

Article

A DSGE-VAR Analysis for Tourism Development and Sustainable Economic Growth

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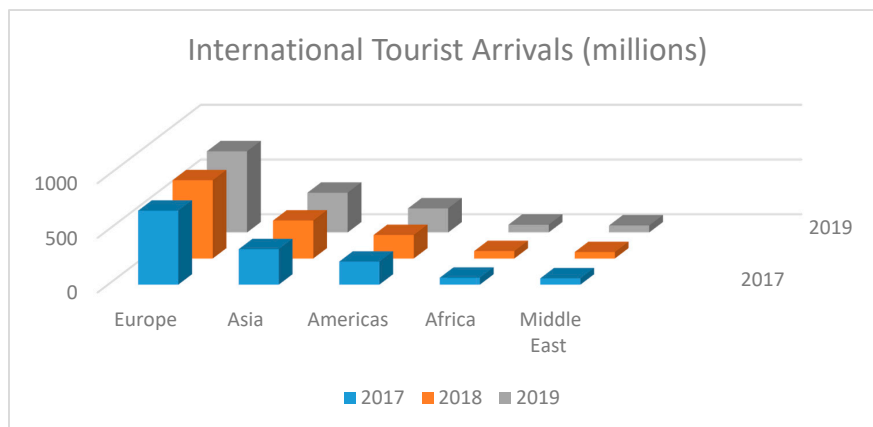


Abstract: This paper aims to provide a better basis for understanding the transmission connection between tourism development and sustainable economic growth in the empirical scenario of International countries. In this way, we have applied the dynamic stochastic general equilibrium (DSGE) model in different countries in order to check the power of generalization of this framework to study the tourism development. Also, we extend this model to obtain the long-term effects of tourism development with confidence intervals. The influence of tourism development on sustainable economic growth is proved by our results and show the indirect consequences between tourist activity and other industries produced through the external effects of investment and human capital and public sector. Our study confirms that the DSGE technique can be a generalized model for the analysis of tourism development and, especially, can improve previous precision results with the DSGE-VAR model, where vector autoregression (VAR) is introduced in the DSGE model. The simulation results reveal even more than when the productivity of the economy in general enhances, as the current tourist demand increases in greater proportion than more than the national tourism demand. For its part, the consumption of domestic tourism rises more than the consumption of inbound tourism if the productivity of the tourism production enhances, but non-tourism prices decrease at a slower rate and tourism investment needs a longer time to recover to what is established.

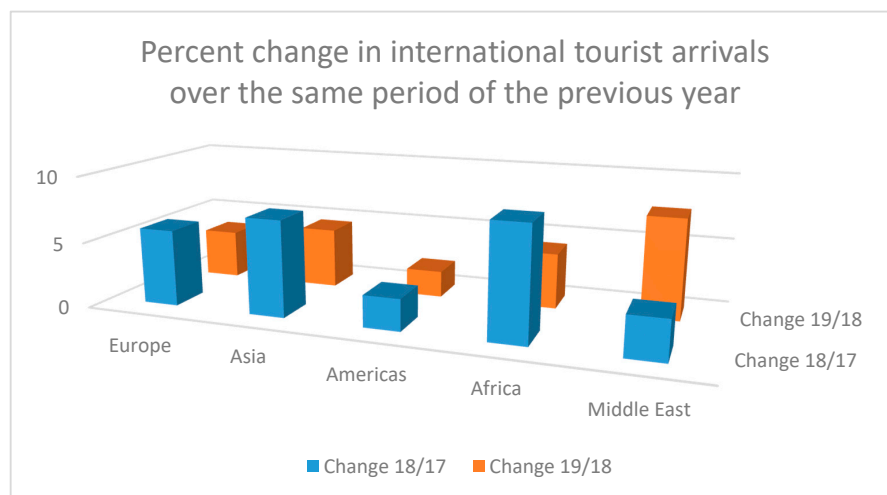
Keywords: tourism development; sustainable economic growth; tourism productivity; European tourism; DSGE-VAR model

1. Introduction

In recent decades, the tourism industry has established itself as a sector of great relevance to the world economy. According to data from the World Tourism Barometer [1], the tourism sector represented 6.8% of world economy every year. Despite being in a current environment of lower economic growth, this sector is resistant as its employment and consumer confidence levels continue to increase in 2019. In fact, following the same report, the international tourism arrivals have grown 4% in the first nine months of 2019, after 6% in 2018, and the international tourism receipts can be seen over a longer period in revenues from visitor spending (Figure 1).



(a).



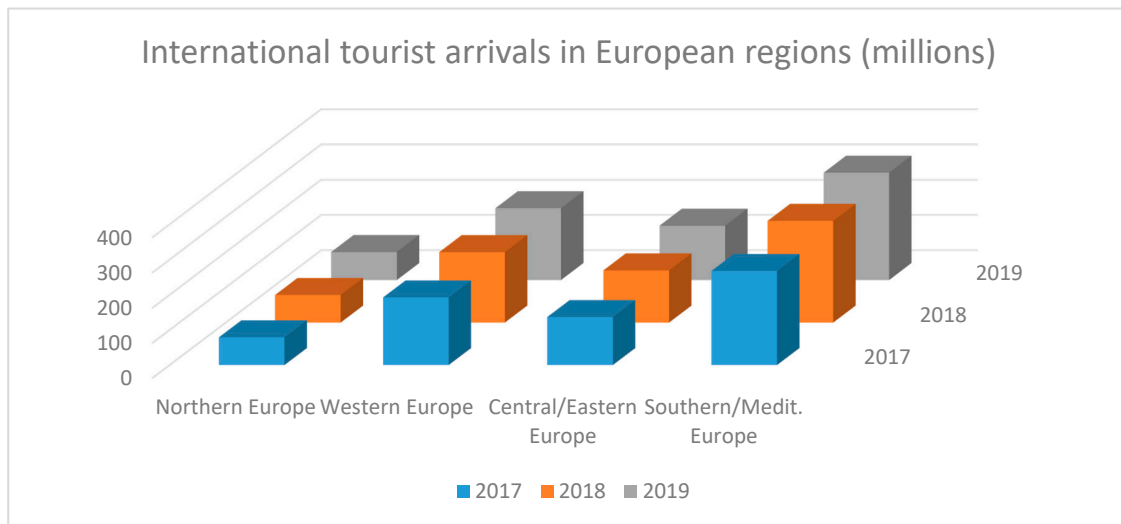
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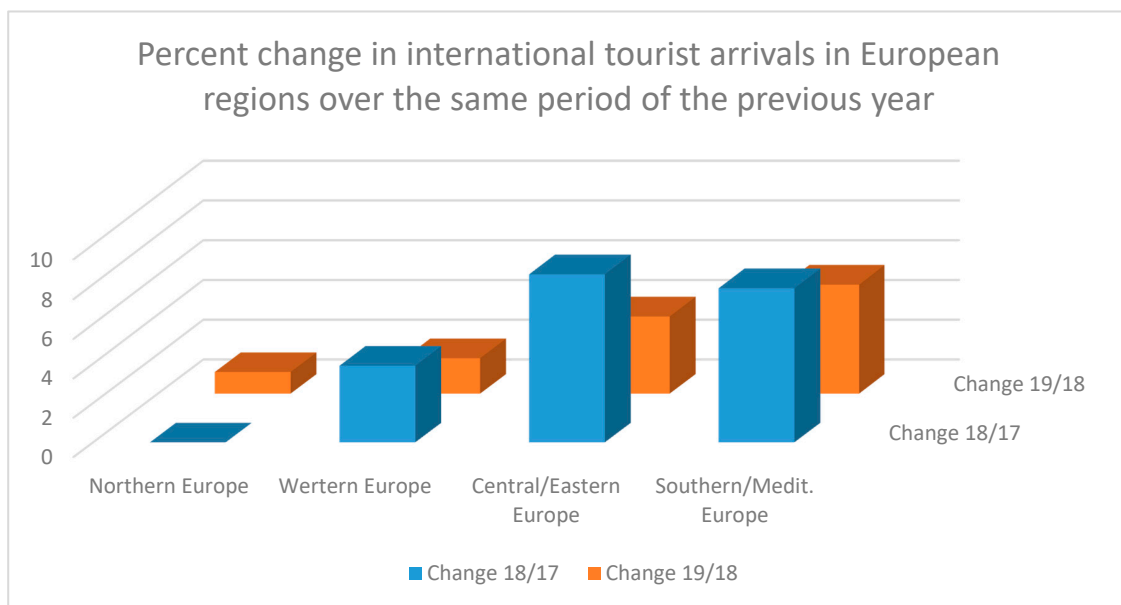
(c).

Figure 1. (a). International tourism (Tourist arrivals in millions); (b). International tourism (Change in tourist arrivals in percentage for the previous year); (c). International tourism (Change in tourist arrivals in percentage for the last quarter of previous year).

The 35 most competitive countries in tourism represent 84% of world tourism GDP and receive 70% of all international tourists [2,3]. For example, in the case of Europe, the European Travel Commission (2019) stated that most European countries increased the number of tourists (Figure 2). The European Travel Commission established a strong economic increase experienced by Europe in 2018 because GDP increased by 1.8% compared to the previous year. Much of the strong economic development was due to tourism, as the travel and tourism sector contributed directly to the Union’s gross domestic product (GDP) at a rate of 3.9% and accounted for 5.1% from the hand of total work in 2018.



(a).



(b).

Figure 2. Cont.



(c).

Figure 2. (a). European tourism (Change in tourist arrivals in percentage for the previous year); (b). European tourism (Tourist arrivals in millions); (c). European tourism (Change in tourist arrivals in percentage for the last quarter of previous year).

As tourism grows, new opportunities for investment, development, and spending on infrastructure also arise, new income is generated, and living standards are increased [4]. Thus, it is widely accepted that international tourism promotes economic development, since it generates competitive advantages generating economic returns through specialization in the production of a tourist product [5]. Currently, one of the most significant debates in the field of economic growth is the measurement of the different effects of tourism development. Thus, great progress has now been established in the study of the relationships between both variables in numerous countries and regions [6–8]. To quantify the impact of the link established between these factors, in the last decade, numerous researchers have developed different statistical methods: The tourism satellite account (TSA), the computable general equilibrium (CGE), and dynamic stochastic general equilibrium (DSGE) models. TSA is the statistical technique that finds tourism as an industry and enables an adequate measuring of its input to the economy [9]. On the other hand, CGE quantifies the main economic changes, including those related to tourism, of the different industries [10]. However, both econometric techniques analyze the impact of tourism development on economic growth but do not determine a true cause–effect relationship [11]; further, they do so taking into account only a certain period. For this reason, researchers have sought other econometric techniques to verify whether tourism development has a significant effect on economic growth. To this end, DSGE was developed, which provides an empirical theoretical and structural explanation of macroeconomic relations and considers dynamic factors and stochastic terms under general equilibrium theory [12].

According to the World Tourism Organization and the International Monetary Fund, a slowdown in world economic growth is expected in 2020. For this reason, we intend to analyze whether an improvement in tourism productivity in some of the main tourist countries can prevent the slowdown in growth, which was experienced by, among others, the European GDP since 2018. Consequently, the objective of this research has been to try to demonstrate that the DSGE model can be applied to different tourist experiences and even increase the precision previously obtained by incorporating vector autoregression (VAR), building the well-known DSGE-VAR model. Using data from leading tourism countries such as France, Japan, and Germany, the impulse-response functions are also developed, including intervals to learn how an improvement in the productivity of the tourism sector

can cause exogenous effects on economic growth, to help in a more precise way to the development and application of economic policies related to tourism development, something demanded by the previous literature [12–14].

More recently, the health crisis caused by the ‘COVID–19’ pandemic has paralyzed much of economic activity in a significant number of countries. One of the most affected sectors has been the tourism sector, which presumably will be one of the last sectors to resume its activity. These months of paralysis can seriously affect the viability of the sector, causing closure of companies and reduction of employment. This model can help articulate and simulate different and exceptional public policies for an extraordinary challenge such as the one that the tourism sector is experiencing. The results that this model can throw on this scenario can vary significantly since it will depend on the level of restrictions that have been applied in each country, both at a general level and at the level of the tourism sector. Those countries that apply a high level of restrictions will cause the level of investments to decrease and recover their level much more slowly than other sectors, considering the results obtained in this work. On the part of the productivity of the tourism sector, it will depend on the restrictions of both the sector and other sectors, since continued restrictions in non-tourism sectors may affect the dynamism observed in the production of tourism goods and services. These restrictions will also affect the added value of tourism goods and services but will have a high impact on other types of goods and services, since the sector has a high level of spillover towards other sectors. In short, the present model allows simulating the effects that the variation of a factor, such as investment or employment, may have on the other factors, both in the tourism sector and in the rest of the economy and its connections, in addition to evaluating possible policies by public institutions and other interest groups.

2. Literature Review

2.1. Background of Tourism Development

It is accepted that tourism development has a positive influence on the economy [15,16], leading to higher production, income, and employment, which promote growth and general economic development in a country [17]. Specifically, the existing empirical literature maintains that the number of tourists visiting a country is a fundamental factor for economic growth since tourism spending provides income to the destination country [18]. Likewise, these profits are used to promote the import of capital goods, which in turn will produce goods and services, which will imply the economic growth of the visiting country [19].

Although most of the studies carried out in this field tend to focus on issues such as job creation and multiplier effects, tourism has a dynamic effect on the economy through indirect effects and externalities in all economic sectors [20]. In this way, tourism stimulates investment in new infrastructure, produces economies of scale, and favors the spread of technical knowledge [18,21]. Similarly, tourism development also contributes to reducing poverty [22], because the promotion of unskilled jobs and the provision of part-time or seasonal jobs, manage to integrate people into employment through the long term [18]. Furthermore, the tourism industry also contributes to economic growth by increasing efficiency through competition between domestic companies and the destination of international tourists [18,23].

2.2. Tourism and Economic Growth.

Recently, a huge interest has arisen in establishing the relevance of tourism in economic growth, considering this measure to be fundamental for the development of tourism sector policies and, in turn, is useful as an evaluation to forecast visitor arrivals and benefits of tourism [24,25]. There is considerable prior research examining the different channels linking tourism to economic growth. In this way, numerous authors have established various variables that define these linking channels [8], such as structural breaks and exchange rates [26], remittances [27], information and communication technology [28], foreign direct investment [29], carbon emissions [30], trade openness [31], and energy consumption [32].

Empirical evidence has shown that there is a stable and durable connection between tourist progress and economic development [19]. This leads to a positive influence of tourist activity on economic development for various reasons [12]. The first of these is related to the increase in foreign currency since the entry of foreign currency into a country can be used to finance for foreign capital or primary goods employed in the production chain [33]. Secondly, we could consider the local investment, since tourism allows stimulating local investment in new infrastructures, such as the transportation facilities [34]. Thirdly, we could cite the labor force since tourism contributes to the generation of employment [35]. Lastly, we consider the diffusion of technical knowledge because tourism is an important diffusion factor of research and human capital accumulation [36]. But they can show differences between countries and considered periods [14].

Different econometric models have been applied to analyze the connection between tourist sector and economic development, for example TSA, CGE, and DSGE [14]. In these models, cointegration and Granger causality and cross-sectional data models are frequently used [24,37,38]. Other investigations have also measured this relationship through time series models [39,40]. However, some authors have used panel data models [13,41,42], because they provide greater efficiency in short-term predictions [43,44]. Although a large amount of empirical research has employed these econometric models, these techniques can analyze the steps between tourist progress and economic development [11]. For this reason, certain researchers have used other econometric techniques to check whether tourism development has a significant effect on economic growth.

TSA is a statistical technique that analyzes tourism as an industry and enables an adequate measuring of its input to the economy. This method is useful to ensure the homologation of data both between countries and another areas of sectors. TSA assesses the size of tourism and its input to GDP and employment in a period [9]. However, the TSA is only an econometric method that reports the significant contribution of tourism in a given time, generally on an annual data [45]. For this reason, the use of other methods is necessary to examine the total contribution of tourism [46,47].

CGE is used to estimate an economy's reaction to changes in exogenous variables [14]. In this way, CGE quantifies the main economic changes, including those related to tourism, of the different industries [10]. They add an input–output basis but connect the sectors of economy, foreign exchange markets, spending behavior of consumers, and public institutions, and show the macro factors of the economy [48]. Thus, the evaluation of the indirect consequences of different industries on economic growth is possible [14].

Also, DSGE has managed to be a basic empirical method in macroeconomics [49]. However, the use of DSGE has been widely questioned in the literature, due to their inability to adjust the data [50]. Despite this, the fit of these models has been improving [12,51], so that later studies demonstrated a better empirical fit regardless of economic openness [52,53]. Wannapan, Chaiboonsri, and Sriboonchitta [54] applied DSGE for the experience in Thailand where it is evident that there are two tourist stages, the low season and the high season, with capital and work factors helping the economic expansion of the country in high season. Changes in trends conclude with the need to improve the design of public policies. Other recent studies have shown great results of precision and explanation with the use of DSGE models, evidencing the need for their generalization and a greater depth of estimation to get more information on the causality studied [14]. In contrast to the large amount of previous research used by TSA and CGE models, DSGE is seldom applied in tourism papers to analyze the connection framework of tourism development to economic growth [14]. Although some authors have used the DSGE approach in their research [49,55,56], Liu, Song, and Blake [13] were the first to introduce the first complete DSGE model in the tourism domain [13,14].

3. Method

According to Liu, Song, and Blake [13], a DSGE model can be used to examine tourism with the general balance of the economy (see Tables 1 and 2). First of all, we have established a utility function of households as firms and households look forwards to get the maximum utility conditioned on budget and, as well, they seek to get profits depending on resource restrictions [14]. The agents

are in complete information situation of the market, so households are not penalized to search for work, physical capital rental, land rental, and financial markets [14]. Secondly, we proposed the Cobb–Douglas form to estimate the production functions of the tourism and non-tourism activities [14]. Thirdly, we developed the productivity function connected to the effects of physical capital and public sector, in which we established the effects of public sector by the private sector, where zero denotes that there were no side effects [13]. Finally, we established a model to measure the export; for that purpose, we used the global price and income indices.

Table 1. Dynamic stochastic general equilibrium (DSGE).

Functions	Variables
<i>The utility function of households</i>	
$U = E_0 \sum_{t=0}^{\infty} \beta^t \frac{[(C_t - hC_{t-1})^{\frac{1+\nu_1}{1-\sigma}} + (\lambda_{1,t} \lambda_{2,t})^{\frac{1+\nu_2}{1-\sigma}}]^{1-\sigma}}{1-\sigma}$	E_0 : expected utility function β : discounted rate h : typifies the habit persistence of consumption C_t : (using a CES function) is composed by: <ul style="list-style-type: none"> ▪ $C_{T,t}$: Tourism products ▪ $C_{NT,t}$: Non-tourism products ▪ $C_{P,t}$: Public services
	u_t : Unemployment rate $\lambda_{1,t}$: Private land supply shock $C_{la,t}$: This exogenous variable represents the result of private land inputs on the economy σ, ν_1 , and ν_2 : the parameters of the constant elasticity of substitution (CES) $C_{M,t}$: is composed by: <ul style="list-style-type: none"> ▪ $C_{MT,t}$: Imports of tourism services ▪ $C_{MNT,t}$: Non-tourism services
<i>The production functions of the tourism and non-tourism activities</i>	
$Y_{T,t} = \Omega_{T,t} K_{T,t}^{\alpha_1} N_{T,t}^{\alpha_2} L_{T,t}^{1-\alpha_1-\alpha_2}$ $Y_{NT,t} = \Omega_{NT,t} K_{NT,t}^{\alpha_3} N_{NT,t}^{1-\alpha_3}$	$Y_{i,t}$ ($i = T, NT$): The value-added of the given sector $\Omega_{i,t}$ ($i = T, NT$): The productivity function connected to the effects of physical capital and public sector $K_{i,t}$ ($i = T, NT$): The physical capital and is calculated by the process: $K_{i,t+1} = I_{i,t} + (1-\delta)K_{i,t}$ ($i = T, NT$) <ul style="list-style-type: none"> ▪ $I_{i,t}$: The physical capital investment in every sector ▪ δ: The depreciation rate ▪ $N_{i,t}$: Human capital enhancement: ▪ $N_{i,t} = H_t n_{i,t}$ ($i = T, NT, P$) ▪ $n_{i,t}$: points out the labor force for the industries ▪ H_t: The spill-over effects of capital and the accumulation of human capital
	$L_{aT,t}$: The private land rentals to the tourist industry
<i>The productivity function connected to the effects of physical capital and public sector</i>	
$\Omega_{i,t} = A_i A_{i,t} (\zeta_{p,t} Y_{p,t})^{\varphi_{p,i}} K_{i,t}^{\varphi_i} \left(\frac{K_{p,t}}{K_{T,t} + K_{NT,t}} \right)^{\varphi_{c,i}} \quad i = (T, NT)$	A_i : The auto-regression processes of the total productivity shocks $A_{i,t}$: The auto-regression processes of the sector that point out sector and total productivity shocks $\zeta_{p,t}$: The exogenous shock to the spill-over effects of public sector $Y_{p,t}$ the effect of public sector $K_{i,t}$: The effect of physical capital $\left(\frac{K_{p,t}}{K_{T,t} + K_{NT,t}} \right)^{\varphi_{c,i}}$: The spillover effect of $K_{p,t}$ $\varphi_{p,i}$: The effect of the public sector $\varphi_{c,i}$: The effect of the private sector $(i = T, NT)$: The parameters
	$L_{aT,t}$: The private land rentals to the tourist industry
<i>The spill-over effects of capital and the accumulation of human capital</i>	
$H_t = \frac{EX_{T,t}^{\alpha_i} (Y_{T,t} - EX_{T,t})^{b_i} \zeta_{H,t}}{H_t^{\alpha_i}} + \frac{EX_{NT,t}^{\alpha_i} (Y_{NT,t} - EX_{NT,t})^{b_i}}{H_t^{\alpha_i}} - \delta_H H_{t-1}$	$EX_{T,t}$: The exports of tourism $\zeta_{H,t}$: The shock to human capital accumulation $EX_{NT,t}$: The non-tourism products $E_{i,t}^{\alpha_i}$ and $(Y_{i,t} - EX_{i,t})^{b_i}$: The effect of the tourism product on human capital a_i, b_i and π_i : The parameters δ_H : The depreciation rate of human capital $H_t^{\alpha_i}$: The externality of experience
	$H_t^{\alpha_i}$: The externality of experience
<i>The exports</i>	
$EX_{i,t} = \left(\frac{P_{i,t}}{RE R_t} \right)^{\theta_{EX_i}} Y_{ROW,t}^{\omega_i} \quad (i = T, NT)$	$\left(\frac{P_{i,t}}{RE R_t} \right)$: The real exchange rate in USD $RE R_t$: The exchange rate $Y_{ROW,t}$: The world income level

Table 2. DSGE-vector autoregression (VAR) model.

Functions	Variables
<i>The model VAR</i>	
$y_t^v = c + B_1 y_{t-1}^v + \dots + B_p y_{t-p}^v + u_t$	y_t^v : represent an $nH \times 1$ vector corresponding to endogenous variables for $t = 1 \dots, T$ c : Group of terms p : The VAR lag length $[B_1, \dots, B_p]$: Parameter matrices u_t : The vector of forecast errors defined by the multivariate normal distribution $N(0; \Sigma u)$
<i>Vector of VAR variables</i>	
$y_t^v = 100 \times [\Delta \log(Y_{T,t}), \Delta \log(Y_{NT,t}), \Delta \log(C_t), \Delta \log(GDP_t), 4\Delta \log(P_t), R_t, \Delta \log(EX_t)]$	YT_t : The production in the tourist industry YNT_t : The production in the non- tourist industries C_t : Per capita real consumption GDP_t : Per capita real GDP P_t : Applies the GDP deflator R_t : The federal funds rate adjusted at the annual rate EX_t : The trade-weighted nominal exchange rate in the United
<i>The DSGE-VAR estimation</i>	
$Y^v = X^v \Phi + u_t$	Y^v be a $T \times nH$ matrix with each row consisting of y_t^v X^v be a $T \times k$ matrix with the t -th row containing in $x_t^v \equiv [1, y_{t-1}^v, \dots, y_{t-p}^v]$ where $k \equiv 1 + p \times nH$. ϕ : The maximum-likelihood estimator is calculated according to DSGE parameters vector
<i>DSGE parameters vector</i>	
$\bar{\Phi}(\theta) = (\lambda T T_{X^v X^v}(\theta) + X^v X^v)^{-1} (\lambda T T_{X^v X^v}(\theta) + X^v Y^v)$	θ : Vector consisting of the DSGE parameters EDh : The expectation operator conditional on the DSGE parameter vector θ

Against this backdrop, we developed a DSGE-VAR model. First, we determined a vector of endogenous variables to express the model VAR. Then, we defined the vector of VAR variables, where the trade-weighted nominal exchange rate in the United States was established. Therefore, a growth in the trade-weighted nominal exchange rate caused the U.S. dollar to depreciate. It is necessary to create stilted information in the DSGE model with regard the prior functions of the DSGE-VAR estimation. Then, this information was used for the prior distributions of VAR [14]. Finally, it was necessary to stipulate a posterior distribution: $p(\Phi, \Sigma_u, \theta|Y) = p(\Phi, \Sigma_u | \theta, Y)p(\theta|Y)$ for the purpose of correctly estimate the model.

4. Model Estimation

4.1. Empirical Results

With the objective to estimate more reliable results in the simulation of the model, information used in this study was collected from the indicators with the sample period from 1992 Q1 to 2017 Q4 from Eurostat, for the cases of France and Germany, and e-Stat Statistics of Japan, for the Japanese case.

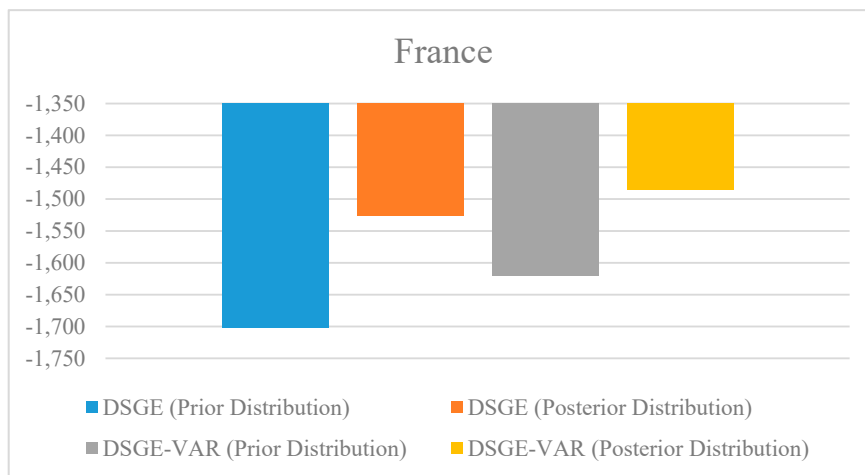
The factors represented were classified in different classes such as structural parameters, shock parameters, and steady-state values. The data of the prior distributions (or also called prior probabilities) of the parameters were extracted from [14,57] and official statistics. In this paper, we used the data for the parameters such as the depreciation rate of physical capital (δ) from [58]. The parameters in H_i and $\Omega_{i,t}$ ($i=T, NT$) represent the accumulation of human capital and the spillover effects of physical capital [59,60], which address the spillover effects of capital about tourism sector. The data for the shock parameters were obtained from [61]. The choice of the prior distributions was defined by [13]. Steady-state data corresponding to the tourist industry were estimated using 2010–2017, and the steady-state data were estimated from official statistics of the countries used. Steady-state information is expressed in Table 3.

Table 3. Steady-state data.

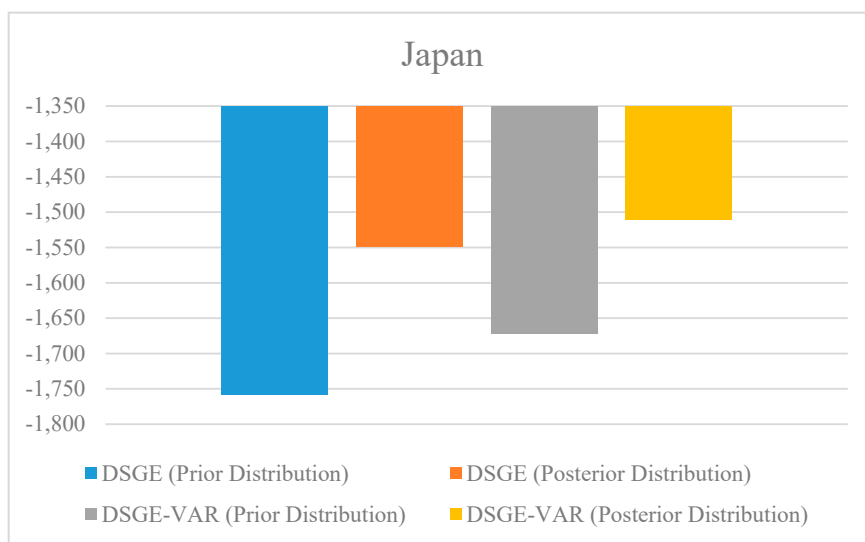
Variables	Code	Value in Steady State	Time Period
GDP/GDP	Y	1.00	–
Tourism Value Added/GDP	Y_T	0.11	2002–2017
Non-tourism Value Added/GDP	Y_{NT}	0.72	2002–2017
Public Service Value Added/GDP	Y_P	0.17	2002–2017
Final Consumption/GDP	C	0.58	2002–2017
Total Investment/GDP	I	0.21	2002–2017
Imports/GDP	CM	0.29	2002–2017
Tourism Exports/GDP	EX_{NT}	0.05	2002–2017
Non-tourism Exports/GDP	EX_T	0.23	2002–2017
Tourism Imports/GDP	CM_T	0.01	2002–2017
Non-tourism Imports/GDP	CM_{NT}	0.29	2002–2017
Tourism Investment/GDP	I_T	0.01	2002–2017
Non-tourism Investment/GDP	I_{NT}	0.16	2002–2017
Public Service Investment/GDP	I_P	0.04	2002–2017
Tourism FDI/GDP	\bar{I}_T^{DF}	0.01	2002–2017
Non-tourism FDI/GDP	\bar{I}_{NT}^{DF}	0.06	2002–2017
Balance of Payments/GDP	BP	0.04	2002–2017
Unemployment	u	0.15	2002–2017
Tourism Consumption/(Final Consumption + Imports)	γ_1	0.08	2002–2017
Non-tourism Consumption/(Final Consumption + Imports)	γ_2	0.50	2002–2017
Public Service Consumption/(Final Consumption + Imports)	γ_3	0.20	2002–2017
Tourism Employment/Employment	n_T	0.11	2002–2016
Non-tourism Employment/Employment	n_{NT}	0.59	2002–2017
Public Service Employment/Employment	n_P	0.27	2002–2017
CPI	P	1.00	–
Tourism Price	P_T	1.00	–
Non-tourism Price	P_{NT}	1.00	–
Public Good Price	P_P	–	–
GDP Growth Rate	g_y	Log (1.02)	1992–2017
Final Consumption Growth Rate	g_C	Log (1.02)	1992–2017
Investment Growth Rate	g_I	Log (1.02)	1992–2017
Government Consumption Growth Rate	g_P	Log (1.02)	1992–2017
Exports Growth Rate	g_{EX}	Log (1.03)	1992–2017
Production Tax Rate	τ_Y	0.12	–

Note: Real terms of the GDP index (2010 = 100).

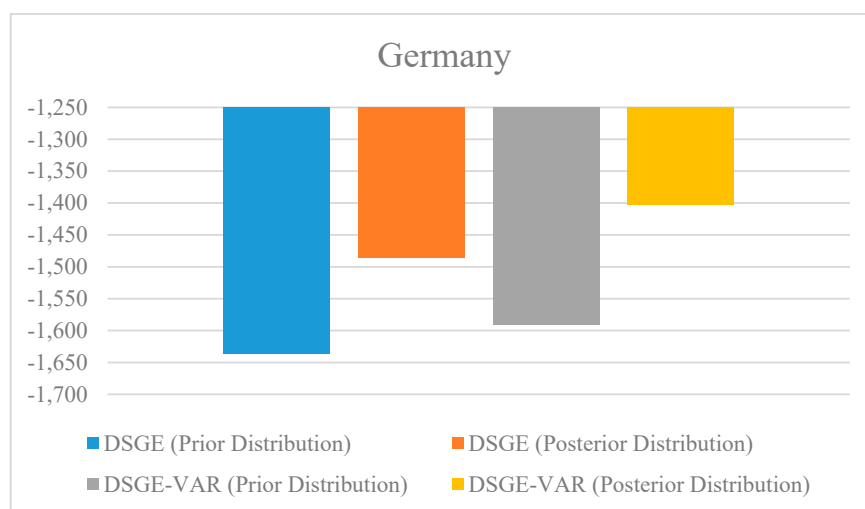
The present model is composed of 55 parameters. The Monte Carlo procedure was employed to calculate the posterior distributions (or also called posterior probabilities) and we used 20,000 simulations in every Markov sequence to compute the results of posterior distribution. Then, half of random simulations were eliminated. Also, to estimate the posterior probabilities, it usually computes for the DSGE models the marginal data density (MDD) $p(Y) = \int p(Y/\theta) p(\theta) d\theta$, because it supplies a summary on the accuracy of the results obtained by the model, representing a suitable criteria for the comparison of results and predictive capacity between models [43]. Figures 3 and 4 show the mean and error (deviation) of MDD estimates after the computing of the DSGE and DSGE-VAR models created. Our results prove a high precision level shown by the DSGE-VAR model compared to DSGE for the three countries considered, if we observe the deviations obtained. These robustness results are within the normality shown by the DSGE-VAR models in previous studies [57].



(a).

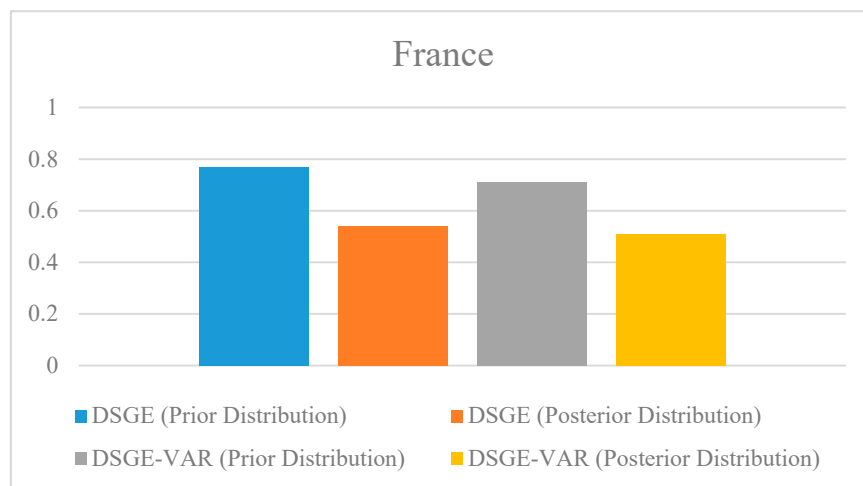


(b).

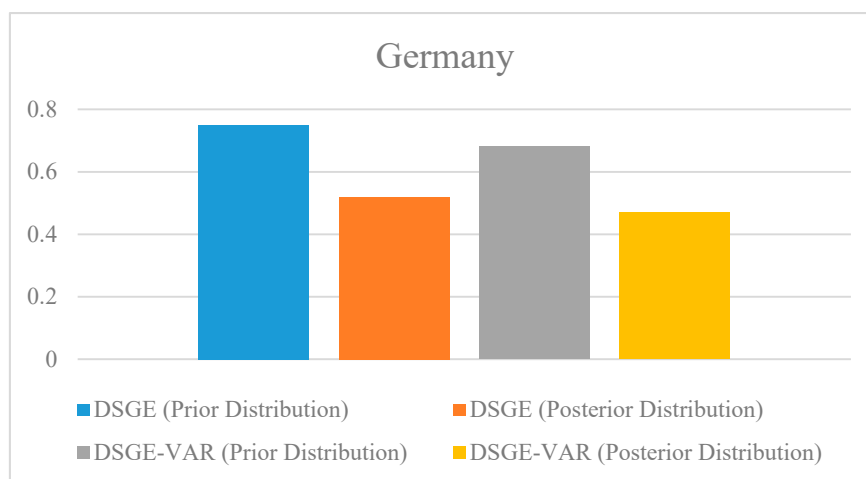


(c).

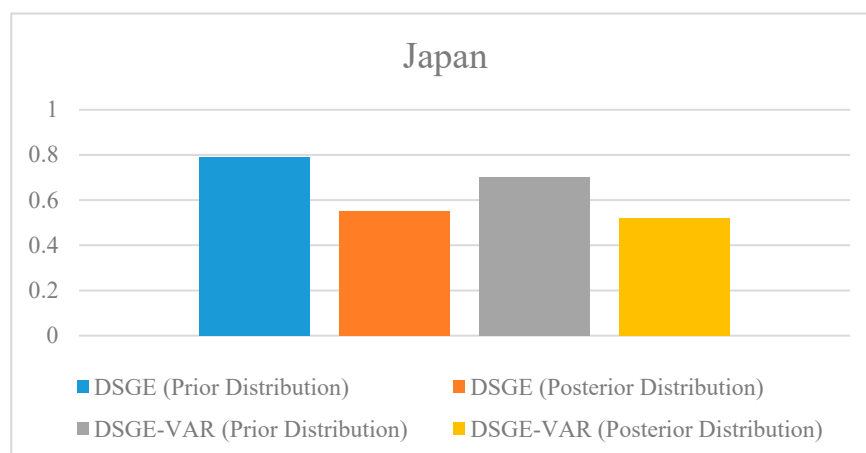
Figure 3. (a). Mean (log marginal data density (MDD)); (b). Mean (log marginal data density (MDD)); (c). Mean (log marginal data density (MDD))



(a).



(b).



(c).

Figure 4. (a). Standard deviation (log MDD); (b). Standard deviation (log MDD); (c). Standard deviation (log MDD).

Tables 4–6, point out the mean and standard deviation of the prior probabilities of every factor for France, Germany, and Japan, respectively. The mean of the posterior probabilities and the 90% confidence level estimated are reported. The estimation results of some of the structural parameters, such as β , δ , α_3 , α_4 , and h , work like the prior means following the same results of the previous literature [54]. The parameter α_1 increased from 0.37 to 0.53 but α_2 decreased from 0.44 to 0.07 for the French case. These changes were larger in the German case (α_1 from 0.37 to 0.52 and α_2 from 0.42 to 0.06) and in the case of Japan (α_1 from 0.36 to 0.51, and α_2 from 0.44 to 0.07). This means that the production of tourism products and services are safer in the cases of Germany and Japan against labor changes than the production of sectors other than the tourism sector.

On the other hand, the coefficients of leisure (v_1), private land (v_2), and intertemporal substitution (σ) were calculated as 1.93, 2.15, and 1.99 for the French case, which after dividing these results by unity, showed us elasticities of 0.52, 0.46, and 0.50, respectively. For the German case, these elasticities were 0.50, 0.48, and 0.52, for the mentioned variables, while for the Japanese model, these elasticities were 0.53, 0.47, and 0.52. In all cases, the elasticities were less than a 1, which is in line with previous works [13]. The substitute elasticity between tourist and non-tourist products (θ_1) was 0.38, 0.40, and 0.35, for France, Germany, and Japan, respectively. These results of substitute elasticity were less than one, coinciding with the previous literature [62], and show a similar level of substitution of tourist products concerning non-tourist products and public services about changes in the price, with Japan being the most rigid case.

Regarding the coefficient of the elastic substitutional effect between FDI and domestic capital investment (θ_2), we obtained a result of 1.45, 1.41, and 1.39, for France, Germany, and Japan, respectively. This coefficient shows that the higher the result, the greater the spill-over effect of FDI in the analyzed market. The results showed an acceptable level, but in the Japanese case, it showed a lower level than that obtained in other analyses [12,14,62]. In this case, the substitute elasticity between tourism and non-tourism imports is also not elastic (θ_3), at 0.53, 0.57, and 0.59. They showed a similar level of substitution of tourism products concerning non-tourist products and public services concerning price changes, with Japan also being the most rigid case.

The price elasticity of tourism exports was modified, with a decrease from -0.39 to -0.38 . The income elasticity of tourist exports incorporated important data, which led to a change from 0.81 in the prior distribution to 1.00 in the posterior distribution. According to the tourist statistics in the world [63], France, Germany, and Japan are among the most important tourist destinations. This means greater international incomes; more people visit these countries. Regarding non-tourism exports, the most valuable non-tourism goods from France, Germany, and Japan were vehicles, machinery, chemicals, and electronic elements. Nevertheless, these tourist products are not as competitive as tourism products. Hence, the price and income elasticities of the non-tourism sectors are much more rigid than the same elasticities of the tourist industry.

The most auto-regressive coefficients remained around 0.90, except for some variables such the productivity in the tourism industry (ρ_{zt}), the productivity in the public service (ρ_{zp}), and the land supply shock (ρ_{La}). The coefficients of productivity in the tourism sector for France, Germany, and Japan were estimated as 0.53, 0.55, and 0.53, respectively. These results showed a lower level of productivity than other experiences analyzed, such as the Spanish one [13,14]. These levels of productivity may be linked to the strong hiring of temporary workers in the tourism sector, which causes a less than optimal level of human capital qualification compared to other sectors. The coefficient of productivity in the public service suffered the most abrupt decrease of the three countries analyzed since the coefficient in the prior distribution was estimated from 0.50 to 0.03 in the posterior distribution for France, from 0.52 to 0.05 for Germany, and from 0.51 to 0.07 from Japan, which shows low productivity of the public sector concerning the private sector, both with tourism and especially with non-tourism. Finally, for the coefficient of land supply shock, in the present study, we found highly developed countries, therefore the supply shocks of land were low since any new land entry available to the market is going to be easily acceptable, something similar to that shown by previous works [14,62].

Table 4. Estimation results for France.

		Prior Distribution	Posterior Distribution	90% Interval	
				Low	High
<i>Structure Parameter</i>					
Discount Rate	β	Beta (0.99,0.00)	0.99	0.99	0.99
Physical Capital Depreciation Rate	δ	Beta (0.02,0.00)	0.02	0.02	0.02
Output Elasticity of Physical Capital in the Tourism Industry	α_1	Beta (0.37,0.10)	0.53	0.51	0.60
Output Elasticity of Human Capital in the Tourism Industry	α_2	Beta (0.44,0.10)	0.07	0.03	0.11
Output Elasticity of Physical Capital in the Non-tourism Industry	α_3	Beta (0.63,0.10)	0.65	0.60	0.70
Output Elasticity of Physical Capital in the Public Service Industry	α_4	Beta (0.63,0.10)	0.69	0.65	0.73
Habit Persistent	h	Beta (0.85,0.01)	0.85	0.85	0.86
Elasticity of Leisure	v_1	Gamma (2.00,0.10)	1.98	1.93	2.09
Elasticity of Private Land	v_2	Gamma (2.00,0.10)	2.10	2.02	2.18
Elasticity of Intertemporal Substitution	σ	Gamma (2.00,0.10)	1.94	1.91	1.98
Substitute Elasticity between Tourism, Non-tourism Goods and Public Services	θ_1	Gamma (0.40,0.10)	0.38	0.37	0.40
Substitute Elasticity between FDI and Domestic Investment	θ_2	Gamma (1.51,0.10)	1.45	1.41	1.47
Substitute Elasticity between Tourism and Non-tourism Imports	θ_3	Gamma (0.40,0.10)	0.53	0.51	0.56
Price Elasticity of Tourism Exports (Absolute)	$\theta_{EX,T}$	Gamma (0.39,0.10)	0.38	0.35	0.41
Price Elasticity of Non-tourism Exports (Absolute)	$\theta E,$	NT Gamma (0.19,0.10)	0.32	0.28	0.35
Income Elasticity of Tourism Exports	ωT	Gamma (0.81,0.10)	1.00	0.94	1.12
Income Elasticity of Non-tourism Exports	ωNT	Gamma (0.27,0.10)	0.05	0.03	0.07
Autoregressive Coefficient of Return Rate	θlr	Beta (0.80,0.10)	0.95	0.92	0.96
Elasticity of Price in the Taylor Rule	θp	Gamma (1.70,0.10)	1.73	1.69	1.76
Elasticity of GDP in the Taylor Rule	θy	Gamma (0.12,0.05)	0.13	0.13	0.14
Elasticity of Tourism Exports in Human Capital Accumulation	a_T	Gamma (0.30,0.10)	0.48	0.43	0.51
Elasticity of Non-exports of the Tourism Industry in Human Capital Accumulation	b_T	Gamma (0.05,0.01)	0.04	0.04	0.05
Scale Effect of Human Capital Accumulated by the Tourism Industry	πT	Gamma (0.30,0.10)	0.31	0.28	0.33
Elasticity of Non-tourism Exports in Human Capital Accumulation	$a T$	Gamma (0.30,0.10)	0.43	0.39	0.46
Elasticity of Non-exports in the Non-tourism industry of Human Capital Accumulation	$B T$	Gamma (0.06,0.01)	0.06	0.05	0.06
Scale Effect of Human Capital Accumulated by the Non-tourism Industry	ΠT	Gamma (0.30,0.10)	0.38	0.34	0.41
Depreciation Rate of Human Capital	δ_H	Gamma (0.04,0.01)	0.05	0.04	0.05
Spill-over Effect of Public Service on Tourism Productivity	$\varphi P,$	T Gamma (0.10,0.01)	0.10	0.10	0.11
Spill-over Effect of Tourism Physical Capital on its Productivity	φT	Gamma (0.05,0.01)	0.05	0.05	0.06
Congestion Effect of Physical Capital on Tourism Productivity	$\varphi C,$	T Gamma (0.04,0.01)	0.04	0.04	0.05
Spill-over Effect of Public Service on Non-tourism Productivity	$\varphi P,$	NT Gamma (0.10,0.01)	0.11	0.11	0.11
Spill-over Effect of Non-tourism Physical Capital on its Productivity	φT	Gamma (0.05,0.01)	0.04	0.04	0.05
Congestion Effect of Physical Capital on Non-tourism Productivity	$\varphi C,$	NT Gamma (0.05,0.01)	0.04	0.04	0.05
<i>Autoregressive Parameter</i>					
Productivity of the Tourism Industry	$P T$	Beta (0.50,0.20)	0.53	0.47	0.68
Productivity of the Non-Tourism Industry	$\rho^{ZN} NT$	Beta (0.50,0.20)	0.99	0.99	0.10
Productivity of the Public Service Industry	$\rho_Z P$	Beta (0.50,0.20)	0.03	0.02	0.04
Total Productivity of all Industries	ρ_Z	Beta (0.51,0.20)	0.91	0.90	0.93
World Output	ρ_{Yrow}	Beta (0.50,0.20)	0.92	0.91	0.94
Real Exchange Rate	ρ_{RER}	Beta (0.78,0.20)	0.84	0.83	0.84
Land Supply Shock	ρ_{La}	Beta (0.50,0.20)	0.30	0.16	0.38
Tourism Imports Price	$\rho_C,$	T Beta (0.51,0.20)	0.85	0.78	0.90
Non-tourism Imports	$\rho_C,$	NT Beta (0.50,0.20)	0.86	0.84	0.86
Human Capital Accumulation Shock	ρ_H	Beta (0.50,0.20)	0.82	0.74	0.94
Public Service Production Shock	ρ_P	Beta (0.50,0.20)	0.10	0.99	1.00
Standard Deviation					
Productivity of the Tourism Industry	ε^{ZT}	IGamma (0.15, 0.25)	0.13	0.11	0.15
Productivity of the Non-Tourism Industry	$\varepsilon^{ZN} T$	IGamma (0.15, 0.25)	0.13	0.12	0.14
Productivity of the Public Service Industry	ε^{ZP}	IGamma (0.15, 0.25)	0.14	0.11	0.16
Total Productivity of all Industries	ε^Z	IGamma (0.15, 0.25)	0.10	0.10	0.10
World Output	ε^{Yrow}	IGamma (0.15, 0.25)	0.11	0.10	0.12
Real Exchange Rate	ε^{RER}	IGamma (0.15, 0.25)	0.11	0.10	0.11
Land Supply Shock	ε^{La}	IGamma (0.15, 0.25)	0.36	0.31	0.42
Tourism Imports Price	$\varepsilon^{CM},$	T IGamma (0.15, 0.25)	0.20	0.14	0.29
Non-tourism Imports	$\varepsilon^{CM},$	NT IGamma (0.15, 0.25)	0.50	0.45	0.52
Human Capital Accumulation Shock	ε^H	IGamma (0.15, 0.25)	0.13	0.11	0.14
Public Service Production Shock	ε^P	IGamma (0.15, 0.25)	0.25	0.22	0.27

Table 5. Estimation results for Germany.

		Prior Distribution	Posterior Distribution	90% Interval	
				Low	High
<i>Structure Parameter</i>					
Discount Rate	β	Beta (0.95, 0.00)	0.95	0.95	0.95
Physical Capital Depreciation Rate	δ	Beta (0.02,0.00)	0.02	0.02	0.03
Output Elasticity of Physical Capital in the Tourism Industry	$\alpha 1$	Beta (0.37,0.10)	0.52	0.50	0.58
Output Elasticity of Human Capital in the Tourism Industry	$\alpha 2$	Beta (0.42,0.10)	0.06	0.03	0.09
Output Elasticity of Physical Capital in the Non-tourism Industry	$\alpha 3$	Beta (0.63,0.10)	0.60	0.57	0.66
Output Elasticity of Physical Capital in the Public Service Industry	$\alpha 4$	Beta (0.63,0.10)	0.65	0.62	0.71
Habit Persistent	h	Beta (0.85,0.01)	0.88	0.87	0.88
Elasticity of Leisure	$\nu 1$	Gamma (2.00,0.10)	1.93	1.90	1.97
Elasticity of Private Land	$\nu 2$	Gamma (2.00,0.10)	2.15	2.13	2.19
Elasticity of Intertemporal Substitution	σ	Gamma (2.00,0.10)	1.99	1.94	2.12
Substitute Elasticity between Tourism, Non-tourism Goods and Public Services	$\theta 1$	Gamma (0.40,0.10)	0.40	0.38	0.41
Substitute Elasticity between FDI and Domestic Investment	$\theta 2$	Gamma (1.51,0.10)	1.41	1.38	1.45
Substitute Elasticity between Tourism and Non-tourism Imports	$\theta 3$	Gamma (0.40,0.10)	0.57	0.52	0.59
Price Elasticity of Tourism Exports (Absolute)	$\theta_{EX,T}$	Gamma (0.39,0.10)	0.34	0.32	0.41
Price Elasticity of Non-tourism Exports (Absolute)	$\theta_{E,T}$	Gamma (0.20,0.10)	0.30	0.28	0.33
Income Elasticity of Tourism Exports	ωT	Gamma (0.82,0.10)	1.05	0.97	1.11
Income Elasticity of Non-tourism Exports	ωNT	Gamma (0.27,0.10)	0.06	0.05	0.08
Autoregressive Coefficient of Return Rate	θ_{tr}	Beta (0.80,0.10)	0.93	0.90	0.95
Elasticity of Price in the Taylor Rule	θ_p	Gamma (1.71,0.10)	1.70	1.68	1.74
Elasticity of GDP in the Taylor Rule	θ_y	Gamma (0.13,0.05)	0.13	0.12	0.13
Elasticity of Tourism Exports in Human Capital Accumulation	a_T	Gamma (0.30,0.10)	0.49	0.44	0.52
Elasticity of Non-exports of the Tourism Industry in Human Capital Accumulation	b_T	Gamma (0.06,0.01)	0.06	0.06	0.07
Scale Effect of Human Capital Accumulated by the Tourism Industry	πT	Gamma (0.30,0.10)	0.36	0.33	0.38
Elasticity of Non-tourism Exports in Human Capital Accumulation	$a T$	Gamma (0.30,0.10)	0.47	0.43	0.48
Elasticity of Non-exports in the Non-tourism industry of Human Capital Accumulation	$b T$	Gamma (0.05,0.01)	0.08	0.07	0.08
Scale Effect of Human Capital Accumulated by the Non-tourism Industry	ΠT	Gamma (0.30,0.10)	0.40	0.36	0.42
Depreciation Rate of Human Capital	δ_H	Gamma (0.05,0.01)	0.07	0.06	0.07
Spill-over Effect of Public Service on Tourism Productivity	$\varphi P,$	T Gamma (0.10,0.01)	0.13	0.12	0.13
Spill-over Effect of Tourism Physical Capital on its Productivity	φT	Gamma (0.05,0.01)	0.07	0.06	0.09
Congestion Effect of Physical Capital on Tourism Productivity	$\varphi C,$	T Gamma (0.04,0.01)	0.06	0.05	0.06
Spill-over Effect of Public Service on Non-tourism Productivity	$\varphi P,$	NT Gamma (0.10,0.01)	0.13	0.13	0.15
Spill-over Effect of Non-tourism Physical Capital on its Productivity	ΦT	Gamma (0.05,0.01)	0.03	0.03	0.04
Congestion Effect of Physical Capital on Non-tourism Productivity	$\varphi C,$	NT Gamma (0.05,0.01)	0.05	0.05	0.06
<i>Autoregressive Parameter</i>					
Productivity of the Tourism Industry	$P T$	Beta (0.50,0.20)	0.55	0.48	0.70
Productivity of the Non-Tourism Industry	$\rho Z T$	Beta (0.50,0.20)	0.93	0.92	0.93
Productivity of the Public Service Industry	ρP	Beta (0.52,0.20)	0.05	0.04	0.07
Total Productivity of all Industries	ρZ	Beta (0.51,0.20)	0.97	0.93	0.90
World Output	ρ_{Yrow}	Beta (0.53,0.20)	0.98	0.94	0.99
Real Exchange Rate	ρ_{RER}	Beta (0.78,0.20)	0.84	0.83	0.84
Land Supply Shock	ρ_{La}	Beta (0.52,0.20)	0.31	0.21	0.37
Tourism Imports Price	$\rho_{CM},$	T Beta (0.51,0.20)	0.87	0.82	0.90
Non-tourism Imports	$\rho_{CM},$	NT Beta (0.50,0.20)	0.82	0.80	0.85
Human Capital Accumulation Shock	ρ_H	Beta (0.53,0.20)	0.87	0.79	0.93
Public Service Production Shock	ρ_P	Beta (0.50,0.20)	0.99	0.98	1.00
<i>Standard Deviation</i>					
Productivity of the Tourism Industry	ε^{ZT}	IGamma (0.15, 0.25)	0.12	0.10	0.14
Productivity of the Non-Tourism Industry	ε^{ZNT}	IGamma (0.15, 0.25)	0.15	0.14	0.16
Productivity of the Public Service Industry	ε^{ZP}	IGamma (0.15, 0.25)	0.14	0.13	0.16
Total Productivity of all Industries	ε^Z	IGamma (0.15, 0.25)	0.13	0.12	0.15
World Output	ε^{Yrow}	IGamma (0.15, 0.25)	0.13	0.11	0.16
Real Exchange Rate	ε^{RER}	IGamma (0.15, 0.25)	0.12	0.11	0.12
Land Supply Shock	ε^{La}	IGamma (0.15, 0.25)	0.34	0.31	0.40
Tourism Imports Price	$\varepsilon^{CM},$	T IGamma (0.15, 0.25)	0.18	0.14	0.28
Non-tourism Imports	$\varepsilon^{CM},$	NT IGamma (0.15, 0.25)	0.48	0.45	0.51
Human Capital Accumulation Shock	ε^H	IGamma (0.15, 0.25)	0.14	0.13	0.15
Public Service Production Shock	ε^P	IGamma (0.15, 0.25)	0.24	0.21	0.27
				Low	High
<i>Structure Parameter</i>					
Discount Rate	β	Beta (0.95, 0.00)	0.95	0.95	0.95
Physical Capital Depreciation Rate	δ	Beta (0.02,0.00)	0.02	0.02	0.03
Output Elasticity of Physical Capital in the Tourism Industry	$\alpha 1$	Beta (0.37,0.10)	0.52	0.50	0.58
Output Elasticity of Human Capital in the Tourism Industry	$\alpha 2$	Beta (0.42,0.10)	0.06	0.03	0.09
Output Elasticity of Physical Capital in the Non-tourism Industry	$\alpha 3$	Beta (0.63,0.10)	0.60	0.57	0.66
Output Elasticity of Physical Capital in the Public Service Industry	$\alpha 4$	Beta (0.63,0.10)	0.65	0.62	0.71

Table 5. Cont.

		Prior Distribution	Posterior Distribution	90% Interval		
				Low	High	
Habit Persistent	h	Beta (0.85,0.01)	0.88	0.87	0.88	
Elasticity of Leisure	$v1$	Gamma (2.00,0.10)	1.93	1.90	1.97	
Elasticity of Private Land	$v2$	Gamma (2.00,0.10)	2.15	2.13	2.19	
Elasticity of Intertemporal Substitution	σ	Gamma (2.00,0.10)	1.99	1.94	2.12	
Substitute Elasticity between Tourism, Non-tourism Goods and Public Services	$\theta1$	Gamma (0.40,0.10)	0.40	0.38	0.41	
Substitute Elasticity between FDI and Domestic Investment	$\theta2$	Gamma (1.51,0.10)	1.41	1.38	1.45	
Substitute Elasticity between Tourism and Non-tourism Imports	$\theta3$	Gamma (0.40,0.10)	0.57	0.52	0.59	
Price Elasticity of Tourism Exports (Absolute)	$\theta_{EX,T}$	Gamma (0.39,0.10)	0.34	0.32	0.41	
Price Elasticity of Non-tourism Exports (Absolute)	θE_t	NT	Gamma (0.20,0.10)	0.30	0.28	0.33
Income Elasticity of Tourism Exports	ωT	Gamma (0.82,0.10)	1.05	0.97	1.11	
Income Elasticity of Non-tourism Exports	ωNT	Gamma (0.27,0.10)	0.06	0.05	0.08	
Autoregressive Coefficient of Return Rate	θ_{tr}	Beta (0.80,0.10)	0.93	0.90	0.95	
Elasticity of Price in the Taylor Rule	θ_p	Gamma (1.71,0.10)	1.70	1.68	1.74	
Elasticity of GDP in the Taylor Rule	θ_y	Gamma (0.13,0.05)	0.13	0.12	0.13	
Elasticity of Tourism Exports in Human Capital Accumulation	a_T	Gamma (0.30,0.10)	0.49	0.44	0.52	
Elasticity of Non-exports of the Tourism Industry in Human Capital Accumulation	b_T	Gamma (0.06,0.01)	0.06	0.06	0.07	
Scale Effect of Human Capital Accumulated by the Tourism Industry	πT	Gamma (0.30,0.10)	0.36	0.33	0.38	
Elasticity of Non-tourism Exports in Human Capital Accumulation	$a T$	Gamma (0.30,0.10)	0.47	0.43	0.48	
Elasticity of Non-exports in the Non-tourism industry of Human Capital Accumulation	$b T$	Gamma (0.05,0.01)	0.08	0.07	0.08	
Scale Effect of Human Capital Accumulated by the Non-tourism Industry	ΠT	Gamma (0.30,0.10)	0.40	0.36	0.42	
Depreciation Rate of Human Capital	δ_H	Gamma (0.05,0.01)	0.07	0.06	0.07	
Spill-over Effect of Public Service on Tourism Productivity	φP_t	T	Gamma (0.10,0.01)	0.13	0.12	0.13
Spill-over Effect of Tourism Physical Capital on its Productivity	φT		Gamma (0.05,0.01)	0.07	0.06	0.09
Congestion Effect of Physical Capital on Tourism Productivity	φC_t	T	Gamma (0.04,0.01)	0.06	0.05	0.06
Spill-over Effect of Public Service on Non-tourism Productivity	φP_t	NT	Gamma (0.10,0.01)	0.13	0.13	0.15
Spill-over Effect of Non-tourism Physical Capital on its Productivity	ΦT		Gamma (0.05,0.01)	0.03	0.03	0.04
Congestion Effect of Physical Capital on Non-tourism Productivity	φC_t	NT	Gamma (0.05,0.01)	0.05	0.05	0.06
<i>Autoregressive Parameter</i>						
Productivity of the Tourism Industry	$P T$	Beta (0.50,0.20)	0.55	0.48	0.70	
Productivity of the Non-Tourism Industry	$\rho_Z T$	Beta (0.50,0.20)	0.93	0.92	0.93	
Productivity of the Public Service Industry	ρP	Beta (0.52,0.20)	0.05	0.04	0.07	
Total Productivity of all Industries	ρZ	Beta (0.51,0.20)	0.97	0.93	0.90	
World Output	ρ_{Yrow}	Beta (0.53,0.20)	0.98	0.94	0.99	
Real Exchange Rate	ρ_{RER}	Beta (0.78,0.20)	0.84	0.83	0.84	
Land Supply Shock	ρ_{La}	Beta (0.52,0.20)	0.31	0.21	0.37	
Tourism Imports Price	ρ_{CM_t}	T	Beta (0.51,0.20)	0.87	0.82	0.90
Non-tourism Imports	ρ_{CM_t}	NT	Beta (0.50,0.20)	0.82	0.80	0.85
Human Capital Accumulation Shock	ρ_H	Beta (0.53,0.20)	0.87	0.79	0.93	
Public Service Production Shock	ρ_P	Beta (0.50,0.20)	0.99	0.98	1.00	
<i>Standard Deviation</i>						
Productivity of the Tourism Industry	ε^{ZT}	IGamma (0.15, 0.25)	0.12	0.10	0.14	
Productivity of the Non-Tourism Industry	ε^{ZNT}	IGamma (0.15, 0.25)	0.15	0.14	0.16	
Productivity of the Public Service Industry	ε^{ZP}	IGamma (0.15, 0.25)	0.14	0.13	0.16	
Total Productivity of all Industries	ε^Z	IGamma (0.15, 0.25)	0.13	0.12	0.15	
World Output	ε^{Yrow}	IGamma (0.15, 0.25)	0.13	0.11	0.16	
Real Exchange Rate	ε^{RER}	IGamma (0.15, 0.25)	0.12	0.11	0.12	
Land Supply Shock	ε^{La}	IGamma (0.15, 0.25)	0.34	0.31	0.40	
Tourism Imports Price	ε^{CM_t}	T	IGamma (0.15, 0.25)	0.18	0.14	0.28
Non-tourism Imports	ε^{CM_t}	NT	IGamma (0.15, 0.25)	0.48	0.45	0.51
Human Capital Accumulation Shock	ε^H	IGamma (0.15, 0.25)	0.14	0.13	0.15	
Public Service Production Shock	ε^P	IGamma (0.15, 0.25)	0.24	0.21	0.27	

Table 6. Estimation results for Japan.

				Low	High
Structure Parameter	β	Beta (0.95, 0.00)	0.95	0.95	0.95
Discount Rate					
Physical Capital Depreciation Rate	δ	Beta (0.02,0.00)	0.02	0.02	0.03
Output Elasticity of Physical Capital in the Tourism Industry	$\alpha 1$	Beta (0.37,0.10)	0.52	0.50	0.58
Output Elasticity of Human Capital in the Tourism Industry	$\alpha 2$	Beta (0.42,0.10)	0.06	0.03	0.09
Output Elasticity of Physical Capital in the Non-tourism Industry	$\alpha 3$	Beta (0.63,0.10)	0.60	0.57	0.66
Output Elasticity of Physical Capital in the Public Service Industry	$\alpha 4$	Beta (0.63,0.10)	0.65	0.62	0.71
Habit Persistent	h	Beta (0.85,0.01)	0.88	0.87	0.88
Elasticity of Leisure	$\nu 1$	Gamma (2.00,0.10)	1.93	1.90	1.97
Elasticity of Private Land	$\nu 2$	Gamma (2.00,0.10)	2.15	2.13	2.19
Elasticity of Intertemporal Substitution	σ	Gamma (2.00,0.10)	1.99	1.94	2.12
Substitute Elasticity between Tourism, Non-tourism Goods and Public Services	$\theta 1$	Gamma (0.40,0.10)	0.40	0.38	0.41
Substitute Elasticity between FDI and Domestic Investment	$\theta 2$	Gamma (1.51,0.10)	1.41	1.38	1.45
Substitute Elasticity between Tourism and Non-tourism Imports	$\theta 3$	Gamma (0.40,0.10)	0.57	0.52	0.59
Price Elasticity of Tourism Exports (Absolute)	$\theta_{EX,T}$	Gamma (0.39,0.10)	0.34	0.32	0.41
Price Elasticity of Non-tourism Exports (Absolute)	$\theta E,$	NT Gamma (0.20,0.10)	0.30	0.28	0.33
Income Elasticity of Tourism Exports	ωT	Gamma (0.82,0.10)	1.05	0.97	1.11
Income Elasticity of Non-tourism Exports	ωNT	Gamma (0.27,0.10)	0.06	0.05	0.08
Autoregressive Coefficient of Return Rate	θtr	Beta (0.80,0.10)	0.93	0.90	0.95
Elasticity of Price in the Taylor Rule	θp	Gamma (1.71,0.10)	1.70	1.68	1.74
Elasticity of GDP in the Taylor Rule	θy	Gamma (0.13,0.05)	0.13	0.12	0.13
Elasticity of Tourism Exports in Human Capital Accumulation	a_T	Gamma (0.30,0.10)	0.49	0.44	0.52
Elasticity of Non-exports of the Tourism Industry in Human Capital Accumulation	b_T	Gamma (0.06,0.01)	0.06	0.06	0.07
Scale Effect of Human Capital Accumulated by the Tourism Industry	πT	Gamma (0.30,0.10)	0.36	0.33	0.38
Elasticity of Non-tourism Exports in Human Capital Accumulation	$a T$	Gamma (0.30,0.10)	0.47	0.43	0.48
Elasticity of Non-exports in the Non-tourism industry of Human Capital Accumulation	$b T$	Gamma (0.05,0.01)	0.08	0.07	0.08
Scale Effect of Human Capital Accumulated by the Non-tourism Industry	ΠT	Gamma (0.30,0.10)	0.40	0.36	0.42
Depreciation Rate of Human Capital	δ_H	Gamma (0.05,0.01)	0.07	0.06	0.07
Spill-over Effect of Public Service on Tourism Productivity	$\varphi P,$	T Gamma (0.10,0.01)	0.13	0.12	0.13
Spill-over Effect of Tourism Physical Capital on its Productivity	φT	Gamma (0.05,0.01)	0.07	0.06	0.09
Congestion Effect of Physical Capital on Tourism Productivity	$\varphi C,$	T Gamma (0.04,0.01)	0.06	0.05	0.06
Spill-over Effect of Public Service on Non-tourism Productivity	$\varphi P,$	NT Gamma (0.10,0.01)	0.13	0.13	0.15
Spill-over Effect of Non-tourism Physical Capital on its Productivity	ΦT	Gamma (0.05,0.01)	0.03	0.03	0.04
Congestion Effect of Physical Capital on Non-tourism Productivity	$\varphi C,$	NT Gamma (0.05,0.01)	0.05	0.05	0.06
Autoregressive Parameter					
Productivity of the Tourism Industry	$\rho Z T$	Beta (0.50,0.20)	0.55	0.48	0.70
Productivity of the Non-Tourism Industry	ρZ	Beta (0.50,0.20)	0.93	0.92	0.93
Productivity of the Public Service Industry	ρP	Beta (0.52,0.20)	0.05	0.04	0.07
Total Productivity of all Industries	ρZ	Beta (0.51,0.20)	0.97	0.93	0.90
World Output	ρ_{Yrow}	Beta (0.53,0.20)	0.98	0.94	0.99
Real Exchange Rate	ρ_{RER}	Beta (0.78,0.20)	0.84	0.83	0.84
Land Supply Shock	ρ_{La}	Beta (0.52,0.20)	0.31	0.21	0.37
Tourism Imports Price	$\rho_{CM,}$	T Beta (0.51,0.20)	0.87	0.82	0.90
Non-tourism Imports	$\rho_{CM,}$	NT Beta (0.50,0.20)	0.82	0.80	0.85
Human Capital Accumulation Shock	ρ_H	Beta (0.53,0.20)	0.87	0.79	0.93
Public Service Production Shock	ρ_P	Beta (0.50,0.20)	0.99	0.98	1.00
Standard Deviation	ϵ_{ZT}	IGamma (0.15, 0.25)	0.12	0.10	0.14
Productivity of the Tourism Industry	ϵ_{ZNT}	IGamma (0.15, 0.25)	0.15	0.14	0.16
Productivity of the Non-Tourism Industry	ϵ_{ZP}	IGamma (0.15, 0.25)	0.14	0.13	0.16
Productivity of the Public Service Industry	ϵ_Z	IGamma (0.15, 0.25)	0.13	0.12	0.15
Total Productivity of all Industries	ϵ_{Yrow}	IGamma (0.15, 0.25)	0.13	0.11	0.16
World Output	ϵ_{RER}	IGamma (0.15, 0.25)	0.12	0.11	0.12
Real Exchange Rate	ϵ_{La}	IGamma (0.15, 0.25)	0.34	0.31	0.40
Land Supply Shock	$\epsilon_{CM,}$	T IGamma (0.15, 0.25)	0.18	0.14	0.28
Tourism Imports Price	$\epsilon_{CM,}$	NT IGamma (0.15, 0.25)	0.48	0.45	0.51
Non-tourism Imports	ϵ_H	IGamma (0.15, 0.25)	0.14	0.13	0.15
Human Capital Accumulation Shock	ϵ_P	IGamma (0.15, 0.25)	0.24	0.21	0.27
Public Service Production Shock					

4.2. Post-estimations

Impulse response functions (IRFs) were applied to describe the consequence of a tourism productivity shock on the economic growth in the countries analyzed. The shocks and confidence

intervals of IRFs of selected variables used for periods 1, 5, and 10 in the models estimated are shown in Table 7.

Table 7. Impulse response functions with confidence intervals.

Variables	Period	France		Germany		Japan	
		Shock	90% C. I.	Shock	90% C. I.	Shock	90% C. I.
Tourism Productivity	1	10.00	[9.37, 10.00]	10.00	[9.30, 10.00]	10.00	[8.85, 10.00]
	5	2.62	[1.75, 3.26]	2.55	[1.67, 3.14]	2.32	[1.59, 3.04]
	10	0.58	[0.11, 0.85]	0.43	[0.08, 0.74]	0.40	[0.08, 0.68]
Tourism Price	1	-14.34	[-12.65, -16.07]	-14.18	[-12.25, -15.73]	-15.94	[-12.79, -16.37]
	5	-2.44	[-1.58, -3.62]	-2.17	[-1.33, -3.16]	-2.28	[-1.41, -3.37]
	10	-0.67	[0.00, -1.45]	-0.51	[0.00, -1.23]	-0.53	[0.01, -1.36]
Tourism Exports	1	6.93	[6.15, 7.67]	6.05	[5.63, 6.86]	6.47	[5.881, 7.56]
	5	1.57	[0.79, 2.82]	1.36	[0.64, 2.48]	1.48	[0.73, 2.55]
	10	0.48	[0.06, 0.75]	0.38	[0.03, 0.72]	0.34	[0.02, 0.67]
Tourism Consumption	1	6.66	[5.86, 7.25]	6.23	[5.53, 7.04]	6.59	[5.87, 7.23]
	5	1.42	[0.63, 2.57]	1.55	[0.70, 2.63]	1.72	[0.83, 2.82]
	10	0.52	[0.14, 0.86]	0.62	[0.17, 0.91]	0.75	[0.23, 0.99]
Tourism Investments	1	-13.33	[-15.47, -12.35]	-12.63	[-14.89, -11.33]	-11.86	[-13.68, -11.42]
	5	2.84	[-1.35, 4.63]	2.45	[-1.78, 4.51]	2.17	[-2.57, 4.02]
	10	0.35	[-2.04, 2.47]	0.51	[-2.38, 2.83]	0.41	[-2.15, 2.17]
Tourism Value Added	1	4.74	[3.76, 6.15]	4.04	[3.23, 5.75]	4.84	[3.67, 6.43]
	5	0.55	[0.23, 1.52]	0.37	[0.10, 1.12]	0.58	[0.31, 1.32]
	10	0.36	[-0.18, 0.82]	0.29	[-0.21, 0.78]	0.49	[-0.12, 0.95]
Human Capital	1	0.05	[0.04, 0.07]	0.06	[0.05, 0.07]	0.05	[0.04, 0.07]
	5	0.02	[0.01, 0.04]	0.03	[0.02, 0.05]	0.03	[0.02, 0.04]
	10	0.01	[-0.02, 0.02]	0.02	[-0.01, 0.03]	0.02	[-0.01, 0.04]
Tourism Capital Spill-over	1	10.88	[8.53, 11.95]	10.46	[8.42, 11.43]	10.16	[8.24, 11.28]
	5	2.33	[1.36, 3.28]	2.18	[1.24, 3.18]	2.18	[1.17, 3.24]
	10	0.65	[0.03, 1.06]	0.54	[-0.16, 0.82]	0.58	[-0.12, 0.85]
Non-tourism Price	1	-0.96	[-1.38, -0.46]	-0.99	[-1.40, -0.49]	-0.91	[-1.31, -0.46]
	5	-0.15	[-0.52, 0.33]	-0.16	[-0.52, 0.38]	-0.13	[-0.51, 0.43]
	10	-0.04	[-0.24, 0.47]	-0.03	[-0.21, 0.49]	-0.07	[-0.21, 0.49]
Non-tourism Exports	1	0.34	[0.20, 0.48]	0.32	[0.17, 0.44]	0.36	[0.23, 0.49]
	5	0.06	[-0.13, 0.25]	0.04	[-0.15, 0.23]	0.08	[0.20, 0.48]
	10	0.02	[-0.17, 0.18]	0.01	[-0.17, 0.18]	0.02	[-0.15, 0.19]
Non-tourism Consumption	1	-0.47	[-0.67, -0.23]	-0.52	[-0.61, -0.28]	-0.49	[-0.59, -0.24]
	5	-0.15	[-0.33, -0.02]	-0.13	[-0.30, -0.04]	-0.18	[-0.39, -0.05]
	10	-0.07	[-0.20, 0.15]	-0.06	[-0.16, 0.18]	-0.08	[-0.17, 0.19]
Non-tourism Investments	1	-0.69	[-0.93, -0.49]	-0.77	[-0.97, -0.51]	-0.61	[-0.96, -0.51]
	5	-0.16	[-0.35, -0.13]	-0.08	[-0.32, -0.10]	-0.10	[-0.35, -0.13]
	10	0.03	[-0.15, 0.18]	0.01	[-0.17, 0.16]	-0.02	[-0.18, 0.12]
Non-tourism Value Added	1	0.25	[0.43, 0.13]	0.29	[0.47, 0.14]	0.29	[0.48, 0.16]
	5	0.05	[-0.18, 0.18]	0.05	[-0.20, 0.21]	0.05	[-0.19, 0.22]
	10	0.08	[-0.21, 0.23]	0.06	[-0.17, 0.24]	0.07	[-0.16, 0.26]
Non-tourism Capital Spill-over	1	0.58	[0.27, 0.72]	0.53	[0.24, 0.68]	0.58	[0.24, 0.70]
	5	0.13	[-0.05, 0.28]	0.09	[-0.14, 0.19]	0.12	[-0.11, 0.21]
	10	0.04	[-0.17, 0.20]	0.03	[-0.14, 0.16]	0.04	[-0.14, 0.18]
Public Goods Sector Value Added	1	0.16	[0.04, 0.33]	0.12	[-0.04, 0.32]	0.13	[-0.02, 0.34]
	5	-0.17	[-0.33, 0.08]	-0.09	[-0.26, 0.12]	-0.14	[-0.31, 0.09]
	10	-0.07	[-0.17, 0.15]	-0.04	[-0.15, 0.19]	-0.05	[-0.15, 0.19]
GDP	1	0.54	[0.47, 0.68]	0.56	[0.52, 0.61]	0.49	[0.40, 0.52]
	5	0.28	[-0.13, 0.34]	0.23	[-0.15, 0.32]	0.30	[-0.09, 0.34]
	10	0.07	[-0.17, 0.18]	0.05	[-0.18, 0.16]	0.04	[-0.19, 0.16]
Tourism Employment	1	1.73	[2.00, 1.53]	1.85	[2.13, 1.58]	1.63	[1.88, 1.52]
	5	0.62	[0.44, 0.78]	0.67	[0.46, 0.80]	0.43	[0.46, 0.80]
	10	0.05	[-0.11, 0.16]	0.06	[-0.11, 0.16]	0.04	[-0.11, 0.16]
Non-tourism Employment	1	0.65	[0.57, 0.82]	0.73	[0.58, 0.89]	0.70	[0.59, 0.87]
	5	0.14	[-0.09, 0.26]	0.17	[-0.07, 0.28]	0.15	[-0.06, 0.25]
	10	0.03	[-0.13, 0.18]	0.02	[-0.13, 0.13]	0.03	[-0.10, 0.13]
Public Goods Sector Employment	1	0.68	[0.58, 0.79]	0.57	[0.47, 0.66]	0.59	[0.48, 0.68]
	5	0.06	[-0.11, 0.14]	0.04	[-0.09, 0.14]	0.04	[-0.07, 0.12]
	10	0.03	[-0.08, 0.15]	-0.01	[-0.10, 0.10]	0.02	[-0.05, 0.11]
Unemployment	1	-4.76	[-5.05, -4.33]	-4.82	[-5.22, -4.40]	-4.53	[-4.79, -4.38]
	5	-1.05	[-1.43, -0.77]	-0.93	[-1.32, -0.70]	-0.90	[-1.22, -0.71]
	10	-0.02	[-0.13, 0.14]	-0.03	[-0.11, 0.10]	-0.02	[-0.10, 0.09]

Note: 90% C.I.

For the French model, in the case of a 10% positive shock to the tourism sector productivity, the previous endowment of production variables remained, the supply of tourism services rose, and the price of tourism services fell by 14.34% (14.17% for the German model, and 15.94% for the Japanese

model, with identical productivity shock). Regarding tourism exports, France showed an increase of 6.92% (6.05% for the German model, and 6.13% for the Japanese model). The tourist consumption benefited from this increase in productivity with a growth of 6.65%, 6.23%, and 6.59% in France, Germany, and Japan, respectively. With these results, it was confirmed that the price elasticity of tourist products was less than 1, within the parameters shown by the previous literature. By lowering prices, there was a greater consumption of this type of product, but the physical capital investment was reduced by 13.32%, 12.63%, and 11.85, respectively.

These results produced a boost of the value-added generated by the tourism industry by 4.73%, 4.82%, and 4.53% for France, Germany, and Japan, respectively. To continue with the successive increase in demand, households increase the level of investment in the tourism sector in years after the start of this productivity shock. In turn, this increase in investment produces an improvement in human capital, around 0.05% in the countries, which positively influences the rest of the sectors of the economy, such as the non-tourism sectors and the public sector. Continuing with the effects in the non-tourism sectors, productivity also increased, creating similar effects seen in the tourism sector. Non-tourism prices decreased in the three cases studied, where they decreased by around 1%, and non-tourism exports also increased slightly thanks to the drop in prices. However, in the case of consumption in non-tourism products, the results showed small decreases, of around 0.5%, due to greater dedication of household income to tourism consumption. As the demand for non-tourism products stagnated, it caused a small drop in investment in non-tourism sectors. Finally, thanks to the influence on the improvement of tourism productivity, the added value of non-tourism products also increased, albeit at a slower growth than that produced in tourism products (close to 0.3% for the group of countries analyzed). These results also showed differences with experiences analyzed by previous studies, where the consumption of non-tourism products grew after an increase in productivity in the tourism sector [12–64].

As for the GDP variable, this 10% increase in tourism productivity stimulated the GDP of France, Germany, and Japan by 0.53%, 0.56%, and 0.49%, respectively. The three countries analyzed have registered very moderate growth in recent years, following the trend of western countries. Therefore, as these are countries with a powerful tourism sector, any marginal increase in tourism productivity will significantly stimulate the GDP of these countries. These conclusions support the results shown by previous studies where there was a positive relationship between productivity and growth [12,62]. Our results increase the literature to give response on the spill-over shocks of physical and human capital and public sector on economic growth when an increase of productivity effects occurs [65]. Hence, the results obtained in this paper are an improvement for the tourism development literature and enhance the knowledge on the connection between tourist industry' productivity and sustainable economic growth.

Finally, another important variable, unemployment, decreased by 4.76%, 4.82%, and 4.53% in France, Germany, and Japan, respectively. This was due to tourist employment increasing more than 1.5% in the countries analyzed, and also, the increase in tourist productivity benefited employment in the non-tourist sectors and the public sector, where it increased by around 0.6%. These results show higher unemployment reductions than those experienced by other countries, such as Spain, with an identical change in tourism productivity [14].

These results show how an increase in productivity in the tourism industry also produces a considerable increase in the consumption of tourism goods, but the influence that capital from the tourism sector has on the rest of the economy is more significant. Despite the abrupt drop that can originate in the investments of the tourist activity, the public institutions responsible for the politics in commerce and industry must stimulate the development of new techniques of production and management of the tourist companies like the automation and digital control of tourism services, or the shared value of such management with companies from other sectors, as this can maximize the added value created by the sector and its positive externalities in the rest of the economy. On the other hand, these possibilities of improving productivity and with it a further expansion of the tourism

sector, create new opportunities for the creation of tourism employment, but also an improvement in human capital and employment in sectors not related to tourism activity.

5. Conclusions

This paper shows the generalization of the positive impact causes by tourism productivity in the economic growth and how these positive effects are spread in the improvement of non-tourism sectors and public goods, which is evidenced in the increase in added value and human capital more competitive. The model is calculated with a DSGE-VAR framework using quarterly data on France, Germany, and Japan from 1992 to 2017.

The estimation results show that an increase of 10% in tourism productivity can improve the value-added of the tourist industry overcomes around 3% and boosts around 0.5% of the GDP growth. Because we are dealing with the most important tourism countries in the world, any increase in tourism development will increase GDP in a considerable proportion. Likewise, the precision results show how the extended model of DSGE-VAR is better than the previous model of DSGE in the countries analyzed, both in estimating the prior and subsequent distribution. Also, while an increase in tourism productivity causes a fall in tourism prices, an increase in tourism consumption and, in principle, a fall in tourism investment, the positive effect in other sectors causes different consequences. An increase in non-tourism exports is observed, but a slight fall in the consumption of these non-tourism products and a longer fall in investment. These differences show different results from the previous experiences analyzed in tourism development [12–14]. Even so, this increase in tourism productivity leaves a spill-over in both capital and added value, as does employment in non-tourism sectors and the public sector.

This paper develops two important additions to the existing knowledge on tourism development. First, this paper expands the work of [13] by incorporating the VAR model into a DSGE framework for the model of tourism economics, and generalizing the model for any country. Second, this study analyzes how the factors of tourism performance stimulate tourist activity' development and sustainable economic growth through the confidence intervals of the IRFs, which is a need demanded by the literature to offer policymakers the levels of response on the possible policies analyzed [12,14]. Finally, the relationships shown by the factors studied by our model and the behavior that it maintains over time helps governments and other policymakers to study different ways that obtain different positive externalities from the tourism sector towards other economic activities [13].

This work may also be a useful tool for managing the tourism sector in the face of the 'COVID-19' pandemic crisis. This model shows different possibilities of study regarding the initial situation of a parameter of said sector and how this parameter would affect the rest of the tourism sector as well as other economic sectors and the public sector. Furthermore, thanks to the calculation of the IRFs and their confidence intervals, it is possible to forecast the time durations of the effects caused by the change of a parameter and also how other parameters may evolve throughout a narrow range of results. Therefore, the reference of said time evolution of the parameters according to the tourism sector and other sectors can help control the effects that the public restrictions caused by the pandemic can produce and its trend according to the evolution of said restrictions.

The results of this study can envisage several future research ideas. In recent years, the effects of unconventional monetary policy have been increasingly analyzed. In this case, future research could focus on the effects of this kind of policy on the sustainability of economic growth, with indicators such as tourism expenditure and energy consumption. Likewise, another recent line of investigation of economic growth is the analysis of fiscal limits, so it would be convenient to study how the tourism sector would react to the application of different fiscal policies concerning other sectors. The introduction of tourist rentals as a new important market in the tourism sector and its effect on economic growth and tourism activity would be an interesting aspect to research.

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and A.L.-G. All of the authors wrote the discussion and conclusions. All authors have read and agreed to the published version of the manuscript.

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