c, t</i> |
| ADF  | −9.28***  | −9.40***    | −3.47**   | −3.47**     | −7.22*** | −7.21***    |
| PP   | −15.05*** | −15.08***   | −3.46**   | −3.38*      | −4.96*** | −4.95***    |
| KPSS | −0.15     | 0.15        | 0.09      | 0.09        | 0.08     | 0.08        |

Note: *c* and *c, t* represent the inclusion of intercept and both intercept and time trend. \*\*\*, \*\* and \* denote 1%, 5%, and 10% significance levels.

the US visitors to China into four groups, that is, visitors seeking outdoor experience, entertainment, culture, and general interests, in which socio-demographic and trip-related characteristics were found to be closely related to the clusters.

Our literature review will focus on two streams of literature. The first is the effect of air transport on international tourism. Many studies have found supportive effects of air transport on international tourism (Zhang and Findlay 2014; Rehman Khan et al. 2017; Alderighi and Gaggero 2019; Law et al. 2022; Hussain 2023). Before the COVID-19 pandemic, the proportion of international tourists traveling by air transport increased from 35% in 1980 to 58% in 2018 (Papatheodorou 2021). Some studies pointed out that international tourism in many countries, for example, Japan, Australia, New Zealand, India, Greece, and Singapore, highly depends on air transport (Keller 2002; Bieger and Wittmer 2006). Bieger and Wittmer (2006) showed that the development of wide-body aircraft has reduced the per passenger operating costs and then stimulated the emergence of intercontinental tourism. The expansion of new air routes also promoted the development of international tourism. Zhang (2015) and Alderighi and Gaggero (2019) confirmed that the public policies in air transport and the existence of low-cost airlines could substantially enhance the traffic volumes of international tourism. Vieira et al. (2019) noted that the airline liberalization in Azores, an autonomous region of Portugal, in 2015 improved the international tourism. Kuok et al. (2023) found that the pricing and capacity increase strengthened mutually in stimulating the international tourism in Australia. Tang et al. (2023) verified that a larger number of routes of air transport is conducive to the increase in the inbound international tourism of China. Furthermore, the number of routes of air transport had a positive effect on the traffic volume of inbound tourism of long-haul markets but in a decreasing way, while it did not significantly affect the traffic volume of inbound tourism of short-haul markets. Finally, Wang and Xi (2023) investigated the effect of the European Union Emissions Trading System (EU ETS) on international tourism from member states of EU. They found that the EU ETS led to a significant decrease in the international visitors from the member states of the EU. In addition, as the EU ETS would significantly increase the travel cost of passengers, it suppressed the long-haul international tourism and encourage the short-haul tourism.

The second stream of literature is about the effect of political relationships on international tourism. Tourism boycotts are commonly regarded as a risk when there are international crises (Wang and Choi 2023; Zhai and Luo 2023). Su et al. (2022) investigated the bidirectional link between political relationships and international tourism. By using China and Japan as an example, they found that the political relationship between the two countries had a significant effect on the number of visitors from China to Japan, but the

similar conclusion is not reached for the number of visitors from Japan to China. By conducting a cross-country study, Zhou et al. (2021) studied how political disputes between China and Korea affected the number of tourists from China to Japan, and how political disputes between China and Japan affected the number of tourists from China to Korea. They found that the political effects peaked in 3 months and became much weaker in half a year. Chen et al. (2022) used the Belt and Road Initiative (BRI) as an example of regional cooperation agreements and quantified the effect of regional cooperation agreements on international tourism, in which a positive promotion effect is found. Vasist and Krishnan (2023) showed that the political disinformation by foreign governments greatly harmed the performance of international tourism in a country. Yang et al. (2023) used the voting records of the United Nations to measure the political ideological distances between countries and found that a larger political ideological distance implied a lower level of international tourism.

The third strand of literature explores the interconnection between political relation and air transport. Cai et al. (2024) investigate the relationship between airline stock returns and political factors, including US–China relations, geopolitical risks, and US partisan conflicts. The findings suggest that predictability in airline stock returns is heightened during extreme political and market conditions, with US partisan conflicts exerting a stronger influence than other political variables. The study concludes with policy recommendations derived from these results. Li and Su (2024) use a novel quantile joint impulse response functions method to investigate the impacts of multiple uncertainty shocks on China's airline stocks' volatility including geopolitical risks. Their results demonstrate that the impacts of the joint uncertainty shocks would be deepened in a more volatile market environment.

### 3 | Data Set and Descriptive Statistics

This study aims to provide empirical evidence of the interactions between US–China political relations, flight frequency, and inbound tourists. We adopt the US–China political relation index developed by Yan and Qi (2009) and Yan et al. (2010). This index was compiled monthly with a consideration of the political events reported in China's most authoritative newspaper—Renmin Ribao and those published by the Ministry of Foreign Affairs of China. The political relation index ranges between −9 and +9 with −9 depicting the most serious conflict and +9 indicating the friendliest relationship. We take difference on the political relation index to ensure stationarity. The second variable is flight frequency which is the number of direct flights from the US to China. The frequency data are from

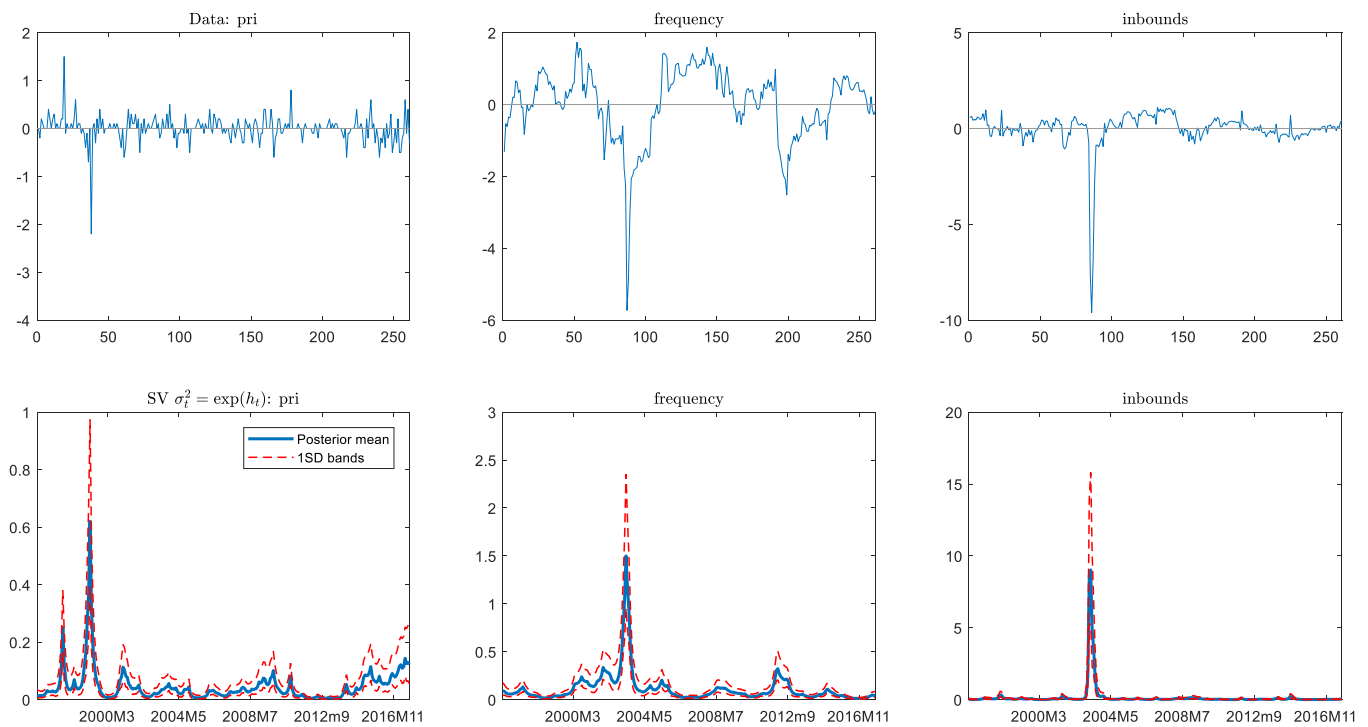


**FIGURE 1** | Data plots and posterior estimates for stochastic volatility of the structural shocks. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1111/epo.12347)]

**TABLE 2** | Diagnostic statistics.

| Parameter | Mean   | SD     | 95%U   | 95%L   | Geweke | Inefficiency |
|-----------|--------|--------|--------|--------|--------|--------------|
| $s_{b_1}$ | 0.0061 | 0.0017 | 0.0037 | 0.0104 | 0.586  | 59.46        |
| $s_{b_2}$ | 0.0067 | 0.0024 | 0.0039 | 0.0134 | 0.378  | 53.21        |
| $s_{a_1}$ | 0.0452 | 0.0086 | 0.0317 | 0.0652 | 0.652  | 17.48        |
| $s_{a_2}$ | 0.0496 | 0.0102 | 0.0331 | 0.0724 | 0.296  | 40.59        |
| $s_{h_1}$ | 0.5923 | 0.1145 | 0.3956 | 0.8382 | 0.902  | 35.65        |
| $s_{h_2}$ | 0.4024 | 0.0809 | 0.2665 | 0.5782 | 0.652  | 34.68        |

Note: The Geweke denotes the convergence diagnostics (CD).

IATA's AirportIS database. The last variable is the number of inbound tourists from the US to China. Again, the data are monthly, which can be found in the Yearbook of China Tourism Statistics. The flight frequency and inbound tourists are seasonally adjusted and further standardized before entering the model. The estimates cover the period from February 1996 to December 2017.<sup>1</sup>

#### 4 | Time-Varying Parameter Bayesian VAR With Stochastic Volatility

A time-varying parameter vector autoregression (TVP-VAR) with stochastic volatility can be expressed as follows,

$$y_t = C_t + H_{1,t} y_{t-1} + H_{2,t} y_{t-2} + \dots + H_{p,t} y_{t-p} + u_t, \quad (1)$$

where  $C_t$  is a  $n \times 1$  vector of time-varying constant coefficients. Likewise,  $y_t = [\text{Pri}_t, \text{Frequency}_t, \text{Tourism}_t]'$ .  $\text{Pri}_t$ ,  $\text{Frequency}_t$ ,

and  $\text{Tourism}_t$  denote the changes of US–China political relation index, detrended flight frequency, detrended inbound tourists to China.  $H_{i,t}$  for  $i = 1, \dots, p$  are time-varying coefficients with the dimension  $n \times n$ .  $u_t$  are unobserved innovations which have the variance-covariance matrix  $\Omega_t$ . In addition,  $u_t$  are assumed to be subjected to a normal distribution with zero mean. Since  $\Omega_t$  is positive definite for all time  $t$ , a lower triangular matrix  $M_t$  and a positive diagonal matrix  $\Sigma_t$  must exist such that  $\Omega_t = M_t^{-1} \Sigma_t \Sigma_t' M_t^{-1'}$ . Specifically,  $M_t$  and  $\Sigma_t$  are defined as,

$$\Sigma_t = \begin{pmatrix} \sigma_{1,t} & 0 & \dots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \dots & 0 & \sigma_{n,t} \end{pmatrix}, \quad M_t = \begin{pmatrix} 1 & 0 & \dots & 0 \\ m_{21,t} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ m_{n1,t} & \dots & m_{nn,t} & 1 \end{pmatrix}.$$

By using a similar manner, we decompose  $u_t$  as the following form such that  $u_t = M_t^{-1} \Sigma_t \varepsilon_t$  and  $\varepsilon_t \sim N(0, I_n)$ . Therefore, Equation (1) is accordingly changed to

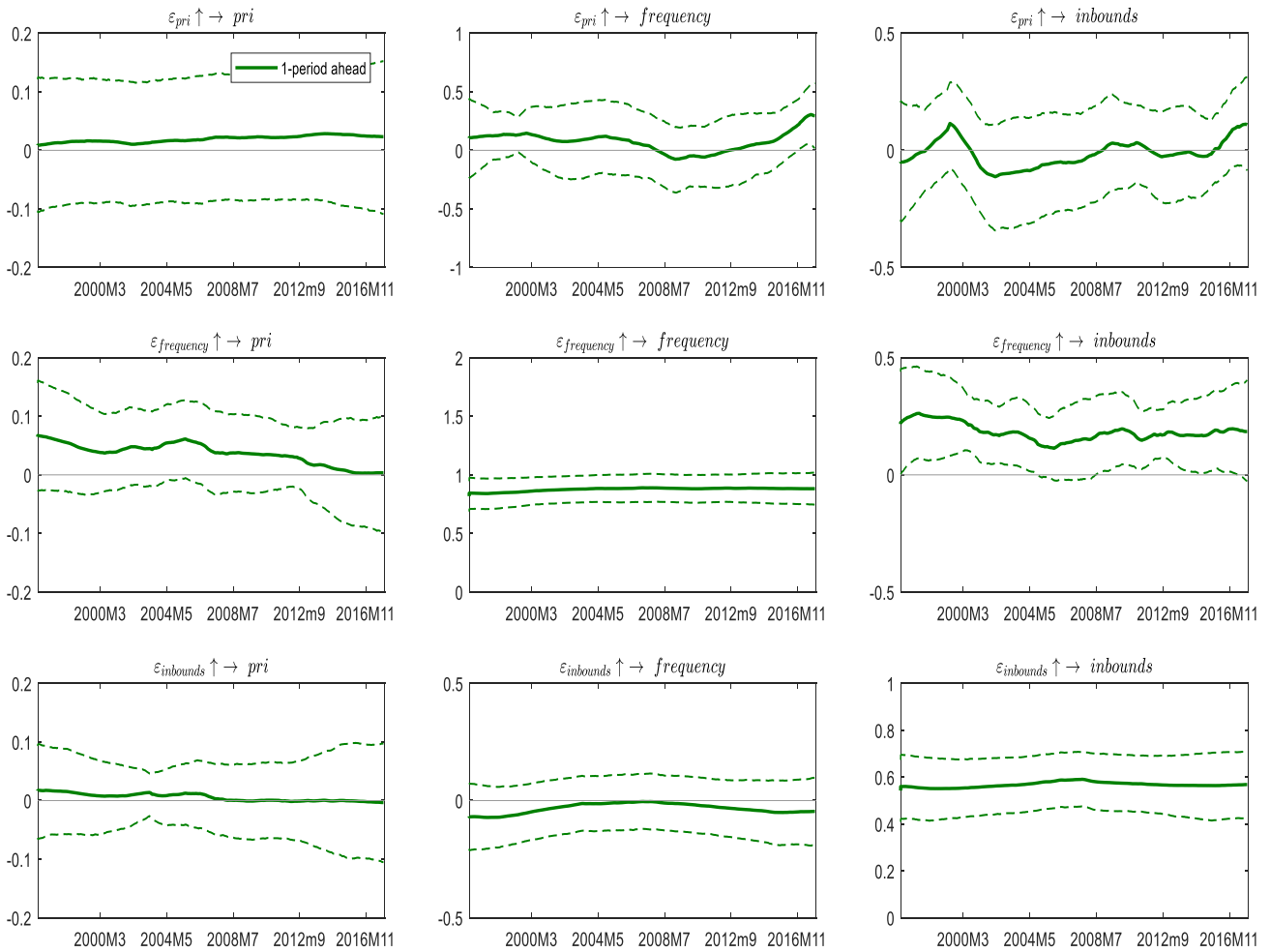


**FIGURE 2** | Horizontal impulse response at 1 horizon. *Note:* Posterior mean (solid line) and 95% credible intervals (dotted line). [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

$$y_t = \mathbf{C}_t + \mathbf{H}_{1,t} y_{t-1} + \mathbf{H}_{2,t} y_{t-2} + \cdots + \mathbf{H}_{p,t} y_{t-p} + \mathbf{M}_t^{-1} \Sigma_t \varepsilon_t. \quad (2)$$

Furthermore, we can rewrite Equation (2) as the following form,

$$y_t = \mathbf{X}_t \boldsymbol{\beta}_t + \mathbf{M}_t^{-1} \Sigma_t \varepsilon_t, \quad t = p + 1, \dots, n,$$

where  $\mathbf{X}_t = \mathbf{I}_k \otimes (1, y'_{t-1}, \dots, y'_{t-p})$  and  $\otimes$  is the Kronecker product operator.  $\boldsymbol{\beta}_t = [(\text{vec}(\mathbf{C}_t))', (\text{vec}(\mathbf{H}_{1,t}))', \dots, (\text{vec}(\mathbf{H}_{p,t}))']'$  is a  $(n^2 p + n) \times 1$  vector, where  $\text{vec}(\cdot)$  denotes the vectorization operator. Since we allow  $\boldsymbol{\beta}_t$ ,  $\mathbf{M}_t$  and  $\Sigma_t$  has subscripts  $t$ , they are all time-varying. Following Primiceri (2005), we stack all the lower-triangular elements in  $\mathbf{M}_t$  as a vector of  $\mathbf{m}_t$ , such that  $\mathbf{m}_t = (m_{21,t}, m_{31,t}, m_{32,t}, \dots, m_{nn-1,t})'$ . Also, we denote  $\mathbf{h}_t$  as a stacked vector of the diagonal elements in the matrix  $\Sigma_t$  such that  $\mathbf{h}_t = (\log(\sigma_{1t}^2), \dots, \log(\sigma_{nt}^2))'$ . Then, we have the following equations,

$$\begin{aligned} \boldsymbol{\beta}_{t+1} &= \boldsymbol{\beta}_t + u_{\boldsymbol{\beta}_t}, \quad \mathbf{m}_{t+1} = \mathbf{m}_t + u_{\mathbf{m}_t}, \\ \mathbf{h}_{t+1} &= \mathbf{h}_t + u_{\mathbf{h}_t} \text{ for } t = p + 1, \dots, n \end{aligned}$$

$$\begin{pmatrix} \varepsilon_t \\ u_{\boldsymbol{\beta}_t} \\ u_{\mathbf{m}_t} \\ u_{\mathbf{h}_t} \end{pmatrix} \sim \mathcal{N} \left( 0, \begin{pmatrix} \mathbf{I} & 0 & 0 & 0 \\ 0 & \Sigma_{\boldsymbol{\beta}} & 0 & 0 \\ 0 & 0 & \Sigma_{\mathbf{m}} & 0 \\ 0 & 0 & 0 & \Sigma_{\mathbf{h}} \end{pmatrix} \right),$$

where  $\boldsymbol{\beta}_{s+1} \sim N(u_{\boldsymbol{\beta}_0}, \Sigma_{\boldsymbol{\beta}_0})$ ,  $\mathbf{m}_{s+1} \sim N(u_{\mathbf{m}_0}, \Sigma_{\mathbf{m}_0})$  and  $\mathbf{h}_{s+1} \sim N(u_{\mathbf{h}_0}, \Sigma_{\mathbf{h}_0})$ . Following Nakajima (2011), we assume that  $\Sigma_{\mathbf{m}}$  and  $\Sigma_{\mathbf{h}}$  are diagonal matrices. Previous experience suggests that the diagonal assumption is not sensitive for empirical results. The parameters are not assumed to follow a stationary process such as AR(1). Rather, the random walk process is assumed. This strategy could reduce the number of estimated coefficients.

We use the Bayesian MCMC routine proposed by Nakajima (2011) to estimate the model. The details of the sampling algorithms can be found in Nakajima's (2011) paper. The TVP-VAR model is implemented by using Bayesian inference. The priors should be carefully determined. The advantages of TVP-VAR model are capturing both gradual and sudden changes in the underlying economic structure. However, over-identification problem may occur if every parameter is allowed to be time-varied. Nakajima (2011) suggests using tight priors on time-varying coefficients  $(\boldsymbol{\beta}_{s+1}, \dots, \boldsymbol{\beta}_n)$  and rather diffuse

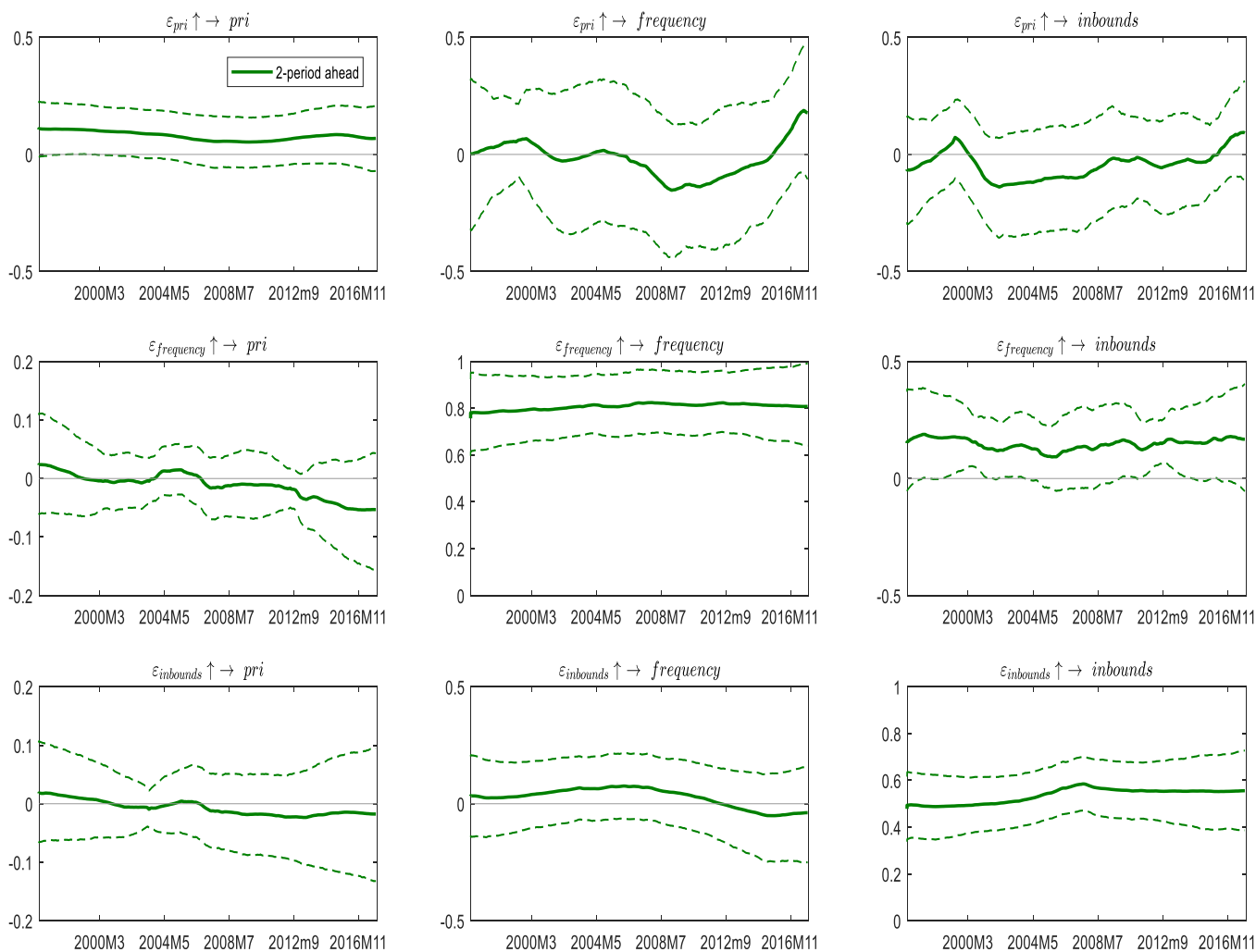


**FIGURE 3** | Horizontal impulse response at 2 horizons. *Note:* Posterior mean (solid line) and 90% credible intervals (dotted line). [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

priors on the simultaneous relations ( $\mathbf{m}_{s+1}, \dots, \mathbf{m}_n$ ) and the volatility ( $\mathbf{h}_{s+1}, \dots, \mathbf{h}_n$ ) of structural shocks.

To address the lag effect of changes in US political relationships on flight frequency and international tourism, the TVP-VAR model is particularly relevant and suitable for this study. It is natural to suspect that political relations changes do not immediately impact flight frequency and tourism; instead, there is a delay before these effects are observed. The TVP-VAR model captures these dynamics by allowing for time-varying relationships among variables, reflecting how the impact of political changes may evolve over time.

## 5 | Empirical Results

### 5.1 | Unit Root Test

As previously discussed, the variables under examination are significantly influenced by seasonal factors. Therefore, our initial step involves employing EViews' seasonal adjustment procedure to mitigate the effects of seasonality within the time series data.

Moreover, upon closer inspection, it becomes evident that there exists a discernible time trend within both the frequency and inbound time series. To address this, we employ a regression technique, modeling the seasonally adjusted time series against a constant, linear trend ( $t$ ), and a quadratic trend ( $t^2$ ). This quadratic term enables us to capture potential nonlinear factors affecting the data evolution. Subsequently, we extract the standardized residuals from this regression process, which serve to encapsulate the unforeseen elements disturbing the time series.

However, in the case of the Political Relations Index (PRI), we opt for a different approach. Given its nature, we employ a first-differencing technique to capture the changes in political relations over time. To ensure that all variables adhere to the stationarity requirement before their integration into the TVP-VAR model, we subject each variable to a battery of unit root tests, including the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The outcomes presented in Table 1 affirm that all variables exhibit stationarity, thereby meeting the prerequisite conditions for further analysis within the TVP-VAR framework.

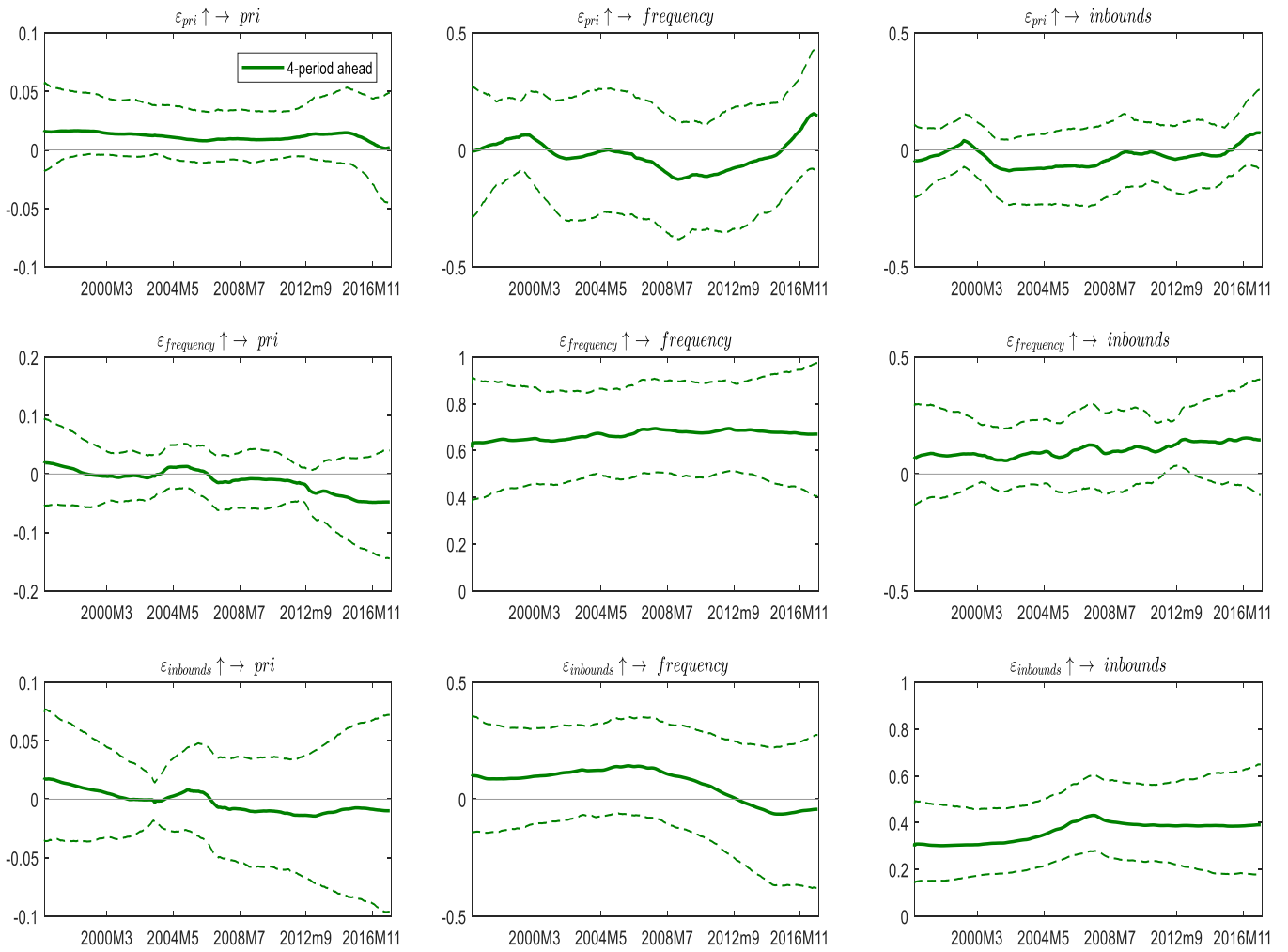


**FIGURE 4** | Horizontal Impulse Response at 4 horizons. *Note:* Posterior mean (solid line) and 90% credible intervals (dotted line). [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

## 5.2 | Time-Varying Vector Autoregression Model

### 5.2.1 | Model Estimates

As suggested above, the detrended variables used in the model are stationary. According to Akaike Information Criteria (AIC), the lags of the VAR model are decided as 2. In this study, we employ the TVP-VAR model with stochastic volatility with Bayesian MCMC methods. Specifically, the MCMC routine was developed by Nakajima (2011).<sup>2</sup> Following Nakajima (2011), we assume that  $\Sigma_\beta$ ,  $\Sigma_m$ , and  $\Sigma_h$  are diagonal matrices. The following priors are assumed for the  $i$ th diagonals of the covariance matrices:

$$(\Sigma_\beta)_i^{-2} \sim \text{Gamma}(20, 10^{-4})$$

$$(\Sigma_m)_i^{-2} \sim \text{Gamma}(4, 10^{-2})$$

$$(\Sigma_h)_i^{-2} \sim \text{Gamma}(4, 10^{-2})$$

For the initial state of the time-varying parameter, we follow the study of choosing flat priors by setting  $\mu_{\beta_0} = \mu_{m_0} = \mu_{h_0} = 0$  and  $\Sigma_{\beta_0} = \Sigma_{m_0} = \Sigma_{h_0} = 10 \cdot I$ . To compute the posterior estimates, we

draw 10,000 samples after discarding the initial 1000 draws as burn-in. Figure 1 provides a comprehensive overview of the analysis, showcasing the sample autocorrelation function alongside the sample paths and posterior densities for the selected parameters. Following the exclusion of samples during the burn-in period (initial 1000 samples), a notable observation emerges: the sample paths exhibit stability, and the sample autocorrelations demonstrate a consistent decline. These findings signify the efficacy of our sampling methodology in yielding samples characterized by minimal autocorrelation, thereby bolstering the reliability of our results.

Table 2 presents a comprehensive summary of our analysis, featuring the posterior means, standard deviations, and 68% credible intervals for the estimated parameters. Additionally, it includes convergence diagnostics (CD) based on Geweke's (1992) method and inefficiency factors derived from the Markov Chain Monte Carlo (MCMC) sample. Notably, our analysis indicates that the null hypothesis of convergence to the posterior distribution is not rejected for the parameters at the 5% significance level, as evidenced by the CD statistics. Moreover, the inefficiency factors exhibit minimal values across most parameters, suggesting efficient sampling procedures. Although the inefficiency factor for  $\gamma$  is also acceptable, approximately 70, it still yields around  $M/100 = 100$  uncorrelated samples, which

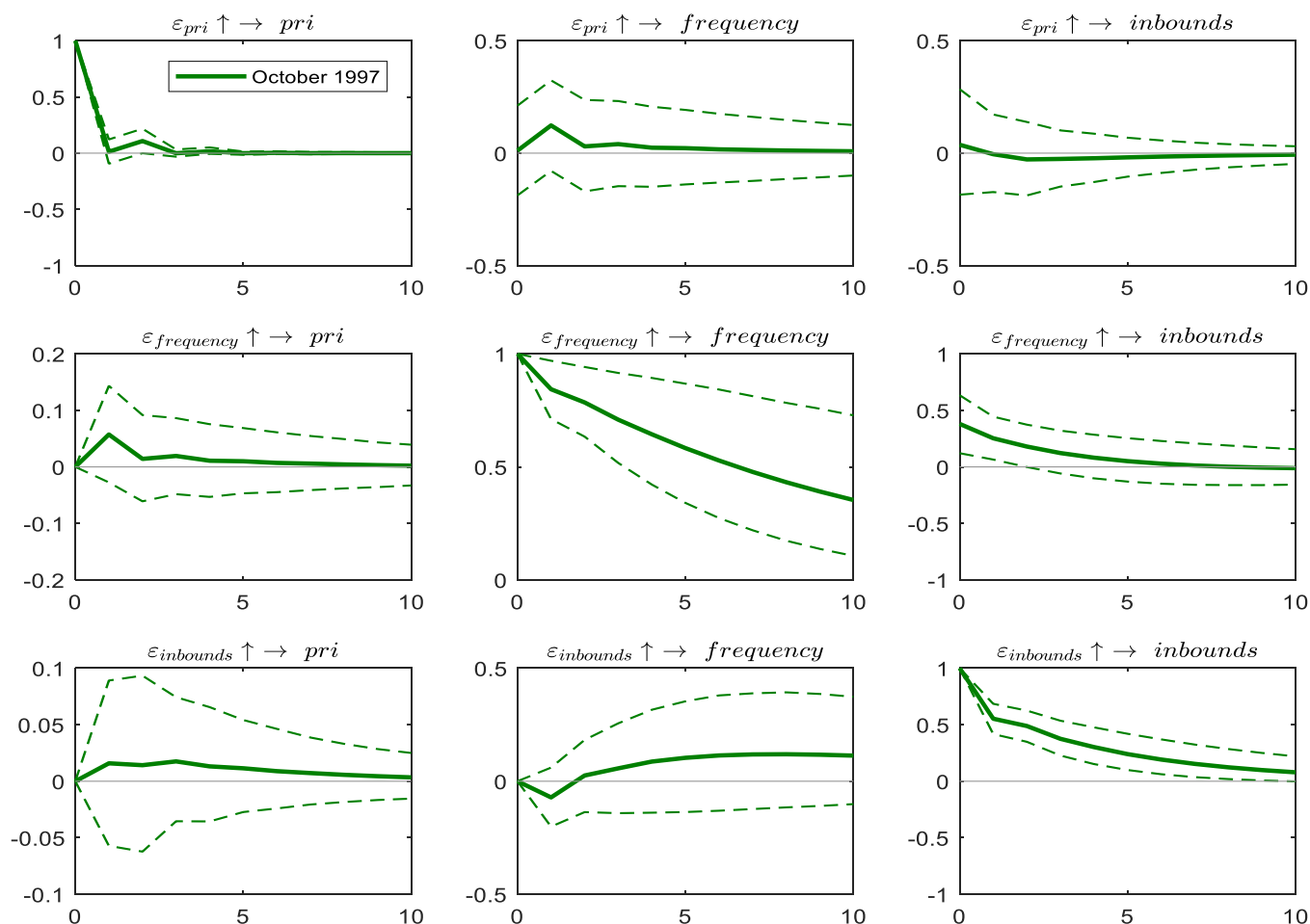


**FIGURE 5** | Impulse response functions in October 1997. *Note:* Posterior mean (solid line) and 90% intervals (dotted line) for the constant VAR model. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

is deemed sufficient for posterior inference. Furthermore, the estimated posterior means closely approximate the true parameter values, with the 68% credible intervals consistently encompassing them for each parameter outlined in Table 2.

### 5.2.2 | The Role of Stochastic Volatility

The estimated stochastic volatility is presented in Figure 2.<sup>3</sup> The stochastic volatility of political relation (*pri*) exhibits a spike in October 1997 and May 1999, respectively. From October 26 to November 3, 1997, President Jiang Zemin visited the US on a state visit. On October 29, both sides issued the “Joint Statement of China and the United States,” announcing that the two countries would strengthen cooperation and work towards establishing a constructive strategic partnership for the 21st century. In January 1998, US Secretary of Defence Cohen made an official visit to China. During the visit, China and the US signed the “Agreement between the Defence Departments of China and the United States on Establishing a Mechanism for Strengthening Consultations on Maritime Military Security.” In 1995, the North Atlantic Treaty Organization (NATO) bombed the Chinese embassy in Belgrade, almost shaking the foundation of the US–Sino relations.

The year 2003, marked by the SARS outbreak in Asia, saw a convergence of stochastic volatility in both frequency and

inbounds, mirroring the uncertain and dynamic nature of the situation. In response, the Chinese government swiftly enacted a series of comprehensive public health measures aimed at curbing the spread of the virus. These measures encompassed a spectrum of interventions, including the imposition of quarantines, implementation of travel restrictions, and the establishment of stringent temperature screenings at key points of entry such as airports and transportation hubs. Moreover, recognizing the urgent need to bolster healthcare capacity, the government embarked on a rapid expansion of healthcare infrastructure. This encompassed the creation of temporary hospitals, the setup of isolation wards, and a significant augmentation of medical personnel and resources allocated to hospitals treating SARS patients.

While these proactive measures proved effective in swiftly containing the spread of SARS, their implementation did not come without repercussions. The stringent travel restrictions and containment efforts had a notable impact on the tourism and aviation sectors, as evidenced by disrupted travel patterns and decreased passenger volumes. This interplay between public health interventions and economic sectors is accurately captured by the phenomenon of stochastic volatility, which reflects the unpredictable fluctuations and uncertainties arising from such complex interactions.

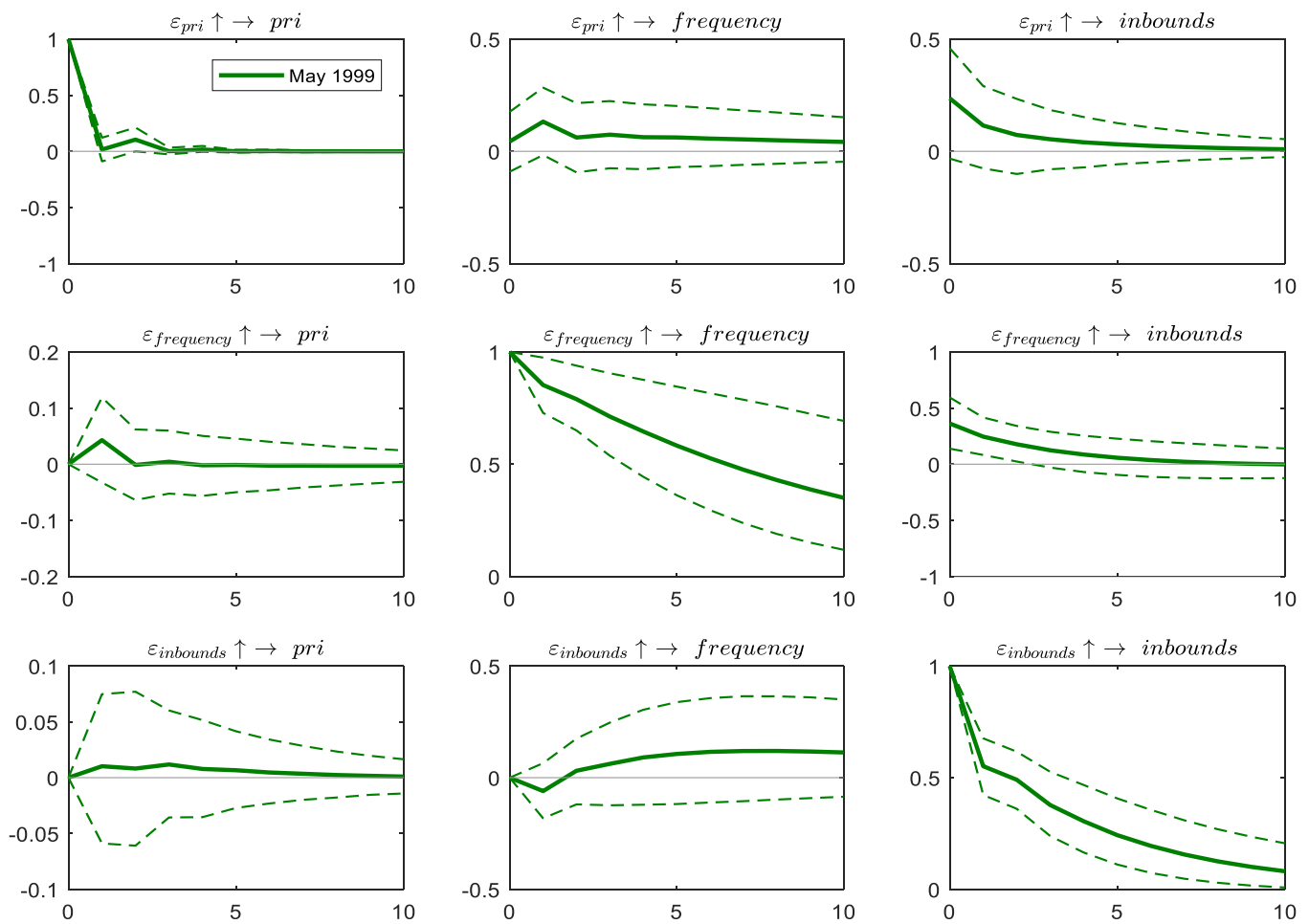


**FIGURE 6** | Impulse response functions in May 1999. *Note:* Posterior mean (solid line) and 90% intervals (dotted line) for the constant VAR model. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

### 5.2.3 | Horizontal Impulse Response Functions

The horizontal impulse response functions serve as valuable tools for understanding the dynamic interactions between variables across different time horizons. In our study, particular emphasis is placed on analyzing these responses at 1, 2, and 4-month horizons. These insights are visually represented in Figures 2–4, respectively. Notably, we observe that positive shifts in political relations exert a positive influence on flight frequency throughout the entire sample period. This finding is consistent with previous studies supporting the positive influence of air transport on international tourism, such as Zhang and Findlay (2014), Rehman Khan et al. (2017), Alderighi and Gaggero (2019), Law et al. (2022), and Hussain (2023). However, the impact of political relations on inbound tourism interactions appears to be less pronounced. Su et al. (2021) show that the impacts of political relations on tourism vary across different countries.

Moving to the second row of our analysis, we explore the effects of flight frequency shocks on both political relations and inbound interactions. Our findings suggest that heightened flight frequency positively contributes to the enhancement of US–China political relations. Simultaneously, an increase in flight frequency is associated with notable and favorable impacts on inbound interactions. Increasing flight frequency

can significantly boost inbound tourism by enhancing accessibility, affordability, and convenience for travelers. With more flight options available, tourists have greater flexibility in choosing departure times and durations of their trips, making the destination more appealing to leisure travelers seeking convenient travel arrangements. Moreover, competition among airlines often leads to lower airfares, making travel more affordable and attractive to budget-conscious tourists. Increased flight frequency also stimulates market demand through heightened awareness and promotional activities, encouraging more people to visit the destination. Additionally, enhanced connectivity facilitates business travel and trade, indirectly contributing to the growth of overall tourism. The influx of tourists drives investment in tourism infrastructure, further improving the destination's appeal and attracting repeat visitors. Overall, increasing flight frequency serves as a catalyst for inbound tourism, fostering economic development and enriching the tourism experience for travelers.

Transitioning to the third row, we investigate the repercussions of inbound shocks on political relations and flight frequency. Surprisingly, our results indicate that inbound tourism shocks do not yield significant effects on either political relations or flight frequency. This finding underscores the nuanced and complex nature of the interactions between these variables, highlighting the need for further exploration and analysis to

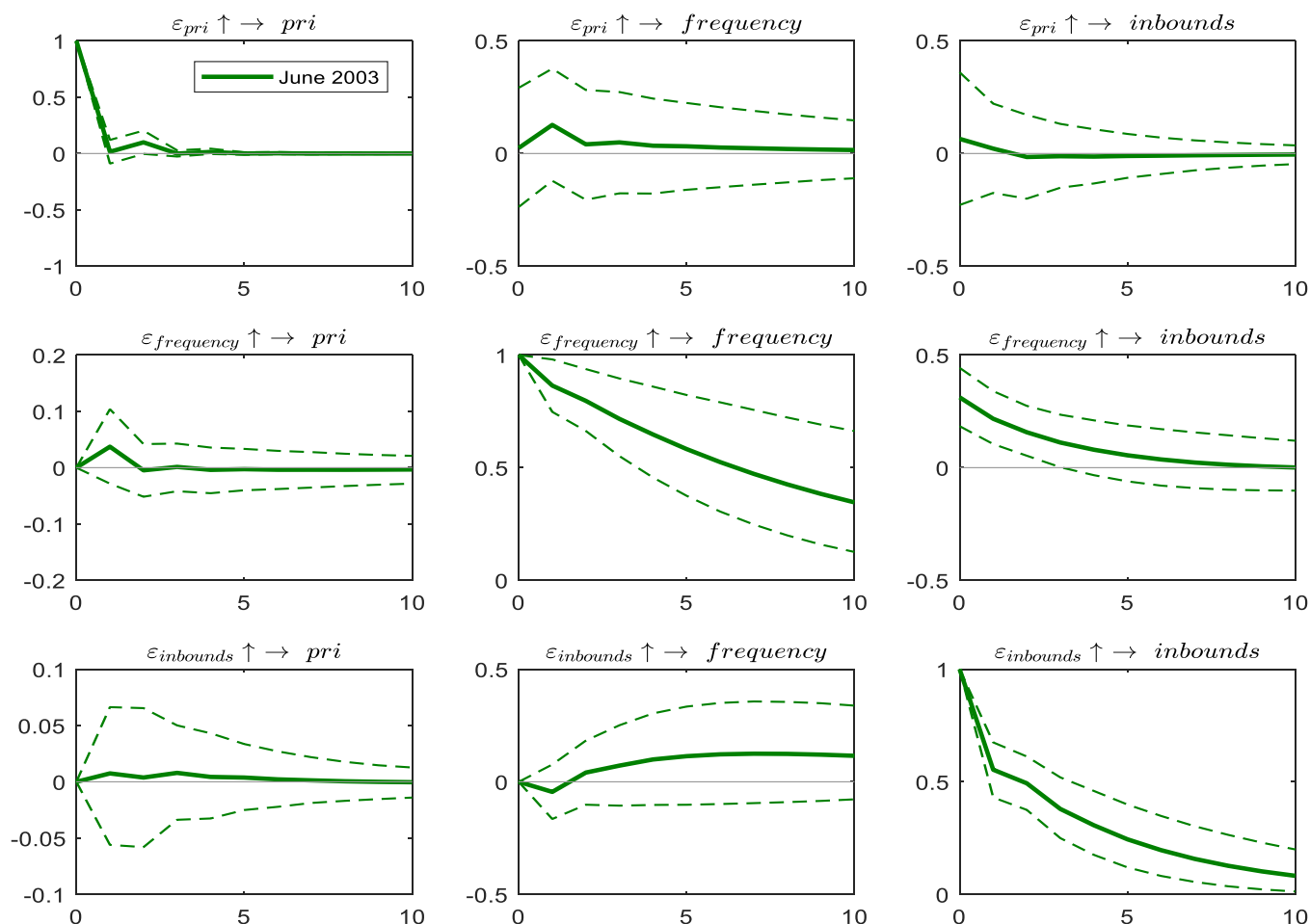


**FIGURE 7** | Impulse response functions in June 2003. *Note:* Posterior mean (solid line) and 90% intervals (dotted line) for the constant VAR model. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

fully comprehend their dynamics. Inbound tourists generally do not exert direct influence on flight frequency or political relations between destinations. Airlines adjust flight schedules primarily based on market demand and economic factors, considering profitability and competition. Political relations are shaped by a multitude of complex geopolitical, economic, and strategic considerations, with tourism playing just one part. Decisions regarding flight routes and bilateral relations are guided by long-term planning, stability, and regulatory frameworks established through international agreements. While tourism may indirectly influence certain aspects of air travel policies and bilateral ties, its impact is typically gradual and mediated by broader geopolitical dynamics.

Figures 3 and 4 show the horizontal impulse response functions for 2-month and 4-month periods, respectively, revealing how the impact of political relation shocks changes over time. Compared to the 1-month period, the influence of these shocks decreases gradually. This means that while political relation shocks still affect flight frequency, their impact becomes weaker over time. Interestingly, even though the impact weakens, the overall shape of the response functions remains like what is seen at the 1-month period. This suggests that the relationship between political dynamics and flight frequency stays consistent, although its immediate effects decrease over longer periods. These findings highlight the complex nature of these temporal dynamics and underscore the importance

of considering different timeframes when studying the effects of political relations.

#### 5.2.4 | Impulse Response Functions at Specific Time Points

The posterior estimates of stochastic volatility reveal critical periods that warrant closer examination, emphasizing the importance of identifying specific times for further investigation. Understanding potential changes in impulse responses during these key intervals provides valuable insights into the underlying dynamics. Figures 5–7 present the impulse response results at various time points. Our earlier analysis identifies significant spikes in the stochastic volatility of political relations in October 1997 and May 1999, indicating periods of increased geopolitical volatility. Similarly, the stochastic volatility of both flight frequency and inbound tourism shows notable increases in 2003, coinciding with the SARS outbreak. Thus, it is crucial to analyze these fluctuations from a policy perspective, recognizing their potential impacts on various socioeconomic areas.

Despite the distinct fluctuations in stochastic volatility across different time periods, it is intriguing to observe that the impulse response functions exhibit remarkable stability. This suggests a consistent transmission of identified shocks

irrespective of temporal variations, underscoring the robustness and persistence of the underlying relationships. In essence, while the external environment may undergo fluctuations, the mechanisms governing the interactions between political frequency, flight frequency, and inbound tourism interactions remain steadfast.

It becomes apparent that political relation shocks consistently augment flight frequency, albeit with minimal impact on inbound interactions. Conversely, frequency shocks wield significant short-term influence on inbound interactions, underscoring the intricate interplay between these variables within specific temporal contexts. Moreover, our analysis reveals that inbound tourism shocks do not yield significant impacts on political relations or flight frequency, indicating an asymmetry in their effects.

Despite conducting analyses across various time periods, the shape of impulse response functions remains largely unchanged. This underscores the robustness and consistency of our findings, reinforcing the stability of the underlying relationships. Moving forward, leveraging these insights to inform policy formulation and strategic decision-making holds immense potential for navigating complex geopolitical landscapes and fostering resilience amidst evolving global dynamics.

To sum up, political relations between countries can significantly impact flight frequency due to their influence on regulatory frameworks, bilateral agreements, and diplomatic negotiations regarding air travel. Positive political relations often lead to more favorable conditions for airlines to operate routes between countries, facilitating increased flight frequency. Conversely, strained political relations may result in restrictions, regulatory hurdles, or even the suspension of flight operations between destinations, reducing flight frequency. These fluctuations in flight frequency directly affect inbound tourists by affecting accessibility, convenience, and affordability. Reduced flight frequency due to political tensions can make it more challenging for tourists to travel to a destination, leading to decreased inbound tourism. Conversely, improved political relations and increased flight frequency can enhance accessibility, making the destination more attractive and accessible to tourists, thereby stimulating inbound tourism. Thus, there's a reciprocal relationship between political relations, flight frequency, and inbound tourism, with each factor influencing and shaping the others.

## 6 | Conclusions

This study examines the dynamics between US–China political relations, flight frequency, and inbound tourists using a TVP-VAR model. The results indicate that warming political relation would increase flight frequency. Beyond that, rising flight frequency would further increase inbound tourists. However, the rising inbound tourists do not seem to make significant impacts on political relations and flight frequency. Based on the conclusions drawn from this study, policymakers can implement several strategic policy suggestions to capitalize on the positive dynamics observed between US–China political relations, flight frequency, and inbound tourism. First, prioritizing diplomatic engagement through regular dialogues and constructive interactions can foster a conducive environment for increased air transport connectivity. Second, investing in air

transport infrastructure and streamlining regulatory processes can accommodate growing passenger demand and enhance the overall travel experience. Third, consider alternative promotional measures to moderate the decrease in inbound tourism when bilateral relations and direct flights are at low levels. For example, the targeted promotional campaigns showcasing diverse attractions and simplifying visa procedures can attract more tourists from both countries. Additionally, diversifying tourism offerings, fostering cultural exchanges, and preparing robust crisis management strategies can ensure the resilience and sustainability of the tourism industry amidst geopolitical uncertainties. By adopting these policies, stakeholders can leverage the potential of increased flight frequency and inbound tourism to strengthen bilateral relations, promote economic growth, and enhance cultural exchange between the US and China.

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## Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Endnotes

<sup>1</sup>This indeed is a limitation of this study due to the unavailability of the data set after December 2017.

<sup>2</sup>Interested readers who want to gain more details about the MCMC routine can refer to the paper by Nakajima (2011).

<sup>3</sup>We adopt the Markov chain Monte Carlo (MCMC) method proposed by Nakajima (2011) to estimate the TVP-VAR model with stochastic volatility.

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### Supporting Information

Additional supporting information can be found online in the Supporting Information section.