THE IMPACT OF TOURISM ON ECONOMIC GROWTH: A DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM APPROACH

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The Impact of Tourism on Economic Growth:

A Dynamic Stochastic General Equilibrium Approach

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CERTIFICATE OF ORIGINALITY

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Abstract

The academic community has studied the impact of tourism on economic growth since the 1990s. Scholars have advocated a tourism-led economic growth (TLEG) hypothesis using the case of Spain and found a significant positive correlation between international tourism and economic growth in most instances. However, most extant studies adopt an econometric approach. The reduced models used in this method lack explicit theoretical support and do not reflect the operating mechanisms of an economy. In other words, a positive correlation found using an econometric approach is insufficient to confirm that tourism leads to economic growth, and cannot explain the causalities among different variables.

This study investigates the contribution of tourism to economic growth when there is a productivity shock in the tourism sector. The study uses Mauritius, Spain, New Zealand and the USA as sample destinations. To address the issue of asymmetric information in the employment market, a two-sector dynamic stochastic general equilibrium model is constructed that incorporates the search-matching theory. The model is estimated and simulated with actual tourism satellite account and economic data from the selected destinations using the Bayesian method.

The main findings are as follows. First, a productivity improvement in the tourism sector can lead to economic growth in the selected destinations. Second, different sensitivities of international tourists to price changes influence the contribution of tourism development to economic growth. Third, the market structure in terms of domestic and international tourism output moderates the impact of tourism on economic growth. Last but not least, the tolerance of consumers for postponing consumption also affects the relationship between tourism and economic growth.

This research expands the application of the dynamic stochastic general equilibrium model in tourism economics by introducing the search-matching theory to the modelling process and using the Bayesian method to estimate and simulate the model for the first time. From a practical perspective, the study will help destination governments and policy-makers to develop long-term tourism policies and strategies.

Key Words: Tourism, Economic Growth, Dynamic Stochastic General Equilibrium, Bayesian Method

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Table of Contents

List of Tables

List of Figures

1. Introduction

Modern tourism started when Thomas Cook boarded his special excursion train in 1841 (Brendon, 1991). International travel was dominated by Western tourists until the 1970s, when Asian tourists started to travel internationally as a result of the fast development of the export and processing industries known as the East Asian Miracle. Today, international visitors from emerging markets such as China and Russia are increasingly contributing to the international tourism market.

Countries endowed with tourism resources have enjoyed fast growth and benefitted from sustained and strong overseas tourism demand. Tourism can play an important role in the economic growth, employment rate and particularly the export industry of a destination. Governments and industries need to identify the relationship between tourism and economic growth to minimise policy risks. Consequently, studying the contribution of tourism to economic growth from both theoretical and practical perspectives is essential and necessary.

The rest of this chapter is organised as follows. The development of tourism and its economic impact is introduced briefly in the next section. After reviewing the history of tourism in recent decades, the research questions are stated and the research objectives are demonstrated. Finally, the contributions of this study are presented, followed by the outline of the thesis.

1.1. Background

Tourism has enjoyed sustained and rapid development in recent decades. In 2014, 1133 million international tourists generated US$1245 billion in tourism receipts and 9% of the global GDP (World Tourism Organization [UNWTO], 2015). UNWTO (2012b) estimated that the contribution of domestic tourism to economic growth is around 1.5 times as much as that of international tourism. Thus, the total contribution of tourism is very large. Statistics on domestic tourism are either unavailable or incomparable due to the application of different measurements and concepts, thus the brief review of the development and economic impact of tourism in the following sub-sections focuses on international tourism. However, it should be kept in mind that if domestic tourism is taken into consideration, the scale and influence of tourism would be much more significant.

1.1.1. The Development of International Tourism

The rapid economic growth after World War II (UNWTO, 2015) made tourism one of the largest and fastest-growing industries in the world.

Table 1.1 and Figure 1.1 show that international tourist arrivals grew rapidly from 25 million in 1950 to 69 million in 1960, representing a more than 10% annual growth rate. Although industrialised countries suffered two oil crises in the 1970s and Asian economies, particularly Southeast Asian countries, were ravaged by the Asian Financial Crisis in 1997 and 1998, international arrivals increased from 278 million in 1980 to 440 million in 1990 and reached 677 million in 2000. International tourism has continued to grow in the new century, despite a few disturbances, such as the 9/11 terrorist attack and the severe acute respiratory syndrome (SARS) in 2003. The event that had the most severe negative impact on tourism demand was the global financial crisis in 2008 and 2009. This crisis decreased international arrivals by more than 4% in 2009, which is the largest decline since 2000. However, international tourism recovered quickly in 2010, due to the exponential expansion in outbound departures from emerging markets such as

China and Russia. International arrivals for the first time broke the 1000 million mark in 2012 and peaked at 1133 million in 2014.

Table 1.1 International Tourist Arrivals and Receipts 1950-2014

Year	Tourist Arrivals (million)	Annual Growth Rate	Tourism Receipts (US$ billion)	Annual Growth Rate
1950	25	-	-	-
1960	69	10.60%	7	-
1970	166	9.12%	18	10.00%
1980	278	5.31%	103	19.17%
1990	440	4.68%	264	9.82%
2000	677	4.42%	475	6.06%
2001	676	-0.03%	464	-2.42%
2002	696	2.96%	482	3.90%
2003	690	-0.86%	529	9.84%
2004	762	10.43%	634	19.85%
2005	807	5.91%	703	10.88%
2006	853	5.70%	768	9.25%
2007	909	6.57%	885	15.23%
2008	927	1.98%	970	9.60%
2009	891	-3.88%	885	-8.76%
2010	949	6.51%	966	9.15%
2011	995	4.85%	1081	11.90%
2012	1035	4.02%	1116	3.24%
2013	1087	5.02%	1197	7.26%
2014	1133	4.23%	1245	4.01%
2005-2014	-	3.84%	-	6.56%
1950-2014	-	6.04%	-	8.30%

Source: UNWTO (2006, 2015)

Tourism receipts[1] rose rapidly from US$7 billion in 1960 to US$1245 billion in 2014. The average annual growth rate of tourism receipts during the last decade was 6.56%, which is twice the growth rate of arrivals. Tourism receipts are the means of transforming international tourism demand into

[1] The term 'tourism receipt' is used interchangeably with 'tourist expenditure'. The former is defined from the supply perspective, whereas the latter is defined from the demand perspective.

a destination's economic growth. Tourism receipts inject money into a destination's economy and this money has a flow-on effect throughout the economy. Therefore, the expansion of the tourism industry can affect other industries and the whole economy through a series of chain effects. Thus, although both tourist arrivals and tourism receipts, shown in Figure 1.1, may be highly correlated to the growth of gross domestic production (GDP), the relationship between tourism receipts and GDP is closer.

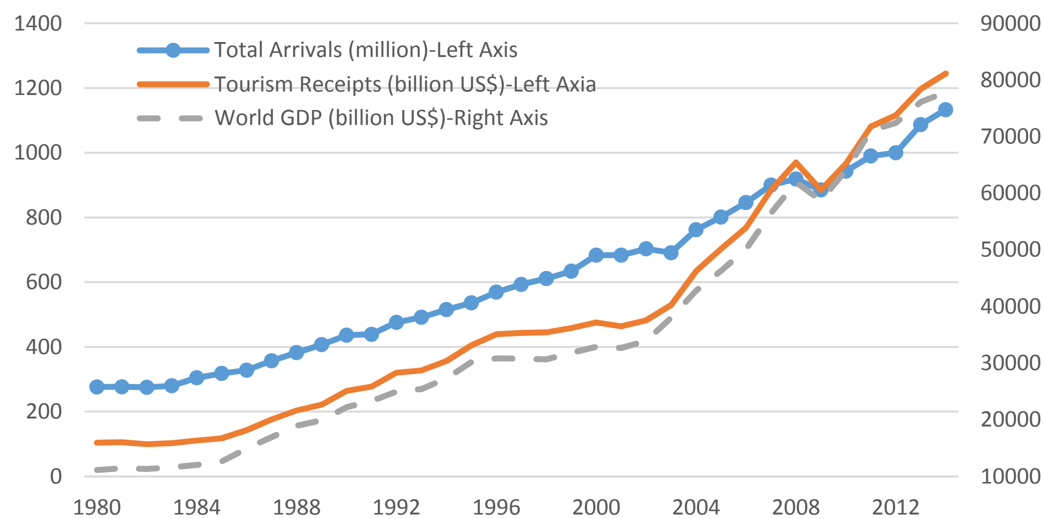


Figure 1.1 Growths in Tourist Arrivals, Tourism Receipts and World GDP

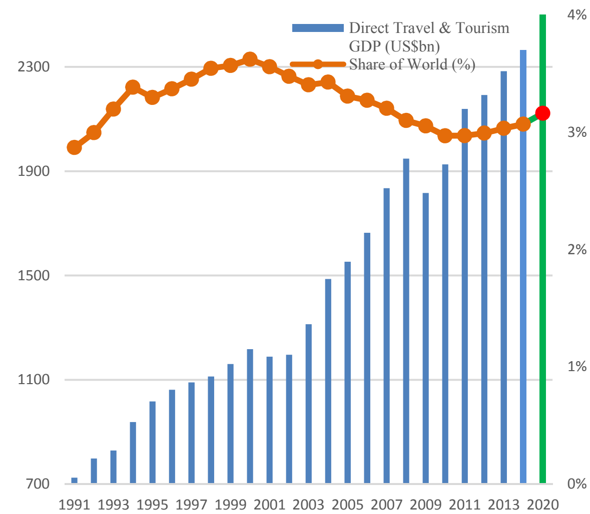
Source: UNWTO (2006, 2015); The World Bank (2015)

1.1.2. The Economic Impact of International Tourism

International tourism plays an important role in the world's economy, especially in the recovery from the global financial crisis in 2008 and 2009 (UNWTO, 2013b). The economic impact of international tourism can be measured by direct and total travel and tourism GDP; total travel and tourism employment; or world visitor exports (World Travel and Tourism Council [WTTC], 2013a).

Direct travel and tourism GDP is the GDP generated by the industries that provide services directly to tourists. Total travel and tourism GDP includes both indirect and induced effects generated by the direct tourism services. The total travel and tourism employment measurements substitute employment data for GDP. World visitor exports is a measure of the expenditures of all international tourists at a destination (WTTC, 2013b). These data are not completely available for all destinations, but are estimated based on the US data. However, this dataset can be used to show the impact of international tourism on the global economy (WTTC, 2013c).

Figure 1.2.1 and Figure 1.2.2 show that direct and total travel and tourism GDPs, which are driven by the strong global tourism demand, have experienced rapid growth since 2003. International tourism output suffered a negative growth in 2009, but recovered quickly in 2010. Direct travel and tourism GDP expanded from US$1926 billion in 2010 to US$2365 billion in 2014, and is predicted to peak at US$3211 billion in 2020. The direct effect of tourism accounts for around 4% of the global GDP. Furthermore, the non-direct output generated by tourism accounts for another 5-6% of the global GDP. Therefore, total travel and tourism GDP accounts for approximately 9% of global GDP. This contribution is forecast to reach US$10292 billion in 2020. International tourism contributes about 3.5% to fixed asset investment and 10% to employment (Figure 1.2.3 and Figure 1.2.4) in addition to its impact on GDP. If the output generated by domestic tourism is taken into consideration, the impact of tourism on economic development is even more significant.



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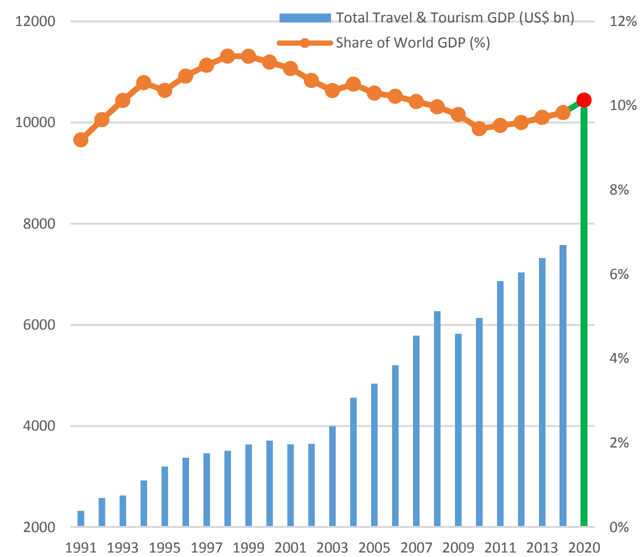

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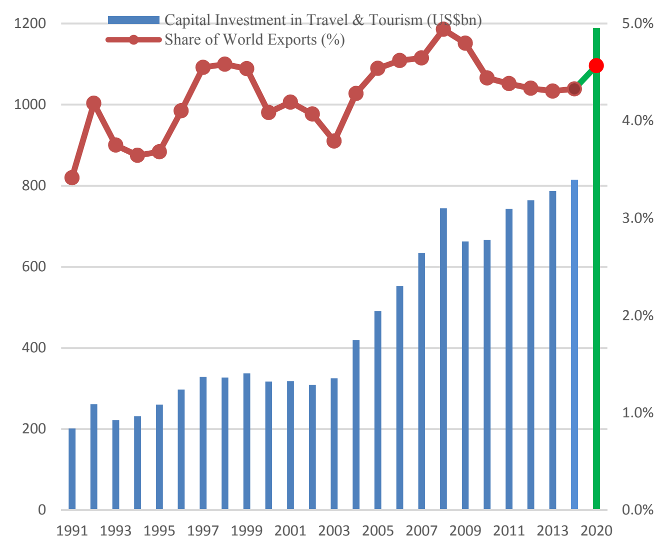

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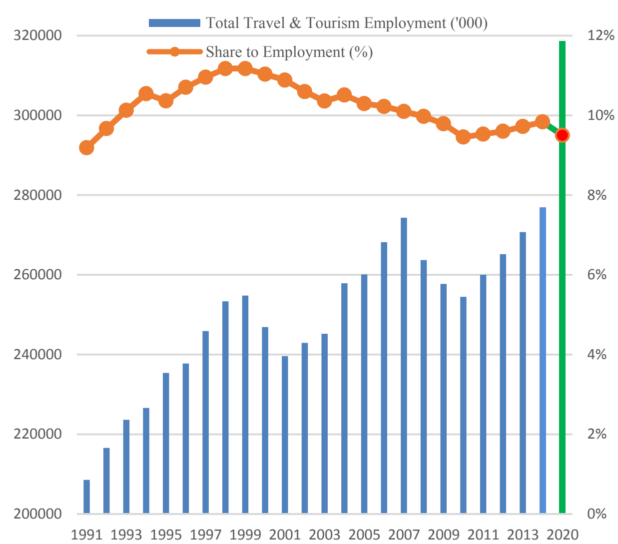

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Figure 1.2 Contributions of Travel & Tourism to the World's Economy

Source: WTTC (2015)

Table 1.2 2014 Top 10 Destinations Measured by Different Indices

Rank	Tourism Receipts	Share to the World	Total Travel & Tourism GDP	Share to the World
1	USA	14.23%	USA	20.02%
2	Spain	5.24%	China	13.46%
3	China	4.57%	Germany	4.90%
4	France	4.45%	Japan	4.90%
5	Macau SAR	4.08%	UK	4.42%
6	Italy	3.65%	France	3.64%
7	UK	3.64%	Italy	3.09%
8	Germany	3.48%	Spain	3.06%
9	Thailand	3.08%	Brazil	2.99%
10	Hong Kong SAR	3.08%	Mexico	2.70%

Source: (1) UNWTO (2015); (2) WTTC (2015); (3) The World Bank (2015)

Tourism has become globally diversified. The rankings of the top 10 destinations vary significantly across different indices (see Table 1.2). The USA receives the most tourism expenditures from international tourists and generated the largest total travel and tourism GDP, 14.23% and 20.02% of the global total, respectively.

Spain has the second highest tourism expenditure; about 5.24% of the global tourist expenditures were spent in Spain in 2014. However, the tourism GDP generated by the country only accounted for 3.06% of the global travel and tourism GDP; Spain ranked eighth among the 184 destinations in this measurement. In contrast, China only received 4.57% of the global expenditures, but contributed 13.46% to the total global travel and tourism GDP. The USA, Spain, China, France, Italy, the UK and Germany are the only seven destinations that appear in both rankings. The other six destinations do not appear in both tables, indicating that the differences between tourism expenditures and generated GDP of these six destinations are significant. Clearly, international tourism demand does not necessarily equal tourism GDP. A high tourism GDP does not necessarily make a significant contribution to a destination's total GDP, even if domestic tourism is taken into consideration, as several factors, such as economic structure, labour costs and the tourism endowment of the destination, may influence the efficiency of the transformation between tourism demand into economic growth. Thus, the relationship between tourism and economic growth is complicated. The research objectives of this study are discussed in detail in the next section. The aim is to determine the mechanisms that transform tourism into economic growth.

1.2. Problem Statement and Research Objectives

1.2.1. Problem Statement

Mature destinations often support the development of the tourism industry. Tourism accounted for 4.5% of Hong Kong's GDP in 2012, and the Hong Kong Tourism Board (HKTB) spends millions of US dollars promoting Hong Kong as a tourist destination. The marketing budget of HKTB was approximately US$56 million in 2013. The Hong Kong government provided a loan of more than US$300 million to support the further expansion of the Ocean Park, which is one of the best theme parks in the world (HKTB, 2013; The Hong Kong SAR Government, 2013). The economy of Spain, which receives the second largest amount of tourism expenditure, is more dependent on tourism; it accounted for 10.9% of Spain`s GDP in 2012 (National Statistics Institute of Spain [NSIS], 2013). Although the budget of the Spanish Tourist Aboard was reduced by 16.7% in 2014 due to the debt crisis, the Spanish government allocated an additional EUR372 million in 2014 to support tourism businesses and invested another EUR6 million in a tourism promotion campaign (Tourism-Review, 2013).

Emerging markets are attracted by the substantial profits of tourism and have adopted tourism as one of the pillar industries of their economies. China announced it plans to develop tourism into a strategic pillar industry in its twelfth Five-Year Plan from 2011 to 2015, and issued the first Tourism Law in 2013 to upgrade the tourism industry and regulate the tourism market more efficiently (Xinhua Net, 2011, 2013). Smaller destinations tend to adopt a regional development strategy. The Association of Southeast Asian Nations (ASEAN), on behalf of 10 Southeast Asian destinations, published the ASEAN Tourism Marketing Strategy for 2012 to 2015 (ASEAN, 2011) to promote intra-ASEAN tourism. The South Pacific Tourism Organization (SPTO), which is composed of 17 island economies in the South Pacific, plans to facilitate cruise shipping and aviation expansion in the future to increase the contribution of tourism to economic growth (SPTO, 2013).

However, increasing tourism demand may not generate equivalent tourism GDP, and a significant contribution from the tourism industry to GDP is not a sufficient condition for fast economic growth, as shown in Table 1.2 (Page 7). According to the Law of Comparative Advantage, countries engaged in international trade must have comparative advantages to maximise global welfare (Ricardo, 1911). In other words, not all countries can achieve economic growth through the development of tourism. Thus, it is essential that countries or regions determine whether tourism will contribute to economic growth before developing any tourism strategies.

1.2.2. Research Objectives

This study uses the dynamic stochastic general equilibrium (DSGE)[2] approach to understand the relationship between tourism and economic growth. Its four sub-objectives are as follows:

1) comprehensively review research on tourism and economic growth and identify the research gap;
2) develop a theoretical framework that considers tourism as a pillar industry;

[2] The DSGE model is also known as the real business cycle (RBC) model.

3) test the framework using data from particular countries; and
4) examine whether tourism could lead to the economic growth of the selected destinations in the long-run.

This study will explore whether tourism can lead to economic growth in different types of economies. The confirmation that tourism has a significant effect on economic growth is essential to both government and industry policies in several ways. First, developing tourism often requires expensive and long-term investment in infrastructure such as the expansion of cruise shipping terminals and airports in South Pacific destinations (SPTO, 2013). Thus, if the contribution of tourism to economic growth is unclear or slow, the extremely high sunk cost could be too high for host governments. This is a real and critical problem faced by some European governments, as they urgently need to promote economic growth, but are financially limited by the debt crisis.

Second, macroeconomic policies target industries that contribute the most to economic growth. One of this study's objectives is to simulate and calculate the contribution of tourism to economic growth. Thus, the results can help governments identify whether developing tourism at a destination will lead to sustainable economic growth. The results will also help enterprises to identify good investments in the tourism industry. Hence, testing the relationship between tourism and economic growth helps governments formulate and implement long-term development strategies and helps enterprises make investment decisions.

1.3. Contributions of the Study

The study contributes to theory and practice in the following ways.

1.3.1. Theoretical Contributions

Most studies use econometric models to test the relationship between tourism and economic growth, and this limits scholars to the development of theoretical models based on modern macroeconomics. This study contributes to tourism economic research by developing theoretical frameworks based on the DSGE approach and by testing the developed frameworks with actual data. The DSGE model provides a stronger theoretical foundation than the econometric approaches and can explore the effects of the 'deep parameters' in the economy, which characterise the fundamental behaviours of agents in the model and are not easy to measure in econometric studies such as the discount rate and preference (Wickens, 2012). The specific theoretical contributions of this study are as follows.

1) The DSGE model, which Kydland and Prescott (1982) used to explore the impact of a productivity shock on economic fluctuations, is based on the microeconomic assumption that households maximise utility and firms maximise profit. The model is composed of a series of dynamic equations with stochastic shocks to capture the behaviour of different representative agents in the economy, and is solved under the general equilibrium framework.
2) Search-matching theory provides a strong microeconomic foundation for the interaction between job hunters and employers by modelling the asymmetric information dynamically, which prevents instantaneous job matching in the labour market. To highlight the role that tourism plays in improving employment, the search-matching theory is introduced to tourism studies for the first time to make the model closer to the reality.

3) This study is the first to apply the Bayesian method to estimate DSGE models in tourism studies. The Bayesian method is a combination of calibration and traditional econometric methods that integrates information from both prior published studies and real data to provide an accurate estimate of parameters and significantly improve simulation results. Reasonable estimation results are vital, as the relationship between tourism and economic growth is tested by the simulation method, which is based on the estimation results of Bayesian method.

4.3.2. Practical Contributions

This study makes two practical contributions.

First, the findings may provide useful insights into the suitability of tourism as a pillar industry of a particular destination. The selected sample destinations cover a range of economic structures and industrialisation stages, such as island economies, industrialised countries and destinations with large territories. Governments considering promoting economic growth through tourism may find these insights into the impact of tourism on economic growth useful.

Second, governments can use the framework developed in this study to simulate the contribution of tourism to the economic growth of a particular destination before formulating long-term strategies, as the two-sector model can be applied to most economies, including island economies that rely on tourism. This approach provides evidence that will decrease policy risks and avoid an unnecessary waste of resources.

1.4. Structure of the Study

The thesis is composed of six chapters, shown in Figure 1. 3. Chapter 1 introduces the background, problem statement, and research objectives and then outlines the theoretical and practical contributions of the thesis. It concludes by summarising the structure of the thesis.

Chapter 2 presents a comprehensive review of extant studies on tourism and economic growth. A brief introduction to the development of economic growth theory is presented to establish the theoretical background of this study. Previous studies of the DSGE and econometric approaches are reviewed separately. This study is the first to examine tourism and economic growth from the perspective of DSGE approach. DSGE models are reviewed despite the presence of the econometric approaches (including time series, panel data and cross-sectional models). The advantages and disadvantages of each method are compared and summarised. The research objectives and contributions of the study address the research gaps identified in these reviews.

Chapter 3 introduces the methodologies used to establish, solve and estimate a DSGE model. The framework used in this study is proposed based on a simple DSGE model that can be solved by hand. Next, the methods for solving and calibrating models, and the Bayesian method are introduced, followed by the introduction of the selected destinations, Mauritius, Spain, New Zealand and the USA.

Chapter 4 demonstrates the use of a two-sector DSGE model in an open economy with search-matching theory under the framework developed in Chapter 3. Due to their dynamic nature, DSGE models must consider how an economy changes from one time period to the next. This typically involves both capital accumulation and forward-looking behaviour, whereby households decide how to allocate their income between savings and consumption, based on their knowledge of future prices and wage rates with the consideration of uncertainty. To estimate the model with the Bayesian method, all of the equations have to be transformed from non-linear to linear forms using the log-linear method. These results are shown following the demonstration of the model. Lastly, the transformation from the observable tourism and economic measurements to the variables defined in the model is illustrated, followed by a description and pre-treatment of the data used in the Bayesian estimation.

Chapter 5 presents and discusses the Bayesian estimation and simulation results. The findings for each destination considered in this thesis, Mauritius, Spain, New Zealand and the USA, are then presented. For each destination, after the introduction of the calibration result, the estimation result is presented and discussed. Next, the simulation result of the baseline model, together with the simulations of key parameters with different priors, are discussed. Lastly, the simulation results of the four models are compared to investigate the overall relationship between tourism and economic growth.

Chapter 6 summarises the main conclusions of the study, discusses its contributions and limitations and offers suggestions for future research.

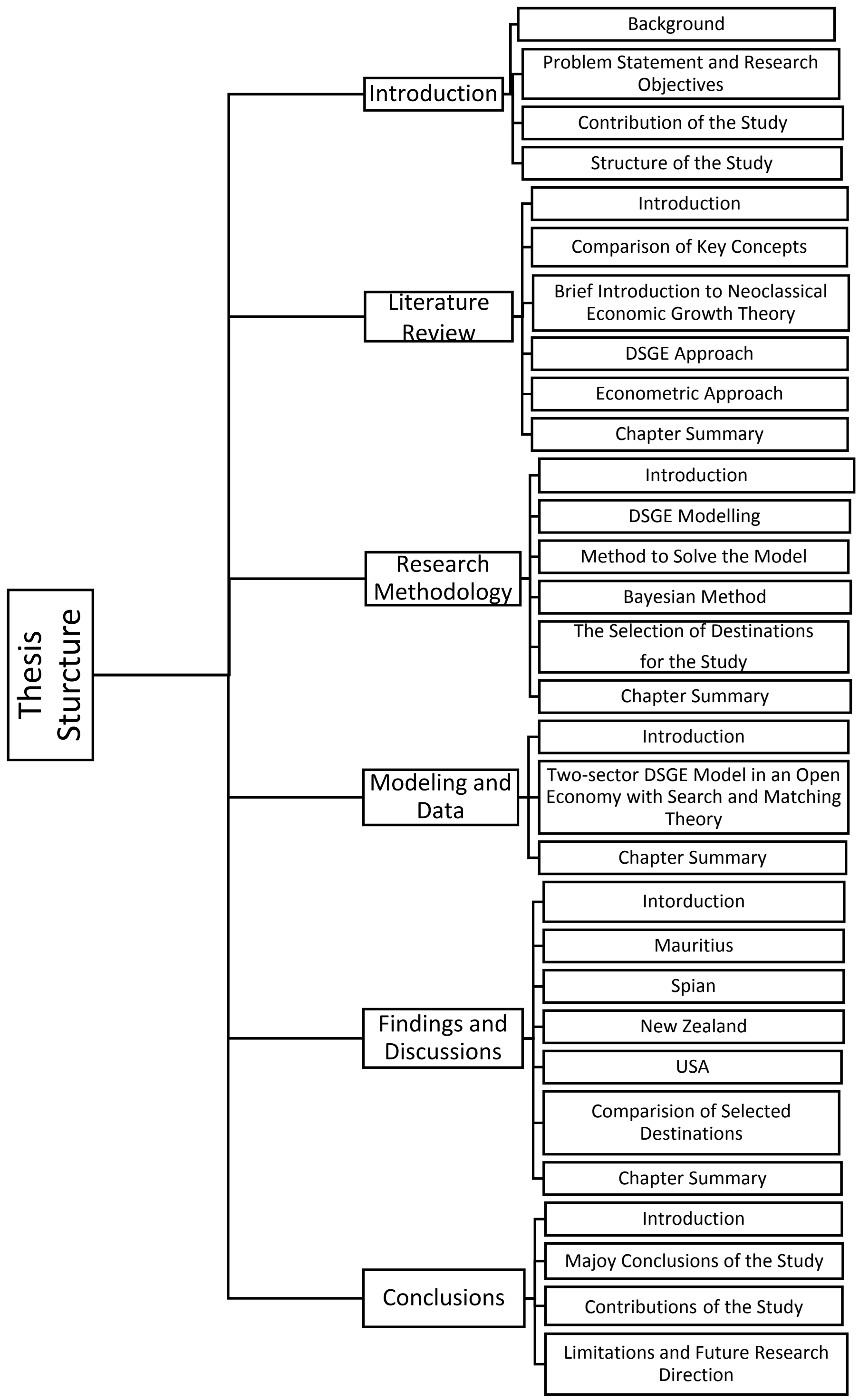


Figure 1. 3 Structure of the Study

2. Literature Review

2.1. Introduction

Although the study of tourism and economic growth can be traced back to the 1970s (e.g., Ghali, 1976), according to Google Scholar, in the 1970 to 2014 period only 306 articles were published that used the terms ‘tourism’ and ‘economic growth’ in the titles. In contrast, in the same period, 683 publications had the term ‘economic development’ and 360 had the term ‘economic impact’ in their titles. Although these figures indicate that the study of tourism and economic growth has been limited, scholars have recently begun to investigate this relationship. Of the 306 studies that focus on tourism and economic growth, 30 were published before 2002 when the tourism-led economic growth (TLEG) hypothesis was proposed by Balaguer and Cantavella-Jordá (2002), 146 were published between 2002 and 2010 and 130, nearly half of them, were published after 2010.

A similar trend can be observed in reviews of tourism economics. In the earlier reviews such as those by Eadington and Redman (1991) and Sinclair (1998), tourism and economic growth was not categorised as an independent topic, but they were discussed as aspects of regional economic impact and economic development. However, in the review of Song, Dwyer, Li and Cao (2012), tourism and economic growth was reviewed as a topic, and Pablo-Romero and Molina (2013) reviewed empirical studies of TLEG.

This recent scholarly interest in the relationship between tourism and economic growth means that it is necessary to review the current range of theoretical and empirical perspectives. Such a review can identify the limitations of current studies and useful future research directions. In addition to reviewing the extant empirical studies, this review pays particular attention to the development of the theoretical models. The articles reviewed in this chapter have been obtained from the Social Science Citation Index (SSCI), Google Scholar, EBSCO host and citations from the most current articles.

Before reviewing these tourism studies, a comparison of key concepts and a brief introduction to neoclassical economic growth theory are presented in Sections 2 and 3, respectively. Section 4 highlights the studies that investigate the impact of tourism on economic growth using the DSGE model. This section also highlights the characteristics of the DSGE model by comparing it with another economic modelling approach known as the computable general equilibrium (CGE) model. Section 5 reviews the studies that use econometric methods to find empirical evidence for the TLEG hypothesis. Section 6 summarises the findings of the literature review.

2.2. Comparison of Key Concepts

Before reviewing the literature, it is necessary to first describe the concepts that will be involved in the review.

2.2.1. Economic Growth and Economic Impact

The first two concepts that need to be clarified are economic growth and economic impact. According to the neoclassical economic growth theory, the driving forces of economic growth are accumulated capital (including physical and human capital) and productivity development (Lucas, 1988). Thus, to investigate the TLEG hypothesis from the perspective of economic growth, it is necessary to determine how capital or technical accumulation in the tourism industry affects the aggregate output growth of the economy in the long-run. The concept of economic impact is broader than that of economic growth. When researchers analyse economic impact, they normally calculate how much the tourism industry contributes to output growth and the interactions between tourism and other industries.

The conclusions obtained from these two types of studies have different policy implications. Research on economic impact provides empirical evidence that can be used to build hypothesis for further studies. In contrast, research on economic growth can explain the evidence and test the proposed hypothesis. As the expansion of any industry would contribute to some extent to economic growth, the information provided by analyses of economic impact may not be enough to support policy decisions related to tourism; stakeholders not only need to know 'how much', they also need to know 'how', before they make decisions. As a result, the conclusions obtained from economic growth studies are more useful than those obtained from economic impact analyses.

2.2.2. Supply and Demand Shock

The second pair of concepts that is essential to clarify is that of supply and demand shocks in an economic model. Straightforwardly, supply shocks are shocks from the supply side, for instance a productivity shock, whereas demand shocks are shocks from the demand side, such as an increase in the income of tourists. Different understandings of supply and demand shocks are the basis of the establishment and development of neoclassical and Keynesian economics, two dominant schools of thought in economics, and a comprehensive comparison is not presented here. However, in general, economic growth focuses on long-term changes and is driven by supply-side issues such as changes in productivity or capital (Lucas, 1988). In contrast, demand shocks are usually used to study short-term economic fluctuations.

In fact, the impact of supply shocks on tourism is not a new topic. Butler (2000) suggested that to avoid a decline in the number of tourists during the last stage of a tourism area life cycle, and to make tourism sustainable, a destination should provide new attractions or develop an untapped nature resource. Both these solutions are supply shocks. Blake, Sinclair and Soria (2006) found that managers in the tourism industry agreed that increasing capital and productivity could benefit business. Furthermore, from the macroeconomic perspective, they used a CGE model of the UK to show that a positive productivity shock created more benefits for the economy.

2.2.3. Granger Causality

Granger causality is a statistical test used in time series analysis to examine whether one variable can be used to forecast another (Granger, 1969). If the test is passed, scholars describe the relationship between two variables as one in which the first Granger causes the second. From this definition, it can be seen that the causality here does not refer to any logical cause-effect relationship. In other words, if a variable A 'Granger causes' another variable B, this is not a sufficient or necessary condition to demonstrate that a real cause-effect relationship exists. Granger (2004) also clarified in his Nobel Prize speech that the Granger causality is not real causality in the philosophised sense and that using the name 'Granger causality' made a necessary distinction from other definitions of causality. Thus, if scholars propose to study how the expansion of tourism contributes to economic growth, the Granger causality test by itself is not rigorous enough to give the answer. From a Granger causality relationship, it can only be concluded that tourism demand is useful for forecasting economic growth.

For example, Balaguer and Cantavella-Jordá (2002) developed the TLEG hypothesis from the export-led economic growth hypothesis in international economics and used the cointegration test and Granger causality test to examine the relationships between GDP, tourism earnings and effective exchange rate (all in real terms). Using quarterly data from Spain for the 1971 to 1997 period, they found long-term relationships between the three variables and that tourism earnings Granger-caused the real GDP. As a result, they concluded that tourism lead to economic growth in Spain.

However, Balaguer and Cantavella-Jordá (2002) did not demonstrate the roles that capital or the technologies of tourism played in the economic growth of Spain; thus, their study did not apply the economic growth theory rigorously and the results of the Granger causality test are not sufficient to explain the relationship between tourism and economic growth in Spain. Actually, Balaguer and Cantavella-Jordá (2002) also argued that their results demonstrated a long-term linear relationship between tourism demand and economic growth in Spain and that the relationship was confirmed in the Granger sense.

In fact, the method used in Balaguer and Cantavella-Jordá (2002) could not prove that tourism drives economic growth. However, scholars adopting an econometric perspective use the TLEG hypothesis to argue that economic growth is generated by the development of tourism (Pablo-Romero & Molina, 2013). Since the TLEG hypothesis was proposed, many researchers have examined its applicability to different destinations, different time periods or different data types. Similar studies have emerged without solid theoretical frameworks or rigorous methodologies and thus, there is no consensus on the TLEG hypothesis.

The following literature review assess the methodologies and results of studies based on economic growth theory.

2.3. Brief Introduction to Neoclassical Economic Growth Theory

Numerous economists have contributed to the development of neoclassical economic growth theory since the 18th century. This section briefly outlines the development of neoclassical economic growth theory and introduces its most representative models.

Ramsey's (1928) study is usually regarded as the first to focus on economic growth in neoclassical economics, although its value was not recognised by scholars for several decades. However, the optimal condition of consumption and the intertemporally separate utility function proposed by Ramsey (1928) have been widely used in almost all subsequent studies of economic growth, asset pricing and business cycle theories (Barro & Sala-i-Martin, 2004, p. 17). During the two World Wars, due to the Great Depression and the booms after the wars, growth theory in neoclassical economics did not develop further. In contrast, Keynesian economics enjoyed great popularity. Although it is not necessary to introduce Keynesian economics in detail in this section, it may be useful to point out one of the key characteristics, as it is also used in studies of tourism economics. The key assumption of Keynesian economics is that effective demand is not sufficient. As a result, once the aggregated demand is altered, the supply side can adjust to match the change in the demand. However, in neoclassical economics, the assumption is that the driving force of economic growth is the technology and capital of the supply side (Lucas, 1988).

Keynesian economics was very successful in stimulating economies after the wars and became dominant in mainstream economics until the 1970s when stagflation emerged in the USA, bringing simultaneous high inflation and unemployment rates. However, Keynesian economics were not originally used to explore the driving forces of economic growth, but specialised in studying economic fluctuations. Thus, when scholars focus on long-term economic growth, some of them return to neoclassical economics.

The first generation of neoclassical growth theory produced the exogenous growth theory as represented by the Solow-Swan model (Solow, 1956; Swan, 1956). They used a neoclassical production function with constant returns to scale, diminishing returns of factors and a substitution effect between factors. The details of these characteristics can be found in Barro and Sala-i-Martin (2004). Assuming there is only one representative firm and one household in the economy, the production function can be written in the Cobb-Douglas form as

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha} , \tag{2.1}$$

where Y_t is the output, K_t is the capital stock and N_t is the labour input; $A_t > 0$ is the level of the technology (it is named productivity as well) and $0 < \alpha < 1$ is the production elasticity of capital. In exogenous growth theory, two of the driving forces of economic growth are exogenous technological improvements (A) and population growth (N). To keep a steady growth of physical investment, the Solow-Swan model assumes a fixed saving rate. As a result, the physical investment in period t can be expressed as

$$I_t = s \cdot Y_t , \tag{2.2}$$

where I_t is the investment of period t, and s is the fixed saving rate. The change of the capital stock is

$$K_{t+1} = I_t + (1 - \delta - n) K_t , \tag{2.3}$$

where δ and n are the depreciation rate and population growth rate, respectively. As a result, in steady state, the capital stock satisfies

$$s \cdot \overline{Y} = (n + \delta)\overline{K} \ , \tag{2.4}$$

where $\overline{Y}$ and $\overline{K}$ are the corresponding steady state values, respectively. According to Equation (2.1), the output Y is also a function of K, so $\overline{K}$ can be calculated by Equation (2.4). And then, based on the national income identity, the consumption C, in steady state could be obtained as

$$\overline{C} = (1 - s)\overline{Y} \ ,$$

(2.5)

To further refine the theory, the Cass-Koopmans model, proposed by Cass (1965) and Koopmans (1965), used the optimal condition of the consumption decision in Ramsey (1928) and transformed the saving rate in the Solow-Swan model from an exogenous variable to an endogenous one.

Each household aims to maximise the overall utility subject to its resource constraints as

$$L = \sum_{s=0}^{\infty} \beta^{s} \{U(C_{t+s}) + \lambda_{t+s}[Y_{t+s} - C_{t+s} - K_{t+s+1} + (1 - n - \delta)K_{t+s}]\} \ , \tag{2.6}$$

where $U(C_t)$ is the utility function that is assumed as a concave function such that $U'(C_t) > 0$ and $U''(C_t) < 0$. It is also assumed that $U(C_t)$ satisfies the Inada conditions such that $U'(C_t) \to \infty$ as $C_t \to 0$ and $U'(C_t) \to 0$ as $C_t \to \infty$, respectively. β and λ are the discount factor and Lagrange multiplier, respectively. After reallocating the first order conditions (FOCs), the Euler Equation can be written as

$$\frac{U'(C_{t+s})}{U'(C_{t+s+1})} = \beta[1 + F'(K_{t+s+1}) - \mathrm{n} - \delta] \quad . \tag{2.7}$$

In the steady state, as the time subscripts can be dropped, the left side of Equation (2.7) equals the unit, so that

$$F'(K) = \frac{1}{\beta} + n + \delta - 1 \quad . \tag{2.8}$$

Using Equations (2.1) and (2.4), the endogenous saving rate can be obtained. Furthermore, Srinivasan (1964) expanded the model from one sector to two sectors.

Although these studies make the exogenous growth theory more reasonable, empirical economists found that the theory was not easy to match with the actual economic data due to the limitations of some key assumptions, such as diminishing returns to inputs. These assumptions lead to the conclusion that economic growth is only driven by technological improvements and population growth. Accordingly, the theory cannot explain why two economies using the same technology and sharing similar population growth rates grow at different rates. This indicates that the model does not contain all of the determinants of economic growth.

From the 1960s to the 1980s, studies of growth theory almost disappeared, and scholars developed the CGE model to study the impact of the changes in exogenous variables such as tax rates and other policies (Johansen, 1974; Taylor & Black, 1974). The CGE model is based on the neoclassical framework and uses an input-output (IO) table or a social accounting matrix (SAM) to emphasise interactions between different sectors or industries. CGE models are widely used in tourism and in other research areas such as public finance, international trade and environmental economics (Chang, 2010). Meanwhile, Kydland and Prescott (1982) developed the RBC model to investigate economic fluctuations. They assumed that the technical level, A_t in Equation (2.1), is an auto-regression (AR) process with a stochastic shock; thus, the main driving force of the economic fluctuation is productivity. The general equilibrium framework is thus expanded to a dynamic and stochastic version. Consequently, the RBC model is also called the dynamic stochastic general equilibrium (DSGE) model.

The second generation of growth theory, endogenous growth theory (also called new growth theory), was advocated by Romer (1986) and Lucas (1988) in the second half of the 1980s. The core of the theory is that the driving force of economic growth comes from innovation (Romer, 1987, 1990), the spill-over effects of knowledge (Grossman & Helpman, 1991; Romer, 1992) and returns of capital, which includes human capital (Romer, 1986; Lucas, 1988). The model often used in endogenous growth theory is the *AK* model. As human capital is considered a driving force of economic growth, the capital item is combined and unified to be expressed by the *K* in *AK*. According to endogenous growth theory, an economy can experience sustained growth even without technological improvement. The conclusions obtained from endogenous growth theory are closer to the real economy than those obtained from exogenous growth theory because the contribution of human capital to economic growth is also taken into consideration. However, the endogenous growth theory is more difficult to empirically prove, as variables such as human capital and the spill over of knowledge are not easy to measure.

There are a few scholars studying economic growth from other perspectives. Becker, Glaeser and Murphy (1999) relate economic growth to population growth, Krugman (1990) adopts a geographical point of view and Acemoglu (2010) adopts a political institution perspective. However, all of these studies are based on either exogenous or endogenous growth theory. Each of these theories has advantages and limitations and they are not completely substitutable for each other, at least before the birth of the third generation of economic growth theory. Although theories of economic growth are still in development, models based on various theories such as the CGE model or the exogenous or endogenous growth models have been used in studies of tourism and economic growth.

2.4. DSGE Approach

2.4.1 DSGE Models in Tourism and Economic Studies

With the development of DSGE modelling techniques in the late 1990s, scholars started to use neoclassical economic growth theory to investigate the contribution of tourism to economic growth. Earlier applications of the DSGE models were based on international trade theory, and the exogenous and endogenous growth theories were introduced thereafter. However, the studies using these methods are still very limited.

2.4.1.1. DSGE Models based on International Trade Theory

Early applications of the DSGE models in tourism used international trade theories to analyse the relationship between tourism and economic growth. Copeland (1991) took tourism as a trade sector and constructed a static general equilibrium model. The conclusion was that generally speaking, the development of tourism could stimulate economic growth. However, foreign-ownership of the tourism industry can cause de-industrialisation, which means that the expansion of tourism may have a negative effect on other industries and even on the economy as a whole. Hazari and Sgro (1995) developed a more dynamic model and found that if the destination was a small country or region, the expansion of tourism would definitely stimulate economic growth; however, if the destination was a large country or region, the net effect of tourism to economic growth must be considered case by case. Nowak, Sahli and Sgro (2003) used an international trade model with three industries, agriculture, manufacture and tourism, to study the impact of tourism and confirmed the conclusions of Copeland (1991) and Hazari and Sgro (1995) that a tourism boom can have a negative effect on the economy of some destinations.

As all three studies incorporated international trade theories, they also studied the impact of taxes, such as tariffs, on the development of other industries and on the economy, together with welfare analyses of the destinations. More importantly, all three studies believed that the expansion of tourism transformed non-tradable goods and services to tradable ones so that exports increased and the terms of trade improved. From the supply side perspective, more resources could be allocated to capital import, which would further increase the overall output of the economy. From the demand side perspective, the injection of foreign currencies by international tourists could displace, to some extent, domestic savings, allowing local residents to increase consumption and thus stimulate economic growth. These mechanisms were introduced into the framework of exogenous growth theory by Hazari and Sgro (2004) and supported by Schubert, Brida and Risso (2011).

2.4.1.2. DSGE Models based on Exogenous Growth Theory

Based on the findings obtained from studies using international trade theories, Hazari and Sgro (2004, Chapter 11) used the Cass-Koopmans model to study the impact of tourism on economic growth. In contrast to Hazari and Sgro (1995), the imported capital in Hazari and Sgro (2004, Chapter 11) was an imperfect substitute for local capital and had to be used as an input to the production of capital goods. To keep the balance of international trade, tourism was taken as an export good that earns foreign currencies and purchases foreign capital. They proved that to sustain economic growth, the host country or region had to have some degree of monopoly power in the tourism supply market. The policy implication is quite obvious: governments should try their best to find and keep the unique features of their destinations. The more differentiated a host country or region is, the greater the possibility of sustained economic growth driven by inbound tourism.

Álvarez-Albelo and Hernández-Martín (2007) built a similar model to Hazari and Sgro (2004, Chapter 11) and calibrated the model using real data. They used the 24 countries in the Organization of Economic Cooperation and Development (OECD) to represent the capital export countries and identified 13 tourism-specialised countries to stand for tourism export countries. Using data from the 1970s to the 2000s, they confirmed that strong demand for tourism from the overseas markets could sustain economic growth in small countries or regions. Chao, Hazari, Laffargue and Yu (2009) included the wage index in a simulation using Hong Kong data and found that tourism could positively contribute to economic growth, but might have a long-term negative effect on the employment market. They also found that if tourism was taken as a luxury product, the contribution to economic growth was more significant. Nowak, Sahli and Cortės-Jimėnz (2007) built a similar model without the simulation process; they used an econometric model to support the findings obtained from the theoretical model. Similar studies can also be found in Schubernt and Brida (2009) and Zhang (2013).

Not all of the studies support the positive connection between tourism and economic growth. Earlier studies such as Copeland (1991) and Hazari and NG (1993) used static general equilibrium models to prove that a tourism boom might have negative impact on economic growth and welfare. Nowak (2007) used the Cass-Koopmans model and theoretically confirmed that in a small and open economy, if tourism was not a labour-intensive industry, the development of tourism might lead to negative impact on the economy as a whole. Chao, Hazari, Laffargue, Sgro and Yu (2006) incorporated the same model and created simulations using German data from the 1996 to 2002 period. They concluded that the expansion of tourism would cause an outflow of capital from the manufacturing industry, suggesting that tourism developed at the cost of de-industrialisation.

2.4.1.3. DSGE Models based on Endogenous Growth Theory

Studies on endogenous economic growth are quite limited, although the pioneer study can be traced back to Lanza and Pigliaru (1999) who used the static version of the Lucas (1988) model to explain why the economies of small countries specialised in tourism grow faster. They concluded that the absolute size of the economy was not a determining factor. The endowment of a natural resource such as natural scenery was the essential condition for a tourism-specialised country to maintain rapid economic growth, as the endowment could fill the productivity gap between tourism and manufacturing industries. However, they also suggested that their conclusion needed to be empirically tested.

Dynamic models were developed in the late 2000s. Lozano, Gómez and Rey-Maquieira (2008) used an AK model that included environmental quality and public good to demonstrate the relationship between the evolution of destinations and economic growth. After assigning the standard textbook values to the parameters and carrying out simulations, they concluded that the contribution of tourism to economic growth did not depend on the tourism area life cycle, but on the quality of the environment and public goods. Schubernt and Brida (2011) used the AK model with an investment adjustment function to refine the simulation results and Schubernt, Brida and Risso (2011) used the same theoretical model combined with an econometric model to test the theoretical findings. Unlike the studies using exogenous growth frameworks, none of the studies using endogenous growth theory implemented simulations with parameter values obtained from a particular destination to empirically test the theoretical findings. As discussed in Section 2.1, endogenous growth theory is not easy to test empirically as the key variables such as human capital are difficult to measure. This may explain why applications of endogenous growth theory in TLEG studies are limited.

2.4.1.4. Limitations of DSGE Models

There are limitations to the applications of DSGE models in tourism and economic growth research. One of the problems is that the values assigned to the parameters in such studies are arbitrary. Kydland and Prescott (1982) argued that 'The selection of the parameter values should reflect the specifications of preferences and technology that are used in applied studies, and that they should be those values for which the model's steady-state values are near the average values for the economy over the period being explained.'

However, Chao, Hazari, Laffargue, Sgro and Yu (2006) used seven years' data to simulate economic growth and Chao, Hazari, Laffargue and Yu (2009) used cross-sectional data. The parameters defined over short time periods do not reflect the 'preferences and technology' of the economy and the 'steady-state values'. As a result, such calibration obtained unreliable simulation results for understanding economic growth.

Another limitation of DSGE models is the source of the shock. In the few DSGE studies that have implemented simulations, the shocks that trigger economic fluctuations are all from the demand side; for example, Chao, Hazari, Laffargue, Sgro and Yu (2006) considered the shock of tourist expenditure and Schubert and Brida (2011) considered the shock of foreign income. As discussed in Section 2.2, both of these shocks are from the demand side. However, in neoclassical economics, economic growth is driven by the supply side shocks of technology and capital (Lucas, 1998). Therefore, most previous studies have in fact studied the role that tourism plays in short-term economic fluctuations; studies using a DSGE model to examine the relationship between tourism and economic growth in the long-term are limited.

2.4.2. DSGE vs. CGE

DSGE and CGE models have similar modelling methods. The applications of CGE models in the tourism field are reviewed in this sub-section, and then the two methods are compared to highlight the relevant characteristics of the DSGE model.

2.4.2.1. Applications of CGE Models

A CGE model is composed of a series of equations that describe the behaviour of agents from both the demand and supply sides within the framework of neoclassical economics. It is empirically based on IO tables or SAMs to reflect the interrelations between different industries in the economy and accounts in the national account system. As the CGE model can be used to simulate and forecast the effects of big events or economic policies on the economy, it is widely applied in macroeconomic studies of international trade, environment and public finance. It was introduced to tourism economics in the 1990s by Adams and Parmenter (1995) and Zhou, Yanagida, Chakravorty and Leung (1997). Blake, Gillhan and Sinclair (2006) demonstrated the contributions of CGE models to tourism economics and reviewed the extant empirical studies that used CGE models in tourism up to 2004.

Adams and Parmenter (1995) built a CGE model based on the ORANI-F database that included 117 sectors of the Australian tourism industry such as hotel, restaurant and air transport. They simulated a 10% expansion of inbound tourism and found that the overall effect of tourism on the economy of Queensland, the Australian state most focused on tourism, was negative, due to the crowding out effect of tourism on the traditional exports industry. In contrast, they predicted that Victoria, which is less dependent on exports than Queensland but more reliant on air transport, would enjoy significant economic expansion. These results support Copeland's (1991), argument that the expansion of tourism might lead to the contraction of other industries and even have a negative effect on economic growth.

Zhou, Yanagida, Chakravorty and Leung (1997) used Hawaiian data to compare the results of the IO multiplier and CGE model and found that the IO multiplier can over-estimate the economic contribution of tourism by 20-30%, due to the lack of consideration of the interactions with other industries. Blake (2000) found that a 10% increase in tourism lead to a 0.05% growth of GDP in Spain and that raising the tax on foreign tourism appropriately might even stimulate economic growth by improving the welfare of local residents. Sugiyarto, Blake and Sinclair (2003) investigated the relationships between tariff, tourism and economic growth in Indonesia using a CGE model with 18 sectors including hotels and restaurants. The simulation results showed that if the tourism demand increased by 10%, even if both the tariff and indirect tax of domestic goods decreased by 20%, the GDP of Indonesia would grow by 0.7%. Similar studies were conducted by Narayan (2003, 2004) for Fiji; Kweka (2004) for Tanzania; Gooroochurn and Milner (2005) and Gooroochurn and Sinclair (2005) for Mauritius; Sinclair, Blake and Gooroochurn (2005) for Cyprus, Malta and Mauritius; Pratt and Blake (2009) for Hawaii's cruise industry; Meng, Siriwardana, and Pham (2013) for Singapore; and Dwyer, Forsyth, Spurr and Thiep (2003) for the Australian state of New South Wales.

Scholars are also interested in the economic impact of one-off events on tourism industry. Blake, Sinclair, and Sugiyarto (2003) measured the negative impact of the foot and mouth disease in the UK in 2001. They forecasted that due to the spread of the disease, the tourism expenditure in 2001 fell £7.7 billion and this decrease pulled down the GDP by £3.6 billion. Even the disease was improved in the following years, the negative impact would be kept until to 2004.

Blake and Sinclair (2003) also examined the US policies to manage the 9/11 terrorist attack and found that the attack reduced tourism receipts by US$50.69 billion, including US$15.89 billion in expenditures from inbound tourists. The US GDP also decreased by US$27.27 billion, US$10.54 billion of which was caused by the fall in inbound tourists. However, the government implemented policies that would restore the lost tourism receipts and GDP by US$37.47 billion and US$9.34 billion, respectively. Thus, the policies saved 26% of the loss in tourism receipts and 66% of the loss in GDP, respectively, demonstrating the value of the US governments' policy decisions.

Other studies used additional exogenous variables to investigate the role of tourism in relieving or expanding external shocks to an economy. Dwyer, Forsyth, Spurr and Vanho (2006) examined tourism, the Iraq War, SARS and economic growth in Australia. Yang and Chen (2009) investigated the contribution of tourism to the economic recovery of Taiwan from SARS. Lee, Moon and Mjelde (2010) used tourism to study the net effect of the 9/11 terrorist attack and the 2002 World Cup on the economic growth of South Korea. Li, Blake and Cooper (2011) illustrated the contribution of tourism associated with the 2008 Olympic Games in Beijing to economic growth in China. Becken and Lennox (2012) simulated an increase in the price of oil in New Zealand and found that tourism could decrease the negative effect of this supply-side shock on the economy. Li and Song (2013) investigated the effect of visa restrictions on tourists to China as a result of the 1989 Tian'an Men Square incident and the 2008 Beijing Olympic Games. The simulation results showed that both of the visa restriction policies hurt the economy of China. Forsyth, Dwyer, Spurr and Pham (2014) simulated an increase in Australia's departure tax. The result indicated that a 17% increase in the tax rate would lead to a decrease in tourism receipts of foreign visitors by 24.59 to 49.18 million Australian dollars, which would decrease the GDP by 1.89 to 3.80 million Australian dollars. (The simulation results varied with different settings for the price elasticities values.)

2.4.2.2. Comparisons between DSGE and CGE models

DSGE models share many key assumptions with CGE models. For example, both are grounded in general equilibrium theory, both assume that consumers aim to maximise utility and that producers seek to maximise profit, and both assign values to the parameters for calibration taken from earlier studies. As a result, some scholars have argued that the two methods should be grouped together (Kehoe & Prescott, 1995; Townsend, 2010).

There are also differences between DSGE and CGE models. The most significant difference is the research objectives. Although both models adopt a general equilibrium perspective, DSGE models use economic growth theories to not only show growth or fluctuation in the economy, but also to illustrate the relationships between economic growth and fluctuations in different macroeconomic sectors. In contrast, CGE models analyse the economic impact and contributions of each industry to the aggregate growth.

Furthermore, most CGE models are multi-sector models and the numbers of sectors/industries contained in a model can range from several to more than one hundred. As a result, one of the advantages of the CGE models is that they can reflect the interactive effects between sectors or industries in addition to the aggregated effect. Although heterogeneous agents or different sectors can be introduced to DSGE models, the current technology limits the number of consumers or sectors that can be included in the models.

The data used by the DSGE and CGE models are also different. DSGE models use time series data to calculate the steady state values of variables, whereas CGE models use cross-sectional data from IO tables or SAMs. Thus, although CGE models can be developed into dynamic versions, the simulations are based on cross-sectional data. The different types of data used by the two models affects the validity of the simulation results.

In summary, both DSGE and CGE models analyse economic issues from a general equilibrium perspective. DSGE models are preferable when the research objectives are aggregate variables, or when the analysis includes a small number of industries and consumers; CGE models highlight interactions between different sectors/industries. In addition, time series data are suitable for DSGE models, whereas data from IO tables or SAMs are often used in CGE models. However, if the sectors/industries in a CGE model are combined into two or three groups, the dynamic framework and time series data of DSGE models could also be applied, as in the study by Carlstrom and Furest (1997). The boundary between DSGE and CGE models is further blurred in the dynamic computable general equilibrium (DCGE) model (Adam & Parmenter, 1995; Blake, 2009) and DCGE models with uncertainty (Pratt, Blake, & Swann, 2013).

2.5. Econometric Approach

After the TLEG hypothesis was first advanced by Balaguer and Cantavella-Jorda (2002), numerous studies used different econometric models and data types to test the hypothesis. Song, Dwyer, Li and Cao (2012) and Pablo-Romero and Molina (2013) are two recent reviews which involve the issue of tourism and economic growth. Pablo-Romero and Molina (2013) focused entirely on the TLEG issue. Both reviews concluded that most empirical studies could not reject the TLEG hypothesis, although a few obtained completely contradictory findings. Song, Dwyer, Li and Cao (2012) argued that the strong sensitivity of the empirical results was due to the misuse of cointegration and the Granger causality test, as discussed in Section 2.1

In this section, previous studies using econometric approaches are reviewed, with a focus on data types, as in Song, Dwyer, Li and Cao (2012) and Pablo-Romero and Molina (2013). The articles selected in this section are drawn from databases such as SSCI, EBSCOhost and Google Scholar. Although fewer articles are reviewed here than in Pablo-Romero and Molina (2013), the articles cited in this section are more representative and up to date. After a brief description of the selected studies, the studies that use time series data, panel data and cross-sectional data are reviewed. Then, a summary of the studies using the econometric approach is provided.

2.5.1. Studies Using the Econometric Approach

Sixty-four studies published between 2002 and September 2013 use the econometric approach to test the TLEG hypothesis. Detailed information about the studies can be found in Appendix 1. Of the 64 studies, 42 use time series data drawn from approximately 40 destinations; 19 use panel data drawn from more than 150 countries; and 3 use cross-sectional data. The time periods range from 1960 to 2011, and include monthly, quarterly and annual data. The basic information of the 64 studies are summarised in Table 2.1 to Table 2.4.

Table 2.1 shows the growth in the number of empirical studies of TLEG using econometric models. Of the 64 studies, 12.5% were published between 2002 and 2005, 28.1% between 2006 and 2009 and 59.4% between 2010 and 2013. Time series data are the preferred data type, used in 65.6% of the studies. Although only 9% of the articles use panel data, if the use of the Granger Causality test is considered, which extends data from the time series dimension to the panel data context (Hurlin, 2004), the number of the studies that can be considered to use panel data increases significantly. Ten of the 19 panel data studies were published after 2010 and half of them use the panel Granger Causality test to examine the TLEG hypothesis. Cross-sectional data are not suitable for models of economic growth, and the three articles that do use this type of data calculate the average of specific time series data to measure the variables for the different destinations.

Table 2.1 Publications Using Different Data Types in Different Periods

	Time Series	Panel Data	Cross-Section	Sub-total
2002-2005	6	2	-	8
2006-2009	10	6	2	18
2010-2013	26	11	1	38
Sub-total	42	19	3	64

Table 2.2 shows that Granger and cointegration tests are the dominant research methods in time series studies. More than half of the time series studies use both the cointegration and the Granger tests, six use only the Granger test, six use only the cointegration test and another six incorporate other methods. Among the studies using panel data models, the dominant method is the dynamic panel data model developed by Arellano and Bond (2001), followed by the panel Granger Causality test. Table 2.3 displays the common variables in these models. In the time series studies, tourism income, including tourism receipts and tourist expenditure in both nominal and real terms, and real GDP are the most frequently used variables. In contrast, in the panel data studies, ratio variables are often used to represent the development of tourism, and GDP per capita is the dominant index of economic growth.

Table 2.4 shows that 37 of the 42 time series studies (88%) cannot rejcet the TLEG hypothesis, 4 reject the hypothesis and 1 study has opposite conclusions for the short-term and long-term analyses. Among the panel data studies, 73.7% (14/19) cannot reject the TLEG hypothesis, 1 does not and 4 have contradictory results. Two of the three cross-sectional studies cannot reject the TLEG hypothesis and one rejects it. In general, published studies support the TLEG hypothesis. These studies are reviewed in the following sub-sections.

Table 2.2 Methods Used in the Econometrical Approach

	Granger	Conintegration	Granger & Cointegration	Dynamic Panel	Other Methods
Time Series	6	6	24	0	6
Panel Data	5	1	2	8	3
Cross-section	0	0	0	0	3

Table 2.3 Key Variables Used in the Econometric Approach

	Tourism Variable			Economic Growth Variable		
	Tourism Receipt/Expenditure	Tourism Arrivals	Others	Real GDP	GDP per capita	Others
Time Series	28	11	4	27	3	12
Panel Data	4	1	14	1	14	4
Cross-section	1	0	2	0	0	3

Table 2.4 Conclusions Obtained by the Econometric Approach

	Supporting TLEG	Rejecting TLEG	Contradictive Conclusion
Time Series	37	4	1
Panel Data	14	1	4
Cross-section	2	1	0

2.5.2. Time Series Model

The time series model is the most widely used method for studying TLEG. Dritsaki (2004) applied vector autoregressive regression and vector error correction models to quarterly data from Greece for the 1960 to 2000 period. He also used the Johansen cointegration test (Johansen, 1988) and Granger test given in Balaguer and Cantavella-Jorda (2002). The conclusion obtained by Dritsaki (2004) could not reject the TLEG hypothesis.

Dubarry (2004) used the Engle-Granger two-stage cointegration test (Engle & Granger, 1987) instead of the Johansen test to study the long-term relationship between tourism and economic growth in Mauritius during the 1952-1999 period, and concluded that a long-term relationship existed between tourism and economic growth. This study demonstrated that a Granger causality from tourism to economic growth existed in Mauritius. A similar study was implemented by Oh (2005) using the quarterly data from South Korea for the 1975 to 2001 period. However, no Granger causality from tourism to economic growth was found, indicating that the expansion of tourism in South Korea did not lead to the economic growth, despite a long-term relationship between tourism and economic growth. Interestingly, Chen and Song (2009) obtained the opposite results when they used an EGARCH-M model with the same variables and a database updated to 2007. Chen and Song (2009) found that a bidirectional positive relationship exists between tourism and economic growth in South Korea, so they could not reject the TLEG hypothesis.

The choice of variables may have significant effects on the findings in time series models. Katircioglu (2009) used the number of overnight international tourists to Turkey and real GDP to test the TLEG hypothesis. Annual data from 1960 to 2006 were collected and, according to the results of both the Engle-Granger and Johansen cointegration tests, there was no long-term relationship between tourism and economic growth, and therefore the TLEG hypothesis cannot be held to be true. In contrast, Husein and Kara (2011) used real tourism receipts as the tourism variable and a dataset that started in 1964. The results of their Johansen cointegration and Granger causality tests indicated that a long-term relationship exists between tourism and economic growth, and that tourism has contributed to the economic growth of Turkey. Contradictory conclusions can also be found in studies conducted by Kadir and Jusoff (2010) and Lean and Tang (2010) in Malaysia.

Endogenous constraints among variables are added to a model to enhance the robustness of the estimation results. Massida and Mattana (2013) applied the structure vector error correct model to quarterly data from Italy for the 1987 to 2009 period and found bidirectional positive relationships between tourism and economic growth in both the short and long terms. However, they found only a unidirectional relationship from economic growth to international trade and from trade to tourism, implying that tourism in Italy could lead to economic growth but international trade was not the intermediate, as no significant linear unidirectional relationship existed from tourism to international trade and then to economic growth.

This conclusion is inconsistent with common sense and economic principles. One of the benefits of international tourism to a destination economy is the ability of tourism to convert non-tradable goods into tradable ones, thus improving the terms of trade and leading to the expansion of international trade. As a result, international trade may not be the only intermediate between tourism and economic growth, but it is at least one. The failure of the structure vector error correct model may be attributed to the constraints added to the variables, which are in reduced forms. Thus, the results could still be affected by external factors such as the selection of variables and the length of the time period. 'Deep structural parameters' (Wickens, 2012, p. 3) are needed to constrain the behaviour of each agent in an economy, just as the processing method in the DSGE models constrains the transmission mechanism in the modelled economy.

Most previous studies cannot reject the TLEG hypothesis, but the conclusions obtained are very sensitive due to the lack of strong endogenous constraints on the variables.

2.5.3. Panel Data and Cross-sectional Model

Some studies have used a panel data model to test the TLEG hypothesis and to expand the sample sizes used in econometric models. Castro-Nuño, Molina-Toucedo and Pablo-Romero (2013) conducted a meta-analysis of panel data studies. They concluded that the TLEG hypothesis could not be rejected based on 12 studies that used a panel data approach, despite the conflicting conclusions obtained by similar models. Eugenio-Martín, Morales and Scarpa (2004) first tested the TLEG hypothesis using a panel data model. They built a dynamic panel data model using data from 21 Latin American countries for the 1985 to 1998 period and found that the TLEG hypothesis only holds true in low and medium-income countries. Fayyisa, Nsiah and Tadesse (2010) used the same estimation method with minor changes to the key variables and updated the time period to test the hypothesis; surprisingly, the results were again inconclusive, as in the studies that used time series models. Fayyisa, Nsiah and Tadesse (2010) confirmed that the TLEG hypothesis could be true for Latin American countries, and not only those in the low- and medium-income group.

The pattern of inconclusive results was again found in the studies that used panel cointegration and panel Granger Causality tests. Cağlayan, Sak and Karymshakov (2012) used the annual data from 135 countries for the 1995 to 2008 period and found a Granger causality from tourism to economic growth. In contrast, the results were inconclusive when Ekanayake and Long (2012) changed the same variables from nominal to real terms and expanded the sample size in both the cross-sectional and time series dimensions.

A similar situation emerged in studies using cross-sectional models. To transform panel data to cross-sectional data, even though it is less suitable for studying economic growth, scholars calculated the averages of the variables for specific periods for each destination and then estimated the overall relationship between tourism and economic growth using the cross-sectional data. Unfortunately, models based on cross-sectional data were still over-sensitive to the estimation results. Brau, Lanza and Pigliaru (2007) used the averages of time series data from 143 countries for the 1980 to 2003 period and estimated the results using the least square dummy variable method. The variables used were real GDP per capita and the ratio between tourism receipts and GDP. The results could not reject the TLEG hypothesis. However, when Figini and Vici (2010) changed the economic variable from real GDP per capita to the growth rate of the per capita disposable income of 150 countries for the 1980 to 2005 period, the hypothesis was rejected.

2.5.4. Summary of the Econometric Approach

Nearly 100 studies using time series, panel and cross-sectional data have tested the TLEG hypothesis (Pablo-Romero & Molina, 2013) developed by Balaguer and Cantavella-Jorda (2002). The general conclusion is that there is a positive relationship between tourism and economic growth. However, this conclusion is not robust, as in most cases neither the model setting nor the methodology applied are appropriate for examining the TLEG hypothesis.

In extant studies, tourism demand variables such as arrivals and tourism receipts/tourist expenditure are usually taken as explanatory variables, and national income variables (e.g., GDP) as dependent variables (Table 2.3). According to the neoclassical economic growth theory, the driving forces of economic growth are stock variables such as capital stock and productivity (Lucas, 1988). However, tourist arrivals and tourism receipts/tourist expenditure are flow variables, which means they cannot be considered production factors and included in production functions. Thus, the above studies could only identify a linear relationship between tourism and economic growth (if significant) and cannot determine whether tourism is a determinant of economic growth.

Furthermore, the absolute volume of the flow variables (e.g. investment) is much smaller than the stock variables (e.g. capital stock), thus the fluctuation of the flow variables is more significant than the stock variables which may lead to inconclusive findings for TLEG studies.

Moreover, as reviewed in Section 2.5.2, a linear relationship only indicates that, based on historical data, the destination could enjoy a sustained economic growth after the expansion of tourism. This relationship, however, is not based on logical causality. The conclusions obtained are easily affected by minor modifications to the model without the endogenous constraints among variables. Thus, it can be argued that some studies have over-estimated the validity of the approaches, such as the Johansen cointegration and the Granger Causality tests, and thus have interpreted the results incorrectly. The research objective of econometric models is to explore the correlations between tourism and economic growth. However, to explain the driving force behind tourism expansion, studies must find and prove the mechanism behind the explored economic phenomenon. The 'deep structural parameters' of DSGE models are needed to impose further endogenous constraints on the model and to enhance the robustness of the results.

2.6. Chapter Summary

This chapter reviews previous studies of the impact of tourism on economic growth. Most of the studies that adopted the econometric approach found that the TLEG hypothesis cannot be rejected, and those that used DSGE models found that tourism could lead to economic growth, although tourism expansion may theoretically have a negative effect on economic growth.

The basic findings on how tourism affects economic growth are as follows. The expansion of tourism may transfer non-tradable goods to tradable ones and thus improve trade terms. The inflow of foreign currencies can be used to import more capital to further stimulate the destination's economic growth. The injection of foreign currencies can to some degree substitute for domestic savings, so that domestic residents can increase consumption and improve their welfare. Some factors that could reduce the positive impact of tourism on economic growth also exist. For example, the expansion of tourism may lead to the outflow of resources from other industries or leakages to overseas stakeholders. However, few published studies have found that the net effects of tourism on economic growth are negative.

Two limitations exist in the literature on the impact of tourism on economic growth. The first limitation is that the development of the DSGE model is still at an early stage. Both exogenous and endogenous growth theories have been used, but these studies have failed to solve the model, calibrate the parameters, and conduct rigorous simulations. As reviewed in Section 2.4.1, some studies have used the parameters from textbooks, which may be different from the actual situation in a destination, and some have assigned ad hoc values to parameters. Thus, the quality of the simulation results is unknown and it is difficult to judge the validity of the conclusions.

The second limitation is the misuse of the econometric approach and misinterpretation of the conclusions obtained by the approach. Most of the studies using the econometric approach have found long-term relationships between tourism and economic growth and confirmed causality from tourism to economic growth using the Granger causality test. However, tourism demand variables are flow variables that should not be considered production factors or involved in production functions. Thus, when tourism demand variables are taken as explanatory variables in regressions with economic growth variables, the results only indicate that there is a linear relationship between them if the coefficients are significant. Furthermore, the conintegration and Granger Causality tests cannot demonstrate that tourism can cause economic growth. Such tests only indicate that tourism is useful for forecasting economic growth (Granger, 2004), but they do not suggest the real cause-effect relationship. Even when reduced constraints were incorporated into some of the structural models, the results were contradictory (Massida & Mattana, 2013; Jin, 2011). Policy suggestions based on these studies are not reliable. The expansion of any industry, not just the tourism industry, can contribute to GDP, but whether this industry drives economic growth needs much more rigorous theoretical and empirical testing.

In summary, many studies have used an econometric approach to show that there is a positive relationship between tourism and economic growth, but there is still a great need to construct a rigorous framework based on economic growth theories to investigate the TLEG hypothesis. Such studies must use real economic data to test whether the theoretical model is consistent with the real world. Suitable methodologies and data are presented in the next chapter.

3. Research Methodology

3.1. Introduction

This study uses the DSGE model to construct a comprehensive framework based on economic growth theory to investigate the impact of tourism on economic growth. The parameters of the model are then estimated using the Bayesian method. Lastly, sensitivity analyses are carried out to examine the influence of the key parameters on the simulation results.

The research methodology, specifically the modelling procedures, are introduced in this chapter. Section 3.1 illustrates a simple DSGE model to show how it works and proposes a framework for this study. Section 3.2 introduces the method to solve the model. Section 3.3 demonstrates the principle of Bayesian estimation. Section 3.4 describes the data that are used in the models. Last but not the least, a summary of this chapter is provided.

3.2. DSGE Modelling

A simple model with an analytical solution is provided at the beginning of this section as an example of the DSGE model. The conceptual framework of the study is subsequently introduced.

3.2.1. A Simple DSGE Model

The basic model used in this study is a Cass-Koopmans model in an open economy. One of the advantages of a Cass-Koopmans model is that, compared to a Solow-Swan model, the saving rate is endogenous, making the model much closer to reality. Another advantage of the Cass-Koopmans model is the ease of measuring the variables when conducting empirical studies that use Bayesian estimations. To demonstrate how a DSGE model works, the analytic solution rather than the numerical solution of a simple open Cass-Koopmans model is presented and calculated by hand.

It is assumed that there is a small destination with a Robinson-Crusoe economy.[3] People living in the destination provide tourism products to international tourists and import products from overseas for their own consumption and investment. As a result, the budget constraint, the resource constraint and the international trade account balance are all equivalent to the national account identity as

$$Y_t = \frac{1}{\phi}(C_t + I_t) \quad , \tag{3.1}$$

where Y_t is the output for exports, C_t and I_t are imported consumption and investment respectively, which are discussed in Chapter 2, and ϕ is the fixed real exchange rate in the direct quotation. This means an increase in ϕ indicates a depreciation of the exchange rate and vice versa. It would be more reasonable to introduce an endogenous floating exchange rate to the model; however, it is easier to obtain the analytic solution using a fixed rate. The production function is also as same as in Chapter 2, and is written as

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha} . \tag{3.2}$$

It is assumed that the technological level, A_t , follows an auto regression (AR) process as

$$A_t = \rho \, \mathrm{A}_{t-1} \quad , \tag{3.3}$$

[3] A Robinson-Crusoe economy is a simple macroeconomic model in which there is only one consumer, one producer and two products. For a detailed description of the model, please see Varian (2009, p. 739).

So incorporating Equation (3.3) into (3.1) and after iteration, we obtain

$$Y_t = K_t^{\alpha}[(A_t)^{1/1-\alpha} N_t)]^{1-\alpha} = K_t^{\alpha}[(\rho A_{t-1})^{1/1-\alpha} N_t)]^{1-\alpha} = \cdots\cdots = K_t^{\alpha}(N_t^{\#})^{1-\alpha}, \tag{3.4}$$

where $N_t^{\#} = (A_0 \rho^t)^{1/1-\alpha} N_t$. This transformation simplifies the calculation process and the implication is that an increase in the productivity of the economy is achieved by the improvement of the human resource; therefore, $N_t^{\#}$ can be regarded as the effective labour input. In a Robinson-Crusoe economy, people are employed by themselves, indicating that the unemployment rate is zero and the growth rate of the labour force is equivalent to the growth of the population, n. As a result, $N_t^{\#}$ could be further written as

$$N_t^{\#} = [\rho^{1/1-\alpha}(1+n)]^t A_0^{1/1-\alpha} N_0 . \tag{3.5}$$

Using first-order Taylor expansion at 1, Equation (3.5) could be re-write as

$$N_t^{\#} = (1+\eta)^t A_0^{1/1-\alpha} N_0 , \tag{3.6}$$

where $\eta \simeq n + \dfrac{\rho - 1}{1-\alpha}$. Furthermore, the variables may be expressed by per capita terms as

$$y_t^{\#} = \frac{Y_t}{N_t^{\#}}, \tag{3.7}$$

and

$$k_t^{\#} = \frac{K_t}{N_t^{\#}} . \tag{3.8}$$

In this section, lower case letters indicate the corresponding per capita variable. Now Equation (3.2) changes to

$$y_t^{\#} = (k_t^{\#})^{\alpha} . \tag{3.9}$$

The national account identity in terms of per capita is

$$y_t^{\#} = \frac{1}{\phi}(c_t^{\#} + i_t^{\#}), \tag{3.10}$$

where $c_t^{\#} = C_t / N_t^{\#}$ and $i_t^{\#} = I_t / N_t^{\#}$. Dividing by $N_t^{\#}$, the capital accumulation equation becomes

$$(1+\eta)k_{t+1}^{\#} = (1-\delta)k_t^{\#} + i_t^{\#}. \tag{3.11}$$

The objective function of this model is

$$\sum_{s=0}^{t} \beta^s U(C_{t+s}),$$

subject to

$$Y_t = \frac{1}{\phi}[C_t + K_{t+1} - (1-\delta)\mathrm{K}_t]. \tag{3.12}$$

If the CES utility function is set as

$$U(C_t) = \frac{C_t^{1-\sigma} - 1}{1-\sigma} = \left[\frac{c_t^{\#1-\sigma} - [(1+\eta)^t A_0^{1/1-\alpha} N_0]^{-(1-\sigma)}}{1-\sigma}\right][(1+\eta)^t A_0^{1/1-\alpha} N_0]^{(1-\sigma)}, \tag{3.13}$$

the Lagrangian can be written as

$$\sum_{s=0}^{\infty} \tilde{\beta}^s \left[\frac{c_{t+s}^{\#\ 1-\sigma} - [(1+\eta)^t A_0^{1/1-\alpha} \mathrm{N}_0]^{-(1-\sigma)}}{1-\sigma}\right][(1+\eta)^t A_0^{1/1-\alpha} \mathrm{N}_0]^{1-\sigma} + \lambda_{t+s}\{\mathrm{k}_{t+s}^{\#\ \alpha} - \frac{1}{\phi}[\mathrm{c}_{t+s}^{\#} + (1+\eta)\mathrm{k}_{t+s+1}^{\#} - (1-\delta)\mathrm{k}_{t+s}^{\#}]\}, \tag{3.14}$$

where $\tilde{\beta} = \beta(1+\eta)^{1-\sigma}$. Thus, the FOCs are

$$\frac{\partial L_t}{\partial c^{\#}_{t+s}} = \tilde{\beta}^s c^{\#}_{t+s}{}^{-\sigma}[(1+\eta)^t A_0^{1/1-\alpha}\ \mathrm{N}_0]^{1-\sigma} - \frac{1}{\phi}\lambda_{t+s} = 0$$
$$\frac{\partial L_t}{\partial k^{\#}_{t+s}} = \lambda_{t+s}[\alpha\, \mathrm{k}^{\alpha-1}_{t+s} + \frac{1}{\phi}(1-\delta)] - \lambda_{t+s-1}\frac{1}{\phi}(1+\eta) = 0 \qquad . \tag{3.15}$$
$$\frac{\partial L_t}{\partial \lambda_{t+s}} = k^{\#}_{t+s}{}^{\alpha} - \frac{1}{\phi}[\mathrm{c}^{\#}_{t+s} + (1+\eta)\,\mathrm{k}^{\#}_{t+s+1} - (1-\delta)\,\mathrm{k}^{\#}_{t+s}] = 0$$

The Euler Equation is

$$\tilde{\beta}\left(\frac{c^{\#}_{t+1}}{c^{\#}_t}\right)^{-\sigma}[\alpha\, \mathrm{k}^{\#}_{t+1}{}^{\alpha-1} + \frac{1}{\phi}(1-\delta)] = \frac{1}{\phi}(1+\eta). \tag{3.16}$$

It can be found that if $\phi = 1$ and $\eta = n$, the Euler Equation changes to the same expression of Equation (2.7). In equilibrium, $\Delta c^{\#}$, Δq and $\Delta k^{\#}$ equal to zero. This implies that

$$\begin{aligned} F'(k^{\#}) = \alpha k^{\#\alpha-1} &= [(1+\eta)/\tilde{\beta} - (1-\delta)]\frac{1}{\phi} \\ &= [1/\beta(1+\eta)^{-\sigma} - (1-\delta)]\frac{1}{\phi} \qquad , \\ &\simeq \{\theta + \delta + \sigma[n + (\rho-1)/(1-\alpha)]\}\frac{1}{\phi} \end{aligned} \tag{3.17}$$

where $\tilde{\beta} = \beta(1+\eta)^{1-\sigma}$ and $\eta = n + (\rho-1)/(1-\alpha)$ are used to substitute $\tilde{\beta}$ and η, respectively, and $\beta = 1/1+\theta\ (\theta > 0)$.

Thus, the solution of $k^{\#}$ can be expressed explicitly as

$$k^{\#} \simeq \left(\frac{\{\theta + \delta + \sigma[\mathrm{n} + (\rho-1)/(1-\alpha)]\}}{\alpha\phi}\right)^{1/\alpha-1}. \tag{3.18}$$

The solutions of $y^{\#}$ and $c^{\#}$ can be obtained by the following equations

$$y^{\#} = (k^{\#})^{\alpha}, \tag{3.19}$$

and

$$c^{\#} = (k^{\#})^{\alpha}\phi - (\eta + \delta)k^{\#}. \tag{3.20}$$

Equation (3.20) suggests that as ϕ increases, the domestic currency depreciates and the relative prices in the destination become cheaper, which could attract more tourists. As a result, the capital stock and output would expand. Equation (3.20) also indicates that the depreciation of the domestic currency could expand the imports of consumption products from overseas markets. As tourism is a labour intensive industry (Pizam, 1982), it is obvious that the growth of labour input, n, can also stimulate economic growth. Productivity improvements in the tourism industry may refer to improvements in management or service quality, or to technological innovation or invention in other industries. As a result, it can be observed in Equations (3.18) and (3.19) that an increase in ρ would also lead to the growth of output if $\rho > 1$. The implications of the analytical solutions are very intuitive and can be used to explain how tourism can to some degree lead to economic growth, even though the model solved above is quite simple.

Compared with the Solow-Swan model, the saving rate equals

$$\begin{aligned} s_t &= 1 - \frac{C_t}{Y_t} \\ &= 1 - \frac{c_t^{\#}}{y_t^{\#}} \\ &= 1 - \phi + \frac{\alpha\phi[(\rho-1)/(1-\alpha)+n+\delta]}{\theta+\delta+\sigma[(\rho-1)/(1-\alpha)+n]}. \end{aligned} \tag{3.21}$$

Although the saving rate is still a constant, it has become an endogenous variable, which is closer to reality.

According to Equation (3.8), $k_t^{\#} = K_t / N_t^{\#}$, indicating that $k_t^{\#}$ is the capital per effective labour. Thus, the capital per capita, K_t / N_t, could keep growing, even though in equilibrium it is a constant. Recall that $N_t^{\#} = (A_0^{1/1-\alpha}\rho^t)^{1/1-\alpha} N_t$, so

$$\frac{K_t}{N_t} = k^{\#} A_0^{1/1-\alpha} (\rho^{1/1-\alpha})^t \simeq k^{\#} A_0^{1/1-\alpha} [(\rho - 1)/(1-\alpha)]^t. \tag{3.22}$$

The growth rate of K_t / N_t along the equilibrium path approximately equals $(\rho-1)/(1-\alpha)$, because both $k^{\#}$ and $A_0^{1/1-\alpha}$ are constants. Similarly, it is easy to calculate that the growth rate of Y_t / N_t and C_t / N_t are $(\rho-1)/(1-\alpha)$. Finally, the growth rates of the aggregated variables K_t , Y_t and C_t can be obtained by including the population growth rate, n , equalling $\eta = n + (\rho-1)/(1-\alpha)$. Due to the presence of the optimal growth rate, η , the model upgrades to a DSGE model instead of a static one.

If $K_t^{\#}$ is defined as

$$K_t^{\#} = (1+\eta)^t K_0 = (1+\eta)^t N_0 \frac{K_0}{N_0} = N_t^{*} \frac{K_0}{N_0}, \tag{3.23}$$

then

$$k_t^{\#} = \frac{K_t}{N_t^{\#}} = \frac{K_t}{K_t^{\#}} \cdot \frac{K_0}{N_0}. \tag{3.24}$$

The value of $k_t^{\#}$ is expressed after the transformation as the deviation of the capital stock from the optimal growth path. As the name suggests, RBC models, such as the one introduced by Kydland and Prescott (1982), are usually used to analyse short-term economic fluctuations. However, Equation (3.24) proves that an RBC model can also be used to study long-term economic growth. The difference is that the deviation in growth models refers to the gap between the original variable and the optimal growth path, instead of the value in steady state. Shocks in the RBC models, such as technological improvements, exchange rates, and tax rates, can consequently be introduced to a growth model studying the contribution of tourism to economic growth.

Although a simple DSGE model is quite stylised, the implication of the solution is obvious, and the model can be used to explain, to some degree, the contribution of tourism to economic growth. The simple DSGE model proves that the RBC model is suitable for the study of economic growth. However, Equations (3.17) to (3.19) show that, given such a simple model, the expression of the solution is quite complicated. Thus, the solution will become more complex if more variables and constraints are introduced to the model. The analytical solution cannot be obtained in most DSGE models, except for limited simple ones. Thus, only the numerical solution is provided due to the complexity of the model used in this study.

3.2.2. The Framework of the Model

The model built in this study is based on the Cass-Koopmans model (Cass, 1965; Koopmans, 1965), which was introduced in Section 3.1.1, but is expanded to model a two-sector economy. The circular flow of the model is illustrated in Figure 3.1. Tourism is usually considered a pillar industry that prompts economic growth; thus, a two-sector model is the easiest way to represent the economy. Although many island economies specialise in tourism, few of them rely completely on the tourism sector. Therefore, the two-sector model is more general and closer to reality than the one-sector model.

There are three agents in the model: households, firms and government. Firms are divided into tourism and non-tourism firms that produce and provide products for both domestic and international consumers. Households spend the income by purchasing government bonds, investing in both sectors, and consuming tourism products, non-tourism products and imports. Imports, government bonds and foreign direct investment (FDI) are introduced into the model to play the role of the outflow from the economy.

In the model, the development of tourism leads to economic growth as follows. The improvement in productivity in the tourism sector leads to the expansion of tourism production. This increase in tourism supply results in a decrease in the relative price of tourism products, and thus attracts more tourism demand from both international and domestic markets. However, households may postpone consumption and spent more on investment to obtain a higher return rate. As they benefit from the development of tourism, households become richer and may consume more tourism products, non-tourism products and imports. The GDP of the destination would show a rapid growth due to the expansion of tourism exports, investment and consumption. However, if the leakage from the imports, government bonds and the earnings by FDI (if any) are too high, the dividends from the expansion of tourism may not cover the loss due to the leakage. Thus, the impact of tourism on economic growth depends on the economic structure of the destination.

This study applies models under the same framework to different destinations to examine the relationship between tourism and economic growth. Improvements in tourism productivity instead of the output expansion of tourism are considered the driving force of the growth. This is the key difference between the economic growth and economic growth accounting models.

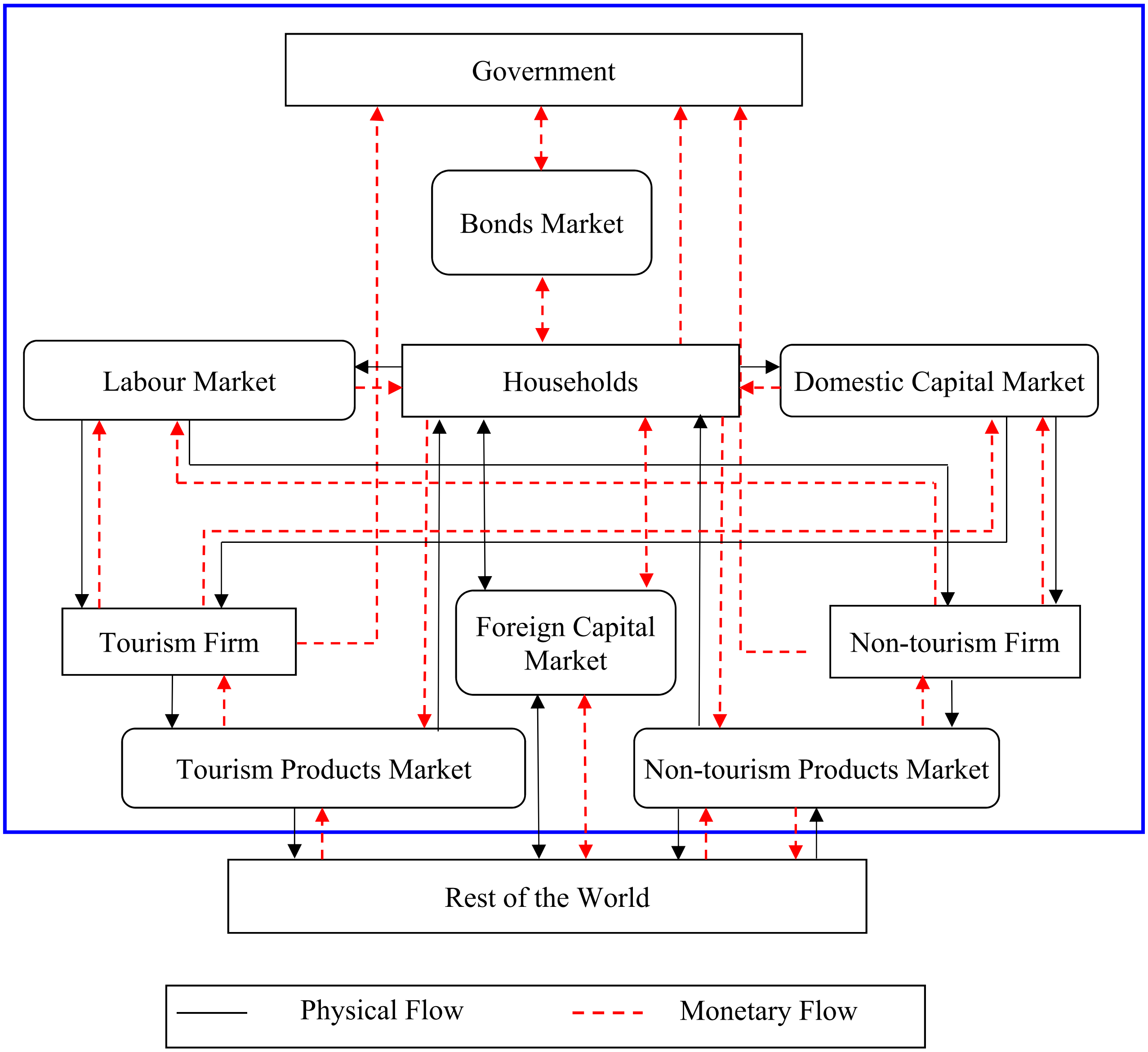


Figure 3.1 Circular Flow Diagram of the Model

3.3. Method to Solve the Model

The model that needs to be solved is

$$\tilde{\beta}\left(\frac{c_{t+1}^{\#}}{c_t^{\#}}\right)^{-\sigma}[\alpha\, \mathrm{k}_{t+1}^{\#\ \alpha-1}+\frac{1}{\phi}(1-\delta)]=\frac{1}{\phi}(1+\eta)$$
$$k_{t+s}^{\#\ \alpha}-\frac{1}{\phi}[\mathrm{c}_{t+s}^{\#}+(1+\eta)\,\mathrm{k}_{t+s+1}^{\#}-(1-\delta)\,\mathrm{k}_{t+s}^{\#}]=0 \quad (3.25)$$

which is a system of nonlinear difference equations. There are two types of model-solution methods: linear and nonlinear model approximations. A wide range of techniques exist for each approximation methods. The technique introduced briefly in this section is Blanchard and Kahn's (Blanchard & Kahn, 1980) linear approximation method. This method is selected because it is the algorithm applied in Dynare, the software used to solve and estimate the model in this study.

The model solved in Section 4.1 is a deterministic model. We need to introduce stochastic shocks to the model if we want to run a simulation. The productivity shock applied by Kydland and Prescott (1982) is one of the most widely used shocks and is the main source of economic fluctuation in RBC models. After including the stochastic shock to tourism productivity and conducting the log-linear transformation of the model, Equation (3.25) can be re-written as

$$\tilde{a}_t+\xi_{1k}\tilde{k}_{t+1}-\xi_c\tilde{c}_t+\xi_{2k}\tilde{k}_t=0$$
$$\zeta_{1c}E_t(\tilde{c}_{t+1})+\zeta_a E_t(\tilde{a}_{t+1})+\zeta_k E_t(\tilde{k}_{t+1})+\zeta_{2c}\tilde{c}_t=0\ , \quad (3.26)$$
$$\tilde{a}_{t+1}-\rho\tilde{a}_t=\varepsilon_{t+1}.$$

where $\{\tilde{\mathrm{k}}_t,\tilde{\mathrm{c}}_t,\tilde{\mathrm{a}}_t\}$ represent logged deviations of capital stock, consumption and productivity from the optimal growth path, respectively, and ε_t is a stochastic shock. The parameters that can deviate from the model presented in Section 4.1 are denoted by $\{\xi_{1k},\xi_c,\xi_{2k},\zeta_k,\zeta_{1c},\zeta_{2c},\zeta_a\}$. The deviation and transformation of the parameters are ignored because the solution of the model is not going to be calculated again in this section. The expectation operator $E_t(.)$ is added to the equations with the introduction of the stochastic shock to reflect the expected values of period *t+1* from the perspective of period *t*. Equation (3.26) can be written in a matrix form as

$$\begin{bmatrix} \tilde{k}_{t+1} \\ E_t(\tilde{c}_{t+1}) \end{bmatrix} = \tilde{A} \begin{bmatrix} \tilde{k}_t \\ \tilde{c}_t \end{bmatrix} + \tilde{B}E(\tilde{a}_t) , \tag{3.27}$$

where $\tilde{A} = \begin{pmatrix} -\xi_{2k} & \xi_c \\ 0 & -\zeta_{2c} \end{pmatrix} \begin{pmatrix} \xi_{1k} & 0 \\ \zeta_k & \zeta_{1c} \end{pmatrix}^{-1}$, $\tilde{B} = \begin{pmatrix} -1 \\ -\zeta_a \rho \end{pmatrix} \begin{pmatrix} \xi_{1k} & 0 \\ \zeta_k & \zeta_{1c} \end{pmatrix}^{-1}$ and $E_t(\tilde{a}_{t+1}) = \rho \tilde{a}_t$. Because the value of $\tilde{k}_{t+1}$ is determined by $\tilde{k}_t$, it is defined as a predetermined variable. Because $\tilde{c}_t$ is calculated by $\tilde{k}_t$, it is, in contrast, called a non-predetermined variable and $\tilde{a}_t$ is an exogenous variable.

Blanchard and Kahn (1980) proved that the system is saddle-path stable and a unique solution exists for the model, if the number of explosive eigenvalues of $\tilde{A}$ equals the number of non-predetermined variables. This sufficient condition is called the Blanchard-Kahn condition. The Dynare software can solve the model automatically and produce the solutions directly if the condition is satisfied. The details of solving the model using the Blanchard and Kahn (1980) method can be found in Uhlig (1999) and Delong and Dave (2011).

3.4. Bayesian Method

The DSGE model can be estimated by the maximum likelihood (ML) method or the Bayesian method. The distinctive difference between the two methods is that the former assumes the data are random variables and the parameters in the model are fixed. In contrast, the Bayesian method assumes that the parameters are randomly distributed. The parameters in a particular model are the conditional probabilistic statements based on the data set. One of the advantages of using the Bayesian method to estimate a calibrated DSGE model, is that the numbers assigned to the parameters in calibration can be used as the means for prior distribution and the new information included in the data can be used to refine the parameters.

When estimating a DSGE model using the Bayesian method, the likelihood function can be written as $L(X \mid \mu)$, where *X* is the data set used to estimate the model and μ is the parameter vector. In the Bayesian method, μ is selected from the set $\Lambda(\mu)$ conditional on the observed data *X*, which is different from the ML method. The joint probability of (X, μ) according to the conditional probability can be calculated as

$$p(X, \mu) = L(X \mid \mu)\pi(\mu), \tag{3.28}$$

where $L(X \mid \mu)$ plays a role as the conditional probability and $\pi(\mu)$ is a particular probability in the prior distribution. If the roles of *X* and μ in Equation (3.28) are swapped, we get

$$p(X, \mu) = P(\mu \mid X)p(X), \tag{3.29}$$

where $P(\mu \mid \mathrm{X})$ and $p(X)$ are the roles played by $L(X \mid \mu)$ and $\pi(\mu)$ in Equation (3.28), respectively. Eliminating $p(X, \mu)$ with Equations (3.28) and (3.29), $P(\mu \mid \mathrm{X})$ can be expressed as

$$P(\mu \mid X) = \frac{L(X \mid \mu)\pi(\mu)}{p(X)}, \tag{3.30}$$

which is the Baye's Rule and $P(\mu \mid \mathrm{X})$ is the posterior probability. The different sampled μ may correspond to different models, because μ is a random variable. Assuming that

$$p(\mu^i \mid \mathrm{X}, M_i) = \frac{p(\mathrm{X} \mid \mu^i, M_i)\, p[\pi(\mu^i) \mid M_i]}{p(\mathrm{X} \mid M_i)} \tag{3.31}$$

represents the posterior probability of $\pi(\mu^i)$ corresponding to the particular model M_i, and then integrating to Equation (3.31), we get

$$p(\mathrm{X} \mid M_i) = \int p(\mathrm{X} \mid \mu^i, M_i)\, p[\pi(\mu^i) \mid M_i] d\mu^i, \tag{3.32}$$

where $\int p(\mu^i \mid \mathrm{X}, M_i) = 1$. The posterior mean of μ^i can be obtained as

$$\mathrm{E}(\mu^{i} \mid \mathrm{X}) = \int \mu^{i} p(\mu \mid \mathrm{X}) d\mu. \tag{3.33}$$

Based on Equation (3.32), the posterior standard deviation is further calculated as

$$\begin{aligned} \sigma(\mu^{i} \mid X) &= \sqrt{E(\mu^{i2} \mid y) - [E(\mu^{i} \mid y)]^{2}} \\ &= \sqrt{\int \mu^{i2} p(\mu^{i} \mid X) d\mu^{i} - \int \mu^{i} p(\mu^{i} \mid X) d\mu^{i}}. \end{aligned} \tag{3.34}$$

Getting the solution of $\mathrm{E}(\mu^{i} \mid \mathrm{X})$ and $\sigma(\mu^{i} \mid X)$ analytically is impossible in most cases, due to the complex likelihood function, as when solving DSGE models. The Metroplis-Hastings algorithm, which is one of the Markov Chain Monte Carlo (MCMC) algorithm sampling methods, is used to create a posterior simulator for the unknown posterior distribution when estimating the DSGE model in the Dynare software.

The expectation of the posterior after s_{th} sampling mean can be expressed as

$$\tilde{\mu} = E(\mu^{i}) = \frac{1}{s} \sum_{r=1}^{s} \mu^{i}, \tag{3.35}$$

with the standard deviation of

$$\sigma(\mu^{i}) = \sqrt{\frac{1}{N}\left(\bar{\kappa}_{0} + 2\sum_{l=1}^{N-1} \bar{\kappa}_{l} \frac{N-l}{N}\right)}, \tag{3.36}$$

where $\bar{\kappa}_{l}$ represents the l^{th}-order autocovariance of the simulated $\mu^{i}s$.

The distinguishing feature of the Metroplis-Hastings algorithm is that not all of the samplers are kept and used to calculate the expectation of the posterior mean and standard deviation. The principle is that there is an acceptable probability with the form of

$$\psi(\mu^{(s-1)}, \bar{\mu}) = \min\left[\frac{p(\mu = \bar{\mu} \mid X) q(\bar{\mu}; \mu = \mu^{(s-1)})}{p(\mu = \mu^{(s-1)} \mid X) q(\mu^{(s-1)}; \mu = \bar{\mu})}, 1\right] \tag{3.37}$$

where $p(\mu=\bar{\mu}\mid X)$ and $p(\mu=\mu^{(s-1)}\mid X)$ are the posterior density of points $\mu=\bar{\mu}$ and $\mu=\mu^{(s-1)}$, respectively, and $q(\bar{\mu};\mu=\mu^{(s-1)})$ and $q(\mu^{(s-1)};\mu=\bar{\mu})$ are points of the density that are used to sample the simulators of μ^{i} and evaluate at $\mu=\bar{\mu}$ and $\mu=\mu^{(s-1)}$, respectively. The chain of the samplers tends to stay in the distribution of areas with higher posterior probability towards the lower, based on the probability of Equation (3.37). Equation (3.35) is thus implicitly weighted by the posterior probability, although it is presented as a simple average formula to calculate $\bar{\mu}$. The details to deviate $\tilde{\mu}$ and $\sigma(\mu^{i})$ and the introduction of the Metroplis-Hastings algorithm can be found in Koop (2003).

The nature of Bayesian estimation in most instances cannot be easily seen due to its complexity. In some special cases, however, such as a linear regression model with normal-gamma natural conjugate prior distribution, simulation is unnecessary and the analytical solution of the estimation, $\bar{\mu}$, is available.

Suppose the conditional distribution of μ on h is $\mu\mid h\sim N(\underline{\mu},\mathrm{h}^{-1}\underline{V})$ and $h\sim G(\underline{s}^{-2},\underline{v})$, where $\underline{\mu}$ and $\underline{S}^{-2}$ denote the prior information about the means of the two distributions, respectively, and $h^{-1}\underline{V}$ and $\underline{v}$ denote the prior information about the variance information, respectively. As a result, the normal-gamma natural conjugate prior distribution can be represented as

$$(\mu,h)\sim NG(\underline{\mu},\underline{\mathrm{V}},\underline{\mathrm{s}}^{-2},\underline{v}). \tag{3.38}$$

The posterior distribution is

$$(\mu,h\mid X)\sim NG(\bar{\mu},\bar{\mathrm{V}},\bar{\mathrm{s}}^{-2},\bar{v}), \tag{3.39}$$

where

$$\overline{V} = (\underline{V}^{-1} + X'X)^{-1}$$
$$\overline{\mu} = \overline{V}(\underline{V}^{-1}\underline{\mu} + X'X\hat{\mu}), \tag{3.40}$$
$$\overline{\mathrm{v}} = \underline{\mathrm{v}} + \mathrm{N}$$

and $\hat{\mu}$ is the estimation of parameters in the ML method. Using Equation (3.40), $\overline{s}^{-2}$ can be expressed explicitly as

$$\overline{v} \cdot \overline{s}^{-2} = \underline{v} \cdot \underline{s}^{-2} + v \cdot s^{-2} + (\hat{\mu} - \underline{\mu})'[\underline{\mathrm{V}} + (\mathrm{X}'\mathrm{X})^{-1}]^{-1}(\hat{\mu} - \underline{\mu}), \tag{3.41}$$

where s^{-2} is the standard error of the ML estimation. It is obvious that the Bayesian estimation of μ is the average of the prior $\underline{\mu}$ and the ML estimation $\hat{\mu}$ weighted by $\underline{V}^{-1}$ and $X'X$, respectively. The calibrated value of the parameters are used as the priors when estimating DSGE models using the Bayesian method. Thus, the weights show the extent to which the posterior estimation is affected by the prior information (the 'guess' of the parameters) and the ML estimation, respectively. The larger $\underline{V}^{-1}$ is, the greater the amount of information abstracted from prior information, meaning that the guess is more certain. In contrast, the larger $X'X$ is, the greater the amount of information obtained from the data, indicating that the prior information has been more strongly corrected by the real data. The result of the Bayesian method is more robust and competitive as it combines information from both priors and ML or, more generally speaking, from traditional econometric estimations.

The impulse response function (IRF) is used to present the responses of key variables in the model to an unexpected positive surge in production in the tourism sector. If it causes a positive dynamic change in GDP, this indicates that the expansion of tourism results in higher economic growth than the original trend.

3.5. The Selection of Destinations for the Study

The preceding discussions show that time series data for the variables in the tourism sector, such as tourism value added, employment and capital stock, are essential to the estimation of the DSGE model, particularly for the Bayesian method. However, traditional national accounts do not consider tourism an industry or sector. Therefore, tourism statistics such as output and value added of the tourism sector can only be obtained from a tourism satellite account (TSA), which complements conventional national accounts and is compiled independently.

Due to this restriction, Mauritius, Spain, New Zealand and the USA are selected as destinations for this research. To explain why these destinations are chosen, we first briefly introduce TSAs.

3.5.1. TSA

A TSA is based on the same concepts and principles as the System of National Accounting 93 (SNA93), and it measures the economic impact of tourism from both the demand and supply sides, including contributions to GDP, employment, capital formation and tax. The TSA accounting principle is straightforward and can be divided into two steps: split and aggregation. This first step, split, involves separating tourism-related economic activities from other industries in the national account using secondary data or complementary surveys. The aggregation step integrates the separated data to comprehensively measure the economic impact of tourism.

More than 70 countries or regions including the USA, Spain, Australia, New Zealand and Mauritius have compiled TSAs since Canada published the first TSA in 1994. The statistical departments of the United Nations (UN), the European Community (EC), OECD and UNWTO jointly published *Tourism Satellite Account: Recommended Methodological Framework* (herein

TSA: RMF, 2001, 2008) to unify definitions related to tourism that are used in TSAs. Although most of the destinations take TSA: RMF (2001, 2008) as a framework for designing their own TSAs, the definitions are not exactly the same in different countries. For example, in Australia and New Zealand 'A product is classified as a tourism-characteristic product if at least 25 percent of its production is purchased by tourists' (Statistics New Zealand [SNZ], 2015). In contrast, the TSAs of the USA and Canada do not include the aforementioned specific categorisation. Furthermore, the TSA is called the Tourism and Travel Satellite Account (TTSA) in the USA, and it uses different definitions. Thus, caution is needed when comparing the output of TSAs from various countries or regions. This study uses TSA data from different destinations, as the aim is to test the impact of tourism on economic growth and not to compare the tourism value added.

The development of TSAs has been a focus in the academic community. Some scholars studied the development of TSAs for different destinations such as Nordström (1996) for Sweden or Meis (1999) and Libreos, Massieu and Meis (2006) for Canada. Other researchers, such as Frechtling (1999), identified the usefulness of TSAs for the study of the economic impact of tourism. Frechtling (2010) is an updated version of Frechtling (1999) that introduced TSA based on TSA: RMF 2008. Smeral (2006) argued that the output of a TSA can only account for direct effects and cannot show the indirect and induced effects. Dwyer, Forsyth and Spurr (2007) followed by comparing the differences between the TSA framework and the CGE model, using Australia as an example; they showed that TSA and CGE models are complementary methods. Jones and Munday (2007) and Alhert (2008) compiled TSA to IO tables and studied the impact of tourism on environmental issues and the German economy, respectively. Unlike Jones and Munday (2007) and Alhert (2008), who only used one-year's TSA to match the IO table, this study uses time series data from TSAs in the model estimation. This can be seen as an expansion of the application of TSA data.

3.5.2. The Selection of Research Destinations

Mauritius, Spain, New Zealand and the USA are selected to test the TLEG hypothesis. Although Mauritius only published TSAs for 2005 and 2010, it is, to the best of my knowledge, the only island economy with available TSAs. The two years of TSA data are not helpful for Bayesian estimation, but they help us to understand the structure of the tourism industry in Mauritius from the demand side. The valued added benefits of tourism can be obtained from the IO tables. The details of the data calibration for Mauritius are introduced in the following sections. Spain, New Zealand and the USA are three of the first destinations to compile TSAs and the figures have been published annually since 1995, 1999[4] and 1998, respectively. Although only the USA publishes quarterly TSA data, the annual data of Spain and New Zealand can be transformed to quarterly data based on quarterly tourism receipts or tourism exports to further expand the sample size.

These four destinations represent different degrees of tourism specialisation.

Mauritius is a typical island economy and tourism is the most important pillar industry in this destination. International tourist arrivals to Mauritius and tourism receipts for Mauritius have experienced rapid growth since 1995, with average annual growth rates of 4.86 and 7.52%, respectively. The direct contribution of tourism to GDP was 10.8 % in 2013 (Table 3.1), which is the largest of the country's five pillar industries, sugar, tourism, textile, financial services and information and communication technology sectors. Although Mauritius is not as representative

[4] The TSA data from New Zealand for the 1995 to 1998 period are from pilot tests.

of an island economy that specialises in tourism as destinations such as Fiji or the Maldives in terms of the contribution of tourism to GDP, it is a practical option given the data availability of tourism statistics.

Spain achieved industrialisation through the development of tourism (Sinclair, 1998; Balaguer & Cantavella-Jordá, 2002; Dritsakis, 2004). Manufacturing imported fixed capital and technologies using the surplus in the current account that accumulated through the expansion of tourism exports. The accumulation of capital was essential to the economic growth of Spain in the 1960s (Balaguer & Cantavella-Jordá, 2002 cited from Padilla, 1998). Although the growth of inbound tourism in Spain is moderate (See Table 3.1), given the large number of arrivals, the expansion is still significant. The macroeconomic of Spain was successively damaged by the global financial crisis and the European debt crisis and has not yet recovered. Hence, this is a good opportunity to test whether tourism can help Spain to escape from the shadow of these crises.

The economic structure of New Zealand is similar to Spain's. The direct contribution of tourism to GDP has been relatively steady over the past five years (around 3.7%, which is only one percent lower than that of Spain) (See Table 3.1). The difference is that the economic growth of New Zealand apart from tourism is driven by tertiary industry sectors rather than manufacturing. New Zealand is thus selected to test the impact of tourism on economic growth in different industry structures.

The USA is a destination with a much larger territory than the others. Lanza and Pigliaru (1999) constructed a theoretical model and mathematically explained that the relative endowment of natural resources, rather than territorial size, determines whether the TLEG hypothesis is supported in small and tourism specialised countries. However, as the fourth largest country in terms of territory, the USA attracted around 63.9 million arrivals and US$180.7 billion tourism receipts in 2013 (See Table 3.1), ranking second and first globally, respectively (UNWTO, 2014). Although it is not easy to compare the relative natural resources of the USA with other small and tourism-specialised countries, it is necessary to investigate the impact of tourism on economic growth in such a large and important destination. Like the USA, Canada covers a large territory, but does not compile quarterly TSA data. However, given the rank of the USA in international tourism, it is more representative and meaningful than Canada for our study.

Table 3.1 Tourist Arrivals, Tourism Receipts and Direct Tourism Contribution of the Selected Destinations

	Mauritius			Spain		
	Arrivals (thousand)	Receipts (US million)	Direct Contribution of Tourism to GDP (%)	Arrivals (thousand)	Receipts (US million)	Direct Contribution of Tourism to GDP (%)
1995	422	430	-	39324	27369	4.8
1996	487	504	-	40541	29751	5.0
1997	536	478	-	43252	28649	5.4
1998	558	496	-	47749	31592	5.6
1999	578	453	16.0	46775	32497	6.0
2000	656	542	16.9	47898	31454	5.8
2001	660	624	17.3	50094	33829	5.7
2002	682	612	17.6	52327	35468	5.2
2003	702	696	17.1	50854	43863	5.1
2004	719	853	17.3	52430	49996	4.9
2005	761	871	16.9	55914	52960	4.9
2006	788	1007	17.4	58004	57543	4.8
2007	907	1299	17.7	57666	65020	4.7
2008	930	1448	16.1	57192	70434	4.6
2009	871	1117	13.8	52178	59539	4.3
2010	935	1282	14.5	52677	52525	4.5
2011	965	1488	11.9	56177	59892	4.9
2012	965	1477	11.6	57464	55916	5.1
2013	993	1321	10.8	60661	-	-
AAGR	4.86%	7.52%		2.44%	4.29%	-

	New Zealand			USA		
	Arrivals (thousand)	Receipts (US million)	Direct Contribution of Tourism to GDP (%)	Arrivals (thousand)	Receipts (US million)	Direct Contribution of Tourism to GDP (%)
1995	1409	2318	3.4	43318	82304	2.8
1996	1529	2553	-	46489	90231	2.9
1997	1497	2211	4.7	47766	94294	3.0
1998	1485	1857	4.4	46395	91423	3.0
1999	1607	2237	4.2	48491	94586	2.9
2000	1787	2249	4.1	50891	103088	2.8
2001	1909	2350	4.3	46907	89819	2.7
2002	2045	3077	4.4	43581	83651	2.8
2003	2104	4030	4.6	41218	80250	2.8
2004	2334	4771	4.5	46086	93397	2.8
2005	2366	4984	4.4	49206	102769	2.8
2006	2409	4792	4.3	50977	107825	2.8
2007	2455	5414	4.2	55979	122542	2.8
2008	2447	5152	4.2	57937	141380	2.6
2009	2448	4592	3.8	54884	120290	2.5

2010	2525	4906	3.6	59796	134450	2.5
2011	2601	5579	3.6	62711	152315	2.6
2012	2565	5454	3.6	66969	165574	2.6
2013	2718	-	3.7	63873	180714	2.6
AAGR	3.72%	5.16%	-	2.18%	4.47%	-

Notes: 1. AAGR indicates the average annual growth rate; 2. Limited by the data availability of TSA, the direct contribution of tourism to GDP in Mauritius is deviated from IO table covering the sectors of hotl and transportation.
Source: UNWTO (1999, 2002, 2004, 2007a, 2007b, 2011, 2012); Statistics Mauritius [SM] (2015);NSIS (2004, 2010, 2013); SNZ (2013); OTTI (2014)

3.6. Chapter Summary

This chapter outlines the procedures for applying the DSGE model in a step-by-step investigation of the impact of tourism on economic growth. A two-sector model is proposed after solving a simple DSGE model by hand to display the structures of the artificial economies. Blanchard and Kahn's method is introduced to show how to solve a DSGE model numerically, because it is impossible to obtain analytical solutions for complex DSGE models. Then the procedures to implement the Bayesian estimation are presented. Lastly, TSAs and the selection of sample destinations in this study are discussed.

4. The Model and Data

4.1 Introduction

In this chapter, a two-sector mode is developed mathematically from the framework introduced in the preceding chapter. In Section 4.2, the model is presented in detail, then the results of the log-linear transformation are presented and the data are discussed. Section 4.3 summarises the chapter.

4.2 Two-Sector DSGE Model in an Open Economy with Search and Matching Theory

A two-sector DSGE model in an open economy with search and matching theory is used to model the economies of the selected destinations. Song *et al*. (2012) argued that most tourism research focusing on employment is based on neoclassical labour economics that do not consider the frictions in employment markets. To address the impact of tourism on unemployment in selected destinations such as Spain and the USA, the search and matching theory is introduced to tourism economics. The model is presented mathematically in Section 4.2.1, followed by the log-linearised result of the model. Then the variables and data used in the Bayesian estimation process are introduced.

4.2.1. The Model

There are three types of representative agents in an open economy: households, firms and government. For this study, the firms are divided into two sectors: the tourism and non-tourism sectors. It is assumed that some members of each household work in the tourism sector, some in the non-tourism sectors and some are unemployed.

4.2.1.1. Search and Matching

Search-matching theory was developed by Mortesen and Pissarides (1994). It provides a strong microeconomic foundation for understanding the interaction between job hunters and employers by modelling the asymmetric information that prevents instantaneous job matching in an employment market. It is assumed that employees can transfer between sectors without any restrictions. Thus, unemployment in an economy can be expressed as

$$u_t = 1 - n_t \quad , \tag{4.1}$$

where u_t and n_t are the overall unemployment and employment rates, respectively. As assumed by Gerlter & Trigari (2006), the number of newly matched jobs, m_t, is determined by unemployment rate, u_t, and vacancies, v_t, with the Cobb-Douglas production format:

$$m_t = u_t^{\sigma_m} v_t^{1-\sigma_m} \quad . \tag{4.2}$$

The probabilities of a firm recruiting a new employee and unemployed person finding a job are

$$q_t = \frac{m_t}{v_t} \tag{4.3}$$

and

$$p_t = \frac{m_t}{u_t} \quad , \tag{4.4}$$

respectively. As a result, the hiring rate in tourism sector $x_{T,t}$ and in non-tourism sector $x_{NT,t}$ equal

$$x_{i,t} = \frac{q_t v_t}{n_{i,t}} \; (i = T, NT) \quad , \tag{4.5}$$

where $n_{T,t}$ and $n_{NT,t}$ are the ratios of tourism and non-tourism employment to overall employment, respectively. Firms and job hunters take q_t and p_t as given.

4.2.1.2. Household

It is assumed that households have infinite lives and will maximise the discounted value of the lifetime utility for consumption (C_t) such that

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t), \tag{4.6}$$

where the instantaneous utility function is

$$U(C_t) = \frac{[(C_t - hC_{t-1})\zeta_{C,t}]^{1-\sigma}}{1-\sigma} \quad , \tag{4.7}$$

and where β is the discount factor, h is the parameter to capture the habit persistence of consumption and $\frac{1}{\sigma}$ is the elasticity of the intertemporal substitution. $\zeta_{C,t}$ is a preference shock that follows an auto-regressive process such that $\zeta_{C,t} = \rho_C \zeta_{C,t-1} + \varepsilon_t^C$. C_t is aggregated by tourism products $C_{T,t}$, non-tourism products $C_{NT,t}$ and imported non-tourism products $C_{M,t}$ as

$$C_t = [\gamma_1^{\frac{1}{\theta_1}} (\mathrm{C}_{T,t})^{\frac{\theta_1 - 1}{\theta_1}} + \gamma_2^{\frac{1}{\theta_1}} (\mathrm{C}_{NT,t})^{\frac{\theta_1 - 1}{\theta_1}} + (1 - \gamma_1 - \gamma_2)(\mathrm{C}_{M,t} \cdot \zeta_{CM,t})^{\frac{\theta_1 - 1}{\theta_1}}]^{\frac{\theta_1}{\theta_1 - 1}} \quad , \tag{4.8}$$

where $0 < \gamma_1, \gamma_2 < 1$ are, respectively, the shares of domestic tourism and non-tourism products in final consumption and $\theta_1 > 0$ is the elasticity of substitution across various products[5]. $\zeta_{CM,t}$ is a stochastic shock to imports that follows an auto-regressive process.

If the price of imports is taken as a numeraire, the price index P_t can be expressed as

$$P_t = [\gamma_1 (\mathrm{P}_{T,t})^{1-\theta_1} + \gamma_2 (\mathrm{P}_{NT,t})^{1-\theta_1} + (1 - \gamma_1 - \gamma_2)]^{\frac{1}{1-\theta_1}} \tag{4.9}$$

[5] Subscripts T, NT and M represent tourism, non-tourism and imports, respectively.

where $P_{T,t}$ and $P_{NT,t}$ are the price index of tourism and non-tourism products, respectively. The budget constraint of households is

$$(C_t + K_{t+1} + B_{t+1}) = [u_t b + (1-\tau_w)(w_{T,t}\,\mathrm{n}_{T,t} + w_{NT,t} n_{NT,t})] + (\mathrm{r}_t + 1 - \delta)\,\mathrm{K}_t + (1 + r_{b,t}) B_t] \quad . \tag{4.10}$$

In Equation (4.10), K_t is the capital stock in period t, r_t is the nominal earning rate of fixed asset investment and δ is the depreciation rate. B_t is a one period treasury security with a nominal earning rate of $r_{b,t}$ and b is the nominal earnings from the unemployment insurance that is assumed as a constant ratio of wage. $w_{i,t}$ (i=T,NT) are the nominal wage levels of the tourism and non-tourism sectors, respectively, and τ_w is the tax rate of wages.

The first order conditions of households are

$$\lambda_t = (C_t - h \cdot C_{t-1})^{-\sigma} - h\beta(C_{t+1} - hC_t)^{-\sigma} \quad , \tag{4.11}$$

$$\lambda_t = \lambda_{t+1}(\mathrm{r}_{t+1} + 1 - \delta) \ , \tag{4.12}$$

$$\lambda_t = \lambda_{t+1}(r_{b,t+1} + 1) \ , \tag{4.13}$$

$$C_{T,t} = \gamma_1 (\frac{P_t}{P_{T,t}})^{\theta_1} C_t \ , \tag{4.14}$$

$$C_{NT,t} = \gamma_2 (\frac{P_t}{P_{NT,t}})^{\theta_1} C_t \ , \tag{4.15}$$

and

$$C_{M,t} \bullet \zeta_{CM,t} = (1 - \gamma_1 - \gamma_2)(P_t)^{\theta_1} C_t , \tag{4.16}$$

where λ_t is the Lagrange multiplier. Equation (4.11) is the marginal utility of consumption, whereas Equations (4.12) and (4.13) are the saving-investment decisions on capital investment and treasury security, respectively. Equations (4.14) to (4.16) are the optimal consumption levels of $C_{T,t}$, $C_{NT,t}$ and $C_{M,t}$, respectively.

4.2.1.3. Firms

It is assumed that representative firms in both the tourism and non-tourism sectors use the Cobb-Douglas production technology such that

$$Y_{i,t} = A_{i,t} K_{i,t}^{\alpha_i} n_{i,t}^{1-\alpha_i} \ (i = T, NT) \ , \tag{4.17}$$

where $Y_{i,t}$ is the real value added of the representative firm in period t, $K_{j,t}$ and $n_{j,t}$ are the capital and labour inputs in the production, respectively. α_i is the output elasticity of capital, and $A_{i,t}$ is the productivity of each sector, which follows

$$A_{i,t} = \rho^A A_{i,t-1} + \varepsilon_{i,t}^A \ (i = T, NT) \ , \tag{4.18}$$

where $\varepsilon_{j,t}^A$ is an exogenous stochastic shock. The capital stock in period $t+1$ is composed of the fixed capital investment to period $t+1$ in period t and the capital stock left in period t.

$$K_{i,t+1} = \zeta_{I,t} I_{i,t} + (1-\delta) K_{i,t} \ (i = T, NT) \ , \tag{4.19}$$

where $I_{i,t}$ is the fixed capital investment from the household in period t and δ is the quarterly deprecating rate. $\zeta_{I,t}$ is an exogenous shock to investment that follows an auto-regression process of $\zeta_{I,t} = \rho_I \zeta_{I,t-1} + \varepsilon_t^I$.

$I_{j,t}$ is aggregated by domestic investment $I_{i,t}^D$ and FDI $I_{i,t}^F$ as

$$I_{i,t} = [\gamma_3^{\frac{1}{\theta_2}} (I_{i,t}^D)^{\frac{\theta_2 - 1}{\theta_2}} + (1-\gamma_3)^{\frac{1}{\theta_2}} (I_{i,t}^F)^{\frac{\theta_2 - 1}{\theta_2}}]^{\frac{\theta_2}{\theta_2 - 1}} \ (i = T, NT) \ . \tag{4.20}$$

γ_3 is the share of domestic investment in each sector and θ_2 is the substitute elasticity between domestic and foreign investment. If $\gamma_3 > 1$, it means the destination is a capital export country.

According to Orrego & Vega (2013), as the imports price is the numeraire of the model, the cost minimisation problem of the investment is

$$\min_{I_{i,t}^{D}, I_{i,t}^{F}} P_{i,t} I_{i,t}^{D} + RER_t I_{i,t}^{F} \quad (i = T, NT), \tag{4.21}$$

subject to Equation (4.20), and RER_t is the real exchange rate priced by the indirect quotation method. The optimal domestic and foreign investment are given as

$$I_{i,t}^{D} = \gamma_3 I_{i,t} \zeta_{I,t} \quad (i = T, NT), \tag{4.22}$$

and

$$I_{i,t}^{F} = (1-\gamma_3) I_{i,t} (\frac{P_{i,t}}{RER_t})^{\theta_2} \zeta_{I,t} \quad (i = T, NT). \tag{4.23}$$

The evolution of employment in each period is

$$n_{i,t+1} = \rho \bullet n_{i,t} + q_t v_t \quad (i = T, NT) \tag{4.24}$$

where ρ is the fraction of employees who keep their jobs successfully from period t to $t+1$. Equation (4.24) means that the employment in each sector is the sum of employees who were kept from the last period and the new employees who got a job in this period.

Firms aim to maximise profit, *Pro,* by choosing the optimal capital stock and number of employees. As the recruitment probability p_t is taken as given, firms need to decide how many vacancies should be posted in each period. The profit of a firm can be expressed as

$$\Pr o(K_{it}, n_{it}) = P_{i,t}(1-\tau_Y)\,\mathrm{Y}_{i,t} - r_t K_{i,t} - w_{i,t} n_{i,t} - \frac{\kappa}{2}(\mathrm{x}_{i,t})^2\,\mathrm{n}_{i,t} + \beta E_t \Lambda_{t,t+1} \Pr o(K_{i,t+1}, n_{i,t+1}) \quad (i = T, NT), \tag{4.25}$$

subject to Equations (4.19) and (4.24). In Equation (4.25), $\Lambda_{t,t+1} = \lambda_{t+1} / \lambda_t$ and $\beta \Lambda_{t,t+1}$ is the discount rate of firms. $\frac{\kappa}{2}(x_{i,t})^2 n_{i,t}$ is a convex adjustment cost of employment and τ_Y measures the production tax rate.

The first order condition of $K_{i,t}$ is

$$r_t = \alpha_i (1 - \tau_Y) \frac{P_{i,t} Y_{i,t}}{K_{i,t}} \quad (i = T, NT) \cdot \tag{4.26}$$

The marginal profit of recruiting a new employee is

$$J_{i,t} = a_{i,t} - w_{i,t} + \frac{\kappa}{2} x_{i,t}^2 + \rho \beta E_t \Lambda_{t,t+1} J_{i,t+1} \quad (i = T, NT), \tag{4.27}$$

where $a_{i,t} = (1 - \tau_Y)(1 - \alpha_i) P_{i,t} Y_{i,t} \zeta_{L,t} / n_{i,t}$ is the marginal production of labour and $\zeta_{L,t}$ is an exogenous shock to $a_{i,t}$, following an auto-regression process of $\zeta_{L,t} = \rho_L \zeta_{L,t-1} + \varepsilon_t^L$.

Equation (4.27) indicates that the benefit of hiring one more employee in period *t* is calculated by the firm's surplus obtained from the recruitment, $a_{i,t} - w_{i,t}$, the savings on adjustment $\frac{\kappa}{2} x_{i,t}^2$ (i.e. the adjustment cost is considered sunk) and the discounted stream of the marginal benefit in the future. Thus, the marginal cost of hiring another employee in period *t* should equal the benefit the new employee will bring to the firm in the future, which can be expressed as

$$\kappa x_{i,t} = \beta E_t \Lambda_{t,t+1} J_{i,t+1} \quad (i = T, NT) \ . \tag{4.28}$$

Using the envelop theorem, the hiring decision of firms can be rewritten as

$$\kappa x_{i,t} = \beta E_t \Lambda_{t,t+1} (\mathrm{a}_{i,t+1} \text{-} \mathrm{w}_{i,t+1} + \frac{\kappa}{2} x_{i,t+1}^2 + \rho \kappa x_{i,t+1}) \quad (i = T, NT) \ . \tag{4.29}$$

4.2.1.4. Wage Bargaining

Although as individual workers employees do not have enough bargaining power to negotiate wages with firms, due to the existence of labour unions and legal protections, firms need to consider the benefits of workers when they offer a contract wage. To capture the bargaining process between employers and employees, the Nash bargaining technique is introduced to show how wages are codetermined by both parties.

Nash bargaining is a widely used economic model proposed by Nash (1950) to investigate interactions in the bargaining process, with a Pareto efficient solution. According to Gerlter & Trigari (2006), suppose the wage bargaining follows a Cobb-Douglas function, which is presented as

$$\max H_{i,t}^{\eta} J_{i,t}^{1-\eta} \quad (i = T, NT) \quad , \tag{4.30}$$

where $H_{i,t}$ is the worker's surplus to have a job and as discussed earlier, $J_{i,t}$ is the firm's surplus to hire a worker and η is the bargaining power of employees.

The income flow of an employed worker and a job-hunter are defined as

$$V_{i,t} = w_{i,t} + \beta E_t \Lambda_{t,t+1}[\rho V_{i,t+1} + (1-\rho)U_{i,t+1}] \ (i = T, NT), \tag{4.31}$$

and

$$U_{i,t} = b + \beta E_t \Lambda_{t,t+1}[p_t V_{i,t+1} + (1-p_t)U_{i,t+1}] \ (i = T, NT) \ . \tag{4.32}$$

The implications of Equations (4.31) and (4.32) are straightforward. The income flow of a worker who is employed in period *t* depends on the wage of period *t* and future expectations, with the probability of ρ that he will keep the job and $1 - \rho$ that he will be unemployed. A job hunter's income is composed of unemployment insurance *b* and the future expectation, with the probability of p_t that she will find a new job and $1-p_t$ that she will remain unemployed. Thus, the worker's surplus, $H_{i,t}$, is

$$H_{i,t} = V_{i,t} - U_{i,t} = w_{i,t} - b + \beta E_t \Lambda_{t,t+1}(\rho - p_t) H_{i,t+1} \ (i = T, NT) \ . \tag{4.33}$$

We use the firm's surplus, Equation (4.27), together with Equation (4.33) to determine the first order condition of Equation (4.30), which is

$$\eta J_{i,t} = (1-\eta) H_{i,t} \ (i = T, NT) \ . \tag{4.34}$$

Substitute $J_{i,t}$ and $H_{i,t}$ from Equations (4.27) and (4.33), respectively, and Equation (4.34) is expanded to

$$\eta(a_{i,t} - w_{i,t} + \frac{\kappa}{2} x_{i,t}^2 + \rho\beta E_t \Lambda_{t,t+1} J_{i,t+1}) = (1-\eta)[w_{i,t} - b + \beta E_t \Lambda_{t,t+1}(\rho - p_t) H_{i,t+1}] \ (i = T, NT) \tag{4.35}$$

Rearrange the terms, and then $w_{i,t}$ can be expressed as

$$w_{i,t} = \eta(a_{i,t} + \frac{\kappa}{2} x_{i,t}^2) + (1-\eta)(b + \beta E_t \Lambda_{t,t+1} p_t H_{i,t+1}) \ (i = T, NT) \ . \tag{4.36}$$

Equation (4.36) shows that in Nash bargaining the wage is decided by the combination of the firm's surplus and the worker's surplus. Substitute Equations (4.28) and (4.34) into Equation (4.36), and $w_{i,t}$ can be expressed as a function of $a_{i,t}$, $x_{i,t}$ and p_t, which is easy to simulate:

$$w_{i,t} = \eta(a_{i,t} + \frac{\kappa}{2} x_{i,t}^2 + \beta\kappa E_t \Lambda_{t,t+1} p_t x_{i,t+1}) + (1-\eta) b \ \ (i = T, NT) \ . \tag{4.37}$$

4.2.1.5. Government and International Economy

The budget of government is defined as

$$\tau_w (w_{T,t} n_{T,t} + w_{NT,t} n_{NT,t}) + \tau_y P_t Y_t + B_{t+1} = (1 + r_{b,t}) B_t \ . \tag{4.38}$$

In Equation (4.38), the left-hand side of the equation is the income of the government including wage taxes, production taxes and the inflow from selling the treasury security of the next period, and the right-hand side is the payment of the principal and interest of the treasury security in this period.

The exports are measured by foreign currency and determined by domestic prices after adjustments for the real exchange rate and the income of the world economies.

$$EX_{i,t} = (\frac{P_{i,t}}{RER_t})^{\theta_{ex_i}} Yrow_t^{\omega_i} \quad (i = T, NT) \ , \tag{4.39}$$

where $\theta_{ex,i}$ and ω_i are the price and income elasticities, respectively. The setting is consistent with most of the tourism demand modelling literature such as Song, Kim and Yang (2010). The balance of the international payment is

$$P_t \bullet BIP_t \,/\, RER_t = EX_{T,t} + EX_{NT,t} - (C_{M,t}\zeta_{CM,t}) - I_{T,t}^F - I_{NT,t}^F \ . \tag{4.40}$$

The international payment is composed of the exports of tourism and non-tourism products minus the imports and FDI. However, if the foreign investments are negative, the country is exporting capital to the world.

The income of the world economies and the real exchange rate follow an auto-regressive processes such that

$$Yrow_t = \rho_{Yrow} Yrow_{t-1} + \varepsilon_t^{Yrow} , \tag{4.41}$$

and

$$RER_t = \rho_{rer} RER_{t-1} + \varepsilon_t^{RER} \ . \tag{4.42}$$

where ρ_{yrow} and ρ_{rer} are the auto-regressive coefficients and $\varepsilon_{yrow,t}$ and $\varepsilon_{rer,t}$ are two exogenous stochastic shocks.

4.2.1.6. Market Clearing Conditions

The following equations have to be satisfied in equilibrium

$$Y_t P_t = Y_{T,t} P_{T,t} + Y_{Nt,t} P_{Nt,t} \ , \tag{4.43}$$

$$I_t P_t = I_{T,t} P_{T,t} + I_{NT,t} P_{NT,t} \ , \tag{4.44}$$

$$n_t = n_{T,t} + n_{NT,t} \ , \tag{4.45}$$

and

$$P_t Y_t = P_t (C_t + I_t + BIP_t) + \frac{\kappa}{2} (x_{T,t}^2 n_{T,t} + x_{NT,t}^2 n_{NT,t}) \tag{4.46}$$

Equations (4.43) to (4.45) are the aggregations of the product market, capital market and employment market, respectively, and Equation (4.46) is the resource constraint on the economy. To close the model, a conventional Philipps curve is introduced to capture the connection between the price level and the economy:

$$P_t = (u_t - u_{t-1})^{\rho_{Ph}} \ . \tag{4.47}$$

4.2.2. Log-linear Result of the Model

The model introduced in the preceding section is composed of 41 equations with 41 endogenous variables. There are also eight exogenous variables and shocks in the model. To solve and estimate the model, the non-linear equations need to be transformed to linear forms.

The log-linear method is used to linearise the model. After the transformation, the initial values of all of the variables are set to zero, which significantly simplifies the process of model solving, as one of the trickiest steps in solving a non-linear model is finding initial values for the variables.

The result of the log-linear process are as follows.[6]

4.2.2.1. Search and Matching

- Unemployment

$$\tilde{u}_t = -(\overline{n} / \overline{u})\tilde{n}_t \tag{4.48}$$

- Matching:

$$\tilde{m}_t = \sigma_m \tilde{u}_t + (1-\sigma_m)\tilde{v}_t \tag{4.49}$$

- Transition probability of finding a job

$$\tilde{q}_t = \tilde{m}_t - \tilde{v}_t \tag{4.50}$$

- Transition probability of hiring a worker

$$\tilde{p}_t = \tilde{m}_t - \tilde{u}_t \tag{4.51}$$

- Hiring rate

$$\tilde{x}_{T,t} = \tilde{q}_t + \tilde{v}_t - \tilde{n}_{T,t} \tag{4.52}$$

$$\tilde{x}_{NT,t} = \tilde{q}_t + \tilde{v}_t - \tilde{n}_{NT,t} \tag{4.53}$$

4.2.2.2. Household

- Marginal utility

$$\lambda_t = -\sigma(1-h)\frac{\overline{C}}{\overline{Y}}[\tilde{C}_t - h\tilde{C}_{t-1} + \zeta_{C,t} + h\beta(\tilde{C}_{t+1} - h\tilde{C}_t + \zeta_{C,t+1})] \tag{4.54}$$

- Firm's discount factor

[6] In the presentation of log-linear results, the variables are given the same names as in the preceding section. However, a variable that is modified by '-' or '~'indicates a steady state or a percentage deviation from the steady state, respectively.

$$\tilde{\Lambda}_{t,t+1} = \tilde{\lambda}_{t+1} - \tilde{\lambda}_t \qquad (4.55)$$

- Saving-investment decisions

$$\tilde{\Lambda}_{t,t+1} + \tilde{r}_{t+1} = 0 \qquad (4.56)$$

$$\tilde{\Lambda}_{t,t+1} + \tilde{r}_{b,t+1} = 0 \qquad (4.57)$$

- Optimal consumptions

$$\tilde{C}_{T,t} = \theta_1(\tilde{P}_t - \tilde{P}_{T,t}) + \tilde{C}_t \qquad (4.58)$$

$$\tilde{C}_{NT,t} = \theta_1(\tilde{P}_t - \tilde{P}_{NT,t}) + \tilde{C}_t \qquad (4.59)$$

$$\tilde{C}_{MT,t} + \zeta_{CM,t} = \theta_1(\tilde{P}_t) + \tilde{C}_t \qquad (4.60)$$

4.2.2.3. Firms

- Production function

$$\tilde{Y}_{T,t} = \tilde{A}_{T,t} + \alpha_T \tilde{K}_{T,t} + (1-\alpha_T)\tilde{n}_{T,t} \qquad (4.61)$$

$$\tilde{Y}_{NT,t} = \tilde{A}_{NT,t} + \alpha_{NT} \tilde{K}_{NT,t} + (1-\alpha_{NT})\tilde{n}_{NT,t} \qquad (4.62)$$

- Capital accumulation

$$\tilde{K}_{T,t+1} = (1-\delta)\tilde{K}_{T,t} + \delta \tilde{I}_{T,t} + \zeta_{I,t} \qquad (4.63)$$

$$\tilde{K}_{NT,t+1} = (1-\delta)\tilde{K}_{NT,t} + \delta \tilde{I}_{NT,t} + \zeta_{I,t} \qquad (4.64)$$

- Investment composition

$$\tilde{I}^D_{T,t} = \tilde{I}_{T,t} + \zeta_{I,t} \qquad (4.65)$$

$$\tilde{I}^D_{NT,t} = \tilde{I}_{NT,t} + \zeta_{I,t} \qquad (4.66)$$

$$\tilde{I}^F_{T,t} = \tilde{I}_{T,t} + \theta_2(\tilde{P}_{T,t} - R\tilde{E}R_t) + \zeta_{I,t} \qquad (4.67)$$

$$\tilde{I}^F_{NT,t} = \tilde{I}_{NT,t} + \theta_2(\tilde{P}_{NT,t} - R\tilde{E}R_t) + \zeta_{I,t} \qquad (4.68)$$

- Human capital accumulation

$$\tilde{n}_{T,t} = \rho \tilde{n}_{T,t-1} + \tilde{q}_t \tilde{v}_t \tag{4.69}$$

$$\tilde{n}_{NT,t} = \rho \tilde{n}_{NT,t-1} + \tilde{q}_t \tilde{v}_t \tag{4.70}$$

- Marginal product

$$\tilde{r}_t = \tilde{Y}_{T,t} - \tilde{K}_{T,t} + \tilde{P}_{T,t} \tag{4.71}$$

$$\tilde{r}_t = \tilde{Y}_{NT,t} - \tilde{K}_{NT,t} + \tilde{P}_{NT,t} \tag{4.72}$$

$$\tilde{a}_{T,t} = \tilde{Y}_{T,t} - \tilde{n}_{T,t} + \tilde{P}_{T,t} + \zeta_{l,t} \tag{4.73}$$

$$\tilde{a}_{NT,t} = \tilde{Y}_{NT,t} - \tilde{n}_{NT,t} + \tilde{P}_{NT,t} + \tilde{\zeta}_{l,t} \tag{4.74}$$

- Recruitment decision

$$\tilde{x}_{T,t} = \psi_a \bullet \tilde{a}_{T,t+1} - \psi_w \bullet \tilde{w}_{T,t+1} + \psi \bullet \tilde{\Lambda}_{t,t+1} + \beta(1+\rho)\tilde{x}_{T,t+1} \tag{4.75}$$

$$\tilde{x}_{NT,t} = \psi_a \bullet \tilde{a}_{NT,t+1} - \psi_w \bullet \tilde{w}_{NT,t+1} + \psi \bullet \tilde{\Lambda}_{t,t+1} + \beta(1+\rho)\tilde{x}_{NT,t+1} \tag{4.76}$$

where $\psi = \beta / (\kappa \bullet \overline{x})$, $\psi_a = \overline{a} \bullet \psi$ and $\psi_w = \overline{w} \bullet \psi$. In steady state, there are no differences between the two sectors, thus, the subscripts of "*T*" and "*NT*" are removed.

4.2.2.4. Wage Bargaining

$$\tilde{w}_{T,t} = \phi_a \bullet \tilde{a}_{T,t} + \phi_p \bullet \tilde{p}_t + \phi_x \bullet \tilde{x}_{T,t} + \phi_p \bullet \tilde{x}_{T,t+1} \tag{4.77}$$

$$\tilde{w}_{NT,t} = \phi_a \bullet \tilde{a}_{NT,t} + \phi_p \bullet \tilde{p}_t + \phi_x \bullet \tilde{x}_{NT,t} + \phi_p \bullet \tilde{x}_{NT,t+1} \tag{4.78}$$

where, $\phi_a = \eta \, \overline{a} \, / \, \overline{w}$ $\phi_x = \eta (\kappa \bullet \overline{x}^2) / \overline{w}$ *and* $\phi_p = \beta \eta \, \overline{p} \overline{H} \, / \, \overline{w}$.

4.2.2.5. Government and International Economy

- Government budget

$$\begin{aligned} &\tau_Y \overline{YP}(\tilde{Y}_t + \tilde{P}_t) + \tau_w \overline{w}_T \overline{n}_T (\tilde{w}_{T,t} + \tilde{n}_{T,t}) + \tau_w \overline{w}_{NT} \overline{n}_{NT} (\tilde{w}_{NT,t} + \tilde{n}_{NT,t}) \\ &+ \overline{B}(\tilde{B}_t - \tilde{B}_{t-1}) = \overline{rb}\overline{B}(\widetilde{rb}_t + \tilde{B}_{t-1}) \end{aligned} \tag{4.79}$$

- Exports

$$EX_{T,t} = \theta_{EX,T}(\tilde{P}_{T,t} - \widetilde{RER}_t) + \omega\widetilde{Yrow}_t \tag{4.80}$$

$$EX_{NT,t} = \theta_{EX,NT}(\tilde{P}_{NT,t} - \widetilde{RER}_t) + \omega\widetilde{Yrow}_t \tag{4.81}$$

- Balance of international payment

$$\begin{aligned}&\overline{BIP}\bullet\overline{P} / \overline{RER}(\widetilde{BIP}_t + \tilde{P}_t - \widetilde{RER}_t) = \overline{EX}_T \bullet \widetilde{EX}_{T,t} + \overline{EX}_{NT} \bullet \widetilde{EX}_{NT,t} \\ &- \overline{C}_M(\tilde{C}_{M,t} + \zeta_{CM,t}) - \overline{I}_T^F \bullet \tilde{I}_{T,t}^F - \overline{I}_{NT}^F \bullet \tilde{I}_{NT,t}^F\end{aligned} \tag{4.82}$$

4.2.2.6. Market Clearing Conditions

- Market clearing

$$\overline{P}\overline{Y}(\tilde{P}_t + \tilde{Y}_t) = \overline{P}_T\overline{Y}_T(\tilde{P}_{T,t} + \tilde{Y}_{T,t}) + \overline{P}_{NT}\overline{Y}_{NT}(\tilde{P}_{NT,t} + \tilde{Y}_{NT,t}) \tag{4.83}$$

$$\overline{PI}(\tilde{P}_t + \tilde{I}_t) = \overline{P}_T\tilde{I}_T(\tilde{P}_{T,t} + \tilde{I}_{T,t}) + \overline{P}_{NT}\overline{Y}_{NT}(\tilde{P}_{NT,t} + \tilde{I}_{NT,t}) \tag{4.84}$$

$$\overline{n}\tilde{n}_t = \overline{n}_T\tilde{n}_{T,t} + \overline{n}_{NT}\tilde{n}_{NT,t} \tag{4.85}$$

$$\tilde{P}_t = \gamma_1\tilde{P}_{T,t} + \gamma_2\tilde{P}_{NT,t} \tag{4.86}$$

- Resource constraint

$$\begin{aligned}&\tilde{Y}_t + \tilde{P}_t = \overline{C}/\overline{Y}(\tilde{C}_t + \tilde{P}_t) + \overline{I}/\overline{Y}(\tilde{I}_t + \tilde{P}_t) + \overline{BIP}/\overline{Y}(\widetilde{BIP}_t + \tilde{P}_t) \\ &+ (1 - \overline{C}/\overline{Y} - \overline{I}/\overline{Y} - \overline{BIP}/\overline{Y})(2\tilde{x}_{T,t} + 2\tilde{x}_{NT,t} + \tilde{n}_{T,t} + \tilde{n}_{NT,t})\end{aligned} \tag{4.87}$$

- Phillips curve

$$\tilde{P}_t = \rho_{Ph}(\tilde{u}_t - \tilde{u}_{t-1}) \tag{4.88}$$

4.2.2.7. Exogenous Variables

$$\tilde{A}_{T,t} = \rho^A\tilde{A}_{T,t-1} + \varepsilon_{T,t}^A \tag{4.89}$$

$$\tilde{A}_{NT,t} = \rho^A\tilde{A}_{NT,t-1} + \varepsilon_{NT,t}^A \tag{4.90}$$

$$\tilde{\zeta}_{C,t} = \rho_C\tilde{\zeta}_{C,t-1} + \varepsilon_t^C \tag{4.91}$$

$$\tilde{\zeta}_{I,t} = \rho_I \tilde{\zeta}_{I,t-1} + \varepsilon_t^I \quad (4.92)$$

$$\tilde{\zeta}_{L,t} = \rho_L \tilde{\zeta}_{L,t-1} + \varepsilon_t^L \quad (4.93)$$

$$\widetilde{Yrow}_t = \rho_{Yrow} \widetilde{Yrow}_{t-1} + \varepsilon_{yrow,t} \quad (4.94)$$

$$\widetilde{RER}_t = \rho_{rer} \widetilde{RER}_{t-1} + \varepsilon_t^{RER} \quad (4.95)$$

$$\zeta_{CM,t} = \rho_{CM} \zeta_{CM,t-1} + \varepsilon_t^{PM} \quad (4.96)$$

4.2.3. Observable Variables and Data

4.2.3.1. Selection of Observable Variables and Data Transformation

Eight variables, GDP, tourism value added, final consumption, total fixed capital formation, tourism exports, non-tourism exports, imports and CPI are selected as the observable variables for the destinations.

Data for Mauritius

As Mauritius only compiled TSAs for 2005 and 2010, tourism and non-tourism exports are not available for other years. Thus, these two variables are excluded from the observable variables of Mauritius. The quarterly data of the other six variables, except CPI, are obtained from the Statistics Board of Mauritius (Table 4.1). The CPI index is based on 2010 data and is collected from the *International Financial Statistics* of the International Monetary Fund (IMF).

Due to the lack of annual TSA data, the IO tables for 1997, 2002 and 2007 are used to calculate the value added of tourism of Mauritius. According to the 2005 and 2010 TSAs, the aggregation of lodging, food and beverage serving services and transport services sectors accounts for 79 and 84% of the tourism value added, respectively. Because the contributions from other sectors to tourism cannot be split out without a TSA, these three sectors are selected to represent the tourism sector of Mauritius. The output multipliers are calculated based on IO tables to estimate indirect and induced effects. To show the dynamic trend of tourism development, multipliers of the 1999 - 2001 and 2003 - 2006 periods are represented by the averages of multipliers of the 1997 - 2002 and 2002 - 2007 periods, respectively.

Table 4.1 Observable Variables in Models

Variable	Mauritius			Spain		
	Data Source	Frequency	Time Period	Data Source	Frequency	Time Period
GDP	SM	Quarterly	1999-2014	NSIS	Quarterly	1995-2012
Total Final Consumption	SM	Quarterly	1999-2014	NSIS	Quarterly	1995-2012
Total Fixed Capital Formation	SM	Quarterly	1999-2014	NSIS	Quarterly	1995-2012
Imports	SM	Quarterly	1999-2014	NSIS	Quarterly	1995-2012
Non-tourism Exports	N/A	N/A	N/A	NSIS	Quarterly	1995-2012
Consumer Price Index	SM	Quarterly	1999-2014	NSIS	Quarterly	1995-2012
Tourism Value Added	SM	Quarterly	1999-2014	NSIS	Quarterly	1995-2012
Tourism Exports	N/A	N/A	N/A	NSIS	Quarterly	1995-2012
	New Zealand			USA		
	Data Source	Frequency	Time Period	Data Source	Frequency	Time Period
GDP	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013
Total Final Consumption	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013
Total Fixed Capital Formation	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013
Imports	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013
Non-tourism Exports	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013
Consumer Price Index	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013
Tourism Value Added	SNZ	Quarterly	1999-2014	OTTI	Quarterly	1998-2013
Tourism Exports	SNZ	Quarterly	1999-2014	BLS	Quarterly	1998-2013

Data for Spain and New Zealand

The data for Spain and New Zealand are drawn from NSIS and SNZ, respectively (Table 4.1). The tourism value added and tourism exports of the two destinations are obtained from the annual TSAs, and the data are split into quarterly data. The data for New Zealand can be transformed using quarterly tourism receipts. However, the tourism receipts of Spain do not cover the whole sample period selected for Bayesian estimation, so the values of tourism exports in the current account are used as the weight to split the data. It is necessary to clarify that the tourism exports in the current account are different than those given in a TSA. The former is collected from customs, whereas the latter is from surveys of international tourists. Although the TSA data sets are more comprehensive than the current account, the seasonal effects should be the same. Thus, it is reasonable to weight the tourism value added and tourism exports given in the TSA by tourism exports in the current account.

The Data for the USA

Tourism value added of the USA from 1999 Q1 to 2013 Q4 are obtained from OTTI (Table 4.1). OTTI publishes the direct value added, direct output and indirect output of the tourism industry; thus, the ratio between direct value added and direct output of tourism is used to estimate the indirect value added of tourism based on the indirect output. CPI is collected from the IMF and the other variables are collected from the Bureau of Labour Statistics.

Seasonal adjustments are carried out using the X12 method for the variables of all of the destinations before the nominal variables are transformed to real terms with the CPI.

4.2.3.2. Measurement Equations

The measurement equations of the model is as follows.

$$\left\{\begin{array}{l}
\mathrm{d}\log Y_{ob,t} = g_y + \tilde{Y}_t - \tilde{Y}_{t-1} + \varepsilon^A_{NT,t} \\
\mathrm{d}\log Y_{ob-T,t} = g_{yt} + \tilde{Y}_{T,t} - \tilde{Y}_{T,t-1} + \varepsilon^A_{T,t} \\
\mathrm{d}\log C_{ob,t} = g_y + \tilde{C}_t - \tilde{C}_{t-1} + \varepsilon^A_{NT,t} \\
\mathrm{d}\log I_{ob,t} = g_y + \tilde{I}_t - \tilde{I}_{t-1} + \varepsilon^A_{NT,t} \\
\mathrm{d}\log EX_{ob-T,t} = g_{yt} + \widetilde{EX}_{T,t} - \widetilde{EX}_{T,t-1} + \varepsilon^A_{T,t} \\
\mathrm{d}\log EX_{ob-NT,t} = g_y + \widetilde{EX}_{NT,t} - \widetilde{EX}_{NT,t-1} + \varepsilon^A_{NT,t} \\
\mathrm{d}\log CM_{ob,t} = g_y + \tilde{C}_{M,t} - \tilde{C}_{M,t-1} + \varepsilon^A_{NT,t} \\
\mathrm{d}\log P_{ob,t} = g_y + \tilde{P}_t - \tilde{P}_{t-1} + \varepsilon^A_{NT,t}
\end{array}\right\} \qquad (4.97)$$

Although all four countries are popular international destinations, the contribution of tourism to the GDP is less than 10%, except in Mauritius where it makes up 17% of the GDP in the sample period. Thus, a stochastic shock to the non-tourism sector is used to represent the shock to the whole economy in the measurement equations. In contrast, to test the impact of the expansion of tourism on economic growth, it is necessary to consider an independent shock that is specific to the tourism sector. As tourism export data from Mauritius are not available, the fifth and sixth equations related to exports in Equation (4.97) are not applicable to Mauritius.

4.3. Chapter Summary

This chapter proposes a two-sector DSGE model in an open economy to study the contribution of tourism to economic growth. The search and matching theory is introduced to tourism economics to highlight the role of unemployment in the selected destinations. There are 41 endogenous variables and eight exogenous variables (six for the Mauritian model) in the model. The first order conditions of the model are linearised by the log-linear method to obtain the numerical solution. Then, the selected observable variables of the models and the necessary data transformation are illustrated, followed by the introduction of the measurement equations. The findings and a discussion of the estimation results of the model are presented in the following chapter.

5. Findings and Discussions

5.1 Introduction

This chapter investigates the impact of tourism on economic growth using the estimation results of the model discussed in the previous chapter. The results for Mauritius, Spain, New Zealand and the USA are presented in Sections 5.2 to 5.5, respectively. In each section, the procedures are as follows. The first step is to show the calibration results for the prior distributions of the parameters, and then the Bayesian estimation results. In the third step, IRFs that correspond to a positive productivity shock in the tourism sector are used to simulate the impact of tourism on economic growth. Finally, sensitivity analyses are carried out to test the impact of key parameters on the contribution of tourism to economic growth. Section 5.6 compares the simulation results of the four destinations and Section 5.7 summarises the chapter.

5.2 Mauritius

As an island economy, Mauritius has often been used by scholars to study the relationship between tourism and economic growth (Durbarry, 2004; Lee & Chang, 2008; Fayissa, Nsiah, & Tadasse, 2008). Durbarry (2004) examined the TLEG hypothesis in Mauritius using cointegration and Granger causality tests and concluded that the development of tourism in Mauritius is the Granger cause of economic growth. In this section, the developed DSGE model is estimated with the Bayesian method and then IRFs are used to explore the transmission mechanisms that drove the empirical findings of previous studies.

5.2.1 Calibration of the Parameters in the Mauritian Model

There are three types of parameters in this study's models: structure parameters, shock parameters and other parameters. Structure parameters are parameters that determine the properties of the model, such as the discount rate β , and they are not easy to observe (Wickens, 2012). Shock parameters include the auto-regressive coefficients and the stochastic error terms of the exogenous variables. Other parameters are the steady states of selected variables and parameters that can be calculated by other known parameters. Only the structure and shock parameters are used in the Bayesian estimation, as they are not easy to observe, whereas most of the steady states can be collected from the real tourism and economic data.

The calibration method is used to assign values for the prior distributions of the parameters. The difference between calibration and estimation methods is that calibration selects values for the parameters from other sources, rather than estimating the parameters from real data. The calibration method selects data from three main sources: previous studies, micro-economic surveys and estimations.

In the Mauritian model, there are 18 structure parameters, 11 shock parameters and 30 other parameters. The results of the calibration are given in the following subsections.

5.2.1.1 Calibration of Structure Parameters in the Mauritian Model

The prior distributions of the structure parameters are shown in Table 5.1. As few economic studies focus on the economy of Mauritius, the priors of the parameters are obtained from the DSGE literature. Some conventional parameters, such as β , δ and $\alpha_i (i = T, NT)$, are taken from Smets and Wourters (2003), which is a classic DSGE model that has been used by the European Central

Bank for years. Some of the employment market parameters are from Gerlter and Trigari (2006), which is a pioneer study that introduced search-matching theory to DSGE studies. σ , θ_1 and θ_2 are three substitute elasticities that influence consumption and investment, respectively. The elasticities are calibrated using the values given in Orrego and Vega (2013), which is a study focused on the discussion of Dutch disease. Although these parameters are not valued according to real data or studies focused on Mauritius, they are the best available information that could be found for the model and they are further corrected by the Bayesian estimation. ρ and κ are two parameters calibrated by the values of other parameters. $\theta_{EX,T}$, $\theta_{EX,NT}$, ω and ρ_{PH} are four elasticities that are estimated by the real data, as their determinants, such as price, GDP and unemployment rate, are easy to collected. The estimation results are presented in Appendix 2.1.

Table 5.1 Prior Distribution of Structure Parameters in the Mauritian Model

Structural Parameters		Prior Distribution	Source
Discount Rate	β	Beta (0.99,0.001)	Smets & Wouters(2003)
Depreciation Rate	δ	Beta (0.025,0.01)	Smets&Wouters(2003)
Output Elasticity of Capital in Tourism Sector	α_T	Beta (0.3,0.1)	Smets&Wouters(2003)
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	Beta (0.3,0.1)	Smets&Wouters(2003)
Survival Rate of Employees to Keep the Job	ρ	Beta (0.983,0.01)	Based on $\overline{p}$
Barging Power of Employees	η	Beta (0.5,0.1)	Gerlter & Trigari (2006)
Elasticity of New Hires to Unemployment	σ_m	Gamma (0.5,0.1)	Gerlter & Trigari (2006)
Adjustment Cost of Recruitment	κ	Gamma(152.06,10)	Based on $\overline{a}$
Habit Persistent	h	Beta (0.552,0.1)	Smets&Wouters(2003)
Elasticity of Intertemporal Substitution	σ	Gamma (2,0.1)	Orrego & Vega (2013)
Substitute Elasticity between Products	θ_1	Gamma (0.4,0.1)	Orrego & Vega (2013)
Substitute Elasticity between FDI and Domestic Investment	θ_2	Gamma (1.5,0.1)	Orrego & Vega (2013)
Ratio of Unemployment Benefit to Salary	b	Beta (0.4,0.1)	Gerlter & Trigari (2006)
Price Elasticity of Tourism Exports (Absolute Value)	$\theta_{EX,T}$	Gamma (0.346,0.1)	Regression
Price Elasticity of Non-tourism Exports (Absolute Value)	$\theta_{EX,NT}$	Gamma (0.478,0.1)	Regression
Income Elasticity of Non-tourism Exports	ω_{NT}	Gamma (0.496,0.1)	Regression
Income Elasticity of Tourism Exports	ω_T	Gamma (0.512,0.1)	Regression
Elasticity of Philipps Curve (Absolute Value)	ρ_{PH}	Gamma (0.672,0.1)	Regression

Note: Figures in parentheses are the mean and standard deviation of the distribution respectively.

According to Guerrón-Quintana and Nason (2013), parameters between zero and unit should follow the Beta distribution and parameters which that rule out negative values follow the Gamma distribution. As the price elasticities of exports and the elasticity of the Phillips curve are negative, it is assumed that their absolute values follow the Gamma distribution and the negative signs are retained in the log-linearised equations. As in Gerlter and Trigari (2006), most benchmark values of the standard deviations of the prior distributions are set to 0.1, but some are assigned other values to ensure suitable intervals from where the posterior means in the Bayesian estimation are drawn.

5.2.1.2 The Calibration of Shock Parameters in the Mauritian Model

Due to data availability, there are only six observable variables in the Mauritian model. To avoid the stochastic singularity issue, it is necessary to include as many exogenous variables (shocks) as observable variables in the model. In this model, we include the productivity shocks in the tourism and non-tourism sectors ($A_{T,t}$ and $A_{NT,t}$), income of the world economy ($Yrow_t$), shock to consumption preferences ($\zeta_{C,t}$), shock to imports ($\zeta_{CM,t}$) and the real exchange rate ($\widetilde{RER}_t$). The auto-regressive coefficients and standard deviations of the shocks are shown in Table 5.2. As little information about the parameters given in Table 5.2 could be collected, the priors are taken from Gerlter, Sala and Trigari (2008); therefore, the auto-regressive coefficients follow the Beta distribution (0.500, 0.1) and the standard deviations follow the Inverse Gamma (0.15, 0.25) distribution. As the data describing the real exchange rate can be observed, the mean of the prior distribution is obtained from the auto-regression. The selection of Beta and Inverse Gamma (IGamma) distributions is consistent with the argument of Guerrón-Quintana and Nason (2013).

Table 5.2 Prior Distribution of Shock Parameters in the Mauritian Model

Parameters		Prior Distribution	Source
(a) Auto-regressive Coefficient			
Productivity	ρ^{A}	Beta (0.500,0.1)	Gertler,Sala, &Trigari (2008)
Income of the World Economy	ρ_{ROW}	Beta (0.500,0.1)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ρ_{C}	Beta (0.500,0.1)	Gertler,Sala, &Trigari (2008)
Imports	ρ_{CM}	Beta (0.500,0.1)	Gertler,Sala, &Trigari (2008)
Real Exchange Rate	ρ_{RER}	Beta (0.996,0.001)	Regression
(b) Standard Deviation			
Productivity of Tourism Sector	$\varepsilon_{T,t}^{A}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Productivity of Non-tourism Sector	$\varepsilon_{NT,t}^{A}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Income of the World Economy	ε_{t}^{Yrow}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ε_{t}^{C}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Imports	ε_{t}^{CM}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Real Exchange Rate	ε_{t}^{RER}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)

Note: Figures in parentheses are the mean and standard deviation of the distribution respectively.

5.2.1.3 The Calibration of Other Parameters in the Mauritian Model

Table 5.3 presents the calibration of other parameters in the Mauritian model. The steady states of the selected variables, including $\overline{Y}_T, \overline{Y}_{NT}, \overline{C}, \overline{I}, \overline{CM}, \overline{EX}_T, \overline{EX}_{NT}, \overline{I}_T, \overline{I}_{NT}, \overline{I}_T^F, \overline{I}_{NT}^F, \overline{BP}$ and $\overline{B}$, are used as parameters in the log-linearised model. The steady states are expressed as the average ratio between the corresponding variable and the GDP. The proportion of tourism and non-tourism consumption in the sum of final consumption and imports, and the proportion of tourism and non-tourism employment to total employment are used to calibrate the steady states of γ_1, γ_2, $\overline{n}_T$ and $\overline{n}_{NT}$, respectively. It is assumed that there is no arbitrage in the equilibrium; thus, all of the prices equal the unit. g_y and g_{yt} serve as the long-term economic growth rates in the measurement equations, so they are transformed to logarithm forms. The tax rates in equilibrium are obtained from the Mauritius Revenue Authority with a fixed rate of 15%.

The steady states of the aggregated macroeconomic variables, such as $\overline{Y}_T, \overline{Y}_{NT}, \overline{C}, \overline{I}, \overline{CM}$, $\overline{I}_T^F, \overline{I}_{NT}^F, \overline{BP}$, $\tilde{u}$, $\overline{g}_y$ and $\overline{g}_{yt}$ are calculated based on the real data for the 1999 to 2014 period. Caution is needed when the data for the value added of tourism is used, as the value added data are obtained from the IO table rather than the TSAs of Mauritius, which are only available for 2005 and 2010. The Mauritius government also estimated the values of some variables for the 2006 to 2009 period, based on the results of the 2005 TSA, thus parameters such as $\overline{EX_T}$, $\overline{EX_{NT}}$, $\overline{I_T}$ and $\overline{I_{NT}}$ and ratios such as γ_1 and γ_2 are calculated based on the data from the 2005 to 2010 period. Tourism employment data are only be available from the 2010 TSA, which is the only data source for $\overline{n}_T$ and $\overline{n}_{NT}$. The balance of the treasury of Mauritius is not available, so the ratio of Treasury Security/GDP was set to 0.250, which is the warning line for emerging countries as estimated by IMF (2003). The other parameters listed in Table 5.3 are the ones that can be calculated from other parameters.

As an empirical research method, calibration is challenged that the selection of parameters is subjective. Because the role of priors is to provide as much information about the parameters as possible, the priors are corrected with information included in the real data when using the ML estimation.

Table 5.3 Calibration of Other Parameters in the Mauritian Model

Variables		Value in Steady State	Time Period/Source
GDP/GDP	$\overline{Y}$	1.000	-
Tourism Value Added/GDP	$\overline{Y_T}$	0.172	1999-2014
Non-tourism Value Added/GDP	$\overline{Y}_{NT}$	0.827	1999-2014
Final Consumption/GDP	$\overline{C}$	0.821	1999-2014
Total Investment/GDP	$\overline{I}$	0.237	1999-2014
Imports/GDP	$\overline{CM}$	0.636	1999-2014
Tourism Exports/GDP	$\overline{EX_T}$	0.137	2005-2010
Non-tourism Exports/GDP	$\overline{EX_{NT}}$	0.702	2005-2010
Tourism Investment/GDP	$\overline{I}_T$	0.004	2005-2010
Non-tourism Investment/GDP	$\overline{I}_{NT}$	0.233	2005-2010
Tourism FDI/GDP	$\overline{I_T^F}$	0.003	1999-2014
Non-tourism FDI/GDP	$\overline{I_{NT}^F}$	0.020	1999-2014
Balance of Payment/GDP	$\overline{BP}$	-0.017	1999-2014
Treasury Security/GDP	$\overline{B}$	0.250	-
Unemployment	$\overline{u}$	0.084	1999-2014
Tourism Consumption/(Final Consumption+Imports)	γ_1	0.026	2005-2010
Non-tourism Consumption /(Final Consumption+Imports)	γ_2	0.436	2005-2010
Tourism Employment /Employment	$\overline{n}_T$	0.122	2010
Non-tourism Employment/ Employment	$\overline{n}_{NT}$	0.878	2010
CPI	$\overline{P}$	1.000	-
Tourism Price	$\overline{P_T}$	1.000	-
Non-tourism Price	$\overline{P}_{NT}$	1.000	-
Average Growth Rate of GDP	g_y	Log(1.032)	1999-2014
Average Growth Rate of Non-tourism Value Added	g_{yt}	Log(1.026)	1999-2014
Production Tax Rate	τ_Y	0.150	Mauritius Revenue Authority
Wage Tax Rate	τ_W	0.150	
Turnover Probability of Unemployed People	$\overline{p}$	0.185	2009-2014
Employee's Surplus	$\overline{H}$	4.552	Based on $\overline{u}$ and $\overline{B}$
Hiring Rate	$\overline{x}$	0.017	Based on $\overline{p}$ and $\overline{u}$
Marginal Product of Labor	$\overline{a}$	0.595	$\kappa \cdot \overline{x}[(1/\beta - \overline{x}/2 - \rho) + \eta(\overline{x}/2 + \overline{p})]/(1-\eta)$
Wage	$\overline{w}$	1.593	$\eta(\overline{a} + \kappa \overline{x}^2/2 + \kappa \overline{xp}) + (1-\eta)b$

5.2.2 Estimation Results of the Mauritian Model

The Dynare software is used to conduct the Bayesian estimation. The posterior mode is estimated by the Monte Carlo-based optimisation routine and used to initialise the Metropolis-Hastings algorithm and the jumping distribution. To obtain a good acceptance rate (around 25 to 33%, [Adjemian *et al*., 2014]), the scale of the jumping distribution is set to 0.3. Five parallel Markov chains of 100,000 runs each are drawn from the posterior kernel for the Metropolis-Hastings algorithm to simulate the posterior distributions of the parameters. The first 45% draws are discarded as burn-in draws to remove any dependence between the five chains.

5.2.2.1. Convergence Diagnostics of the Model of Mauritius

As five parallel chains are used to simulate the posterior distributions, it is assumed that they should converge to each other in a good estimation. The multivariate and univariate convergence diagnostics developed by Brooks and Gelman (1998) are introduced to assess the convergence of all of the estimated parameters. The basic idea of the Brooks and Gelman (1998) test is that the draws from all of the chains should converge to the mean of the draws from individual chains. The 80% interval of pooled draws from all of the sequences and the mean of draws from each individual sequence are selected by Brooks and Gelman (1998) to test the convergence. To enhance the reliability of the test, the convergence of the second and third central moments of the above sequences are also examined. If the five chains converge to each other, the two lines should remain stable horizontally and be close to each other.

The multivariate convergence diagnostic is used to test the convergence of all of the parameters simultaneously, representing the overall convergence of the model. The sequences of multivariate diagnostic are calculated based on the posterior likelihood function, which means the posterior kernel is used to aggregate the parameters. The sequences of the absolute mean and the second and third moments of the multivariate convergence diagnostic are shown in Figure 5.1. The top chart shows the sequences of the absolute mean and the middle and bottom charts show the second and third moments, respectively. In Figure 5.1, the dotted lines are the statistics that are calculated from the pooled draws from all of the sequences, and the black lines represent the means of the draws from individual sequences. The lines based on the pooled draws converge and even overlap the lines based on the individual draws in all three figures. This means that, overall, the five chains of the parameters converge and the simulations of the posterior distributions are reliable.

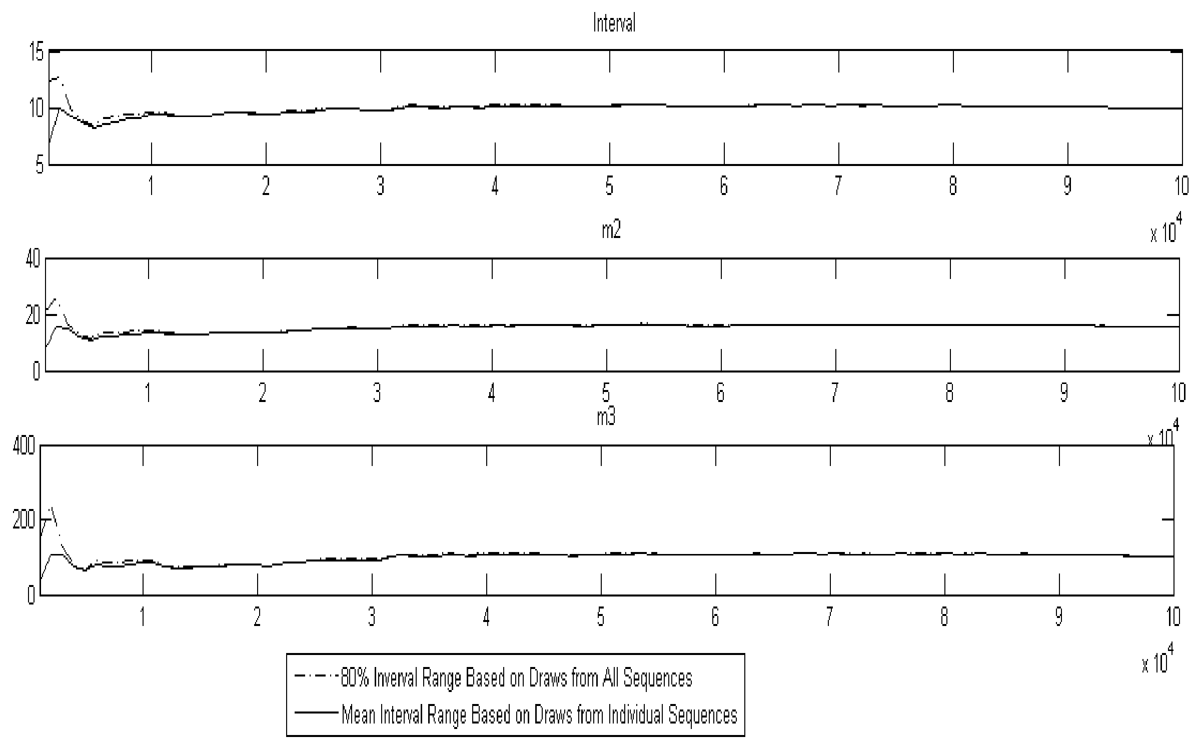


Figure 5.1 Multivariate Convergence Diagnostic of the Mauritian Model

Figure 5.2 shows the results of the univariate convergence diagnostic for all of the parameters in the Mauritian model. The figures in the first column are the diagnostics for the absolute mean between the 80% interval range that is based on the pooled draws from all of the sequences (dotted line) and the mean interval range that is based on the draws from individual sequences (black line). The second and third columns are used to examine the convergence of the squared and cubed absolute deviation from the pooled and within-sample means, respectively.

Although for some parameters such as the standard deviation of $\varepsilon^{A}_{NT,t}$ (SE_eps_Ant) and the discount rate δ (Delta) there is a gap between the two lines for some pairs of draws, the two lines finally converge and overlap each other as the number of draws increases. Thus, both the multivariate and univariate convergence diagnostic tests show that the 80% interval based on pooled draws from all of the sequences and the mean interval based on individual draws converge for all 28 parameters, indicating that the posterior distributions of the 28 parameters generated by the five MCMCs are reliable.

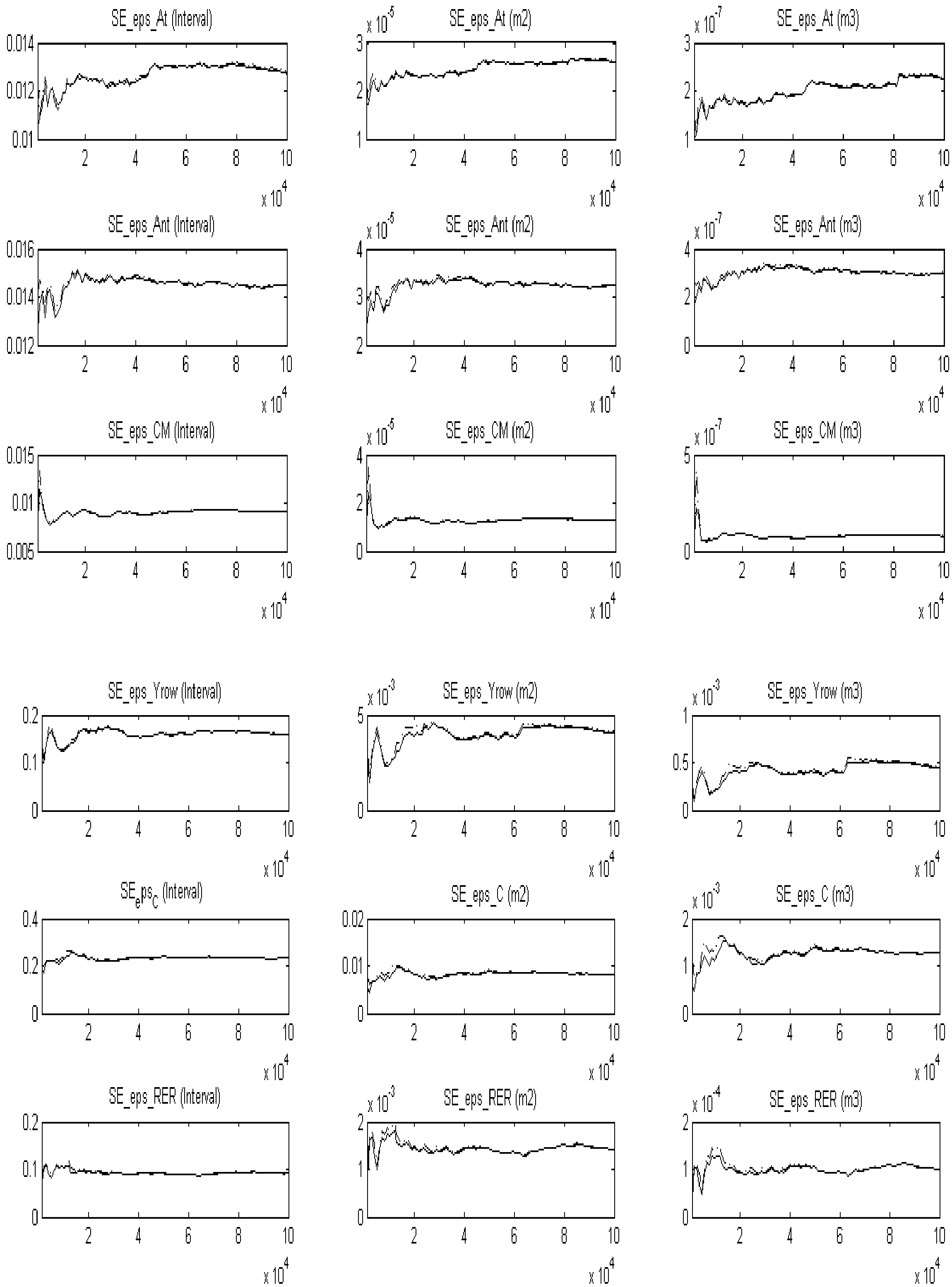


Figure 5.2 Univariate Convergence Diagnostic of the Mauritian Model

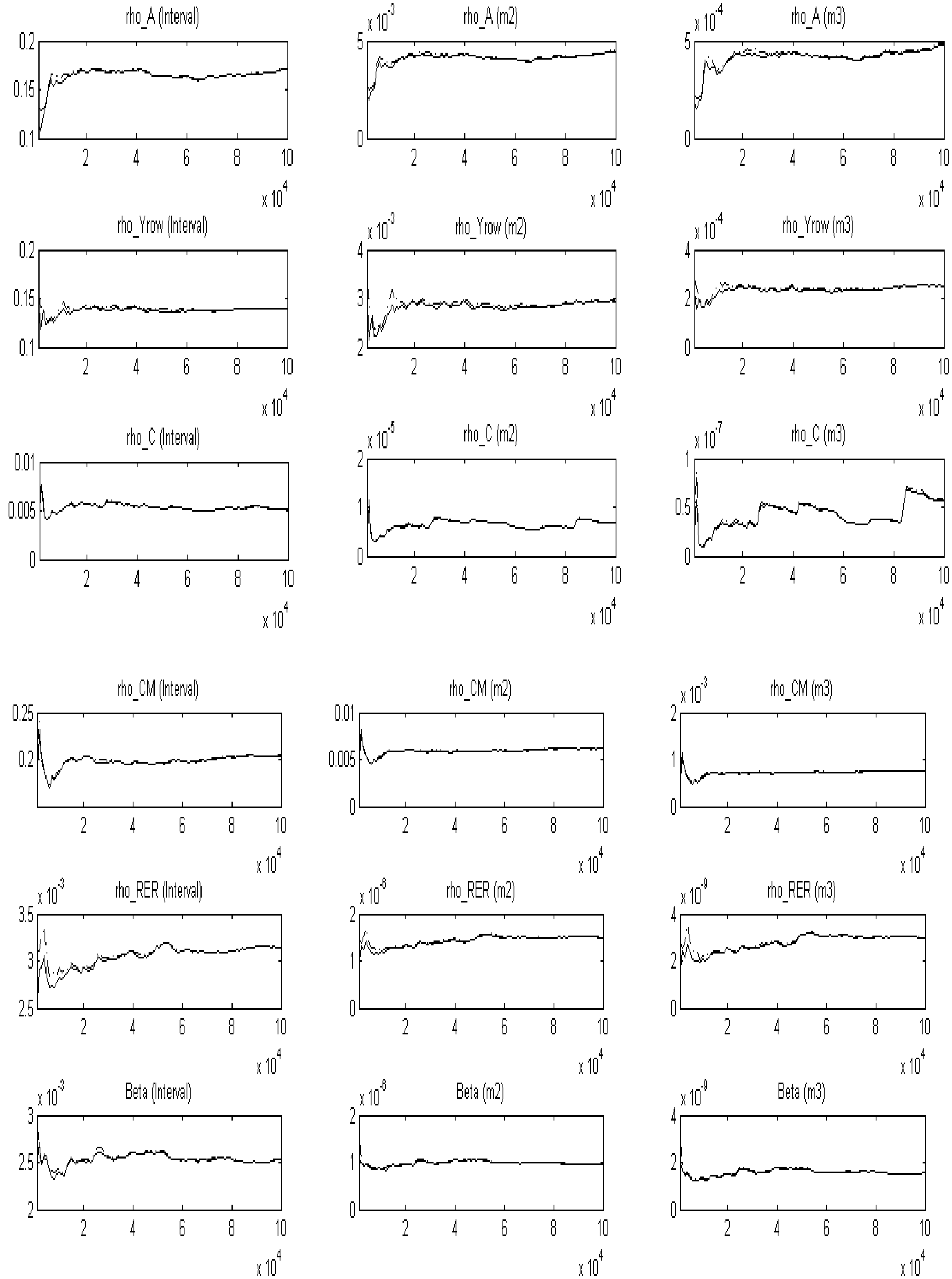


Figure 5.2 Univariate Convergence Diagnostic of the Mauritian Model (Continued)

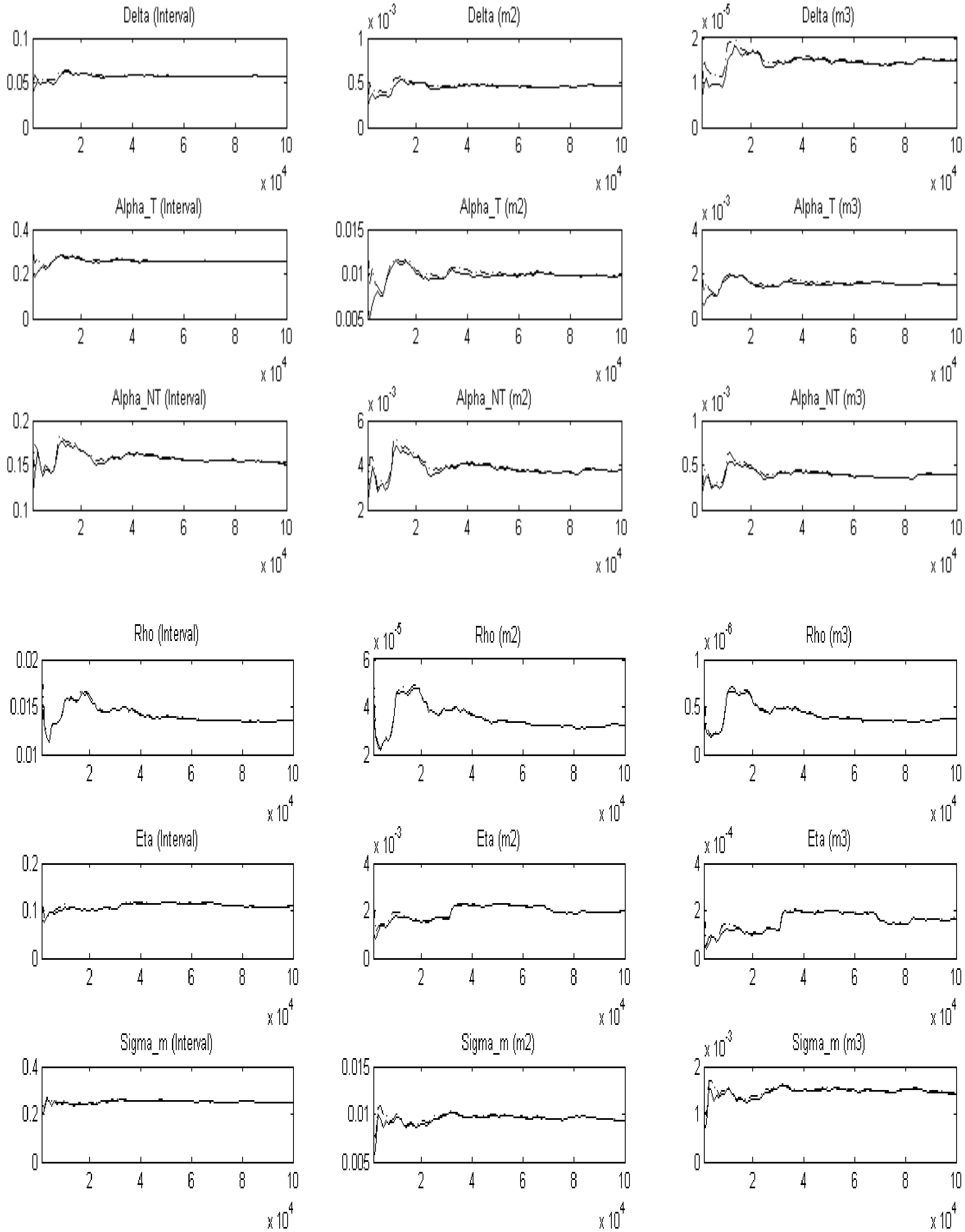


Figure 5.2 Univariate Convergence Diagnostic of the Mauritian Model (Continued)

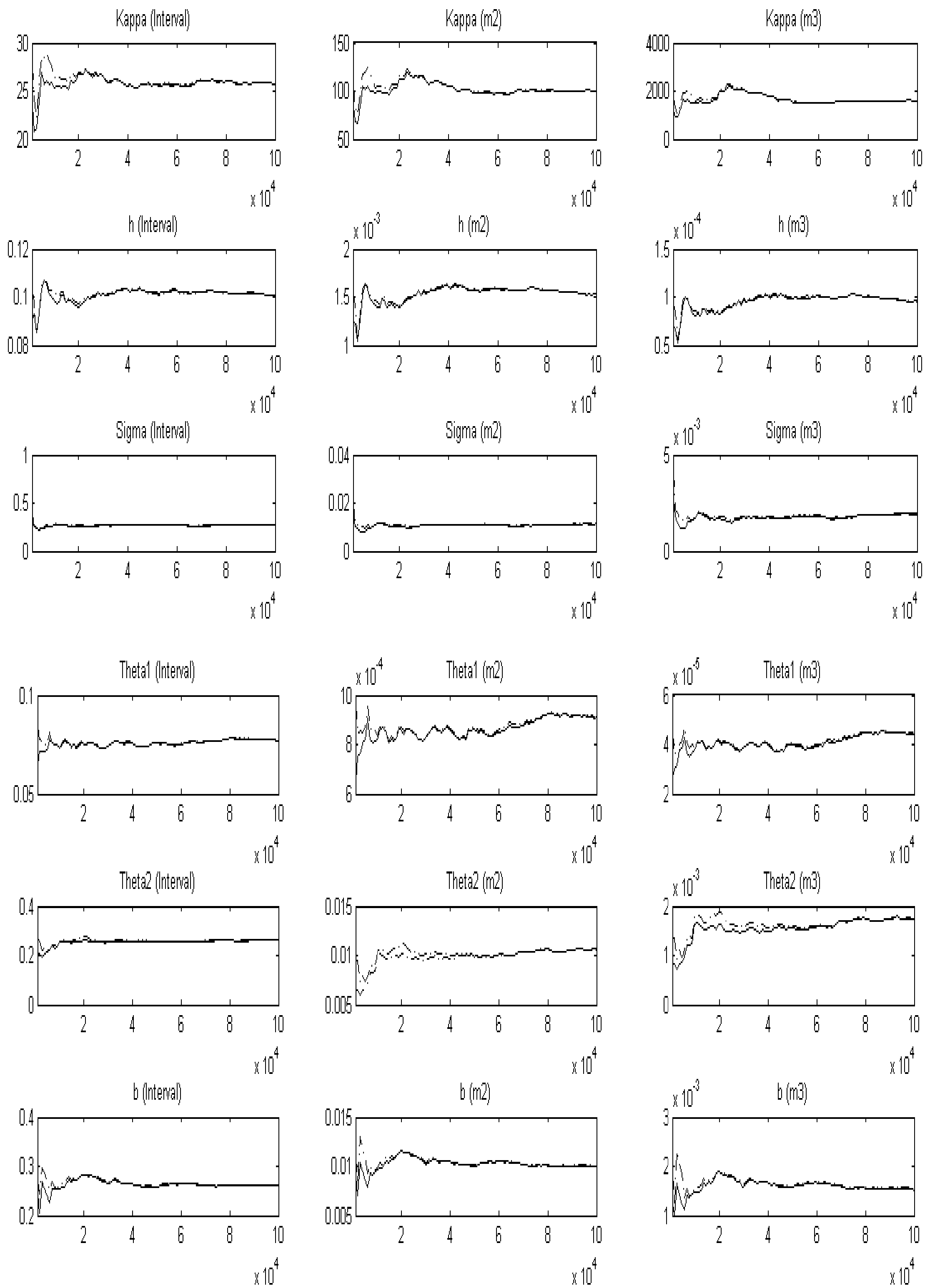


Figure 5.2 Univariate Convergence Diagnostic of the Mauritian Model (Continued)

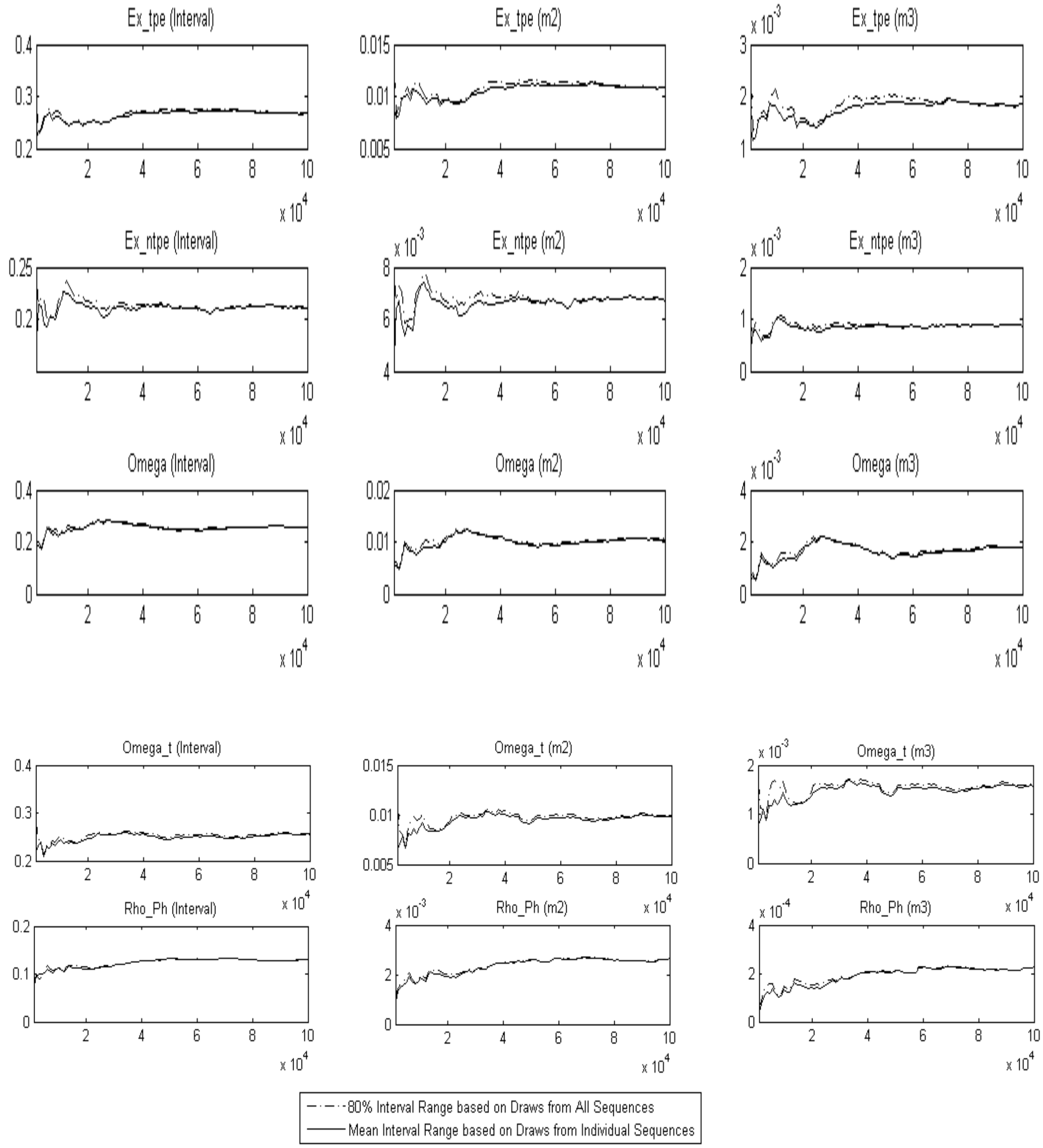


Figure 5.2 Univariate Convergence Diagnostic of the Mauritian Model (Continued)

5.2.2.2. Estimation Results of the Mauritian Model

The results for the 29 parameters estimated by the Bayesian method in the Mauritian model are presented in Table 5.4. In addition to the estimation of the mean for the posterior distributions, the 90% interval estimations are also provided for more robust results. The prior and posterior distributions of the 28 parameters are shown in Figure 5.3.

Table 5.4 Estimation Results of the Mauritian Model 1999Q1-2014Q4

Structure Parameter		Prior Mean	Posterior Mean	90% Interval Low	90% Interval High
Discount Rate	β	0.990	0.990	0.988	0.992
Depreciation Rate	δ	0.025	0.102	0.071	0.140
Output Elasticity of Capital in Tourism Sector	α_T	0.300	0.312	0.145	0.466
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	0.300	0.616	0.519	0.718
Survival Rate of Employees to Keep the Job	ρ	0.983	0.846	0.840	0.854
Barging Power of Employees	η	0.500	0.112	0.047	0.172
Elasticities of New Hires to Unemployment	σ_m	0.500	0.498	0.340	0.655
Adjustment Cost of Recruitment	κ	152.064	155.264	139.017	171.736
Habit Persistent	h	0.552	0.173	0.107	0.236
Elasticity of Intertemporal Substitution	σ	2.000	2.334	2.158	2.510
Substitute Elasticity between Products	θ_1	0.400	0.145	0.096	0.194
Substitute Elasticity between FDI and Domestic Investment	θ_2	1.500	1.507	1.336	1.675
Ratio of Unemployment Benefit to Salary	b	0.400	0.409	0.247	0.577
Price Elasticity of Tourism Export(Absolute)	$\theta_{EX,T}$	0.346	0.372	0.201	0.539
Price Elasticity of Non-Tourism Export (Absolute)	$\theta_{EX,NT}$	0.478	0.613	0.474	0.745
Income Elasticity of Non-tourism Exports	ω_{NT}	0.496	0.528	0.363	0.694
Income Elasticity of Tourism Exports	ω_T	0.512	0.517	0.359	0.685
Elasticity of Philipps Curve(Absolute)	ρ_{Ph}	0.672	0.866	0.787	0.949
Auto Regressive Parameter					
Technology	ρ_A	0.500	0.521	0.410	0.630
World Output	ρ_{Yrow}	0.500	0.260	0.169	0.348
Consumption Preference	ρ_C	0.500	0.951	0.948	0.953
Real Exchange Rate	ρ_{RER}	0.996	0.994	0.992	0.996
Shock to Imports	ρ_{CM}	0.500	0.563	0.436	0.696

Standard Deviation					
Technology shock of Tourism	ε^{At}	0.150	0.054	0.046	0.062
Technology shock of Non-tourism	ε^{Ant}	0.150	0.062	0.053	0.072
World Output	ε^{Yrow}	0.150	0.312	0.211	0.412
Consumption Preference	ε^{C}	0.150	0.459	0.309	0.608
Real Exchange Rate	ε^{RER}	0.150	0.136	0.079	0.192
Shock to Imports	ε^{CM}	0.150	0.036	0.030	0.042

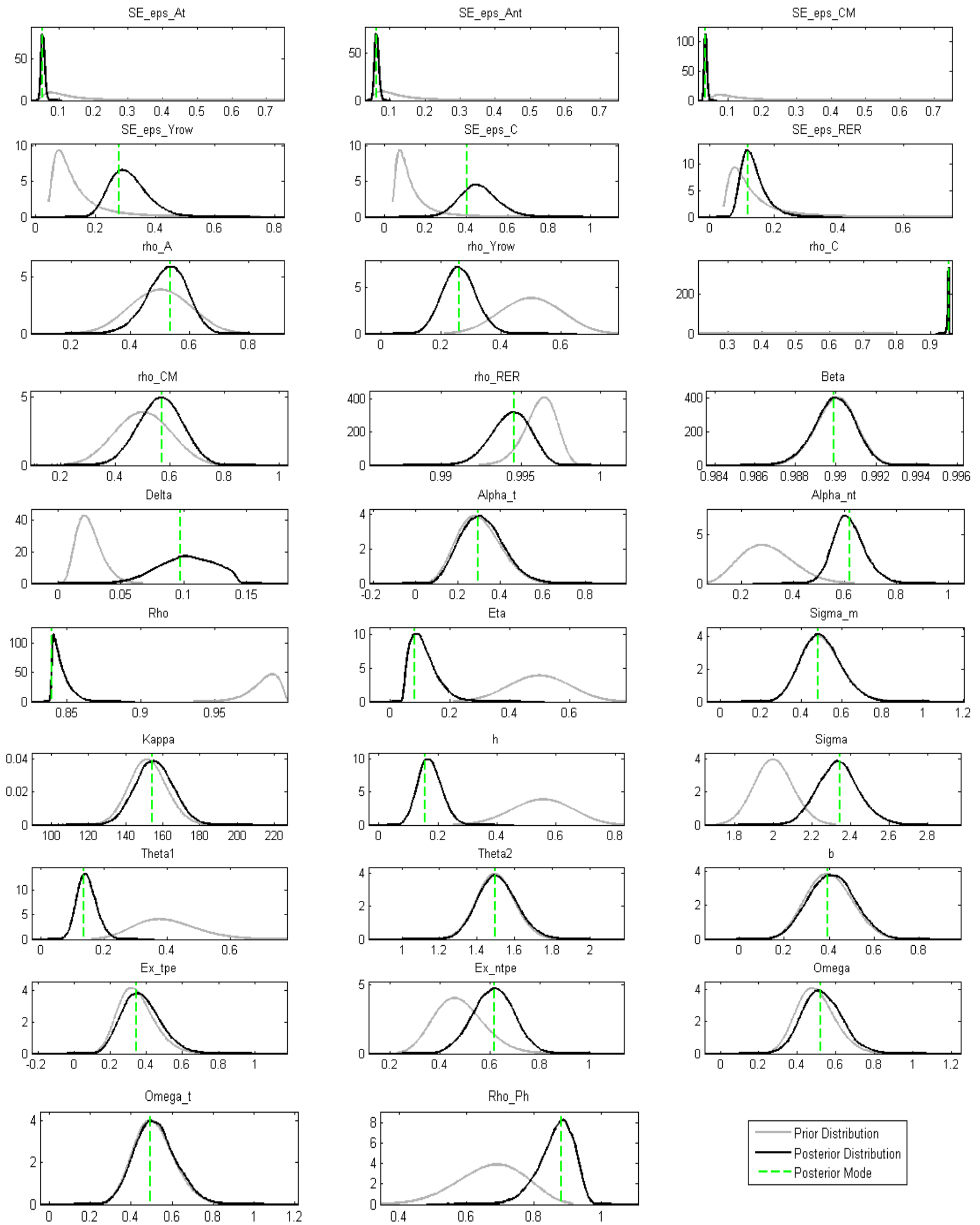


Figure 5.3 Prior and Posterior Distributions of the Estimated Parameters of the Mauritian Model

As the priors of the parameters are obtained from the general literature instead of from studies of Mauritius, it can be observed from Table 5.4 and Figure 5.3 that the priors of most of the parameters are different than the posterior distributions, indicating that the estimation results have been corrected by the real tourism and economic data.

Significant differences between the priors and posteriors of key parameters related to tourism can be observed. The intertemporal substitute elasticity parameter (σ), which affects the trade-off between the consumption of today and the future, is estimated as 2.334, yielding a substitute elasticity of 0.428 ($\frac{1}{\sigma}$). According to the meta-analysis of the estimation of intertemporal substitute elasticity by Havranek *et al*. (2015), the mean of the elasticity using macro data is around 0.5. Thus, our estimation for Mauritius should be acceptable.

The estimated substitute elasticity between products (θ_1) for Mauritius is 0.145. In one of the few empirical studies focusing on the substitute elasticity between tourism and non-tourism products, Lanza, Temple and Urga (2004) estimated the elasticity for 13 OECD countries and found that all of the substitute elasticities are less than unit, but four are not significant. Although there are no studies to directly support our estimation for Mauritius, the results of the OECD countries show that the substitute elasticity between tourism and non-tourism products is likely to be insensitive. As domestic tourism consumption accounts for 2.58% of the consumption bundle of households (Mauritius Statistics, 2015), the low substitute elasticity is reasonable.

The price elasticity of tourism exports is 0.372, indicating that international tourists are not sensitive to changes in prices, probably due to the history and geographic background of Mauritius. According to Mauritius Statistics (2015), the largest inbound market to Mauritius is the United Arab Emirates (UAE), followed by Reunion Island, France and South Africa. The four source markets accounted for a 65.35% market share in 2014. The UAE is one of the richest countries in the world, Reunion Island and South Africa are closer to Mauritius than other source markets, thus tourists from these markets may not be sensitive to changes in prices. Mauritius was colonised by France for 100 years, French, although is not the official language, is still widely used in Mauritius. As a result, French tourists may prefer Mauritius, due to the familiar culture and environment and may not be sensitive to changes in prices.

Some other parameters are change significantly by the Bayesian estimation. For example, the output elasticity of capital in the non-tourism sector (α_{NT}) increased from 0.300 to 0.616, indicating that, compared to the tourism sector which had an elasticity of 0.312, the non-tourism sector is more capital-intensive. The prior of the bargaining power of employees (η) is obtained from Gerlter and Trigari (2006) and Gertler, Sala and Trigari (2008), two studies based in the US. Corrected by the real data of Mauritius, η fell from 0.500 to 0.112, suggesting that employees in Mauritius do not have strong bargaining power in the labour market.

In terms of the shock parameters, the auto-regressive coefficient of world output (ρ_{Yrow}) is only 0.260, which is lower than expected, and the consumption preference (ρ_C) increases from 0.500 to 0.951, perhaps due to the small sample size. Furthermore, as the simulation is driven by a shock in tourism productivity, rather than the world output and consumption preference which are assumed to be constant, the estimation results of the two parameters do not affect the simulation which is applied to examine the impact of tourism on economic growth.

5.2.3 Findings of the Mauritian Model

In macroeconomics, IRFs are usually carried out to present the reaction of the economy to an exogenous shock. The IRFs of selected variables in the Mauritian model are presented in Figure 5.4 and the IRFs of each variables are included in Appendix 3. The bold lines in Figure 5.4 are the IRFs, and the space between the two black lines of each variable is the 90% highest posterior density interval. The vertical axis is the percentage by which the variable fluctuates, and the horizontal axis is the quarterly time line.

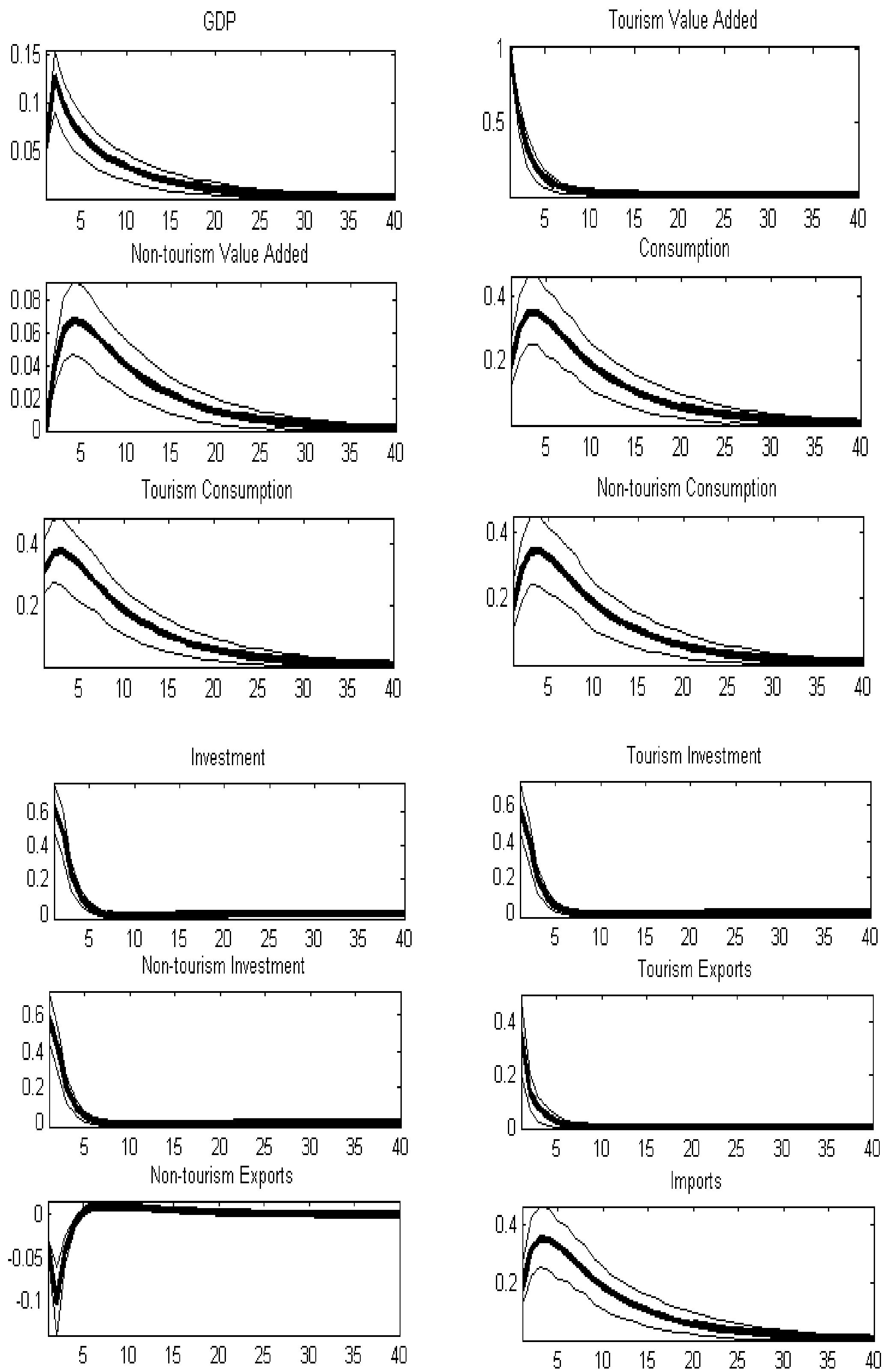


Figure 5.4 IRFs of the Mauritian Model (%)

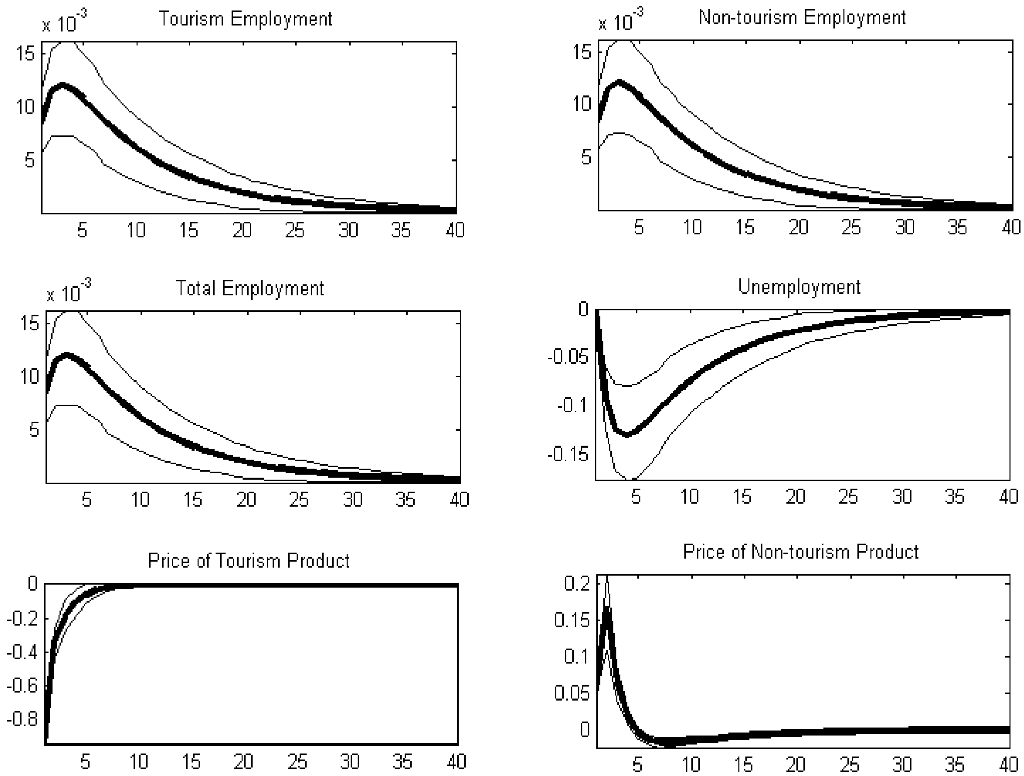


Figure 5.4 IRFs of the Mauritian Model (%) (Continued)

5.2.3.1 Impact of the Productivity Shock on the Product Markets of Mauritius

With a 1% positive productivity shock which may cause by the improvement of management level or service quality, tourism value added increases 1%. Due to the expansion of the supply, the price of a tourism product drops 0.8%, and the price of a non-tourism product increases 0.16%, compared to the price of imports, which is taken as the numeraire. Thus, domestic consumption of tourism products grows 0.37%. As the estimated inbound price elasticity of Mauritius is -0.346, the tourism exports increase around 0.36%. In contrast, due to the relatively higher price, the exports of non-tourism products decreases by around 0.1%. The expansion of tourism production requires more capital stock and labour, so the wage and return rate increases. As the tourism and non-tourism sectors share the same long-term nominal return rate and wage index, the improved benefit also leads to capital and labour inflow to the non-tourism sector. Because the substitute elasticity between products is only 0.145, the change of price does not significantly affect the share of the products in households' consumption bundle. The increase in the consumption of tourism products, non-tourism products and imports is very close, ranging from 0.34 to 0.37%. Although the price of non-tourism products rises, the consumption increases due to the improvements in income. Thus, both the value added of the two sectors and GDP increases, indicating that the development of tourism leads to economic growth in Mauritius.

The implication of this finding is straightforward. In an island economy, the development of tourism can lead to economic growth. This is consistent with most of the empirical studies of the TLEG hypothesis. In addition, the simulation results demonstrate the mechanism through which the development of tourism leads to the economic growth, which complements the previous studies.

From the practical perspective, the findings of this model can be used to help policy makers further the development of tourism in Mauritius. However, it should be noted that the investment growth starts to fall after the second period, indicating that households do not have enough resources to support further expansion of production. As a result, the growth in GDP peaks in the third period and then starts to slow down. Thus, the government could consider subsidising investment in the tourism sector or invite more FDI to extend the expansion period of the tourism sector, leading to more sustained growth in GDP.

5.2.3.2 Impact of Inbound Tourism on the Contribution of Tourism to Economic Growth in Mauritius

The 1% increase in value added (Y_T) of tourism is aggregated by domestic tourism consumption (C_T), the purchase of tourism investment (I_T) and exports (EX_T). Because the increased margin of Y_T is fixed, if the aggregated expansion of domestic and inbound consumption is larger than the increased value added, the producer is unable to purchase further fixed asset investment; if the expansion is smaller, the producer can further expand investment. A change in consumption and investment is determined by the inbound price elasticity of the tourism product and the producer's surplus, as illustrated in Figure 5.5.

In Figure 5.5, the vertical and horizontal axes measure the price and demand of tourism products, respectively. The downward lines are the demand curves, D_1 and D_2, representing the inelastic and elastic demand, respectively. The two upward lines are supply curves represented by S_1 and S_2, respectively. It is assumed that the tourism demand of D_1 is inelastic in terms of price. The original equilibrium of D_1 is at E_{1_1}, with the price and demand of P_{1_1} and Q_{1_1}, respectively, so the original producer's surplus is the area of $P_{1\_1}E_{1\_1}P_3$. With a 1% positive productivity shock to the tourism sector, the price decreases and the aggregated domestic and inbound demand increase; thus, the supply curve moves from S1 to S2 and the new equilibrium is at E_{2_1} with the price and demand of P_{2_1} and Q_{2_1}, respectively. The new producer's surplus is the area of $OP_{2\_1}E_{2\_1}Q_{3\_1}$. It is obvious that the new producer's surplus in the new equilibrium is larger than E_{1_1}. Thus, producers expand their fixed asset investment. In this case, the shock to the tourism productivity leads to an increase of C_T, I_T and EX_T simultaneously.

Assuming that tourism demand is more elastic, as shown in D_2, the producer's surplus in the original equilibrium E_{1_1} is the area of $P_{1\_1}E_{1\_1}P_3$, whereas in the new equilibrium it is $OP_{2\_2}E_{2\_2}Q_3$. However, as the absolute value of the price elasticity of D_2 is larger than D_1, the expansion of both domestic and inbound consumption is more significant; thus, there is a smaller new producer's surplus in D_2 than in the original level. In this case, the producers decrease investment.

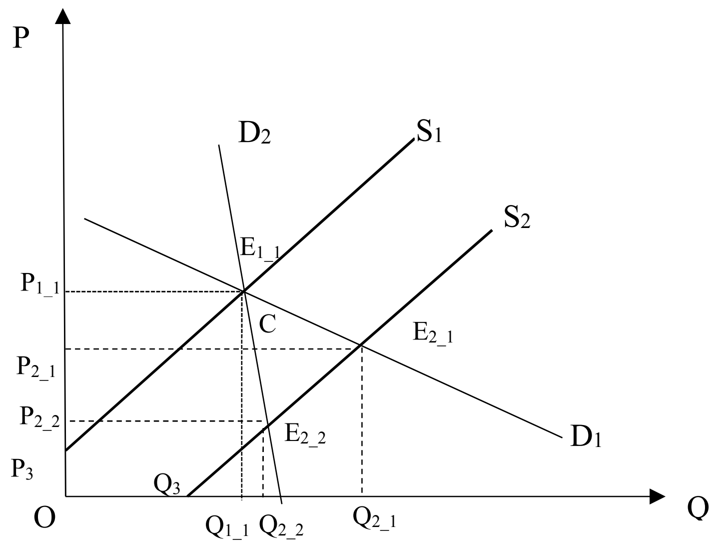


Figure 5.5 Price Elasticity and Producer's Surplus

Caution is needed when explaining Figure 5.5, as it does not indicate that when tourism demand is inelastic, the producers increase investment, but when it is elastic, they decrease investment. Figure 5.5 shows that for the increase in elasticity (absolute value), there is a threshold that triggers the change in producers' behaviour. To obtain a full picture of the investment response, simulations with various values of price elasticities are presented in Figure 5.6.

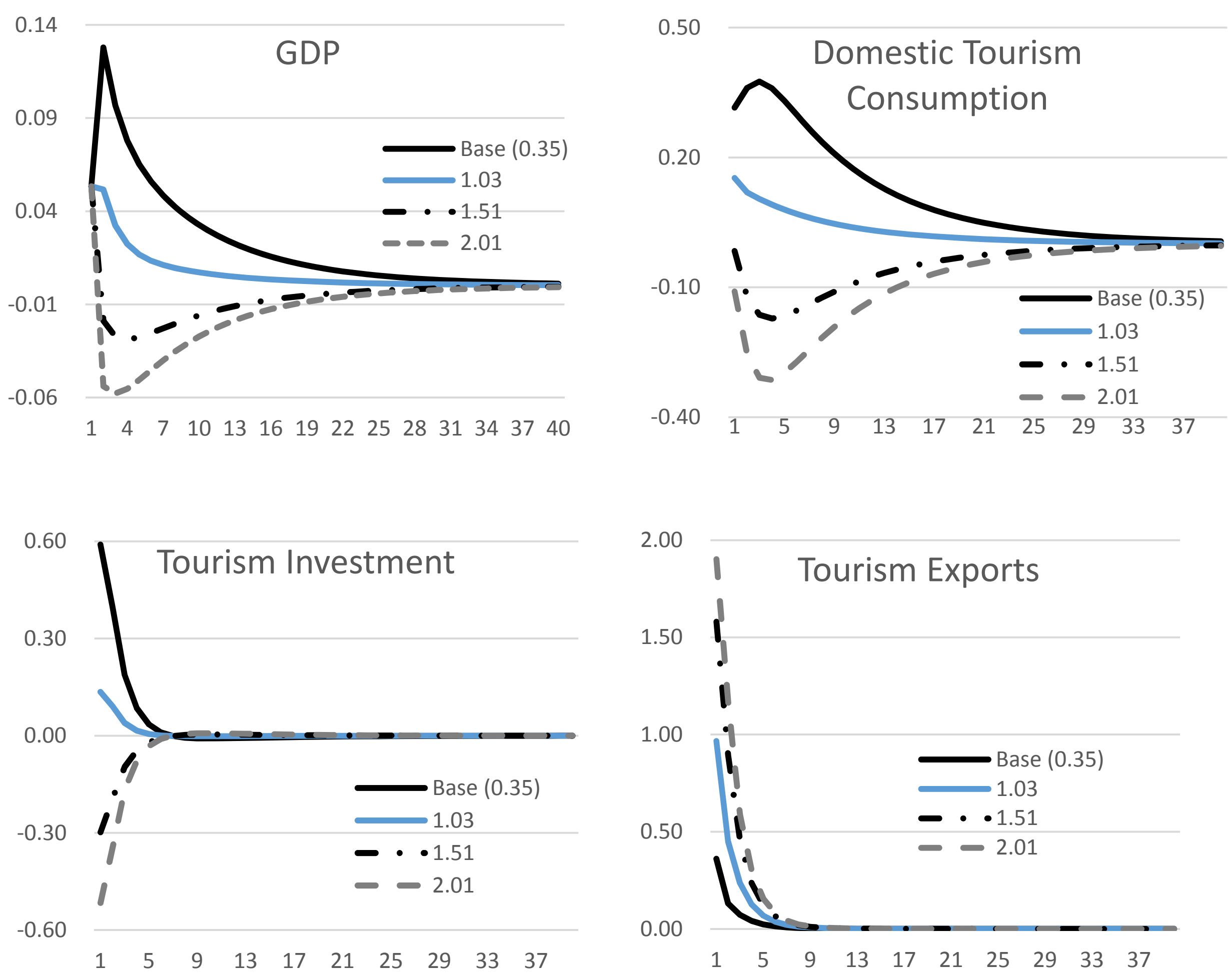


Figure 5.6 IRFs of Selected Variables with Different Inbound Tourism Price Elasticities of the Mauritian Model (%)

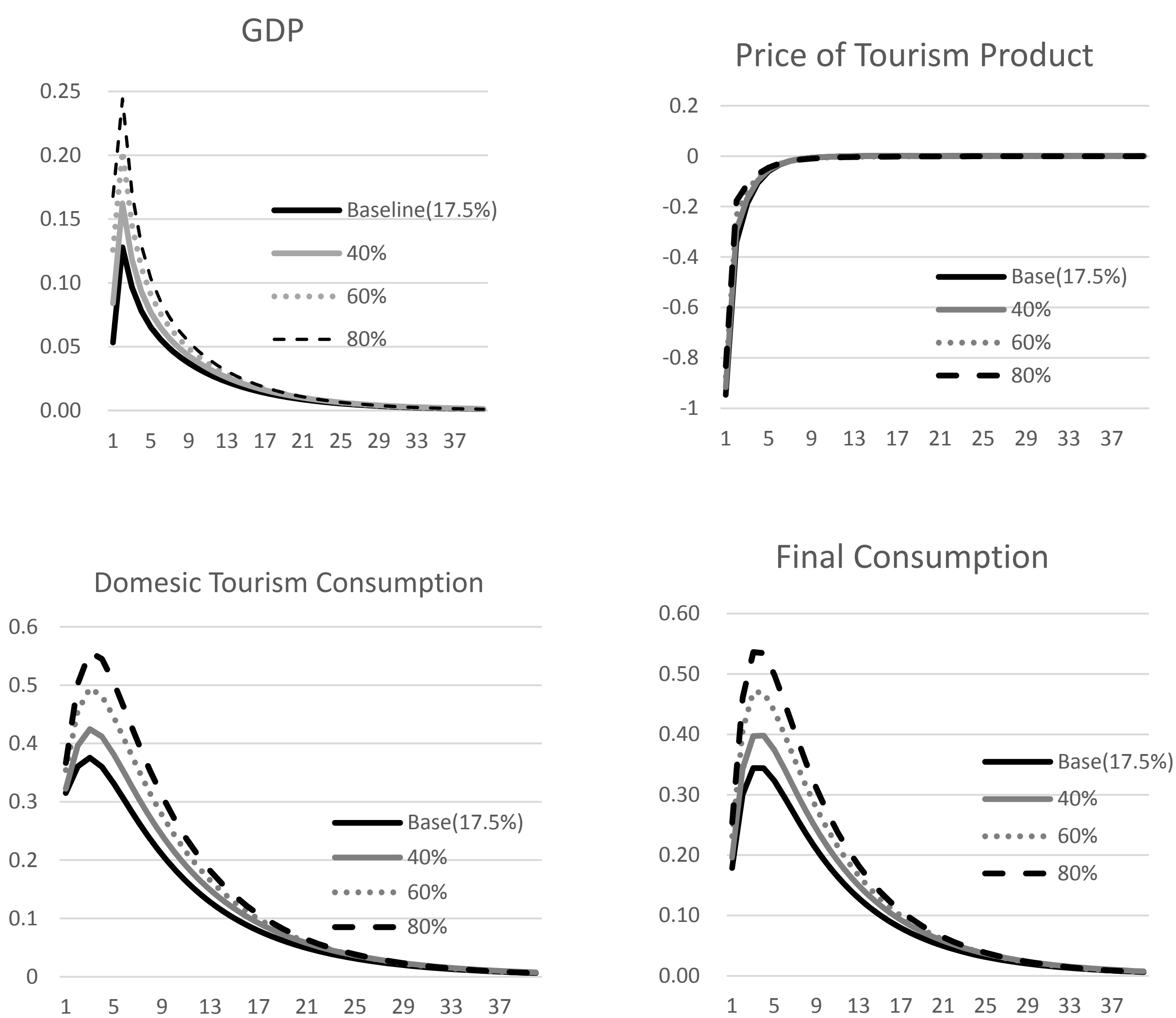
The IRFs of GDP, domestic tourism consumption, fixed asset investment in the tourism sector and inbound tourism demand with various price elasticities are shown in Figure 5.6. The darker solid lines in Figure 5.6 are the IRFs of the baseline model with the estimated price elasticity of 0.37 as an absolute value. The lighter solid line, black dotted line and silver dotted line represent the IRFs with the absolute value of elasticity set at 1.03, 1.51 and 2.01, respectively.

Because the four scenarios are generated by the same shock to the economy, the responses of GDP in the first period are the same; there is a 0.05% increase. Figure 5.6 confirms that as the absolute value of price elasticity increases, it reaches a threshold beyond which producers' surpluses become smaller. As a result, investment and even domestic tourism consumption can be crowded out by strong growth in tourism exports.

Based on the estimation results, the threshold for the absolute value of the model for Mauritius is between 1.03 and 1.51. When the price elasticity is 1.03, all of the demand variables are stimulated by the productivity shock. In contrast, when it is l.51, investment and domestic consumption respond to the shock negatively. Obviously, the price elasticity of the baseline model is similar to the case of D_1. A positive shock to the productivity of the tourism sector leads to more investment in the tourism sector. Attracted by the higher return rate, more investment flows into the non-tourism sector and more capital stock of K_T and K_{NT} accumulates. As capital stock increases, the employment in both sectors expands and unemployment decreases. Benefitting from the improved wage rate, although both non-tourism products and imports become more expensive, household consumption increases.

5.2.3.3 Impact of Domestic Tourism on the Contribution of Tourism to Economic Growth in Mauritius

One of the characteristics of tourism demand in Mauritius is that it is dominated by international tourists. Tourism exports (net exports in this research) account for 80% of the tourism value added, whereas domestic tourism consumption is less than 20% (Table 5.3). As the estimation of domestic tourism price elasticity is not available for this model, simulations are carried out to examine the impact of tourism on economic growth in Mauritius when the share of domestic tourism increases.



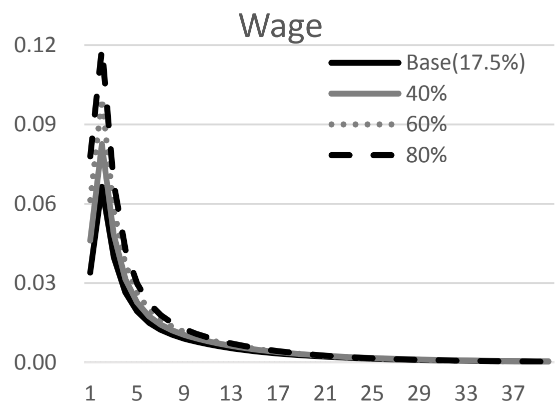


Figure 5.7 IRFs of Selected Variables with Different Shares of Domestic Consumption in Tourism Value Added of the Mauritian Model (%)

Figure 5.7 displays the impact of changes in the relative amount of domestic tourism consumption on the contribution of tourism to economic growth. The vertical axis represents the percentage change in variables that are caused by a 1% positive shock to tourism productivity in Mauritius.

As the share of domestic consumption rises, the drop in tourism product price becomes less significant, shrinking from 0.95% in the baseline model to 0.83% when domestic consumption accounts for 80% of tourism value added. Domestic tourism consumption expands correspondingly; however, the maximal increase is reached in the scenario with a small price downturn. This means that the price elasticities in the four scenarios are different. The scenario in which domestic tourism consumption accounts for 80% of the value added is the most elastic, whereas the baseline model is the most inelastic.

The responses of the selected variables to the same shock to the tourism productivity are diverse in different scenarios. The increase in final consumption in the baseline model is much less than in the 80% case, because the smaller increase in wages results in lower levels of consumption and investment.

Thus, as the share of domestic tourism consumption in tourism value added expands, the growth of GDP becomes more significant, increasing from 0.05% in the baseline model to around 0.23% in the 80% case. Given that the average annual growth rate of GDP in Mauritius is 3.2% (Table 5.7), this contribution is quite significant for a productivity increase of only 1%.

5.2.4 Summary of the Mauritian Model

The Mauritian model is estimated by the Bayesian method using real tourism and macroeconomic data from the 1999 to 2014 period. The convergence diagnostics show that the estimation results are robust, and the prior and posterior distribution figures indicate that most of the parameters are corrected significantly by the information obtained from the data.

The IRF shows that the GDP of Mauritius would increase 0.05% if the productivity of tourism is improved by 1%. It also finds that the price elasticity of tourism products can determine the producers' surpluses and so their fixed asset investment. As the absolute value of the elasticity increases, the surplus and investment decreases. Thus, the GDP would decrease for particular levels of price elasticity. Another finding is that the contribution of tourism to economic growth is much higher when the share of domestic tourism consumption in tourism value added is higher. The simulation shows that the GDP would jump by 0.22% if domestic consumption accounted for 80% of the value added of tourism in Mauritius. As the share of domestic consumption is only 17.5%, the contribution only reaches 0.05%. Given the average annual growth rate of the GDP is 3.2%, the contribution of tourism to economic growth is significant.

Tourism is a pillar industry in Mauritius and our findings show that the development of tourism could lead to economic growth. In addition, if the government subsidised investment in tourism or invited more FDI in the industry, the contribution of tourism to the economic growth in Mauritius would be more significant and sustainable.

5.3 Spain

Spain, which in 2014 was the third and second largest destination in terms of tourist arrivals and tourism receipts, respectively (UNWTO, 2015), is often used to support the TLEG hypothesis, because it is recognised as a country that has achieved industrialisation through the development of tourism (Balaguer & Cantavella-Jordá, 2002; Dritsaki, 2004).

Unfortunately, ravaged by the global financial and sovereign debt crises, the Spanish economy is in a downturn. At this moment, it would be useful and valuable to explore whether tourism can help the Spanish economy steer out of its recession.

5.3.1 Calibration of the Parameters in the Spanish Model

There are 64 parameters and 8 stochastic exogenous shocks in the Spanish model, including 18 structure parameters for the auto-regressive coefficients, 15 shock parameters and another 31 steady state parameters.

5.3.1.1. Calibration of Structure Parameters in the Spanish Model

Table 5.5 shows the prior distributions of the structural parameters. The priors are drawn from previous studies and the regressions are estimated from real data from Spain for the 1995 to 2012 period. Some conventional parameters used in DSGE models, such as β and δ , are from Burriel *et al*. (2010) in which a DSGE model is estimated with the Bayesian method using macroeconomic data from Spain for the 1986 to 2007 period. The parameters for the employment market use the prior distributions given in Gerlter and Trigari (2006), which is the same resource used in the

Mauritian model. σ , θ_1 and θ_2 are obtained from Orrego and Vega (2013). The steady state of b, which is the ratio of unemployment benefit to wage, can be calculated with Equation (4.38), given the steady state of $\overline{B}$, which is calibrated by the average ratio of treasury security to GDP for the 1995 to 2012 period. As the data for the CPI and unemployment rate are observable, the elasticities of the Phillips curve is estimated with the real data for Spain for the 1995 to 2012 period. The specific estimation results are listed in Appendix 2.2.

Table 5.5 Prior Distribution of Structure Parameters in the Spanish Model

Structural Parameters		Prior Distribution	Source
Discount Rate	β	Beta (0.99,0.001)	Burriel et al. (2010)
Depreciation Rate	δ	Beta (0.0175,0.001)	Burriel et al. (2010)
Output Elasticity of Capital in Tourism Sector	α_T	Beta (0.3621,0.05)	Burriel et al. (2010)
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	Beta (0.3621,0.05)	Burriel et al. (2010)
Survival Rate of Employees to Keep the Job	ρ	Beta (0.895,0.001)	Gerlter & Trigari (2006)
Barging Power of Employees	η	Beta (0.5,0.1)	Gerlter & Trigari (2006)
Elasticity of New Hires to Unemployment	σ_m	Gamma (0.5,0.1)	Gerlter & Trigari (2006)
Adjustment Cost of Recruitment	κ	Gamma(17.60,1)	Gerlter & Trigari (2006)
Habit Persistent	h	Beta (0.847,0.1)	Burriel et al. (2010)
Elasticity of Intertemporal Substitution	σ	Gamma (2,0.1)	Orrego & Vega (2013)
Substitute Elasticity between Products	θ_1	Gamma (0.4,0.1)	Orrego & Vega (2013)
Substitute Elasticity between FDI and Domestic Investment	θ_2	Gamma (1.5,0.05)	Orrego & Vega (2013)
Ratio of Unemployment Benefit to Salary	b	Beta (0.24,0.1)	Based on $\overline{B}$
Price Elasticity of Tourism Exports (Absolute Value)	$\theta_{EX,T}$	Gamma (1.908,0.1)	Regression
Price Elasticity of Non-tourism Exports (Absolute Value)	$\theta_{EX,NT}$	Gamma (0.541,0.01)	Regression
Income Elasticity of Non-tourism Exports	ω_{NT}	Gamma (2.418,0.200)	Regression
Income Elasticity of Tourism Exports	ω_T	Gamma (3.374,0.100)	Regression
Elasticity of Philipps Curve (Absolute Value)	ρ_{PH}	Gamma (0.024,0.001)	Regression

Note: Figures in parentheses are the mean and standard deviation of the distribution respectively.

5.3.1.2. Calibration of Shock Parameters in the Spanish Model

Table 5.6 calibrates the auto-regressive parameters and the standard deviations of the eight exogenous stochastic shocks in the model. The coefficients of the productivities of the two sectors and the real exchange rate are estimated using real data from the 1995 to 2012 period. The two shocks, consumption preference and investment efficiency, are obtained from Gertler, Sala and Trigari (2008), which is a Bayesian estimated DSGE model based on Gertler and Trigari (2006). The priors of the other three coefficients, world GDP, labour efficiency and imports, are set as Beta (0.5, 0.1), which are the same as the settings of the unknown auto-regressive coefficients in Gertler, Sala and Trigari (2008). Following the suggestion of Guerrón-Quintana and Nason (2013), all of the auto-regressive coefficients follow Beta distributions. All of the standard deviations are set to 0.1 so that the posterior distribution can have a wider interval for sample drawing.

The standard deviations of the exogenous shocks follow Inverse Gamma distributions (Guerrón-Quintana & Nason, 2013). As the standard deviations of the shocks cannot be observed in real data, the means and standard deviations of the prior distributions are set to 0.15 and 0.25, respectively, which are the same as in Gertler, Sala and Trigari (2008).

Table 5.6 Prior Distribution of Shock Parameters in the Spanish Model

Parameters		**Prior Distribution**	**Source**
(a) Auto-regressive Coefficient			
Productivity	ρ^{A}	Beta (0.983,0.01)	Regression
Income of the World Economy	ρ_{ROW}	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ρ_{C}	Beta (0.724,0.05)	Gertler,Sala, &Trigari (2008)
Investment Efficiency	ρ_{I}	Beta (0.559,0.1)	Gertler,Sala, &Trigari (2008)
Labor Efficiency	ρ_{L}	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Imports	ρ_{CM}	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Real Exchange Rate	ρ_{RER}	Beta (0.530,0.1)	Regression
(b) Standard Deviation			
Productivity of Tourism Sector	$\varepsilon^{A}_{T,t}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Productivity of Non-tourism Sector	$\varepsilon^{A}_{NT,t}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Income of the World Economy	ε^{Yrow}_{t}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ε^{C}_{t}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Investment Efficiency	ε^{I}_{t}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Labor Efficiency	ε^{L}_{t}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Imports	ε^{CM}_{t}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Real Exchange Rate	ε^{RER}_{t}	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)

Note: Figures in parentheses are the mean and standard deviation of the distribution respectively.

5.3.1.3. Calibration of Other Parameters in the Spanish Model

The steady states of the variables used in the log-linearised model are presented in Table 5.7. The values are expressed as the average ratio between the variable and GDP, except γ_1, γ_2, $\bar{n}_T$ and $\bar{n}_{NT}$, which are the tourism and non-tourism shares in the consumption bundle and employment, respectively. Most of the steady states are calculated using real tourism and macroeconomic data for the 1995 to 2012 period, although some, such as the ratio of tourism consumption and final consumption, are based on shorter time periods due to data availability.

Table 5.7 Calibration of Other Parameters in the Spanish Model

Variables		Value in Steady State	Time Period/Source
GDP/GDP	$\bar{Y}$	1.000	-
Tourism Value Added/GDP	$\bar{Y}_T$	0.108	1995-2012
Non-tourism Value Added/GDP	$\bar{Y}_{NT}$	0.892	1995-2012
Final Consumption/GDP	$\bar{C}$	0.770	1995-2012
Total Investment/GDP	$\bar{I}$	0.248	1995-2012
Imports/GDP	$\overline{CM}$	0.292	1995-2012
Tourism Exports/GDP	$\overline{EX}_T$	0.052	1995-2012
Non-tourism Exports/GDP	$\overline{EX}_{NT}$	0.226	1995-2012
Tourism Investment/GDP	$\bar{I}_T$	0.005	2000-2007
Non-tourism Investment/GDP	$\bar{I}_{NT}$	0.243	1995-2012
Tourism FDI/GDP	$\bar{I}_T^F$	-0.002	2000-2007
Non-tourism FDI/GDP	$\bar{I}_{NT}^F$	-0.031	1995-2012
Balance of Payment/GDP	$\overline{BP}$	0.017	1995-2012
Treasury Security/GDP	$\bar{B}$	0.058	1995-2012
Unemployment	$\bar{u}$	0.109	2002-2012
Tourism Consumption/(Final Consumption+Imports)	γ_1	0.086	2000-2007
Non-tourism Consumption / (Final Consumption+Imports)	γ_2	0.409	1995-2012
Tourism Employment /Employment	$\bar{n}_T$	0.112	2002-2012
Non-tourism Employment/ Employment	$\bar{n}_{NT}$	0.888	1995-2012
CPI	$\bar{P}$	1.000	-
Tourism Price	$\bar{P}_T$	1.000	-
Non-tourism Price	$\bar{P}_{NT}$	1.000	-
Average Growth Rate of GDP	g_y	Log(1.022)	1995-2012

Average Growth Rate of Non-tourism Value Added	g_{yt}	Log(1.027)	1995-2012
Production Tax Rate	τ_Y	0.120	2004-2012
Wage Tax Rate	τ_W	0.219	1995-2012
Turnover Probability of Unemployed People	$\bar{p}$	0.118	Based on $\bar{u}$
Employee's Surplus	$\bar{H}$	1.676	Based on $\bar{u}$ and $\bar{B}$
Hiring Rate	$\bar{x}$	0.105	$1-\rho$
Marginal Product of Labor	$\bar{a}$	0.520	$\kappa\bullet\bar{x}[(1/\beta-\bar{x}/2-\rho)+\eta(\bar{x}/2+\bar{p})]/(1-\eta)$
Wage	$\bar{w}$	0.618	$\eta(\bar{a}+\kappa\bar{x}^2/2+\kappa\overline{xp})+(1-\eta)b$

5.3.2 Estimation Results of the Spanish Model

5.3.2.1. Convergence Diagnostics of the Spanish Model

The multivariate convergence diagnostic is presented in Figure 5.8. All of the deviations from the means of the three orders converge to or even overlap with each other. This indicates that, overall, the five chains of each parameter converge and the simulations of the posterior distributions are reliable.

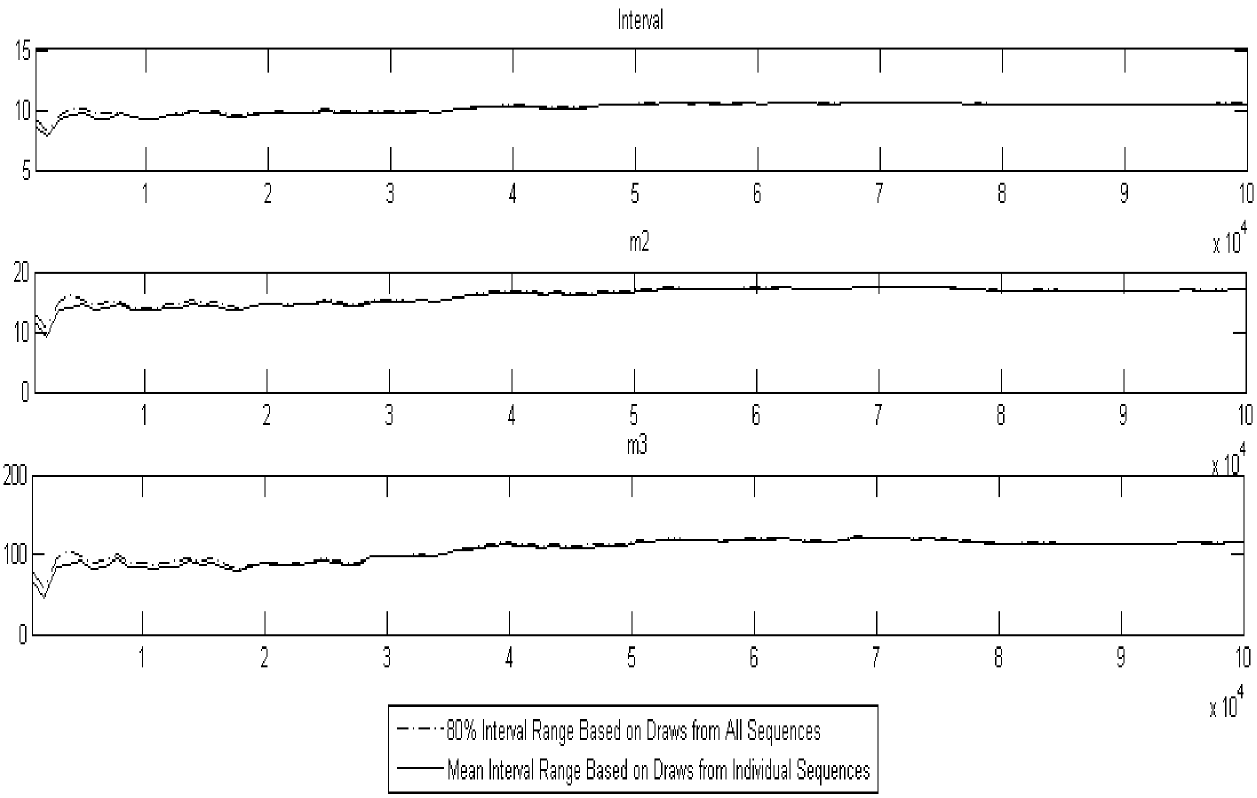


Figure 5.8 Multivariate Convergence Diagnostic of the Spanish Model

Figure 5.9 shows the results of the univariate convergence diagnostic for all of the parameters in the Spanish model. All of the 34 estimated parameters converge in terms of the deviations from the means of the three orders. The results of the diagnostic can be categorised into three groups based on the behaviour of the converging process. The first group is represented by the standard deviations of ε^{A}_{NT} (SE_eps_Ant), ρ_C (rho_C) and κ (kappa); the two lines are almost overlapped, indicating perfect convergence. The second group is composed of parameters such as ε^{Yrow} (SE_eps_Yrow), α_T (Alpha_T) and θ_2 (Theta_2). In this group, the two sequences converge gradually. Although there is a gap between the two lines at the beginning or the middle of the sequences, the lines finally converge to each other. The third group is characterised by parameters such as β (Beta), σ_m (Sigma_m) and h. In their charts, there is a gap between the two lines and they do not overlap at any point; however, the gap between them is quite small (for example, less than 0.001 for β). According to Pfeifer (2014), if the two sequences are very close, the simulation of the posterior distribution can be considered reliable.

In summary, based on the multivariate and univariate convergence diagnostics developed by Brooks and Gelman (1998), the simulations of the posterior distributions for all of the estimated parameters of Spain are reliable. This is a necessary condition for the reliability of the means of the posterior distributions, which are taken as the estimated values of the parameters.

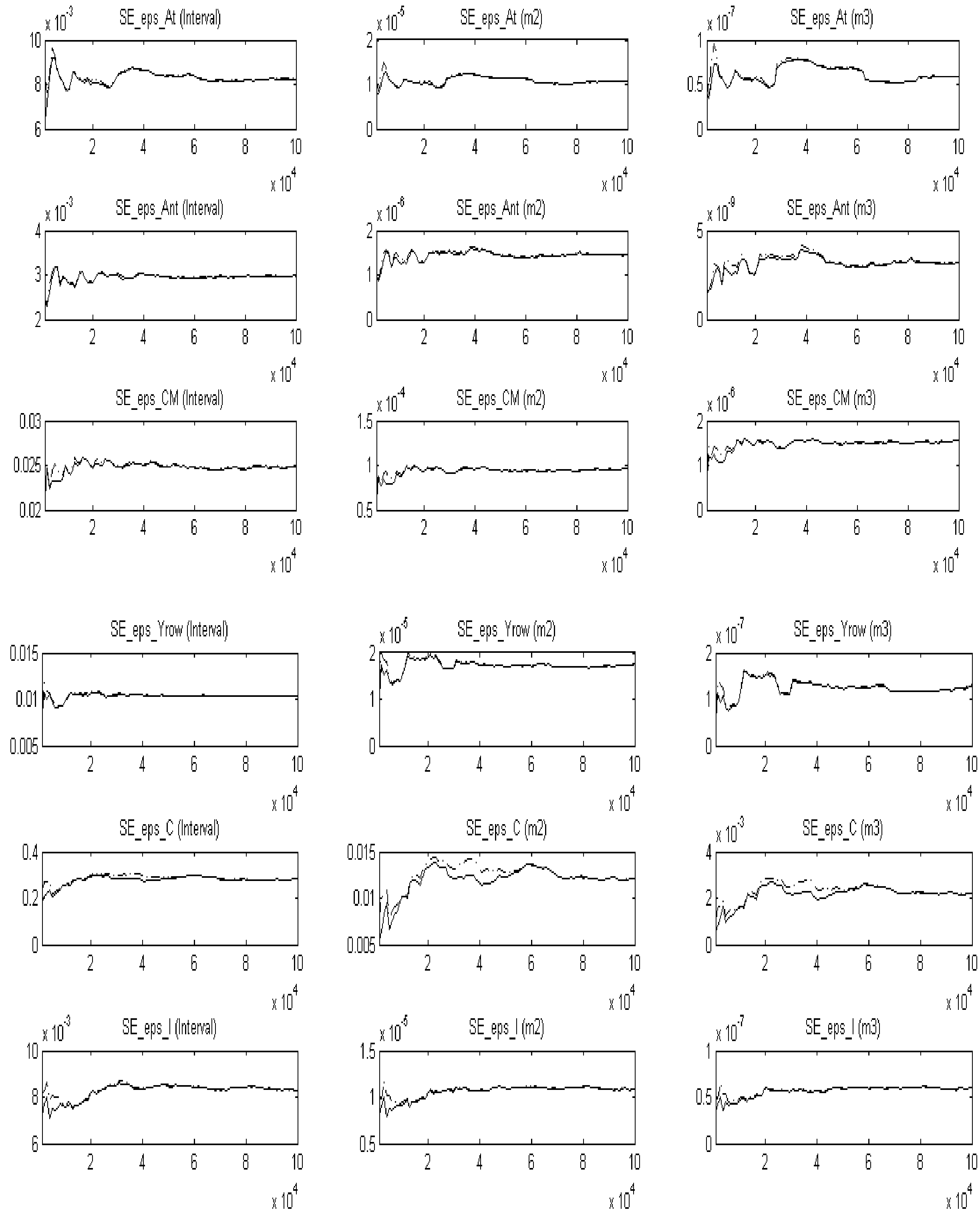


Figure 5.9 Univariate Convergence Diagnostic of the Spanish Model

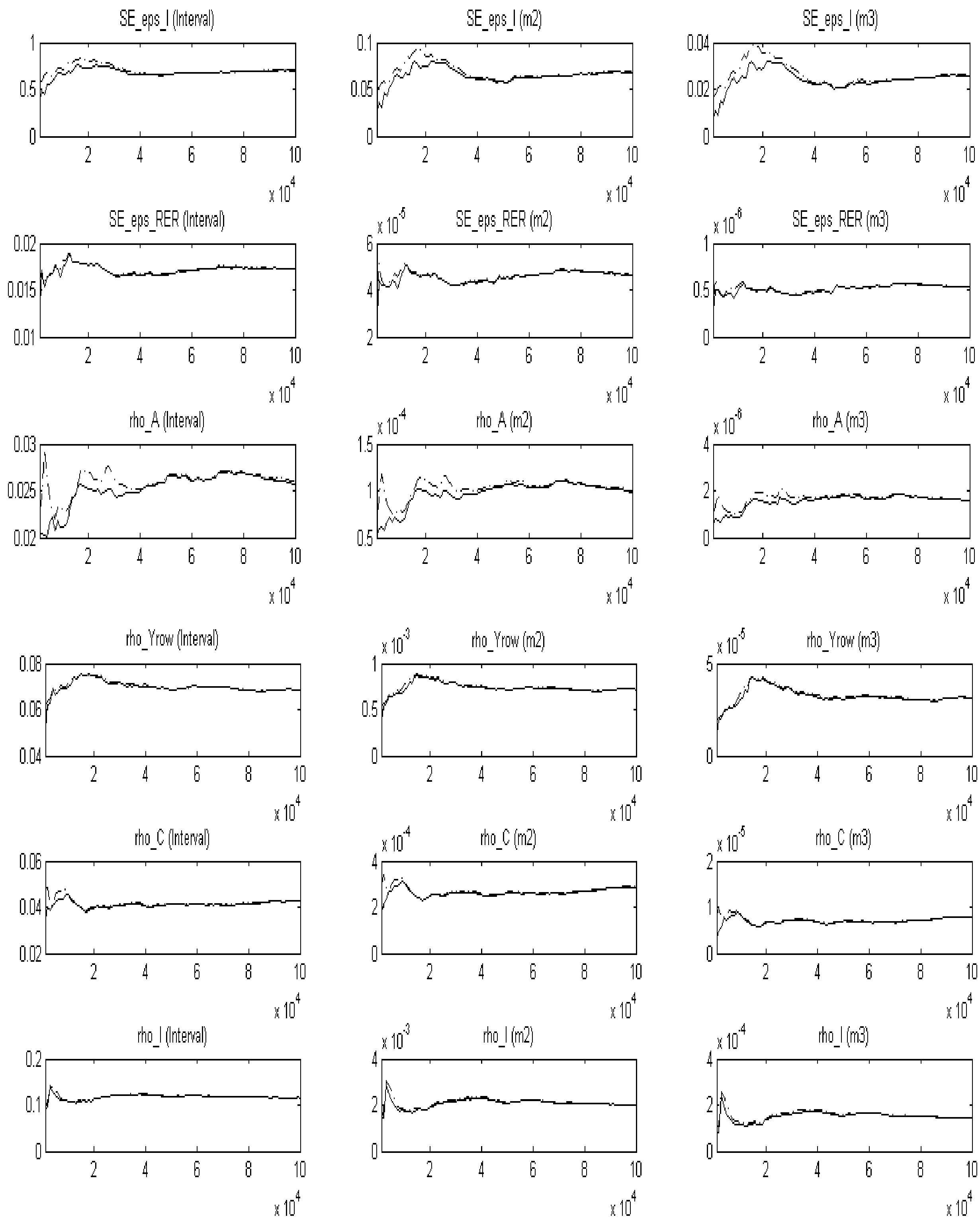


Figure 5.9 Univariate Convergence Diagnostic of the Spanish Model (Continued)

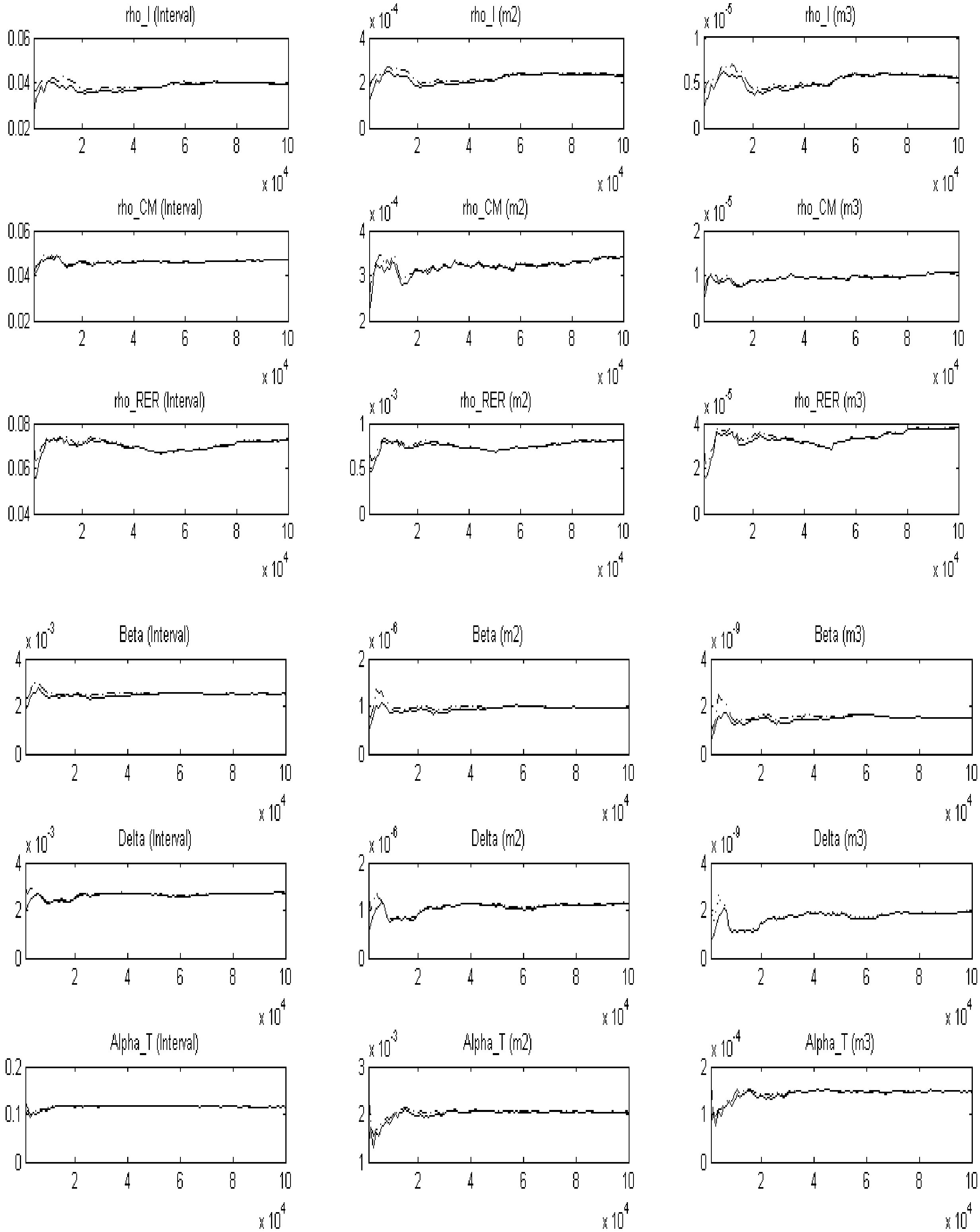


Figure 5.9 Univariate Convergence Diagnostic of the Spanish Model (Continued)

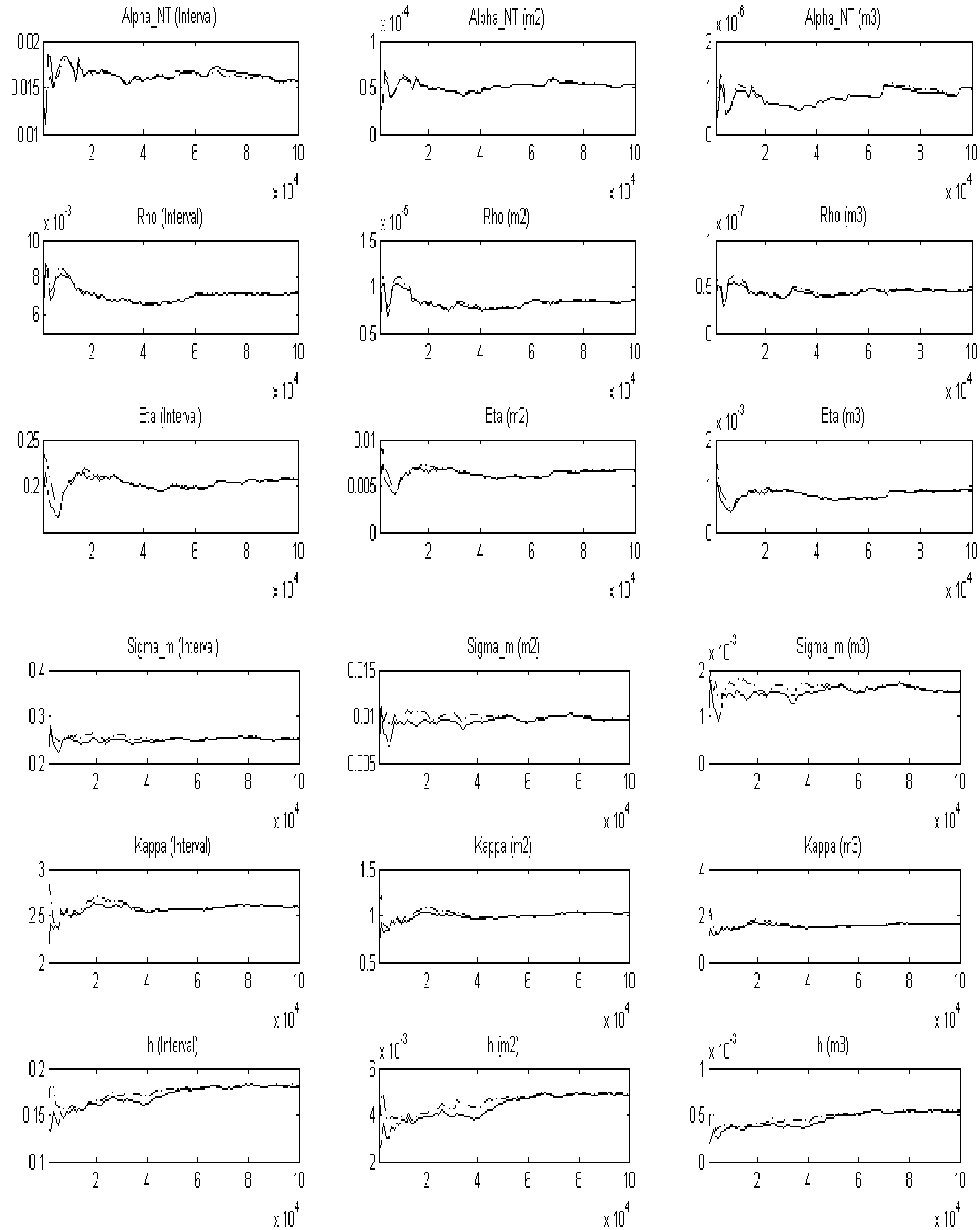


Figure 5.9 Univariate Convergence Diagnostic of the Spanish Model (Continued)

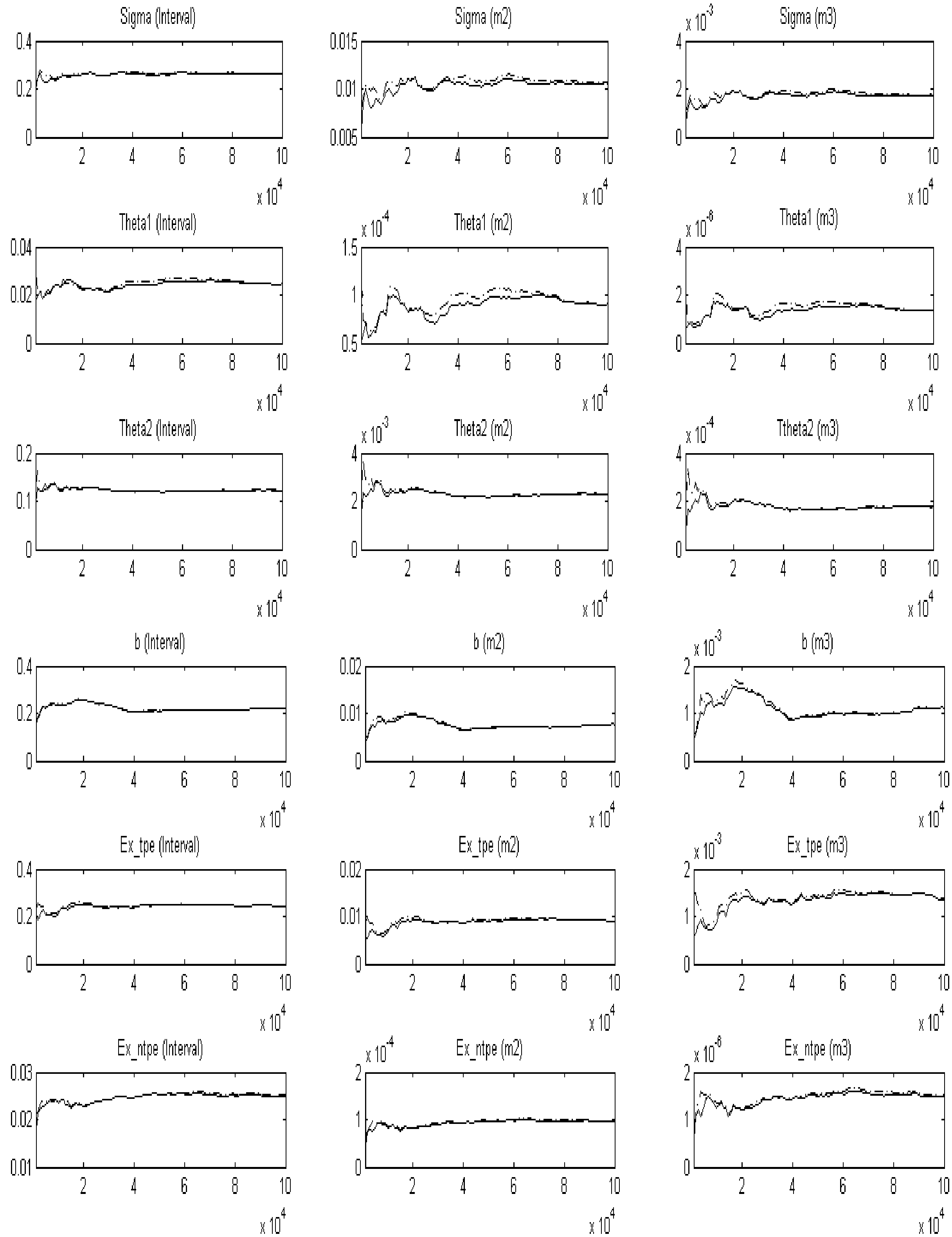


Figure 5.9 Univariate Convergence Diagnostic of the Spanish Model (Continued)

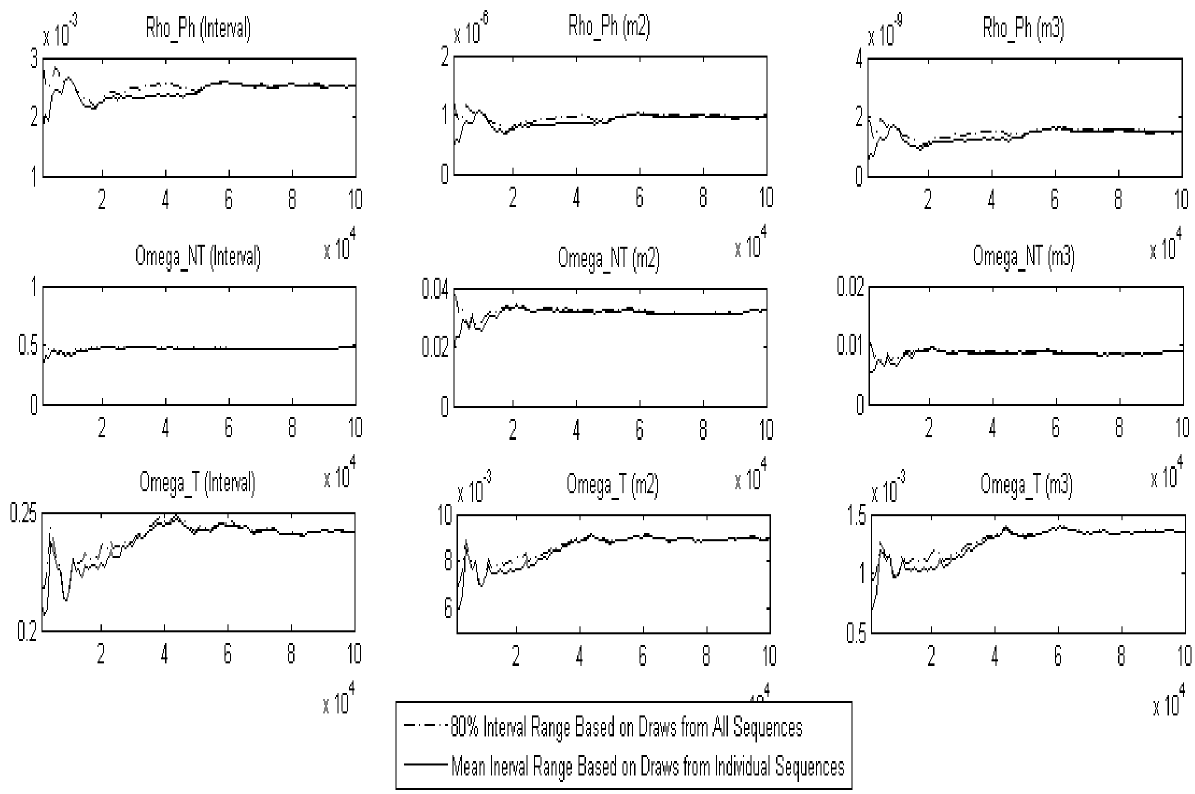


Figure 5.9 Univariate Convergence Diagnostic of the Spanish Model (Continued)

5.3.2.2. Estimation Results of the Spanish Model

The model's estimation results are shown in Table 5.8. The fourth column in the table is the estimation of the posterior mean of each parameter, followed by a 90% interval estimation of the posterior mean. Figure 5.10 presents the prior and posterior distributions of the parameters.

Table 5.8 Estimation Results of the Spanish Model 1995Q1-2012Q4

Structure Parameter		**Prior Mean**	**Posterior Mean**	**90% Interval Low**	**90% Interval High**
Discount Rate	β	0.990	0.990	0.988	0.992
Depreciation Rate	δ	0.018	0.019	0.017	0.021
Output Elasticity of Capital in Tourism Sector	α_T	0.362	0.483	0.409	0.557
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	0.362	0.679	0.670	0.686
Survival Rate of Employees to Keep the Job	ρ	0.895	0.944	0.940	0.948
Barging Power of Employees	η	0.500	0.655	0.523	0.789
Elasticities of New Hires to Unemployment	σ_m	0.500	0.500	0.338	0.659
Adjustment Cost of Recruitment	κ	17.600	17.671	16.006	19.342
Habit Persistent	h	0.847	0.538	0.424	0.654
Elasticity of Intertemporal Substitution	σ	2.000	2.202	2.035	2.375
Substitute Elasticity between Products	θ_1	0.4000	0.401	0.385	0.417
Substitute Elasticity between FDI and Domestic Investment	θ_2	1.5000	1.497	1.420	1.578
Ratio of Unemployment Benefit to Salary	b	0.340	0.216	0.073	0.348
Price Elasticity of Tourism Export(Absolute)	$\theta_{EX,T}$	1.908	1.994	1.838	2.148
Price Elasticity of Non-Tourism Export (Absolute)	$\theta_{EX,NT}$	0.541	0.538	0.522	0.554
Income Elasticity of Non-tourism Exports	ω_{NT}	2.418	3.525	3.235	3.833
Income Elasticity of Tourism Exports	ω_T	3.374	3.144	2.993	3.305
Elasticity of Philipps Curve(Absolute)	ρ_{Ph}	0.024	0.024	0.023	0.026
Auto Regressive Parameter					
Technology	ρ_A	0.983	0.966	0.949	0.982
World Output	ρ_{Yrow}	0.500	0.888	0.846	0.933
Consumption Preference	ρ_C	0.724	0.904	0.877	0.932
Investment Efficiency	ρ_I	0.559	0.700	0.625	0.772
Shock to Marginal Production of Labor	ρ_L	0.500	0.920	0.896	0.946
Real Exchange Rate	ρ_{RER}	0.530	0.889	0.844	0.936
Shock to Imports	ρ_{CM}	0.500	0.920	0.893	0.951
Standard Deviation					
Technology shock of Tourism	ε^{At}	0.150	0.032	0.027	0.037
Technology shock of Non-tourism	ε^{Ant}	0.150	0.022	0.020	0.023
World Output	ε^{Yrow}	0.150	0.039	0.032	0.045
Consumption Preference	ε^{C}	0.150	0.750	0.578	0.934
Investment Efficiency	ε^{I}	0.150	0.034	0.029	0.039
Shock to Marginal Production of Labor	ε^{L}	0.150	1.503	1.114	1.958
Real Exchange Rate	ε^{RER}	0.150	0.059	0.048	0.070
Shock to Imports	ε^{CM}	0.150	0.103	0.087	0.119

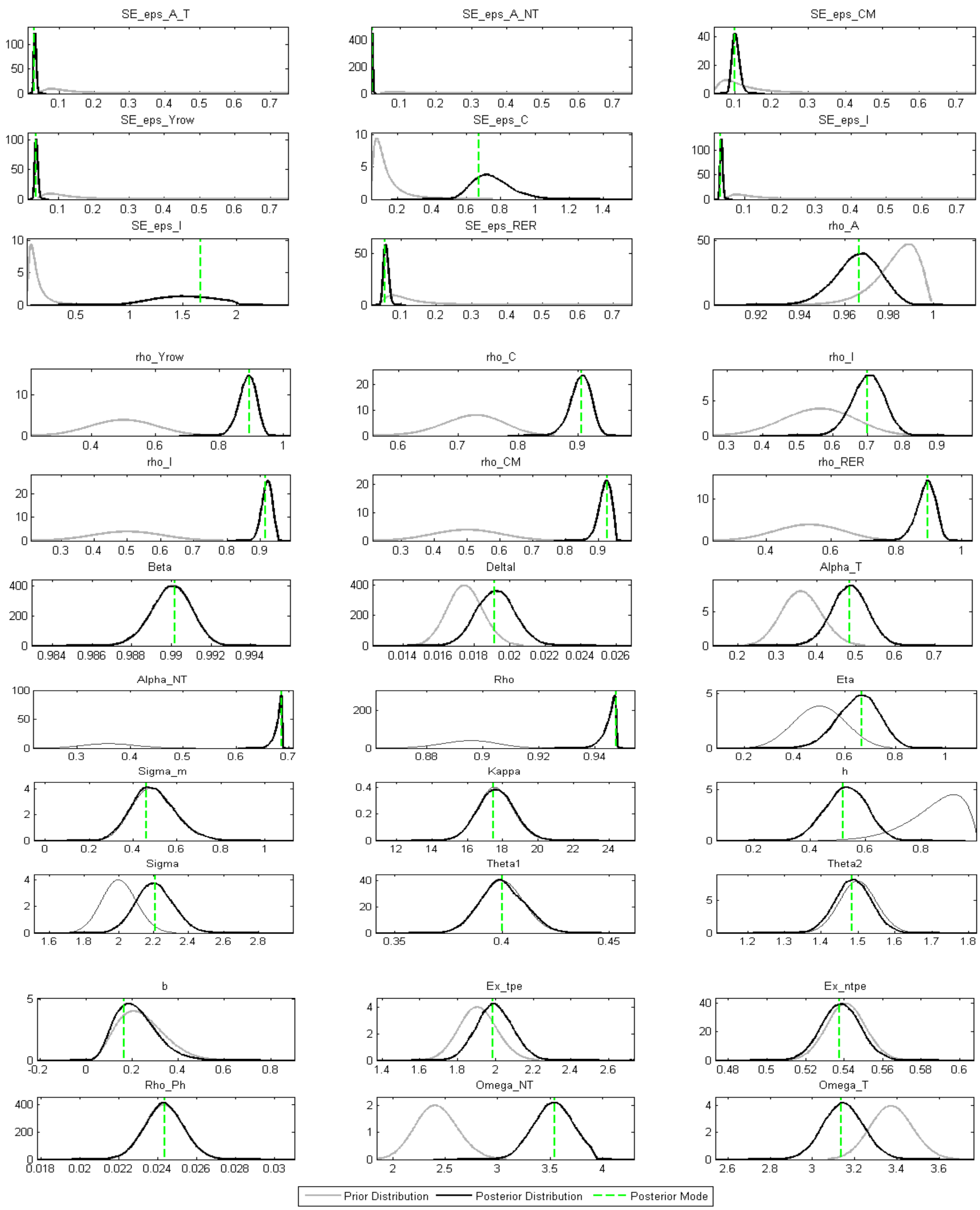


Figure 5.10 Prior and Posterior Distribution of the Structure Parameters of the Spanish Model

The intertemporal substitute elasticity parameter (σ) is estimated as 2.202, indicating an elasticity of 0.454, which is in the reasonable range suggested by Havranek *et al*. (2015). The substitute elasticity between products (θ_1) is 0.401, which is consistent with the findings of Lanza, Temple and Urga (2003) for OECD countries. The estimation of the price elasticity of tourism exports ($\theta_{EX,T}$) is 1.994 in absolute value, which is higher than the estimation of 1.21 given in Lanza, Temple and Urga (2003). However, according to Song, Kim and Yang (2010) and Álvarez-Díaz, González-Gómez and Otero-Giráldez (2012), the price elasticities of the key Spanish source markets are estimated to range from 0.50 to 2.99 and 0.31 to 2.57 in absolute value, respectively. Thus, the estimation of the overall price elasticity in this model is reasonable, as it is within the range of the elasticities of major source markets.

The auto-regressive coefficients of the shocks are very consistent; all of them are close to or larger than 0.9, except ρ_I , which is 0.700. The low memory of the auto-regressive coefficient of investment may be caused by the decreasing trend in investment since 2009. The largest posterior of the standard deviation is ε^L, which equals 1.549; the others range from 0.030 to 0.193. The strong fluctuation of the shock to the marginal production of labour can be explained by the recent high unemployment rate in Spain.

5.3.3 Findings of the Spanish Model

5.3.3.1 Impact of the Productivity Shock on the Product Markets of Spain

IRFs are used to test the impact of tourism on the economic growth of Spain. A 1% positive productivity shock expands the tourism production by 1%. Compared to the price of imports, which is taken as the numeraire of the model, the tourism product price drops by 0.93% and the price of non-tourism products grows by 0.07%. The tourism exports increase by around 1.8% and non-tourism exports drop by 0.035%, given that the estimated price elasticities of tourism and non-tourism products are -1.994 and -0.538, respectively.

The expansion of tourism production requires more input, so more fixed asset investment is purchased and more workers are recruited into the tourism sector. The growing demand for investment in the tourism sector could push up the nominal return rate, which is shared by tourism and non-tourism industries. This more attractive return rate may also lead to the inflow of investment and employment into the non-tourism sector. To increase their returns, households, in the short term, allocate more money to investment and thus reduce consumption. But the increased wages and earnings from theses investment makes households richer and thus they expand their consumption of tourism products, non-tourism products and imports in the following periods.

As a result, a 1% positive shock to tourism may increase GDP, investment and employment. Although the overall consumption decreases in the short term, it rises by around 0.2% in the medium term due to the improvement in household welfare. The simulations results are consistent with the empirical studies showing that tourism leads to the economic growth, and also explain how the growth is achieved.

The development of tourism in Spain increases economic growth for a longer period of time than in Mauritius, because households in Spain decrease their consumption of non-tourism products and imports in the short term to invest more in both industrial sectors. Thus, one policy option is short-term cuts to taxes on non-tourism products and imports to reduce production costs and slow down price increases; this would stimulate consumption and further expand economic growth.

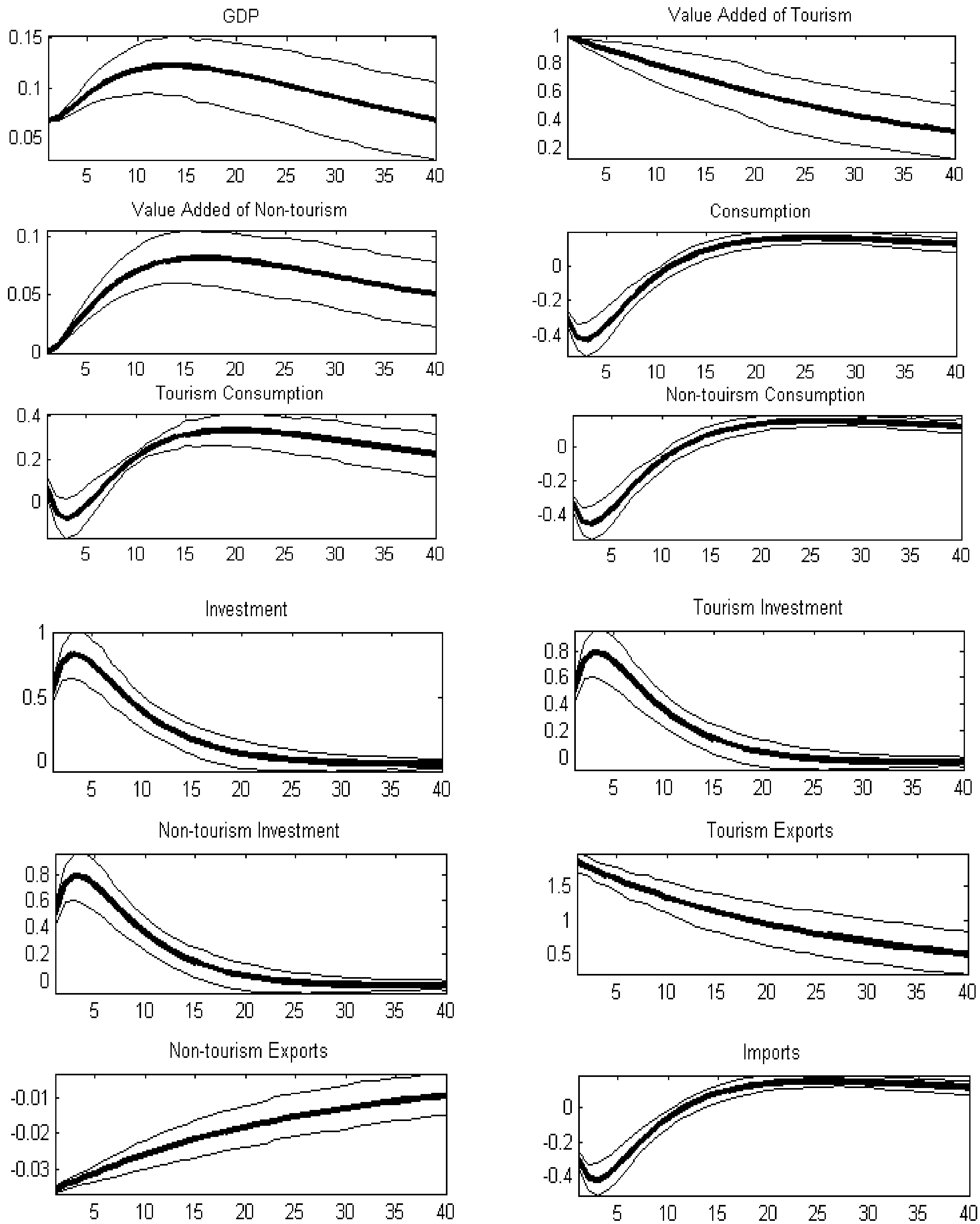


Figure 5.11 IRFs of the Spanish Model (%)

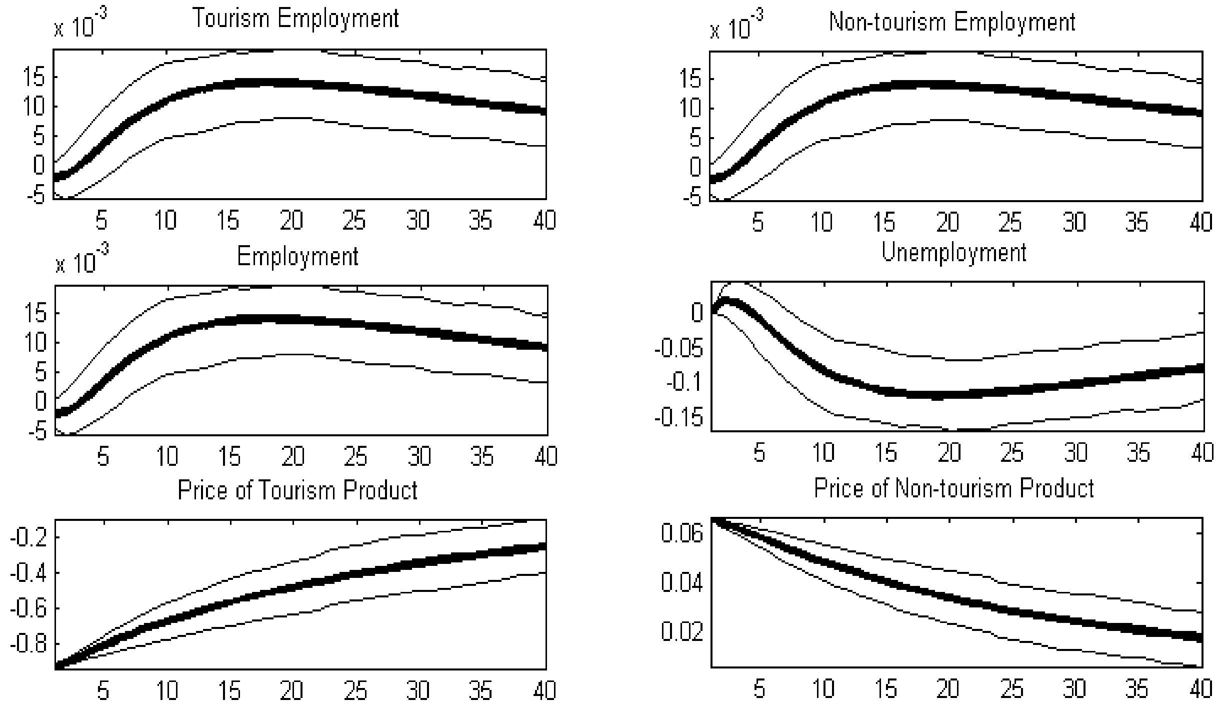
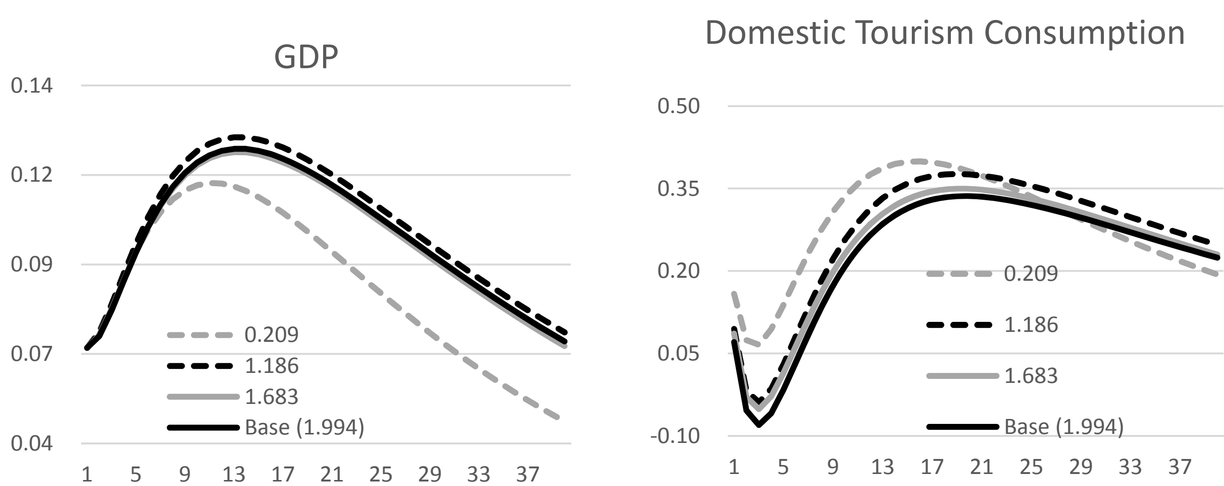


Figure 5.11 IRFs of the Spanish Model (%) (Continued)

5.3.3.2 Impact of Inbound Tourism on the Contribution of Tourism to Economic Growth in Spain

As demonstrated in Figure 5.5, different values of inbound tourism price elasticity influence entrepreneurs' decisions to purchase fixed assets and so influence the contribution of tourism to long-term economic growth. Although the estimates for inbound price elasticities of key Spanish source markets, ranging from 0.31 to 2.99 in absolute values, are taken from previous case studies of tourist demand (Song, Kim & Yang, 2010; Álvarez- Díaz, González-Gómez and Otero-Giráldez, 2012), the data on overall inbound tourism price elasticity are limited. As a result, the elasticity has to be estimated using real data, and the result is the mean of the prior distribution. To examine the contribution of inbound tourism to economic growth more comprehensively, IRFs with different values of price elasticities are presented in Figure 5.12.



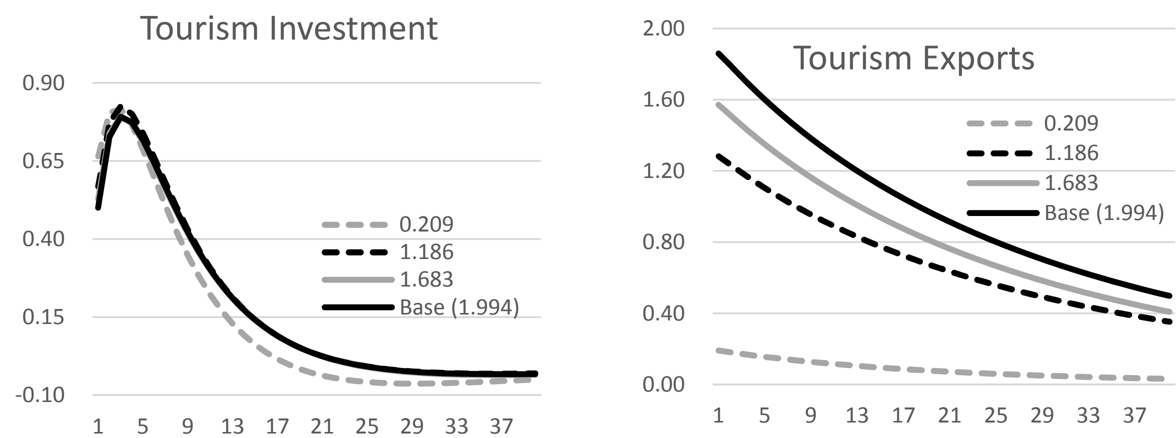


Figure 5.12 IRFs of Selected Variables with Different Inbound Tourism Price Elasticities of the Spanish Model (%)

The posterior estimation of the inbound tourism price elasticity is 1.994, which is represented by the black bold line in Figure 5.12. The estimated posteriors of price elasticities for the priors of 0.5, 1.0 and 1.5 are 0.209, 1.186 and 1.683, respectively. The vertical axis represents the percentage deviation of each variable from the steady state. All of the price elasticities are shown in absolute values.

A 1% positive shock to the productivity of tourism leads to a steady increase in tourism value added in all of the scenarios. However, as the international tourism demand becomes more sensitive to price, the expansion of tourism becomes more significant given the same price decline, ranging from 0.25% for the elasticity of 0.209 to around 2% for the baseline model. The decrease in the price of tourism products stimulates domestic tourism consumption. However, attracted by the increased return rate of investment, households prefer to postpone consumption and reallocate more resources to the factor market. Thus, consumption decreases and investment increases in the short term. As the price sensitivity of international tourism demand increases, households have to postpone or even decrease tourism consumption to gain the same return rate, as the increased value added of tourism is occupied by tourism exports with higher price elasticity. Gradually, as household income improves and the return rate falls, domestic tourism consumption starts to recover; in the long term, domestic tourism consumption grows around 0.2% and investment is cut by 0.1%. Finally, driven by the strong demand from international and domestic markets, the GDP of Spain grows a maximum of 0.11 to 0.12% and there are no negative effects of tourism on economic growth no matter how sensitive international tourists are to changes in Spanish tourism products.

In the Mauritian model, as international tourists become more insensitive to changes in price, tourism contributes more to economic growth. However, the pattern in the Spanish model is not clear. When the price elasticity equals 0.209, the smallest in absolute value, the growth of domestic tourism consumption is the strongest and the expansion of tourism exports and investment is the weakest. In contrast, the increase in domestic consumption is lowest and tourism exports and investment are highest when the elasticity is 1.994. Interestingly, the strongest GDP growth is achieved in neither of these scenarios, but when the elasticity is 1.186. GDP is aggregated by consumption, investment and net exports in this model, and an elasticity of 1.186 does not give the greatest growth for any one of the demand components, but it also does not give the lowest. Thus, when the elasticity is 1.186, the aggregated growth, which is the increase in GDP, is larger than in the other scenarios.

Thus, in the Spanish model, the price elasticity of inbound tourism influences the impact of tourism on economic growth, but the pattern is not unified and changes for each case.

5.3.3.3 Impact of Domestic Tourism on the Contribution of Tourism to Economic Growth in Spain

Domestic tourism consumption accounts for 46.7% of the tourism value added in Spain (The steady states of the variables used in the log-linearised model are presented in Table 5.7). The values are expressed as the average ratio between the variable and GDP, except γ_1, γ_2, $\overline{n_T}$ and $\overline{n_{NT}}$, which are the tourism and non-tourism shares in the consumption bundle and employment, respectively. Most of the steady states are calculated using real tourism and macroeconomic data for the 1995 to 2012 period, although some, such as the ratio of tourism consumption and final consumption, are based on shorter time periods due to data availability.

To get a full picture of the role that domestic tourism plays in the relationship between tourism and economic growth in Spain, simulations using different percentages of domestic tourism in tourism value added are carried out by IRF; the results are presented in Figure 5.13.

As the share of domestic tourism consumption increases from 20 to 80%, the maximal decline in the price of tourism products, which is caused by the positive productivity shock, decreases from 0.97 to 0.87%. Not only does the price fall in all four scenarios, tourism consumption goes down as well. The large decline in price shown in in Figure 5.13 corresponds to weak fluctuations in demand, whereas small changes in price lead to more significant variation in domestic tourism consumption. This indicates that when domestic tourism consumption accounts for 20% of the tourism value added, the demand is less elastic than when it account for 80%.

Given the same productivity shock and international demand, stronger domestic demand requires more investment and labour. Thus in the short term, the decline in consumption when domestic tourism is 80% of tourism is much larger than when it is 20%, because the increased input leads to more production and much stronger domestic demand. In the middle and long term, when the return rate starts to decline, consumption increases in the 80% scenario due to the postponement of the consumption in the short term. Stimulated by the short-term high level of investment and long-term high consumption, the contribution of tourism to economic growth becomes more and more significant as the share of domestic tourism in tourism value added increases in Spain.

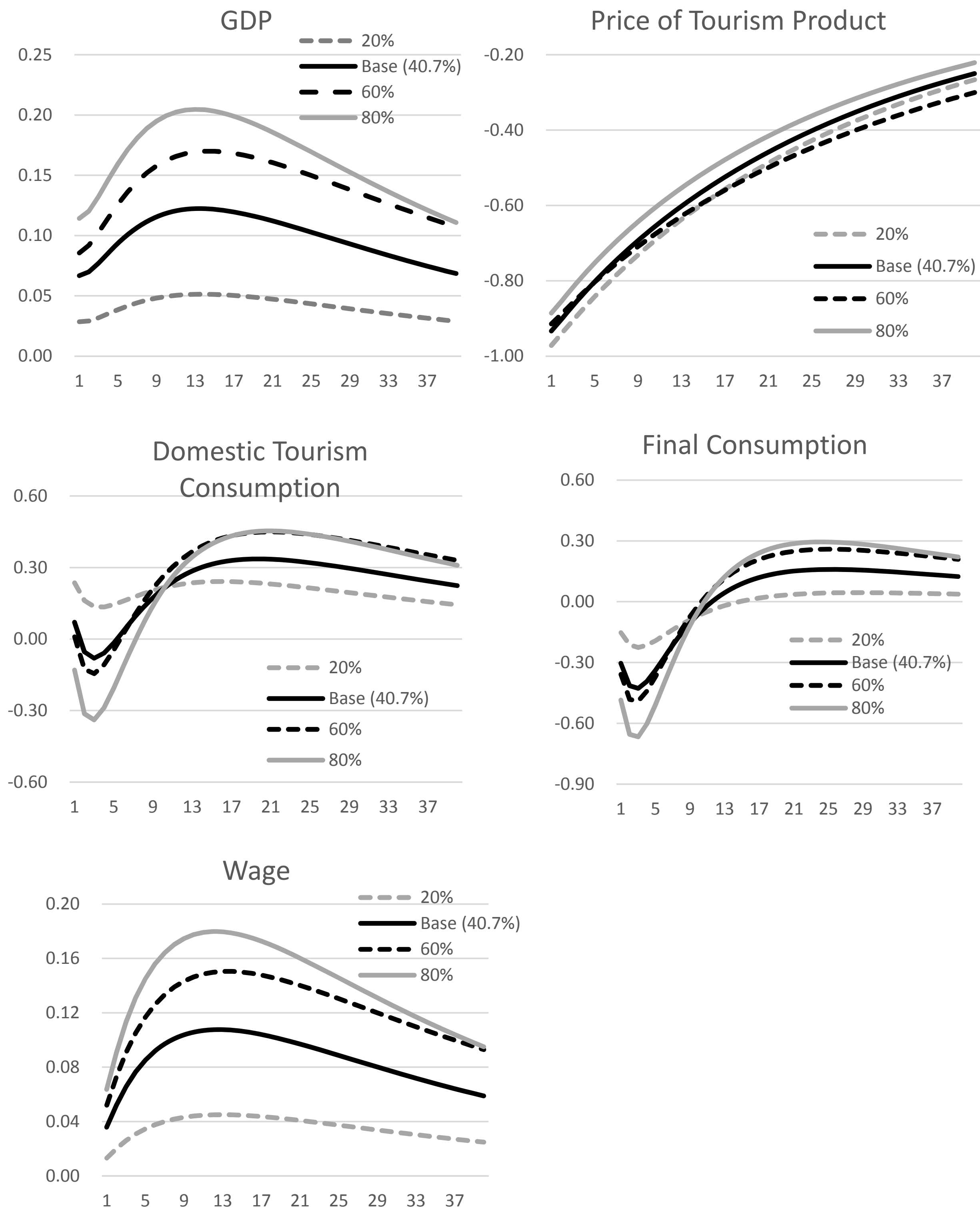


Figure 5.13 IRFs of Selected Variables with Different Shares of Domestic Consumption in Tourism Value Added of the Spanish Model (%)

5.3.4 Summary of the Spanish Model

This section discusses the estimation results of the Spanish model and examines the relationship between tourism and economic growth by modelling a positive productivity shock in the tourism sector of the economy. The priors of the parameters are calibrated by the findings of previous studies, regression results and the real data. Diagnostics and posteriors distributions show that the results of the Bayesian estimations are reliable.

The results of the IRFs show the variations in variables' responses to a productivity shock in the tourism sector. The expansion of tourism leads to the growth of the inbound market. Furthermore, an increase in production requires an increase in factor input. The more attractive return rate and wages will also attract factor inflow to the non-tourism sector. As a result, domestic consumption does not increase in the short term, but investment is expanded. When the return rate starts to decline, the postponed consumption is released as household income is improved. Thus, in Spain, tourism plays a significant role in stimulating economic growth. A 1% productivity shock to the tourism sector leads to a maximal 0.12% growth in GDP. The average annual growth rate of Spain in the last two decades is 2.2% and it has not recovered from the financial crises.

The analysis of the scenarios shows that the price elasticity of inbound tourism affects the relationship between tourism and economic growth in Spain, although the pattern is not clear. As in Mauritius, when domestic tourism accounts for a higher market share, tourism has stronger impact on economic growth.

The development of tourism in Spain leads to economic growth. Thus, the Spanish government should support tourism development in Spain. When the price of tourism products decreases, the government could consider cutting taxes in other industries and the imports sector to further stimulate the consumption of households and so the economic growth of the country.

5.4 New Zealand

Few studies have focused on the relationship between tourism and economic growth in New Zealand. However, it is known that economic growth in New Zealand apart from tourism is driven by industries in the tertiary sector, not in manufacturing, as in Spain. Thus, it is interesting and valuable to examine the impact of tourism on economic growth in a different industry structure.

5.4.1 Calibration of the Parameters in the New Zealand Model

5.4.1.1 Calibration of Structure Parameters in the New Zealand Model

There are 18 structure parameters in the New Zealand model and their prior distributions are presented in Table 5.9. As in the previous two models, the priors of the structure parameters are mainly obtained from previous studies and estimated using real data. Conventional parameters such as β , δ and α_i $(i = T, NT)$ are collected from Beneš *et al*. (2009), which is a DSGE model estimated with the Bayesian method and used by the Reserve Bank of New Zealand. Gerlter and Trigari (2006) and Orrego and Vega (2013) provided the information about parameters that are related to employment and substitute elasticities, respectively. The parameters of tourism and non-tourism exports equations and Phillips curve are estimated using real data and the details of the estimation results are given in Appendix 2.2. Unlike the previous two models, the prior information of ρ and θ_1, which are specialised in New Zealand, are collected from SNZ (2015) and Lartey (2008), respectively.

Table 5.9 Prior Distribution of Structure Parameters in the New Zealand Model

Structural Parameters		Prior Distribution	Source
Discount Rate	β	Beta (0.99,0.001)	Beneš *et al*. (2009)
Depreciation Rate	δ	Beta (0.02,0.01)	Beneš *et al*. (2009)
Output Elasticity of Capital in Tourism Sector	α_T	Beta (0.335,0.05)	Beneš *et al*. (2009)
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	Beta (0.335,0.05)	Beneš *et al*. (2009)
Survival Rate of Employees to Keep the Job	ρ	Beta (0.865,0.001)	SNZ (2015)
Barging Power of Employees	η	Beta (0.5,0.1)	Gerlter & Trigari (2006)
Elasticity of New Hires to Unemployment	σ_m	Gamma (0.5,0.1)	Gerlter & Trigari (2006)
Adjustment Cost of Recruitment	κ	Gamma (2.61,1)	Based on $\overline{x}$
Habit Persistent	h	Beta (0.829,0.1)	Beneˇs *et al*. (2009)
Elasticity of Intertemporal Substitution	σ	Gamma (2, 1)	Orrego & Vega (2013)
Substitute Elasticity between Products	θ_1	Gamma (3, 0.1)	Lartey (2008)
Substitute Elasticity between FDI and Domestic Investment	θ_2	Gamma (1.5,0.5)	Orrego & Vega (2013)
Ratio of Unemployment Benefit to Salary	b	Beta (0.449, 0.01)	Based on $\overline{B}$
Price Elasticity of Tourism Exports (Absolute Value)	$\theta_{EX,T}$	Gamma (0.958,0.1)	Regression
Price Elasticity of Non-tourism Exports (Absolute Value)	$\theta_{EX,NT}$	Gamma (1.244,0.1)	Regression
Income Elasticity of Non-tourism Exports	ω_{NT}	Gamma (1.476,0.1)	Regression
Income Elasticity of Tourism Exports	ω_T	Gamma (1.948,0.1)	Regression
Elasticity of Philipps Curve (Absolute Value)	ρ_{PH}	Gamma (0.438,0.2)	Regression

5.4.1.2 Calibration of Shock Parameters in the New Zealand Model of New Zealand

The priors of the shock parameters are presented in Table 5.10. The values of ρ^A and ρ_C are obtained from Kamber *et al*. (2014), which is also a DSGE model developed by the Reserve Bank of New Zealand for its forecasting project. ρ_{ROW} and ρ_{CM} are from Beneš *et al*. (2009) and the prior of ρ_{RER} is estimated using real data. Following Gertler, Sala and Trigari (2008), the priors of unknown auto-regressive coefficients are set to Beta (0.5, 0.1) and standard deviations to IGamma (0.15, 0.25). For the selection of prior distributions refer to Guerrón-Quintana and Nason (2013).

Table 5.10 Prior Distribution of Shock Parameters in the New Zealand Model

Parameters		**Prior Distribution**	**Source**
(a) Auto-regressive Coefficient			
Productivity	ρ^A	Beta (0.52,0.1)	Kamber *et al*. 2014
Income of the World Economy	ρ_{ROW}	Beta (0.5,0.1)	Beneˇs *et al*. (2009)
Consumption Preference	ρ_C	Beta (0.46,0.1)	Kamber *et al*. 2014)
Investment Efficiency	ρ_I	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Labor Efficiency	ρ_L	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Imports	ρ_{CM}	Beta (0.98,0.001)	Beneˇs *et al*. (2009)
Real Exchange Rate	ρ_{RER}	Beta (0.859,0.001)	Regression
(b) Standard Deviation			
Productivity of Tourism Sector	$\varepsilon^A_{T,t}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Productivity of Non-tourism Sector	$\varepsilon^A_{NT,t}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Income of the World Economy	ε^{Yrow}_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ε^C_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Investment Efficiency	ε^I_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Labor Efficiency	ε^L_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Imports	ε^{CM}_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Real Exchange Rate	ε^{RER}_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)

5.4.1.3 The Calibration of Other Parameters in the New Zealand Model

Table 5.11 presents the steady values of the variables and other parameters as calculated by the log-linear equations. The steady states are shown as the ratio of GDP, except γ_1 and γ_2 are ratios of the households' consumption bundle, which is the sum of the consumption of domestic products and imports, and $\bar{n}_T$ and $\bar{n}_{NT}$ are shares of employment. Most of the aggregate variables are calculated using the data from the 1999 to 2014 period, and the tourism data are drawn from the TSAs, which have been compiled since 1999.

The economic structure of New Zealand is quite similar to Spain in terms of the components of GDP, except that New Zealand is a net capital imports country and the balance of payment is negative in the long term. Furthermore, the contribution of tourism to the GDP of New Zealand

(7%) is lower than in Spain (10.8%, see Table 5.7). Therefore, it is interesting to compare the relationship between tourism and economic growth in the two economies.

Table 5.11 Calibration of Other Parameters in the New Zealand Model

Variables		Value in Steady State	Time Period/Source
GDP/GDP	$\overline{Y}$	1.000	-
Tourism Value Added/GDP	$\overline{Y}_T$	0.070	1999-2014
Non-tourism Value Added/GDP	$\overline{Y}_{NT}$	0.930	1999-2014
Final Consumption/GDP	$\bar{C}$	0.776	1995-2014
Total Investment/GDP	$\overline{I}$	0.248	1995-2014
Imports/GDP	$\overline{CM}$	0.214	1995-2014
Tourism Exports/GDP	$\overline{EX_T}$	0.053	1999-2014
Non-tourism Exports/GDP	$\overline{EX_{NT}}$	0.205	1995-2014
Tourism Investment/GDP	$\overline{I}_T$	0.021	1999-2006
Non-tourism Investment/GDP	$\overline{I}_{NT}$	0.227	1999-2006
Tourism FDI/GDP	$\overline{I}_T^F$	0.001	2000-2007
Non-tourism FDI/GDP	$\overline{I}_{NT}^F$	0.014	1995-2012
Balance of Payment/GDP	$\overline{BP}$	-0.025	1995-2014
Treasury Security/GDP	$\overline{B}$	0.081	2009-2014
Unemployment	$\bar{u}$	0.055	1995-2014
Tourism Consumption/（Final Consumption+Imports)	γ_1	0.062	1999-2014
Non-tourism Consumption / (Final Consumption+Imports)	γ_2	0.721	1999-2014
Tourism Employment/Employment	$\bar{n}_T$	0.104	2001-2014
Non-tourism Employment /Employment	$\bar{n}_{NT}$	0.896	2001-2014
CPI	$\overline{P}$	1.000	-
Tourism Price	$\overline{P}_T$	1.000	-
Non-tourism Price	$\overline{P}_{NT}$	1.000	-
Average Growth Rate of GDP	g_y	Log(1.069)	1995-2014
Average Growth Rate of Tourism Value Added	g_{yt}	Log(1.063)	1999-2014
Production Tax Rate	τ_Y	0.047	2009-2014
Wage Tax Rate	τ_W	0.1224	2009-2014
Turnover Probability of Unemployed People	$\overline{p}$	0.217	Based on $\bar{u}$
Employee's Surplus	$\overline{H}$	0.544	Based on $\bar{u}$and $\overline{B}$
Hiring Rate	$\bar{x}$	0.137	SNZ (2015)
Marginal Product of Labor	$\overline{a}$	0.149	$\kappa \bullet \overline{x}[(1/\beta - \overline{x}/2 - \rho) + \eta(\overline{x}/2 + \overline{p})]/(1-\eta)$
Wage	$\overline{w}$	0.349	$\eta(\overline{a} + \kappa\overline{x}^2/2 + \kappa\overline{xp}) + (1-\eta)b$

5.4.2 Estimation Results of the New Zealand Model

5.4.2.1 Convergence Diagnostic Test of the New Zealand Model

The multivariate convergence diagnostic test of the New Zealand model is shown in Figure 5.14. The pooled sequence and the mean of the sequences converge to each other in the mean, the second and third moments. According to Brooks and Gelman (1998), this indicates that, generally speaking, the estimated posterior distributions in the New Zealand model are reliable.

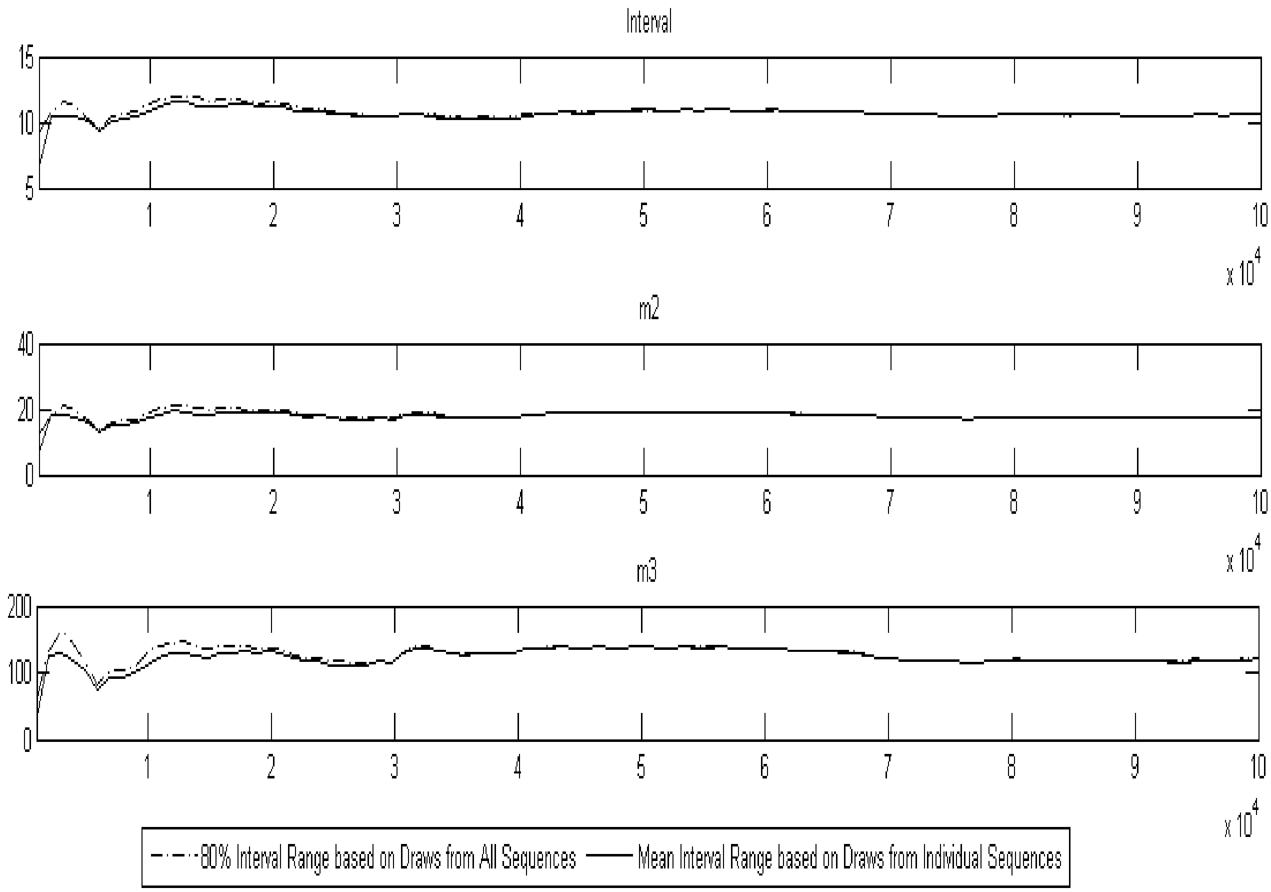


Figure 5.14 Multivariate Convergence Diagnostic Test of the New Zealand Model

The results of the univariate convergence diagnostic test of the each parameter are shown in Figure 5.15. Although for some parameters such as ε^{C} (SE_eps_C) and η (Eta) there are gaps between the pooled and individual sequences at the beginning of the draws, they become overlapped as the number of draws increases. Figure 5.15 indicates that all of the posterior distributions estimated by the Bayesian method in the New Zealand model are reliable.

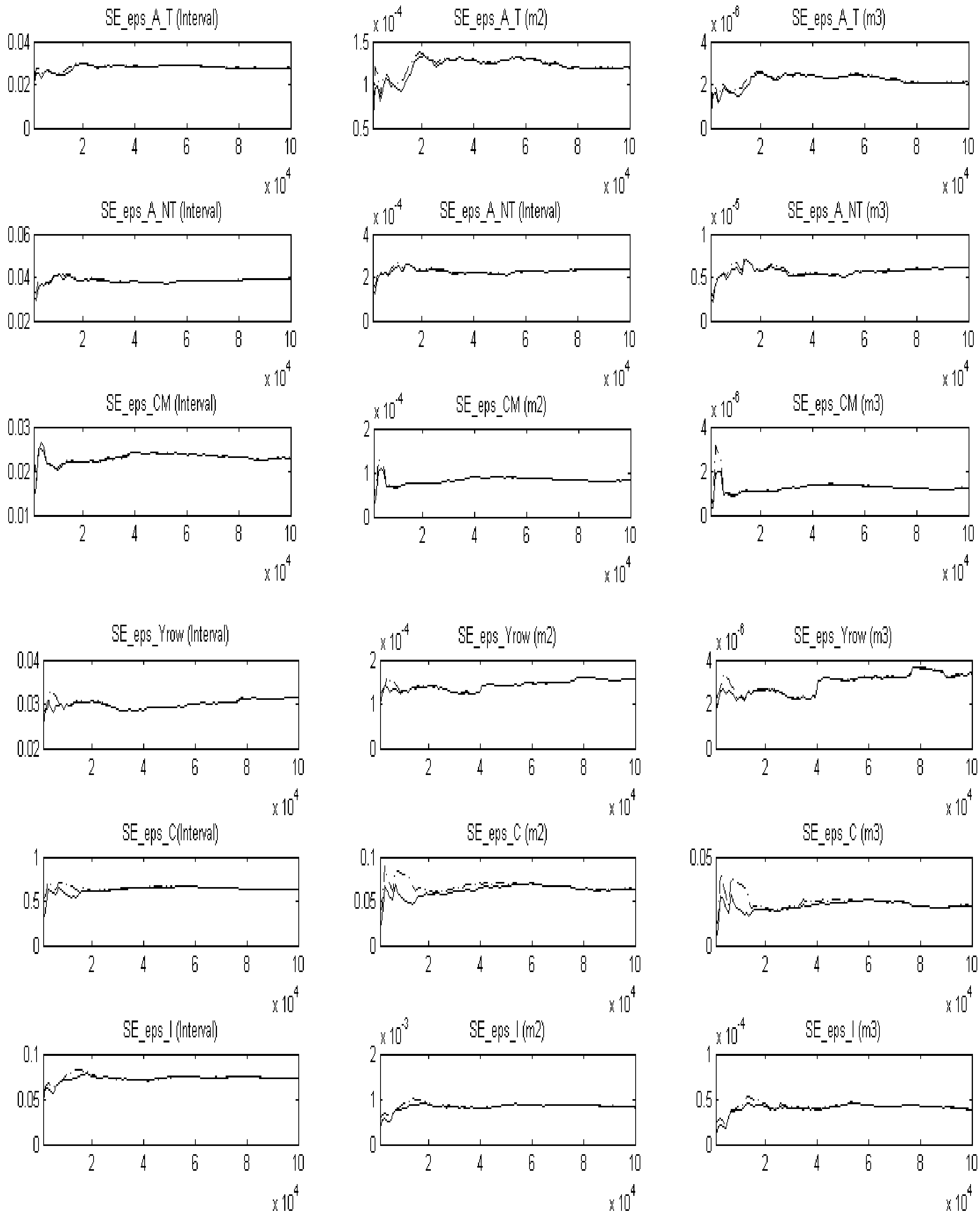


Figure 5.15 Univariate Convergence Diagnostic Test of the New Zealand Model

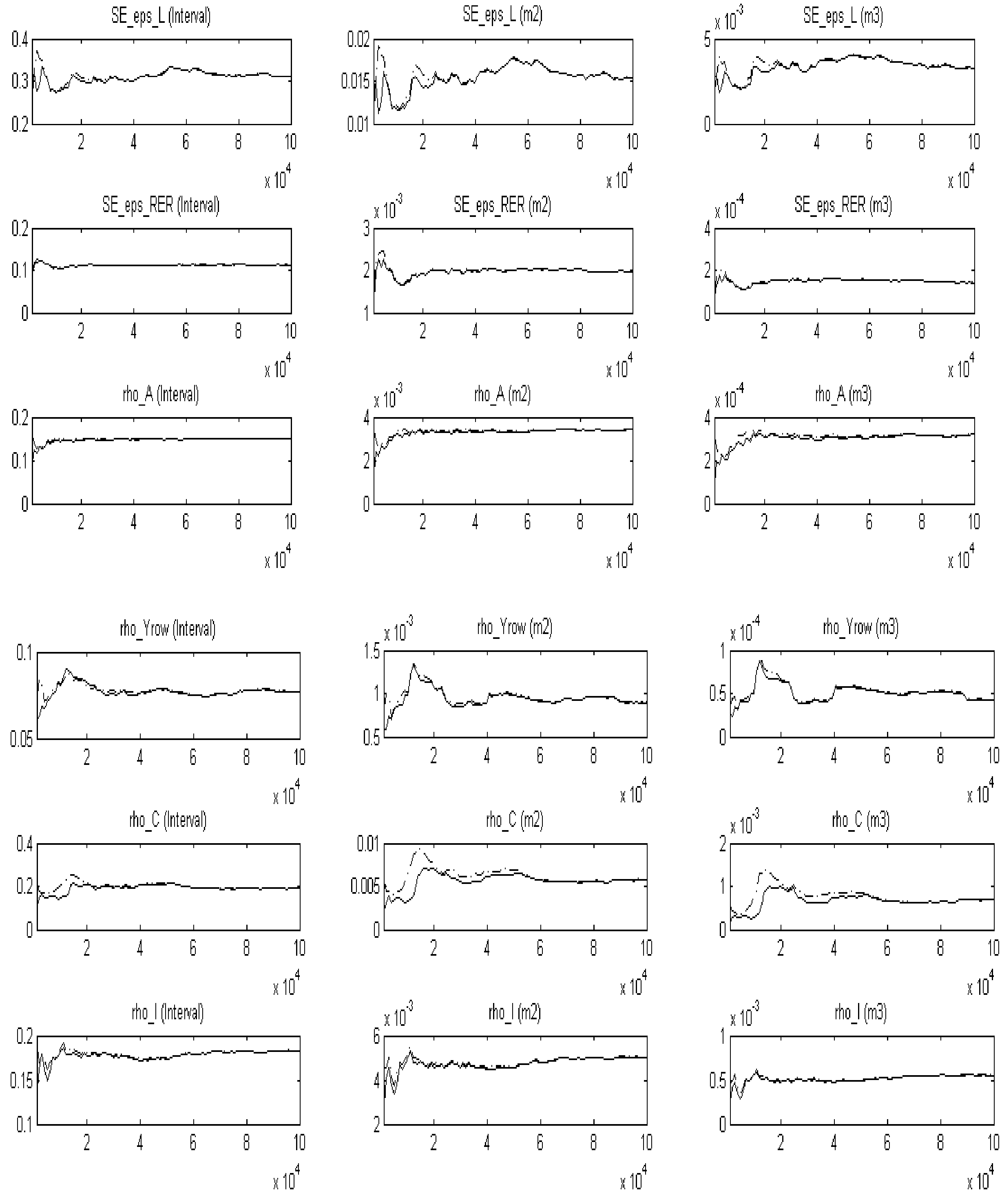


Figure 5.15 Univariate Convergence Diagnostic Test of the New Zealand Model (Continued)

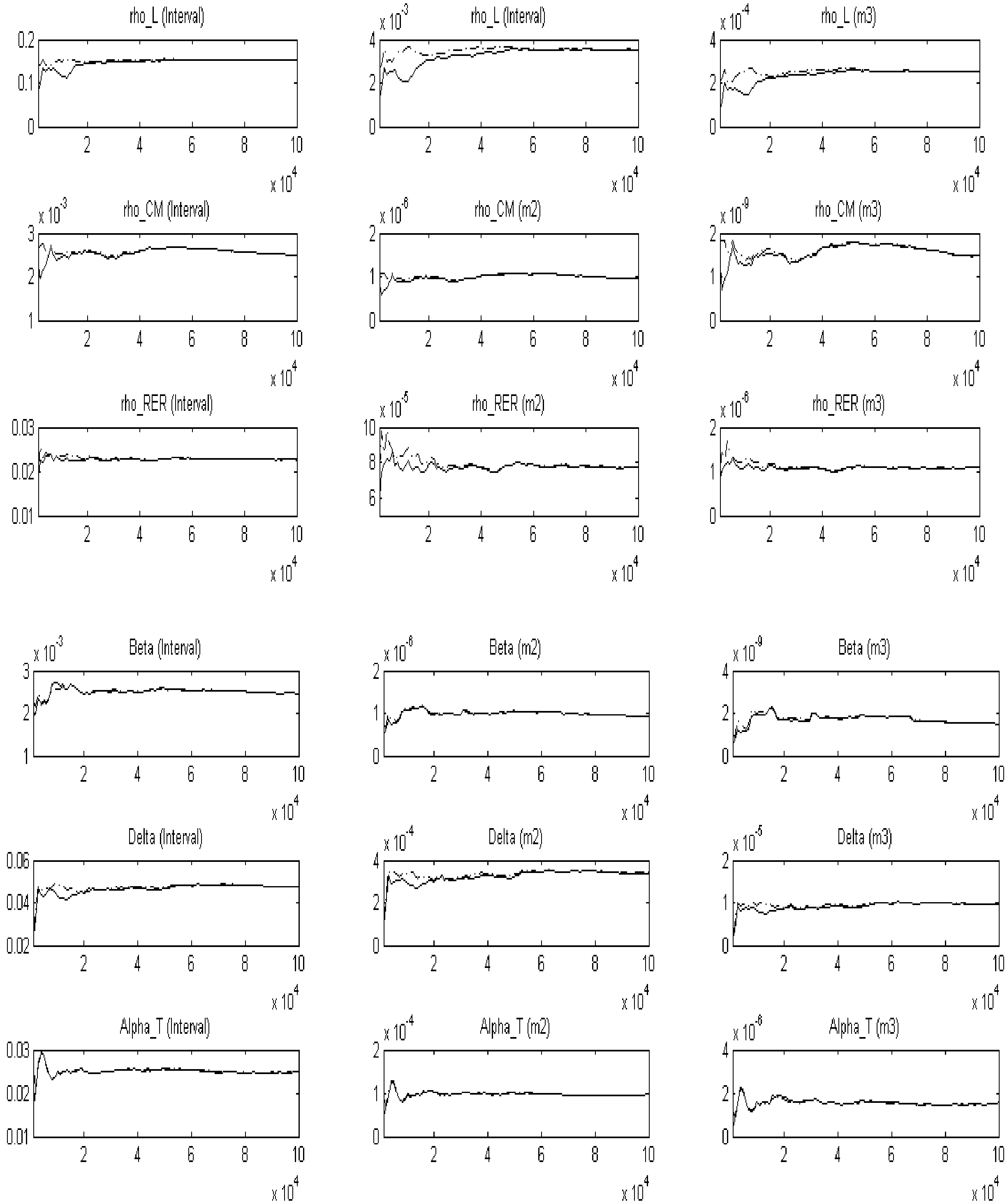


Figure5.15 Univariate Convergence Diagnostic Test of the New Zealand Model (Continued)

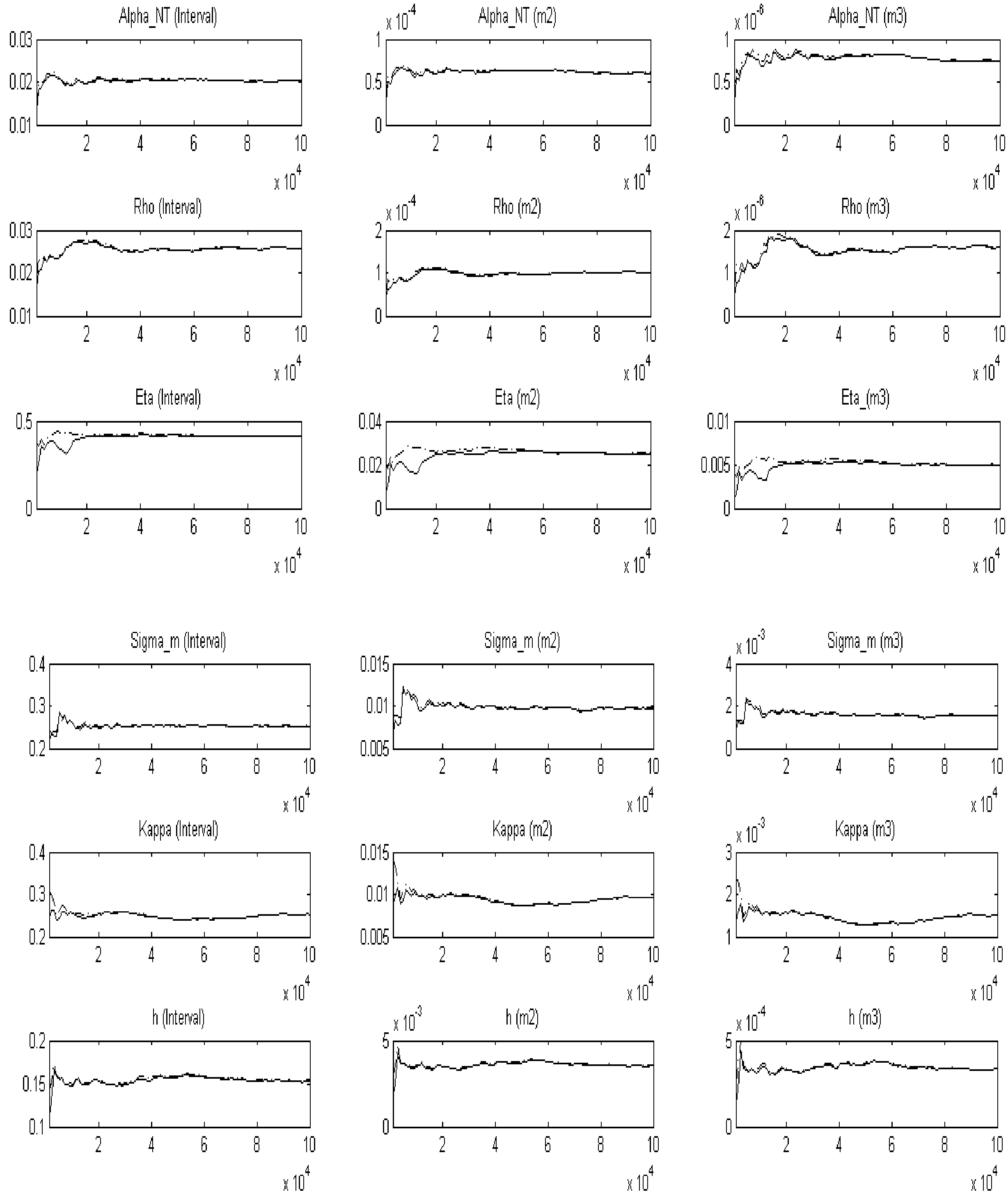


Figure5.15 Univariate Convergence Diagnostic Test of the New Zealand Model (Continued)

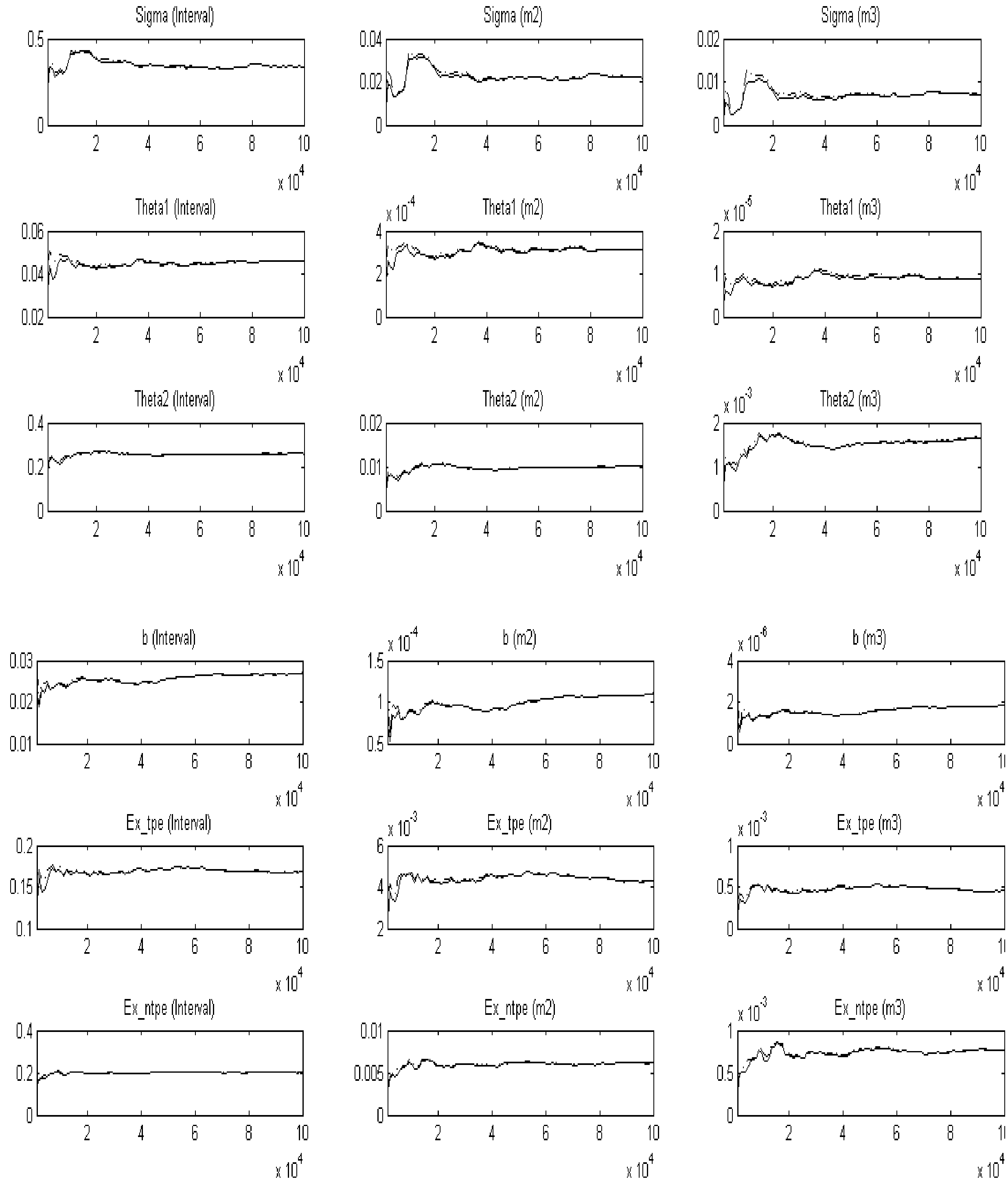


Figure5.15 Univariate Convergence Diagnostic Test of the New Zealand Model (Continued)

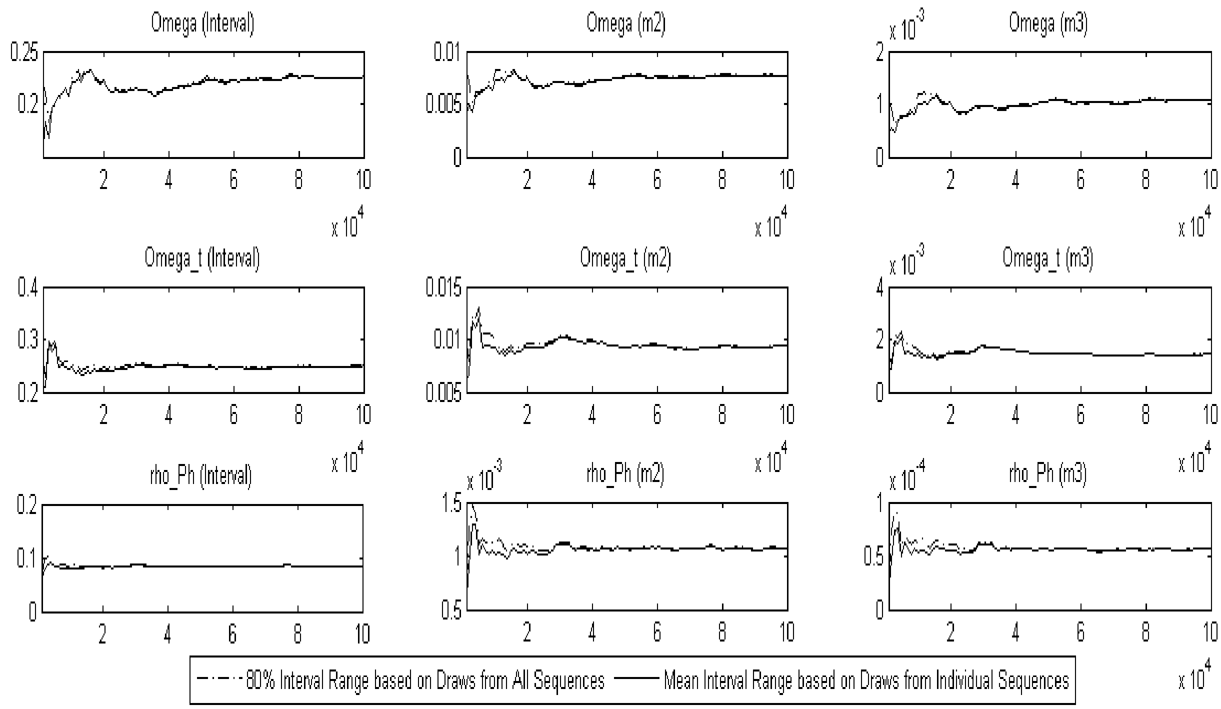


Figure5.15 Univariate Convergence Diagnostic Test of the New Zealand Model (Continued)

5.4.2.2 Estimation Results of the New Zealand Model

Eighteen structure parameters and 16 shock parameters are estimated by the Bayesian method and the results are shown in Table 5.12 and Figure 5.16. A 90% interval estimation of the parameters is also presented in Table 5.12 to provide a more robust result.

Table 5.12 Estimation Results of the New Zealand Model 1999-2014

Structure Parameter		**Prior Mean**	**Posterior Mean**	**90% Interval Low**	**90% Interval High**
Discount Rate	β	0.998	0.998	0.996	0.999
Depreciation Rate	δ	0.020	0.092	0.064	0.124
Output Elasticity of Capital in Tourism Sector	α_T	0.335	0.325	0.309	0.342
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	0.335	0.389	0.378	0.400
Survival Rate of Employees to Keep the Job	ρ	0.865	0.872	0.856	0.889
Barging Power of Employees	η	0.500	0.471	0.243	0.706
Elasticities of New Hires to Unemployment	σ_m	0.500	0.497	0.332	0.655
Adjustment Cost of Recruitment	κ	2.611	2.548	2.385	2.708
Habit Persistent	h	0.500	0.420	0.323	0.519
Elasticity of Intertemporal Substitution	σ	2.000	4.845	4.647	5.000
Substitute Elasticity between Products	θ_1	0.400	0.078	0.048	0.105
Substitute Elasticity between FDI and Domestic Investment	θ_2	1.500	1.512	1.346	1.676
Ratio of Unemployment Benefit to Salary	b	0.449	0.446	0.429	0.464
Price Elasticity of Tourism Export(Absolute)	$\theta_{EX,T}$	0.958	0.671	0.563	0.778
Price Elasticity of Non-Tourism Export (Absolute)	$\theta_{EX,NT}$	1.244	1.082	0.952	1.208
Income Elasticity of Non-tourism Exports	ω_{NT}	1.476	1.312	1.165	1.456
Income Elasticity of Tourism Exports	ω_T	1.948	2.075	1.913	2.233
Elasticity of Philipps Curve(Absolute)	ρ_{Ph}	0.438	0.871	0.821	0.925
Auto Regressive Parameter					
Technology	ρ_A	0.520	0.259	0.163	0.355
World Output	ρ_{Yrow}	0.500	0.879	0.830	0.928
Consumption Preference	ρ_C	0.460	0.800	0.682	0.911
Investment Efficiency	ρ_I	0.500	0.422	0.307	0.538
Shock to Marginal Production of Labor	ρ_L	0.500	0.841	0.759	0.929
Real Exchange Rate	ρ_{RER}	0.859	0.885	0.871	0.899
Shock to Imports	ρ_{CM}	0.980	0.980	0.978	0.982
Standard Deviation					
Technology shock of Tourism	ε^{At}	0.150	0.114	0.096	0.131
Technology shock of Non-tourism	ε^{Ant}	0.150	0.154	0.129	0.179
World Output	ε^{Yrow}	0.150	0.085	0.065	0.105
Consumption Preference	ε^{C}	0.150	0.586	0.252	0.948
Investment Efficiency	ε^{I}	0.150	0.274	0.228	0.320
Shock to Marginal Production of Labor	ε^{L}	0.150	1.851	1.669	2.000
Real Exchange Rate	ε^{RER}	0.150	0.395	0.322	0.465
Shock to Imports	ε^{CM}	0.150	0.094	0.079	0.108

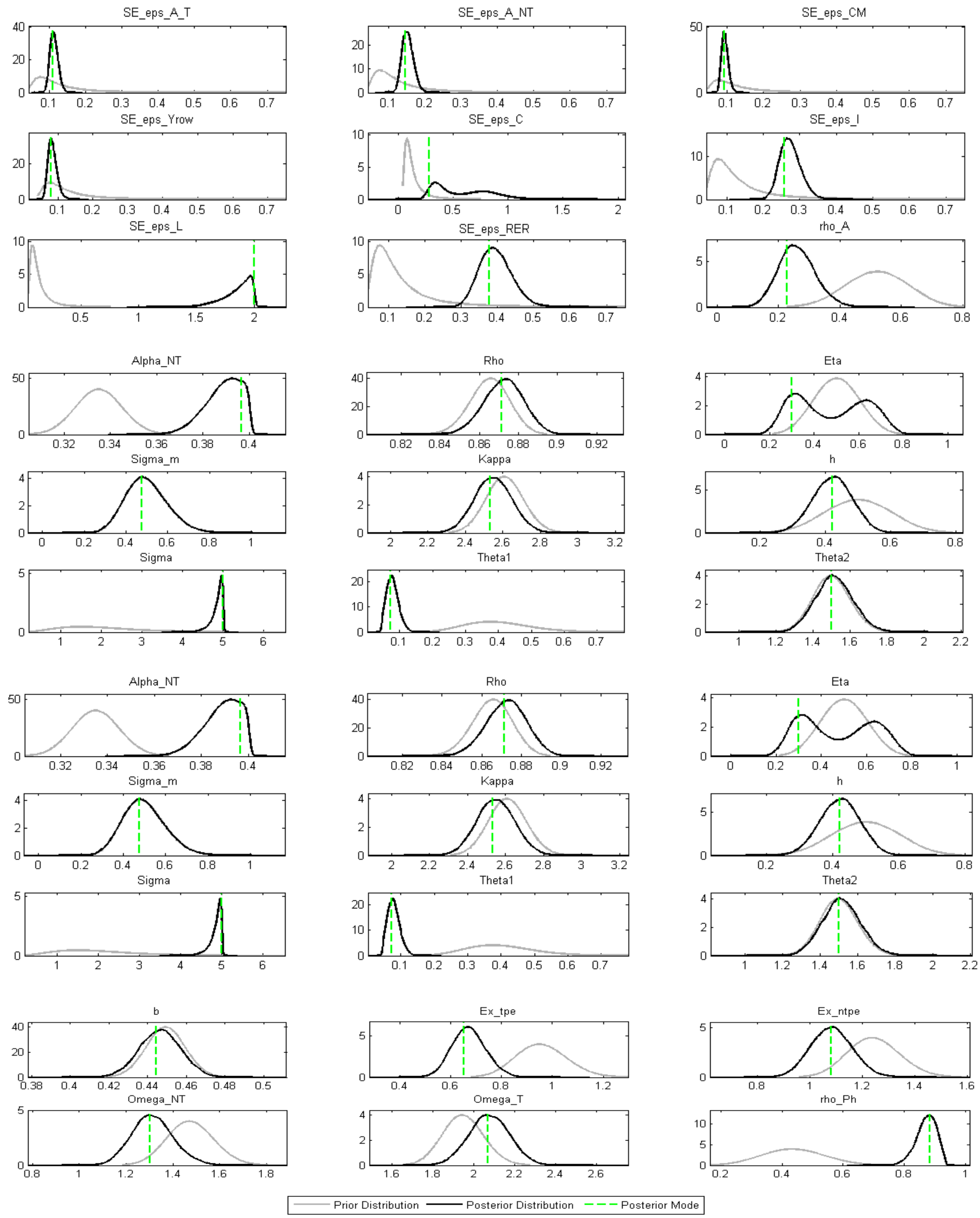


Figure 5.16 Prior and Posterior Distribution of the Structure Parameters of the New Zealand Model

As the data used by Beneš *et al*. (2009) cover up to 2008, most of the prior distributions are updated with data from this study. Some key parameters, for example, the increase in output production elasticity (α_{NT}) to 0.696, indicate that the non-tourism sector is more capital-intensive than the tourism sector.

The parameter of the intertemporal elasticity (σ) is 4.747, indicating an elasticity of 0.21 ($\frac{1}{\sigma}$). Although the elasticity is less than 0.5, the mean of the results reviewed by Havranek *et al*. (2015), the estimated value is still in the reasonable range.

The estimation of substitute elasticity between products (θ_1) is 0.078. It is much lower than the Spanish estimation, but is close to the Mauritian estimation. The estimation is also smaller than unit, indicating an incomplete substitution between products.

The inbound price elasticity ($\theta_{EX,T}$) is estimated as 0.671. Song *et al*. (2015) have shown that the price elasticities of the main source markets of New Zealand range from -0.12 to -1.86. Considering the largest source market of New Zealand is Australia, a neighbouring country that accounts for a 45% market share of the inbound market, an insensitive overall inbound price elasticity is reasonable.

All of the auto-regressive coefficients are estimated to be larger than 0.80, except the productivity and investment efficiency parameters. The low memorable ability of investment efficiency may be caused by the serious fluctuations caused by the global financial crisis; in 2009 investment in New Zealand dropped 20% (SNZ, 2015). As the non-tourism sector accounts for 94% of the value added, a significant fluctuation in investment could lead to the weak persistence of productivity in the economy.

5.4.3 Findings of the New Zealand Model

5.4.3.1 Impact of the Productivity Shock on the Product Markets of New Zealand

The responses of the selected variables to a 1% positive productivity shock in the tourism sector are presented in Figure 5.17 and the IRFs of all of the variables are given in Appendix 3. With a 1% positive productivity shock to the tourism sector, domestic and inbound tourism demand expands due to the relative drop in the price of tourism products, compared to the price of imports. Meanwhile, as the price of non-tourism products becomes relatively more expensive, the demand for non-tourism products in both domestic and overseas market decreases.

Note that the intertemporal elasticity of New Zealand is estimated as 0.21; thus, the trade-off between consumption in this period and in the future is very gentle and therefore households do not reallocate resources between consumption and investment. As a result, the increases in investment in both sectors is only around 0.2%. Furthermore, the substitute elasticity between tourism and non-tourism products is 0.078, so the utilities of the two products to the households of New Zealand are quite different. Even if the price of tourism products declines, households may not buy more tourism products with the money originally budgeted for non-tourism products. Thus, the consumption of non-tourism products may not decrease significantly. In contrast, as the expansion of production requires more employment in the two sectors, household incomes improve and consumption of non-tourism products increases. Finally the GDP of New Zealand only increases around 0.04% maximally with a 1% positive productivity shock to the tourism sector, because no significant fluctuation is shown in either domestic tourism consumption or investment, which limits the changes to the other variables including GDP.

The contribution of the development of tourism to economic growth is much smaller in New Zealand than in Spain. The gap is caused by the low increase in investment in New Zealand. The intertemporal elasticity of New Zealand is only 0.21, which is much lower than in Spain (0.45); thus, households in New Zealand do not reallocate as much to the capital market as Spanish households. Although improvements in productivity in the tourism sector increase the value added by 0.04%, the growth rate decreases due to lack of investment in further development that will continue the growth in subsequent periods.

Thus, although the sector structure of the two destinations is similar, the impact of tourism development on economic growth is different due to the various preference of households. The practical implication for the New Zealand government is to encourage more domestic investment or to attract more FDI to develop tourism in a way that will maintain the economic growth that is triggered by improvements in the productivity of the tourism sector.

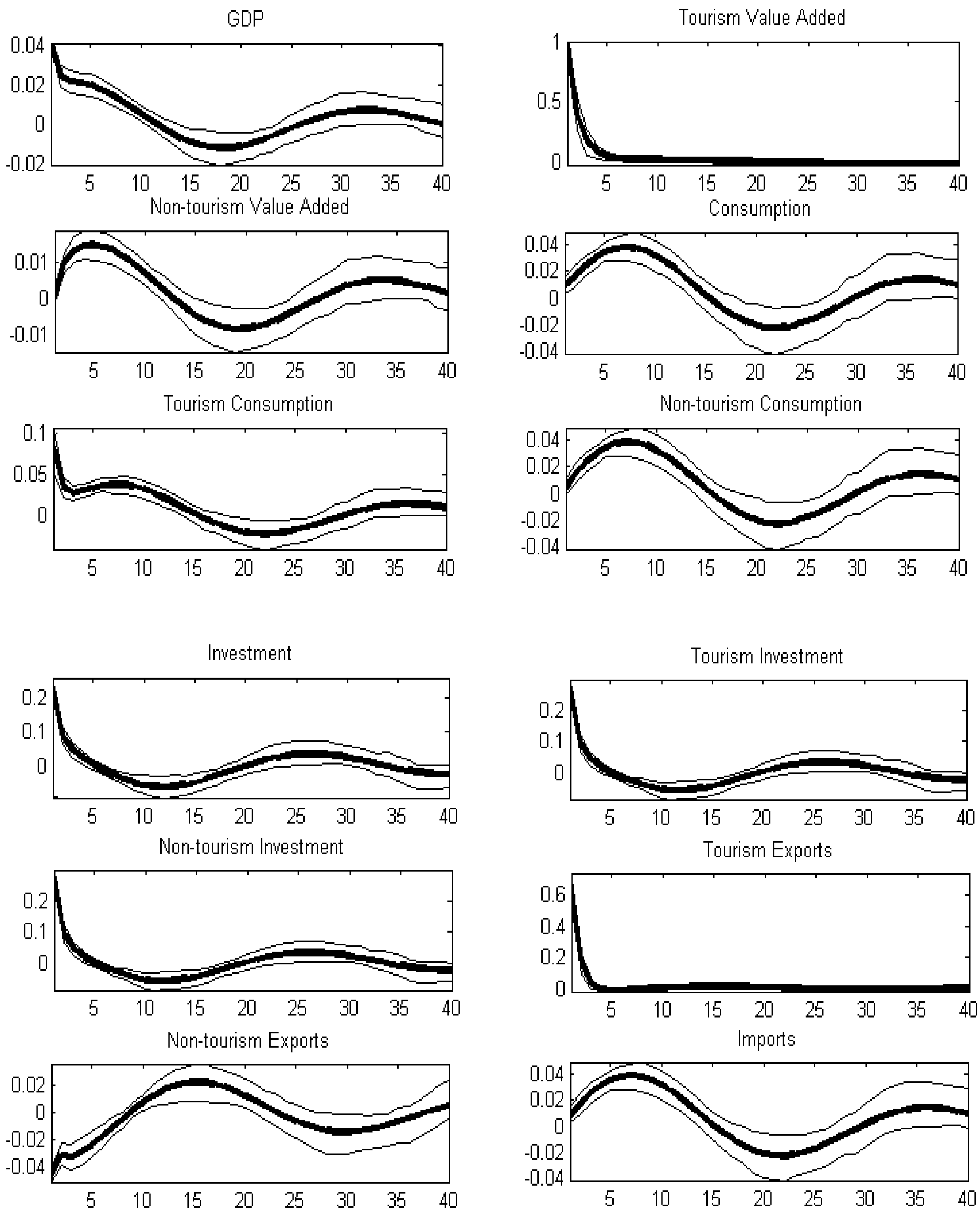


Figure 5.17 IRFs of the New Zealand Model (%)

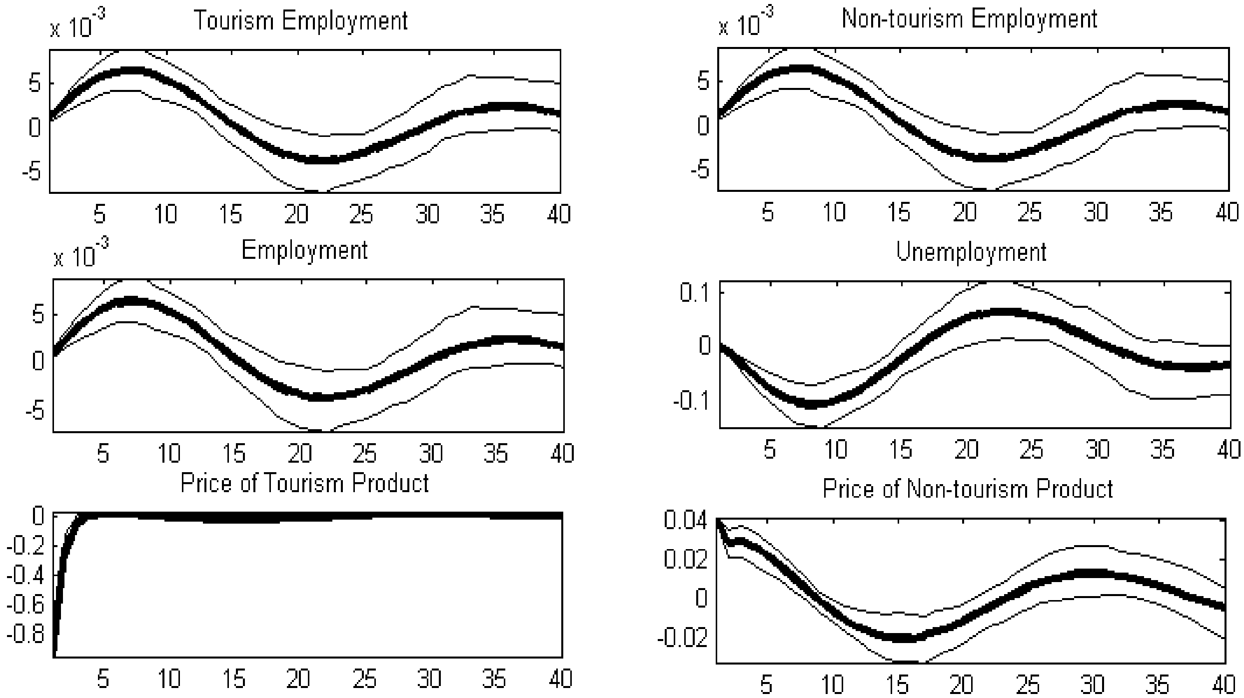


Figure 5.17 IRFs of the New Zealand Model (%) (Continued)

5.4.3.2 Impact of Inbound Tourism on the Contribution of Tourism to Economic Growth in New Zealand

Different values of price elasticity change the reactions of international tourism demand to a productivity shock in the tourism sector and affect firms' decisions to purchase fixed asset investments. Thus various priors of price elasticity are assigned to the New Zealand model to examine the impact of inbound tourism on the contribution of tourism to economic growth; the results are presented in Figure 5.18. Black solid lines represent the IRFs of the baseline model with a posterior estimation of 0.617. Values of 0.702, 1.159 and 1.990 correspond to the priors of 1, 1.5 and 2, respectively.

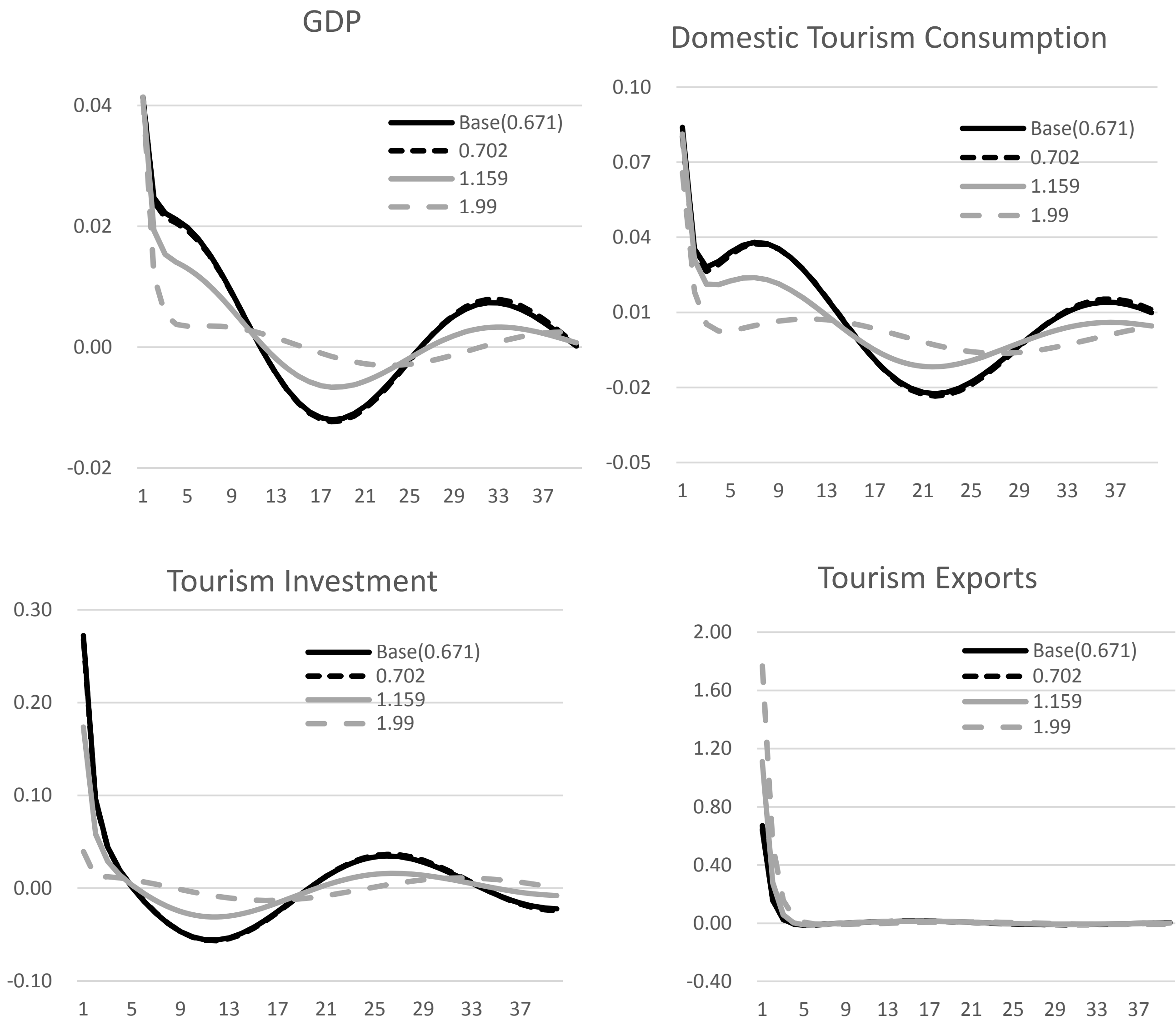


Figure 5.18 IRFs of Selected Variables with Different Inbound Tourism Price Elasticities of the New Zealand Model (%)

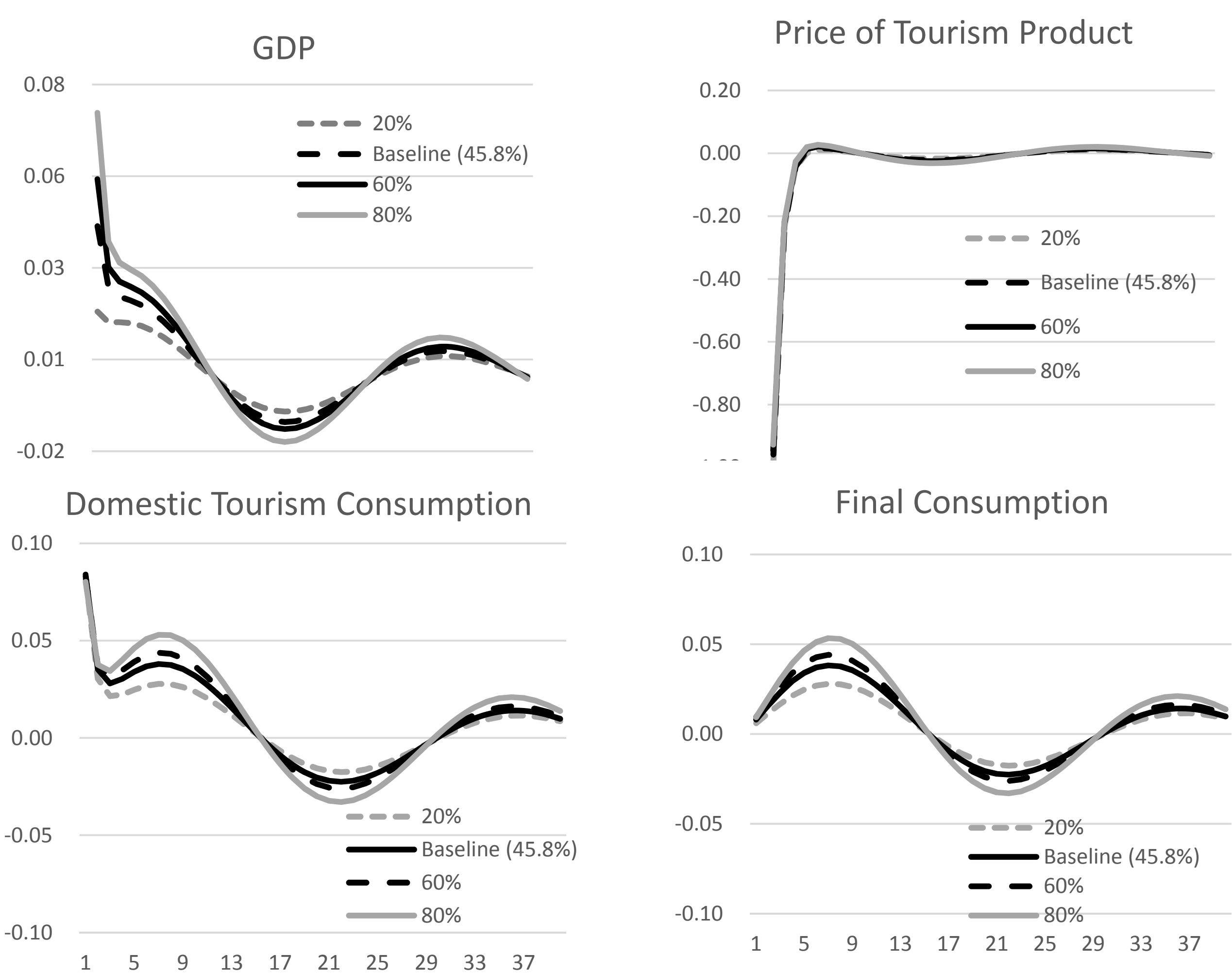
The settings of the parameters in the four scenarios are the same expect for the prior distributions of the price elasticity of tourism exports. As all of the scenarios have the same productivity shock, the change in tourism price and tourism value added is also the same. Hence, an increase in domestic tourism consumption is similar, as domestic price elasticity is the same, although this parameter is omitted in the model. As the inbound tourism demand becomes more sensitive to the changes in price, the tourism exports increase from 0.64 to 1.77%.

Given the same rise in tourism value added and higher exports, there are fewer resources to be reallocated between consumption and investment. When the price elasticity is -0.671 in the base line model, the amount of resources allocated to inbound tourism demand is the least of the four scenarios and there are more resources for investment and consumption. To increase earnings, households provide more fixed assets to the capital market and more rent to firms than in the other three scenarios. Thus, when inbound demand converges to the original level, the decline in investment is the largest in the baseline model, and the scenario with an elasticity of -1.99 has the smallest increase in investment. It is assumed that tourism and non-tourism investment share the same return rate; thus, a change in tourism investment causes a change in investment in the non-tourism sector. As it is affected by fluctuations in investment, which is one of the main input factors for production, the GDP fluctuates correspondingly, but a few periods later than investment, because time is needed to transform investment into value added.

In short, the responses of inbound tourism to different price elasticities show that tourism positively affects economic growth in New Zealand. However, the degree of fluctuation in the GDP depends on the values of the parameter.

5.4.3.3 Impact of Domestic Tourism on the Contribution of Tourism to Economic Growth in New Zealand

As in Mauritius and Spain, as the share of domestic tourism consumption increases from 20 to 80% of the total tourism consumption, the contribution of tourism to economic growth rises from 0.02 to around 0.08% (Figure 5.19). The impact of domestic tourism on the relationship between tourism and economic growth in New Zealand is not as significant as in the other two destinations because the intertemporal elasticity and substitute elasticity between products are lower than in the other two models. As a result, the fluctuation of tourism consumption is also less significant leading to a flatter response of wages. The small improvement in income limits the expansion of non-tourism consumption and investment. Finally, the increase in GDP is limited to only 0.02 to 0.08%.



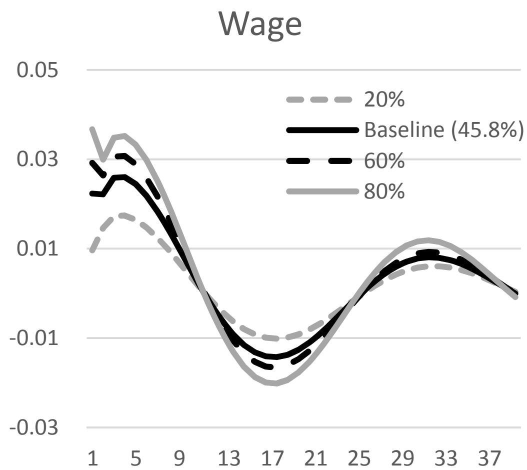


Figure 5.19 IRFs of Selected Variables with Different Shares of Domestic Consumption in Tourism Value Added of the New Zealand Model (%)

5.4.4 Summary of the New Zealand Model

The relationship between tourism and economic growth is examined with a Bayesian estimation of the DSGE New Zealand model. The estimation results are reliable as all of the parameters pass the convergence test. There is a positive relationship between tourism and economic growth; however, GDP only increases 0.04%, because the intertemporal elasticity and substitute elasticity between products in New Zealand's households are low. Thus, the changes in tourism investment, tourism consumption and non-tourism consumption are small, and the sequential responses of other variables are limited. This finding is confirmed by sensitivity analysis. As in Mauritius and Spain, an increase in the proportion of tourism consumption in the consumption bundle increases the contribution of tourism to economic growth. However, even when tourism accounts for 80% of consumption in New Zealand, the contribution to GDP only grows by 0.08%.

Thus, although the sector structure of New Zealand is similar to Spain's, the New Zealand economy is dominated by the tertiary sector (unlike the manufacturing sector in Spain), and as a result the impact of tourism on economic growth is different. In particular, the household preferences are different in the two destinations. Households in New Zealand are less likely than Spanish households to postpone consumption in the current period and to invest more in the capital market. As a result, the economic growth driven by the development of tourism is not maintained for long due to the lack of investment. To stimulate the impact of the tourism sector on economic growth in New Zealand, the government of New Zealand could encourage more domestic investment or attract more FDI to the tourism sector.

5.5 USA

Although it has been argued that small countries have advantages in specialising in tourism (Lanza & Pigliaru, 1999), large countries should also develop their tourism industries. First, countries with large territories may have more resources for developing tourism products. Second, large countries also have more resources to develop tourism-related industries, so there is no need to rely on imports and FDI. This means the leakage outflow from the economy is much less and the benefits of tourism development are kept in the local economy. Thus, the contribution of tourism to economic growth in large countries is more effective. Third, the populations of large countries can provide sufficient labour and domestic demand for tourism. Last but not least, the tourism industry in large countries can benefit from the economy of scale.

Although the tourism-led economic growth (TLEG) hypothesis has been advocated by Balaguer and Cantavella-Jordá (2002) for more than 10 years, there has been little research focusing on the relationship between tourism and economic growth in large countries. As the first and fourth largest country in terms of GDP and territory, respectively, the USA attracted around 63.9 million arrivals and US$180.7 billion tourism receipts in 2014 (See Table 3.1), ranking second and first globally, respectively (UNWTO, 2015).

Thus it is necessary to investigate the relationship between tourism and economic growth in the USA. This could fill the gap in our understanding of tourism and economic growth in large economies. Furthermore, the findings improve the generality and representativeness of the conclusions on the impact of tourism on economic growth.

5.5.1 Calibration of the Parameters in the US Model

5.5.1.1 Calibration of Structure Parameters in the US Model

The structure of the US model is similar to the previous ones; there are 18 parameters in the model. The information about prior distributions are collected from previous studies and from the author's estimations.

Table 5.13 Prior Distribution of Structure Parameters in the US Model

Structural Parameters		Prior Distribution	Source
Discount Rate	β	Beta (0.99,0.001)	Smets & Wouters (2003)
Depreciation Rate	δ	Beta (0.025,0.01)	Smets & Wouters (2003)
Output Elasticity of Capital in Tourism Sector	α_T	Beta (0.3,0.01)	Smets & Wouters (2003)
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	Beta (0.3,0.01)	Smets & Wouters (2003)
Survival Rate of Employees to Keep the Job	ρ	Beta (0.965,0.01)	Based on $\overline{x}$
Barging Power of Employees	η	Beta (0.5,0.1)	Gerlter & Trigari (2006)
Elasticity of New Hires to Unemployment	σ_m	Gamma (0.5,0.1)	Gerlter & Trigari (2006)
Adjustment Cost of Recruitment	κ	Gamma (35.931,0.1)	Based on $\overline{x}$
Habit Persistent	h	Beta (0.552,0.1)	Smets & Wouters (2003)
Elasticity of Intertemporal Substitution	σ	Gamma (2, 1)	Orrego & Vega (2013)
Substitute Elasticity between Products	θ_1	Gamma (0.4, 0.1)	Orrego & Vega (2013)
Substitute Elasticity between FDI and Domestic Investment	θ_2	Gamma (1.5,0.5)	Orrego & Vega (2013)
Ratio of Unemployment Benefit to Salary	b	Beta (0.333, 0.1)	Based on $\overline{B}$
Price Elasticity of Tourism Exports (Absolute Value)	$\theta_{EX,T}$	Gamma (1.618,0.1)	Regression
Price Elasticity of Non-tourism Exports (Absolute Value)	$\theta_{EX,NT}$	Gamma (1.624,0.1)	Regression
Income Elasticity of Non-tourism Exports	ω_{NT}	Gamma (1.961,0.1)	Regression
Income Elasticity of Tourism Exports	ω_T	Gamma (1.968,0.1)	Regression
Elasticity of Philipps Curve (Absolute Value)	ρ_{PH}	Gamma (0.053,0.01)	Regression

The prior distributions of the structure parameters are presented in Table 5.13. The conventional parameters that are usually used in DSGE models, such as β and δ, are obtained from Smets and Wourters (2003). The priors of the parameters that are related to the employment market are drawn from Gerlter and Trigari (2006) and σ, θ_1 and θ_2 are from Orrego and Vega (2013). Parameters such as income and the price elasticities of tourism and non-tourism exports are estimated by the real tourism and economic data, respectively. The details of the estimation result are presented in Appendix 2.

5.5.1.2 Calibration of Shock Parameters in the US Model

The shock parameters of the US model are different from those in the previous models. In tourism demand modelling, the exchange rate is usually presented as the ratio between local currency and US dollars, so it is not applicable in the US model. To avoid the stochastic singularity issue, the number of shocks should equal the number of observables. As the real exchange rate cannot be used in the US model, a stochastic shock to the balance of payment, ζ_{BP} is introduced to keep the same number of shocks as the previous models and to obtain as much information as possible from the real data in the Bayesian estimation. The priors of the model are presented in Table 5.14.

Table 5.14 Prior Distribution of Shock Parameters in the US Model

Parameters		Prior Distribution	Source
(a) Auto-regressive Coefficient			
Productivity	ρ^A	Beta (0.828,0.1)	Smets & Wouters (2003)
Income of the World Economy	ρ_{ROW}	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ρ_C	Beta (0.886,0.1)	Smets & Wouters (2003)
Investment Efficiency	ρ_I	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Labor Efficiency	ρ_L	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Imports	ρ_{CM}	Beta (0.5,0.1)	Gertler,Sala, &Trigari (2008)
Balance of Payment	ρ_{BP}	Beta (0.5,0.01)	Gertler,Sala, &Trigari (2008)
(b) Standard Deviation			
Productivity of Tourism Sector	$\varepsilon^A_{T,t}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Productivity of Non-tourism Sector	$\varepsilon^A_{NT,t}$	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Income of the World Economy	ε^{Yrow}_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Consumption Preference	ε^C_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Investment Efficiency	ε^I_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Labor Efficiency	ε^L_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Imports	ε^{CM}_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)
Balance of Payment	ε^{BP}_t	IGamma (0.15, 0.25)	Gertler,Sala, &Trigari (2008)

The auto-regressive coefficients of productivity (ρ^A) and consumption preference (ρ_C) are obtained from Smets and Wourters (2003). Following Gertler, Sala and Trigari (2008), auto-regressive parameters without any prior knowledge are set to follow the distribution of Beta (0.5, 0.1) and the standard deviation parameters to IGamma (0.15,0.25). The selection of the distributions are suggested by Guerrón-Quintana and Nason (2013).

5.5.1.3 Calibration of Other Parameters in the US Model

The steady states of the variables determined by the log-linear equations are shown in Table 5.15. The data are obtained from OTTI, the Bureau of Labour Statistics and IMF for the 1999 to 2013 period. As with the other three destinations, most of the ratio variables are presented as the ratio of GDP, except γ_1, γ_2, $\overline{n}_T$ and $\overline{n}_{NT}$. γ_1 and γ_2 are the ratios of tourism and non-tourism consumption to the consumption bundle, and $\overline{n}_T$ and $\overline{n}_{NT}$ are the ratios of employment. Tourism value added accounts for 4.8% of the GDP, which is the lowest share in the four countries. The findings discussed in Section 5.2 show that tourism can lead to economic growth in Mauritius, which is a small island economy that takes tourism as a pillar industry; to achieve a more general conclusion about the relationship between tourism and economic growth it is necessary to investigate the impact of tourism on economic growth in a large country with weak reliance on tourism, such as the USA.

Table 5.15 Calibration of Other Parameters in the US Model

Variables		Value in Steady State	Time Period/Source
GDP/GDP	$\overline{Y}$	1.000	-
Tourism Value Added/GDP	$\overline{Y_T}$	0.048	1999-2013
Non-tourism Value Added/GDP	$\overline{Y}_{NT}$	0.952	1999-2013
Final Consumption/GDP	$\bar{C}$	0.868	1999-2013
Total Investment/GDP	$\overline{I}$	0.170	1999-2013
Imports/GDP	$\overline{CM}$	0.151	1999-2013
Tourism Exports/GDP	$\overline{EX_T}$	0.010	1999-2013
Non-tourism Exports/GDP	$\overline{EX_{NT}}$	0.100	1999-2013
Tourism Investment/GDP	$\overline{I}_T$	0.001	1999-2013
Non-tourism Investment/GDP	$\overline{I}_{NT}$	0.169	1999-2013
Tourism FDI/GDP	$\overline{I}_T^F$	0.000	1999-2013
Non-tourism FDI/GDP	$\overline{I}_{NT}^F$	0.000	1999-2013
Balance of Payment/GDP	$\overline{BP}$	-0.003	1999-2013
Treasury Security/GDP	$\overline{B}$	0.429	1999-2013
Unemployment	$\bar{u}$	0.060	1999-2013
Tourism Consumption/（Final Consumption+Imports)	γ_1	0.029	1999-2013
Non-tourism Consumption / (Final Consumption+Imports)	γ_2	0.823	1999-2013
Tourism Employment /Employment	$\bar{n}_T$	0.059	1999-2013
Non-tourism Employment/ Employment	$\bar{n}_{NT}$	0.941	1999-2013
CPI	$\overline{P}$	1.000	-
Tourism Price	$\overline{P}_T$	1.000	-
Non-tourism Price	$\overline{P_{NT}}$	1.000	-
Average Growth Rate of GDP	g_y	Log(1.015)	1999-2013
Average Growth Rate of Tourism Value Added	g_{yt}	Log(1.006)	1999-2013
Production Tax Rate	τ_Y	0.016	1999-2013
Wage Tax Rate	τ_W	0.075	1999-2013
Turnover Probability of Unemployed People	$\overline{p}$	0.035	Based on $\bar{u}$
Employee's Surplus	$\overline{H}$	2.251	Based on $\bar{u}$and $\overline{B}$
Hiring Rate	$\bar{x}$	0.035	1999-2013
Marginal Product of Labor	$\overline{a}$	0.135	$\kappa \cdot \overline{x}[(1/\beta - \overline{x}/2 - \rho) + \eta(\overline{x}/2 + \overline{p})]/(1-\eta)$
Wage	$\overline{w}$	0.267	$\eta(\overline{a} + \kappa \overline{x}^2 / 2 + \kappa \overline{x}\overline{p}) + (1-\eta)b$

5.5.2 Estimation Results of the US Model

5.5.2.1 Convergence Diagnostic Test of the US Model

Figure 5.20 displays the multivariate convergence diagnostic test of the US model. Draws from pooled and individual sequences overlap each other in all three orders of moments. These results indicate that, overall, the estimation results of the US model are reliable.

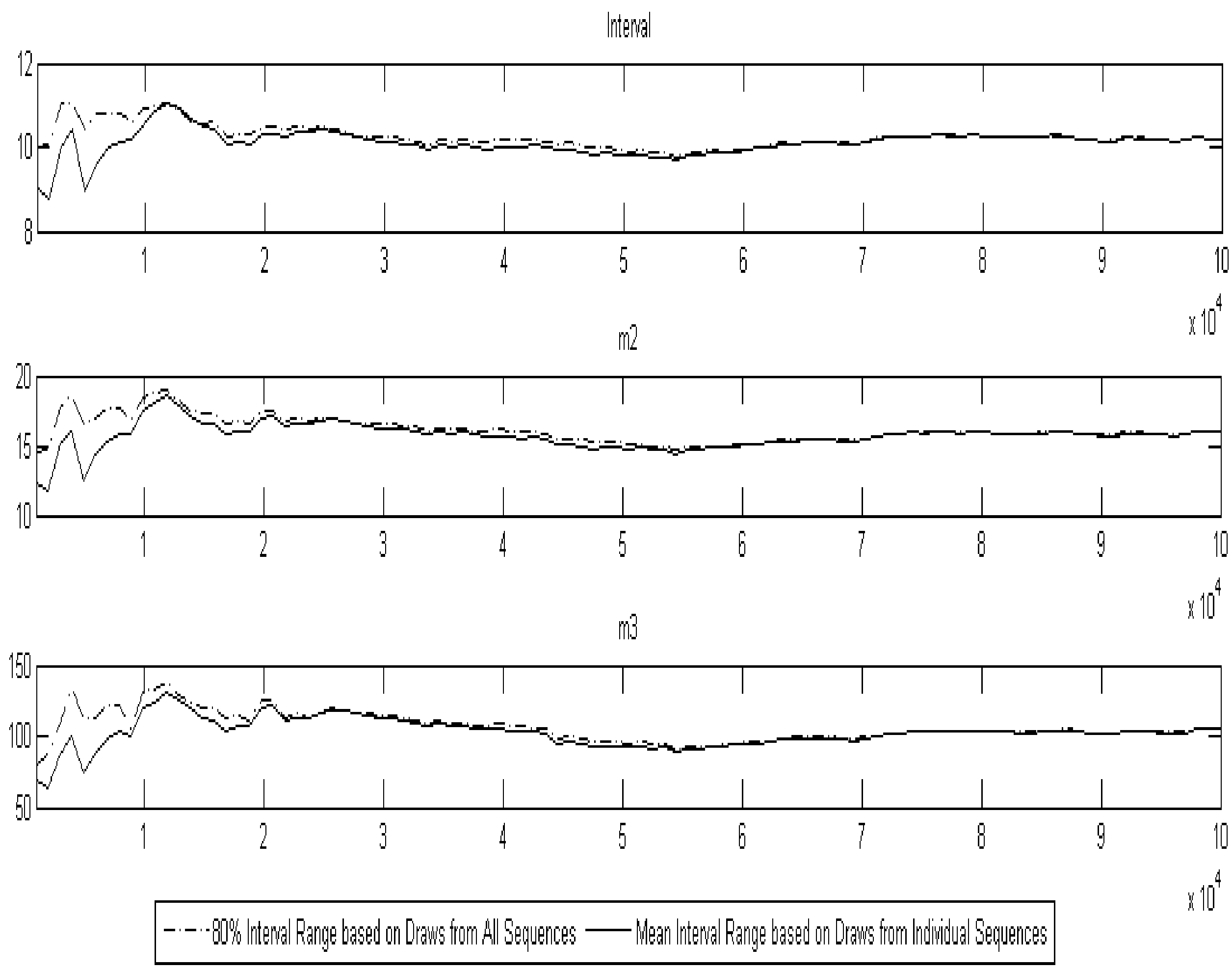


Figure 5.20 Multivariate Convergence Diagnostic Test of the US Model

The convergence of the pooled and individual sequences of each parameter are shown in Figure 5.21. Although for some parameters such as β(Beta) and θ_{EX} (Theta1) there are gaps between the pooled and individual sequences at the beginning of the draws, they converge to each other very quickly. Thus, the two sequences converge for all of the parameters, indicating that the simulated posterior distribution of each parameter is reliable.

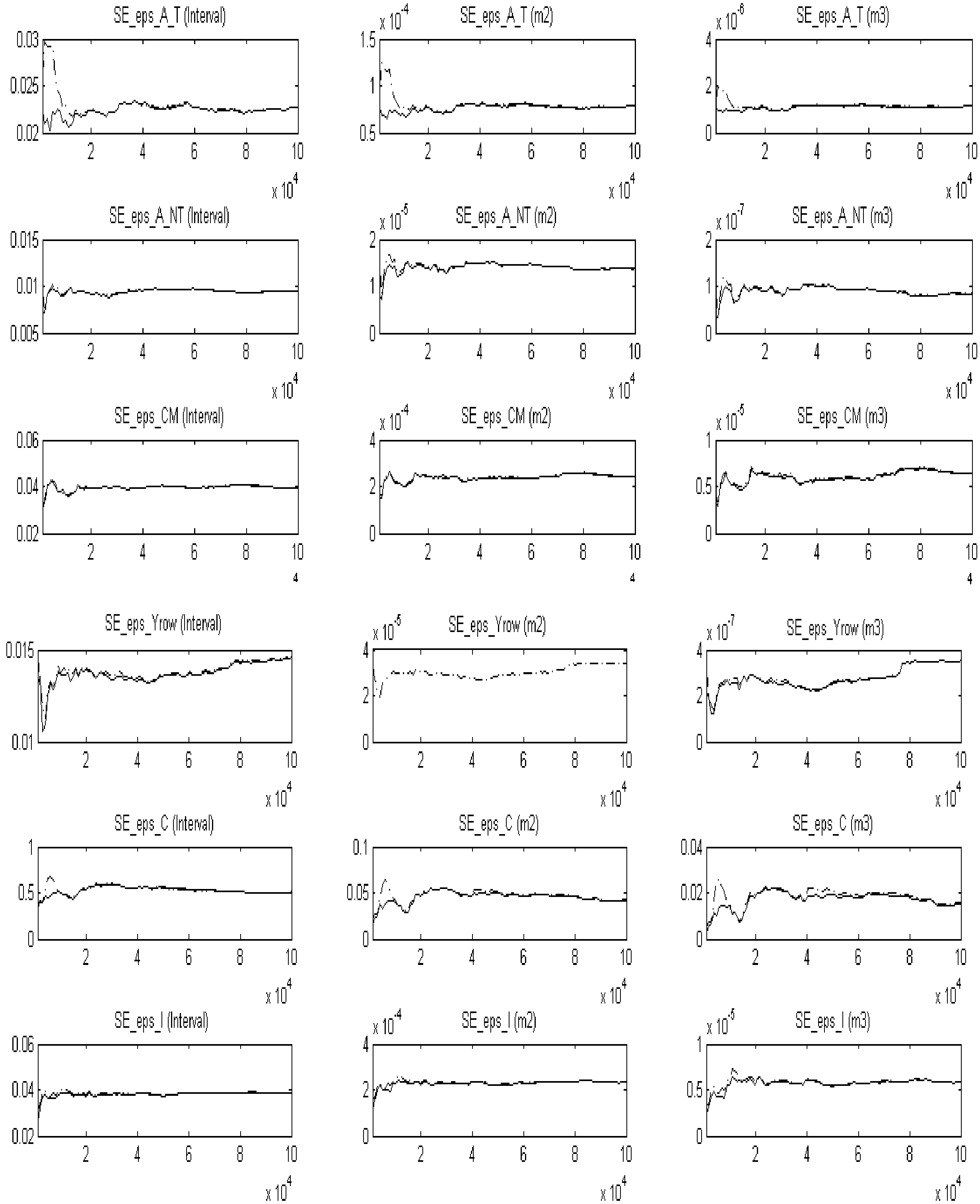


Figure 5.21 Univariate Convergence Diagnostic Test of the US Model

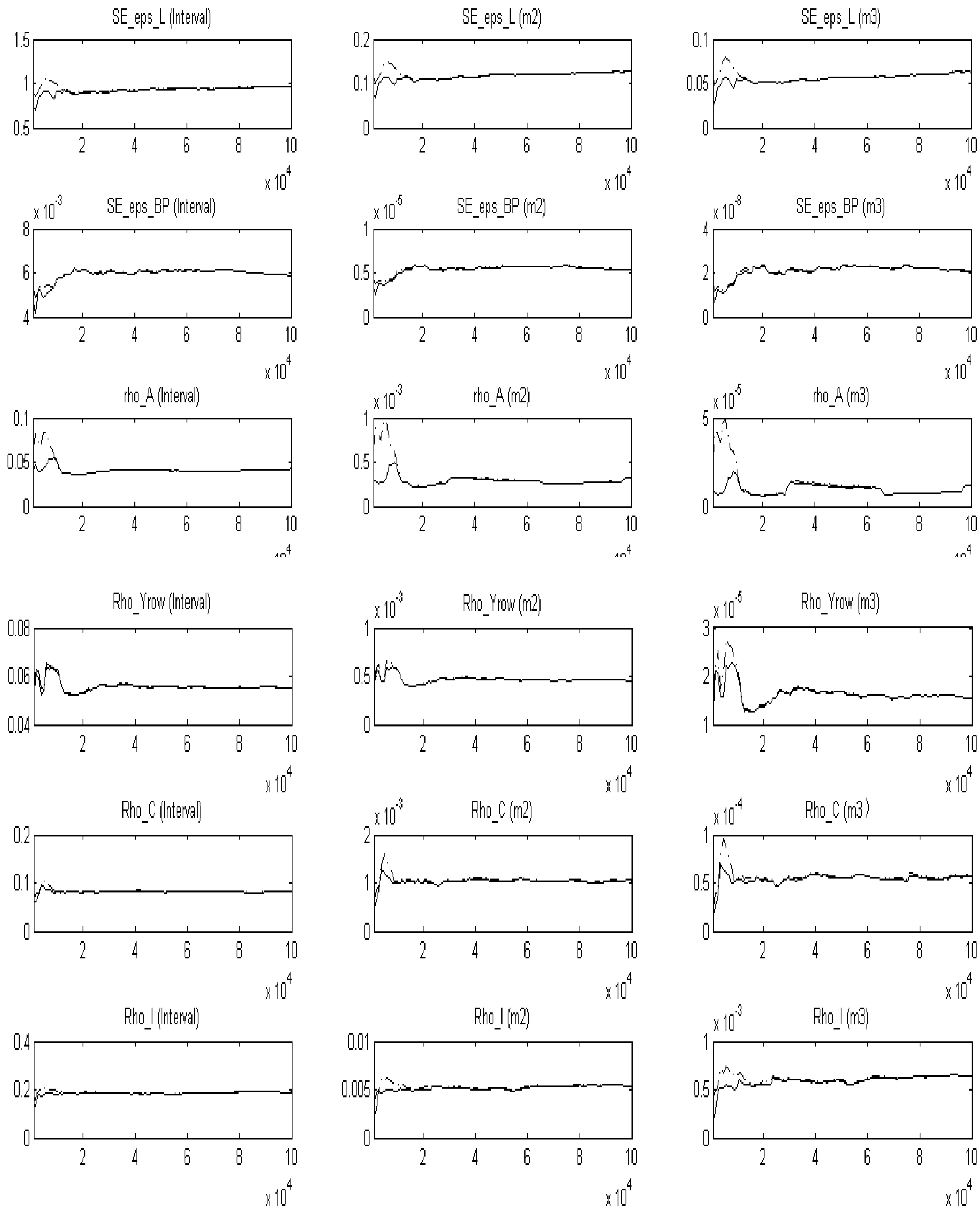


Figure 5.21 Univariate Convergence Diagnostic Test of the US Model (Continued)

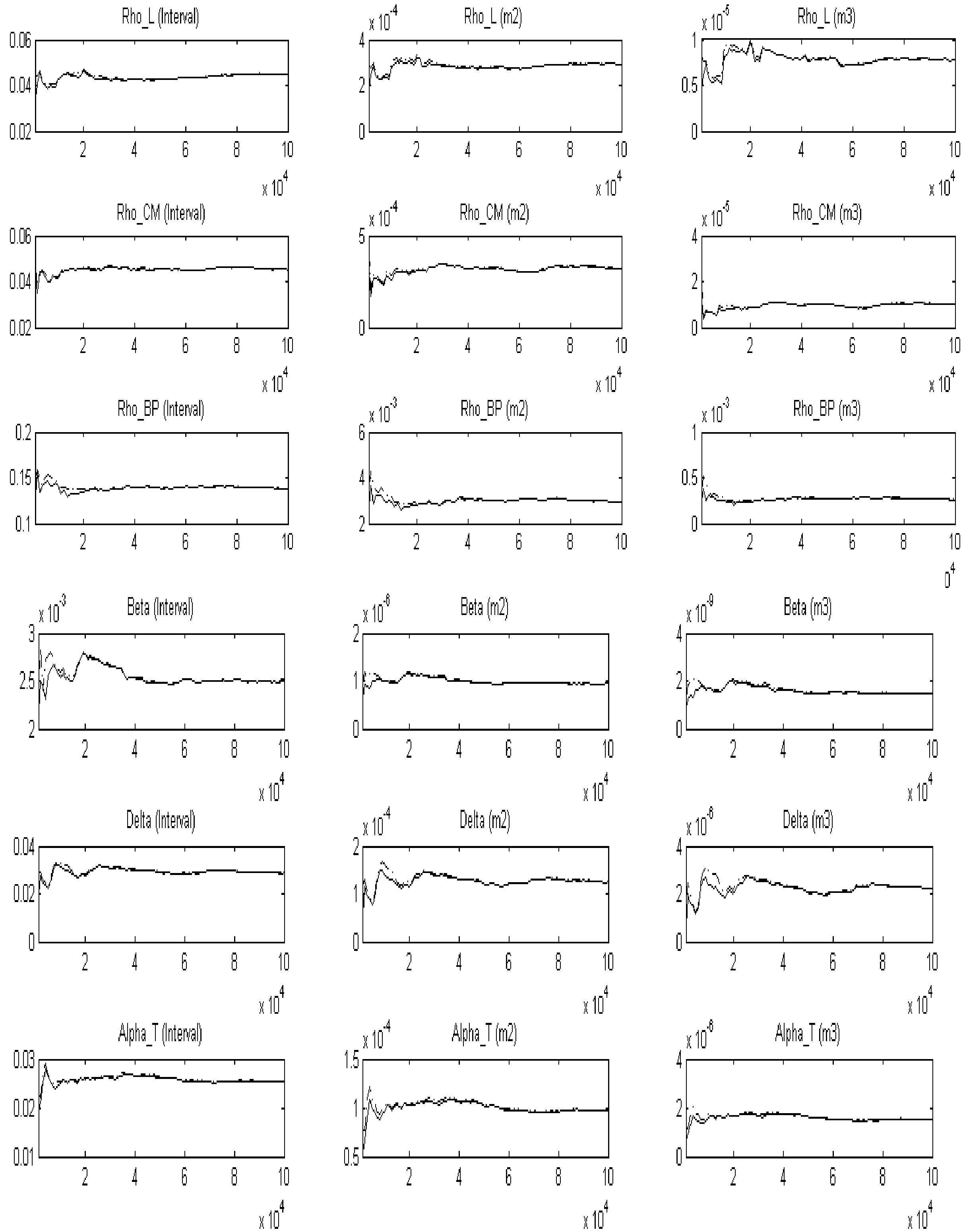


Figure 5.21 Univariate Convergence Diagnostic Test of the US Model (Continued)

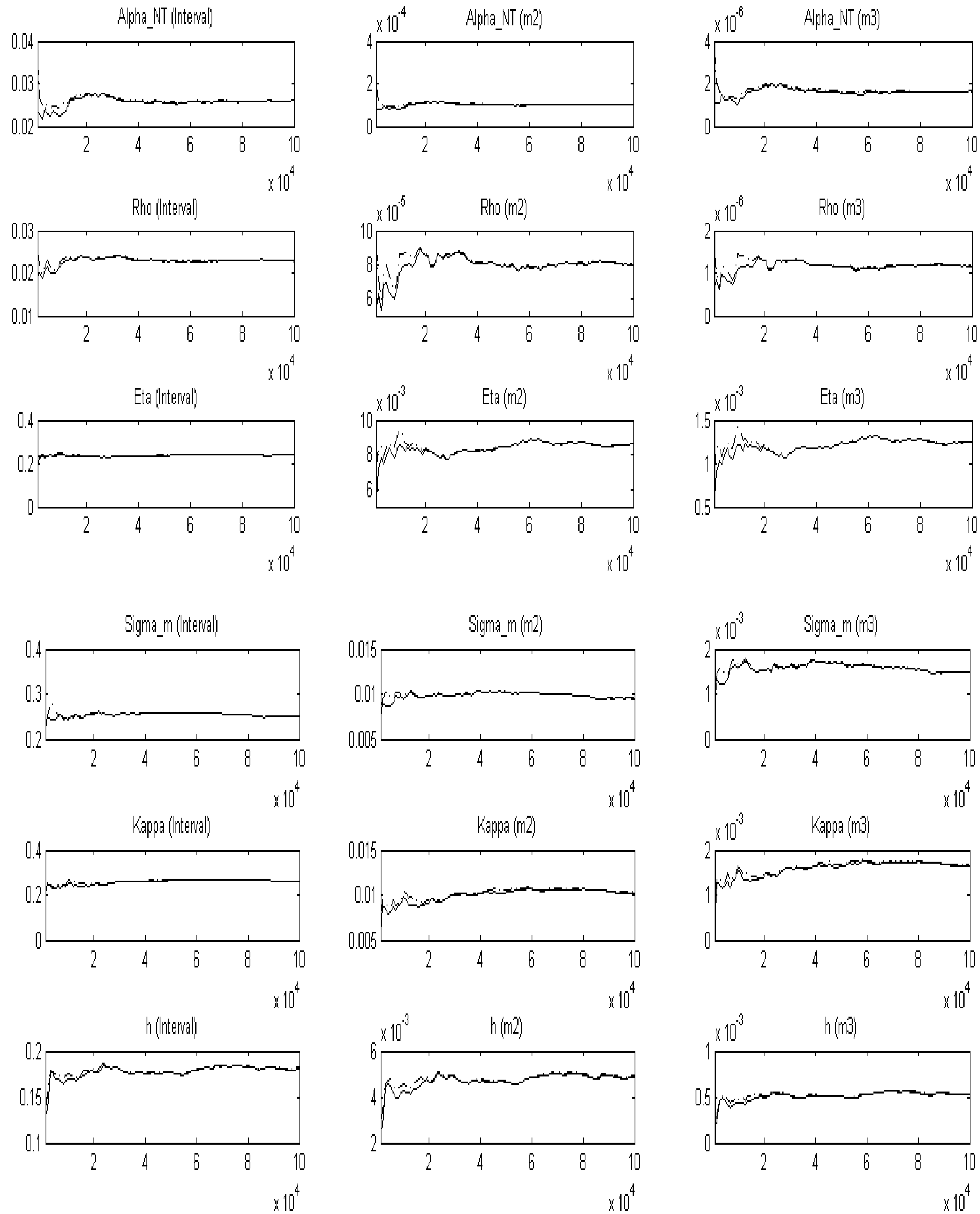


Figure 5.21 Univariate Convergence Diagnostic Test of the US Model (Continued)

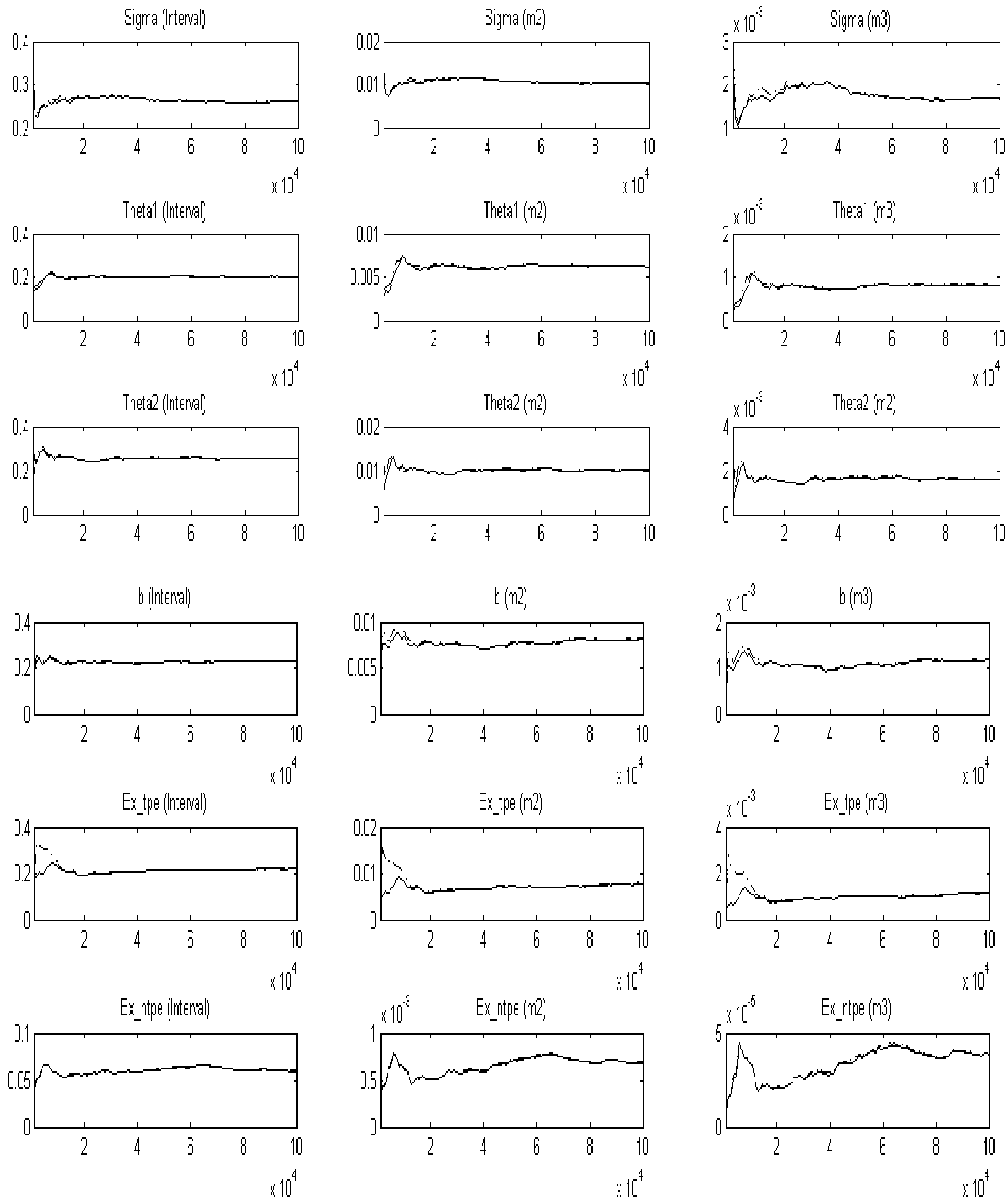


Figure 5.21 Univariate Convergence Diagnostic Test of the US Model (Continued)

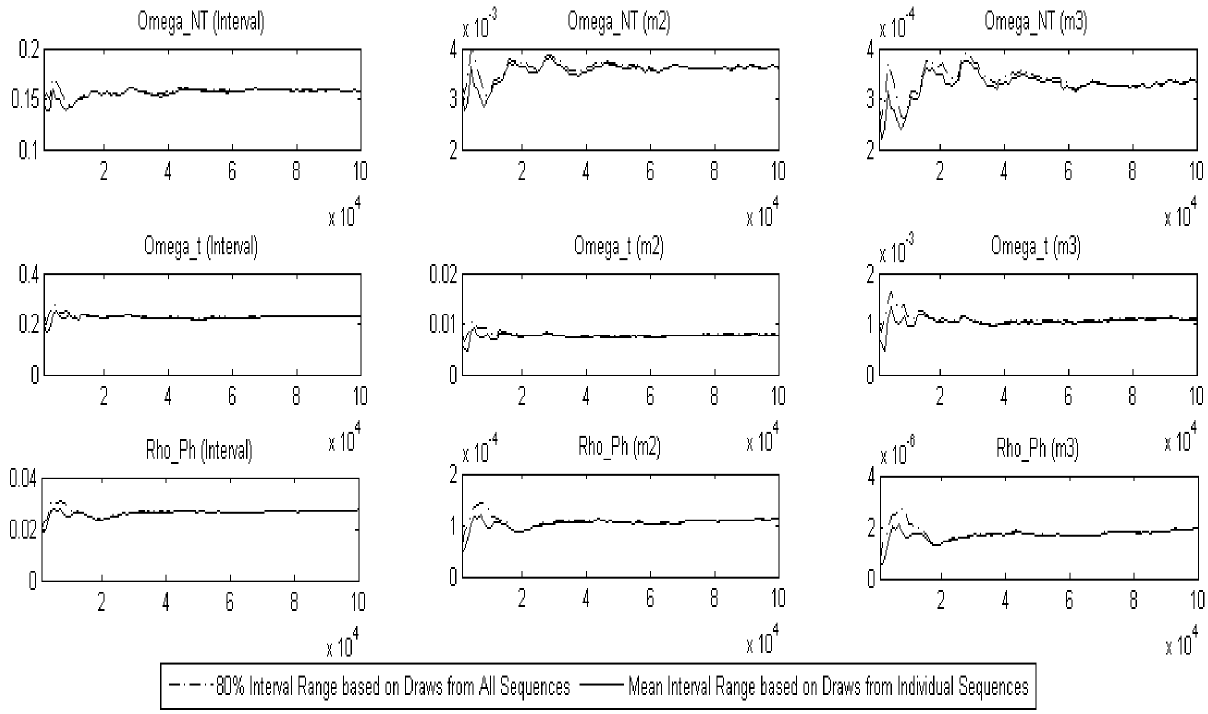


Figure 5.21 Univariate Convergence Diagnostic Test of the US Model (Continued)

5.5.2.2 Estimation Results of the US Model

The estimation results of the US model and the prior and posterior distributions are shown in Table 5.16 and Figure 5.22. The posteriors of most of the parameters are different from the priors and are located in the reasonable range, indicating that the Bayesian estimation captured new information from the real data to update the prior distributions.

Table 5.16 Estimation Results of the US Model 1995-2013

Structure Parameter		**Prior Mean**	**Posterior Mean**	**90% Interval Low**	**90% Interval High**
Discount Rate	β	0.990	0.990	0.988	0.992
Depreciation Rate	δ	0.025	0.126	0.110	0.142
Output Elasticity of Capital in Tourism Sector	α_T	0.300	0.306	0.290	0.322
Output Elasticity of Capital in Non-tourism Sector	α_{NT}	0.300	0.324	0.308	0.341
Survival Rate of Employees to Keep the Job	ρ	0.965	0.972	0.958	0.986
Barging Power of Employees	η	0.500	0.548	0.394	0.699
Elasticities of New Hires to Unemployment	σ_m	0.500	0.499	0.336	0.654
Adjustment Cost of Recruitment	κ	35.931	35.937	35.767	36.101
Habit Persistent	h	0.552	0.504	0.389	0.619
Elasticity of Intertemporal Substitution	σ	2.000	2.118	1.952	2.286
Substitute Elasticity between Products	θ_1	0.400	0.313	0.183	0.436
Substitute Elasticity between FDI and Domestic Investment	θ_2	1.500	1.498	1.332	1.660
Ratio of Unemployment Benefit to Salary	b	0.333	0.329	0.182	0.478
Price Elasticity of Tourism Export(Absolute)	$\theta_{EX,T}$	1.618	1.369	1.230	1.519
Price Elasticity of Non-Tourism Export (Absolute)	$\theta_{EX,NT}$	1.624	2.315	2.281	2.343
Income Elasticity of Non-tourism Exports	ω_{NT}	1.961	1.515	1.411	1.608
Income Elasticity of Tourism Exports	ω_T	1.969	2.390	2.242	2.538
Elasticity of Philipps Curve(Absolute)	ρ_{Ph}	0.053	0.102	0.084	0.119
Auto Regressive Parameter					
Technology	ρ_A	0.828	0.953	0.927	0.981
World Output	ρ_{Yrow}	0.500	0.906	0.873	0.942
Consumption Preference	ρ_C	0.886	0.840	0.789	0.893
Investment Efficiency	ρ_I	0.500	0.480	0.357	0.599
Shock to Marginal Production of Labor	ρ_L	0.500	0.924	0.900	0.953
Balance of Payment	ρ_{BP}	0.500	0.765	0.677	0.853
Shock to Imports	ρ_{CM}	0.500	0.924	0.900	0.953
Standard Deviation					
Technology shock of Tourism	ε^{At}	0.150	0.059	0.044	0.073
Technology shock of Non-tourism	ε^{Ant}	0.150	0.039	0.033	0.045
World Output	ε^{Yrow}	0.150	0.051	0.042	0.060
Consumption Preference	ε^{C}	0.150	0.960	0.638	1.280
Investment Efficiency	ε^{I}	0.150	0.142	0.117	0.167
Shock to Marginal Production of Labor	ε^{L}	0.150	1.335	0.854	1.994
Balance of Payments	ε^{BP}	0.150	0.024	0.021	0.028
Shock to Imports	ε^{CM}	0.150	0.145	0.120	0.170

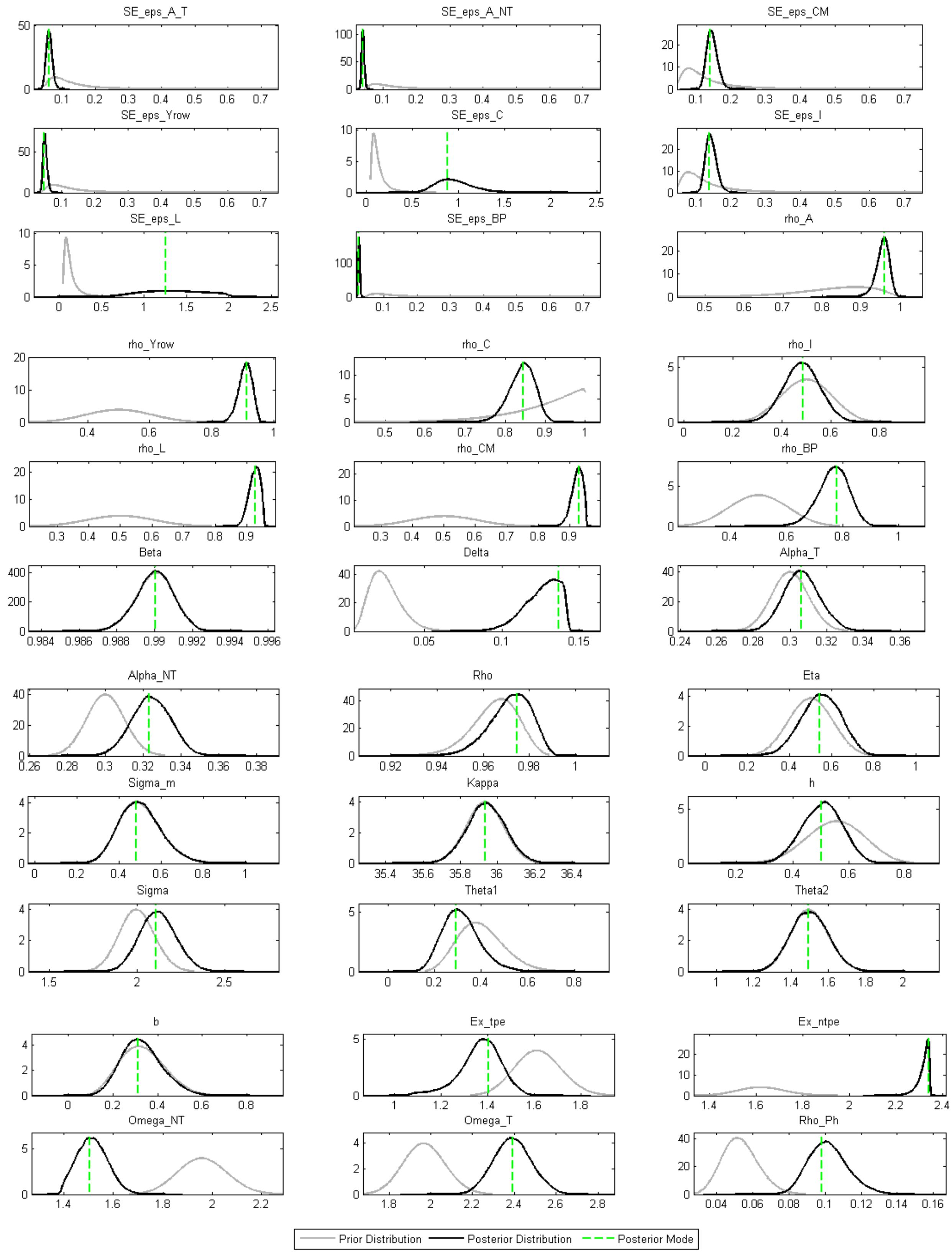


Figure 5.22 Prior and Posterior Distributions of the US Model

In terms of the estimation results of the parameters that characterise tourism consumption and exports, the intertemporal substitute elasticity (σ) is 2.118, indicating an elasticity of 0.472. The estimation is quite close to 0.5, which is the mean of the estimation results in the meta-analysis of Havranek *et al*. (2015), which used macro data.

Although the substitute elasticity between products decreases from 0.400 in the prior distribution to 0.313, the result is consistent with the findings of Lanza, Temple and Urga (2003) for OECD countries; they found that the substitute elasticity is likely to be less than unit.

The income and price elasticities of tourism exports are estimated as 2.390 and 1.369, respectively, in absolute value. According to Song *et al*. (2015), the income and price elasticities of the two major source markets of the USA range from 0.10 to 4.43 and 0.07 to 4.55, respectively, in absolute value. Thus the overall elasticities can be considered reasonable estimations.

In addition, the bargaining power of employees (η) is 0.548, which is a little larger than the prior value of 0.500. Considering the significant impact of labour unions in the USA, the estimation could be close to reality. The habit persistence parameter (*h*) is only 0.502, which fell 10% from the prior value. Although the domestic consumption of the USA decreased less than 1% in 2009 during the global financial crisis, the imports dropped by 23% in the same year. Because imports account for 14.8% of the consumption bundle of households in the USA, the fall in both domestic consumption and imports may influence the estimation of the habit persistence.

All of the estimations of auto-regressive coefficients are greater than 0.84, except the parameters of the shocks to investment and balance of payment. According to the data from the Bureau of Labor Statistics, investment and balance of payment decreased 23 and 54.7%, respectively, in 2009 and started to recover in 2010; such a significant drop would break the memory of the parameters and lead the model to obtain low auto-regressive coefficients.

5.5.3 Findings of the US Model

5.5.3.1 Impact of the Productivity Shock on the Product Markets of the USA

The IRFs of selected variables to a 1% positive productivity shock to the tourism sector are shown in Figure 5.23. The productivity improvement leads to a 1% expansion of the value added of tourism and a 0.9% fall in price of tourism products, compared to the imports price, which is taken as the numeraire of the model. Meanwhile, the price of non-tourism products increases and there is a more than 0.03% growth in the price of imports. As a result, exports of tourism products increase by 1.3%, and of non-tourism products decline by 0.08%. The decrease in the price of tourism products stimulates the expansion of domestic demand, with a growth of 0.6% maximally.

Driven by increasing demand, producers increase the input of productive factors. Attracted by a higher return rate and wages, investment and labour inflows to production in the tourism sector. As the nominal return rate and wages of tourism and non-tourism sectors are the same, factor inflows are also observed in the non-tourism sector. Due to improved income, households gradually spend more on non-tourism products and imports, even though their prices increase.

Although the 0.05% growth in GDP is not large, given that the annual growth rate of the USA from 1999 to 2013 was 0.15%, the contribution of tourism to economic growth is very significant. Tourism value added only accounts for 4.8% of the GDP in the USA, which is less than one third of its contribution in Mauritius; however, if the USA was as specialised as Mauritius in the development of tourism, the impact of tourism on economic growth in the USA would be very close its impact in Mauritius. Thus, the US model shows that tourism can lead to economic growth in a large country. However, due to its limited share of the economic structure, the contribution of tourism to economic growth may not be as significant as in small countries.

The economic structure of a large country is more complicated than that of a small one, so the tourism sector may not be a government's first choice for stimulating economic growth. However, if policy-makers decide to develop the tourism sector, it could lead to the economic growth. In countries where tourism plays a more important role in the economic structure, the contribution of tourism to economic growth is more significant. If the government could encourage more investment in the tourism sector, the boom period would last for longer periods and the economic growth would be more fruitful.

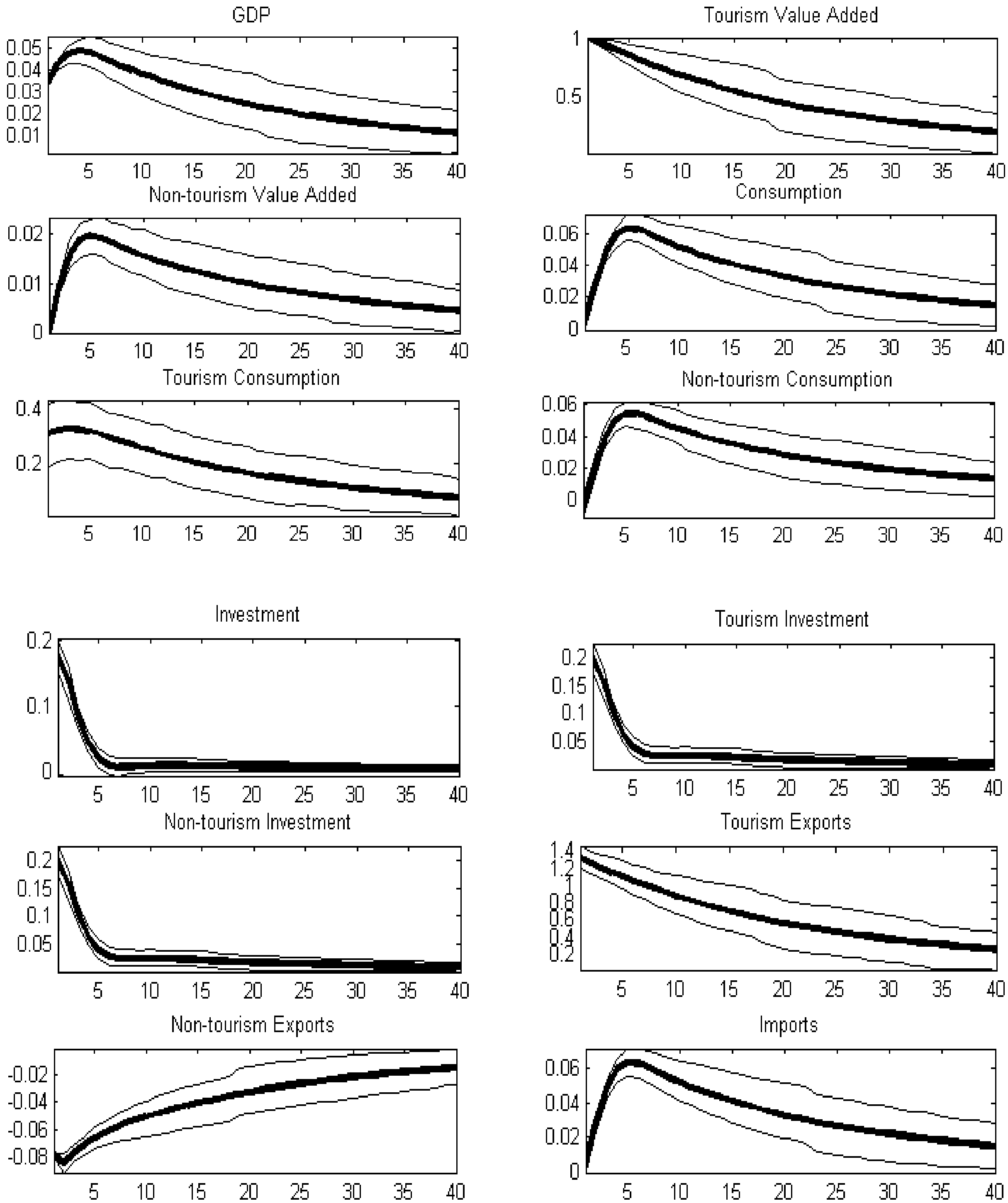


Figure 5.23 IRFs of the US Model (%)

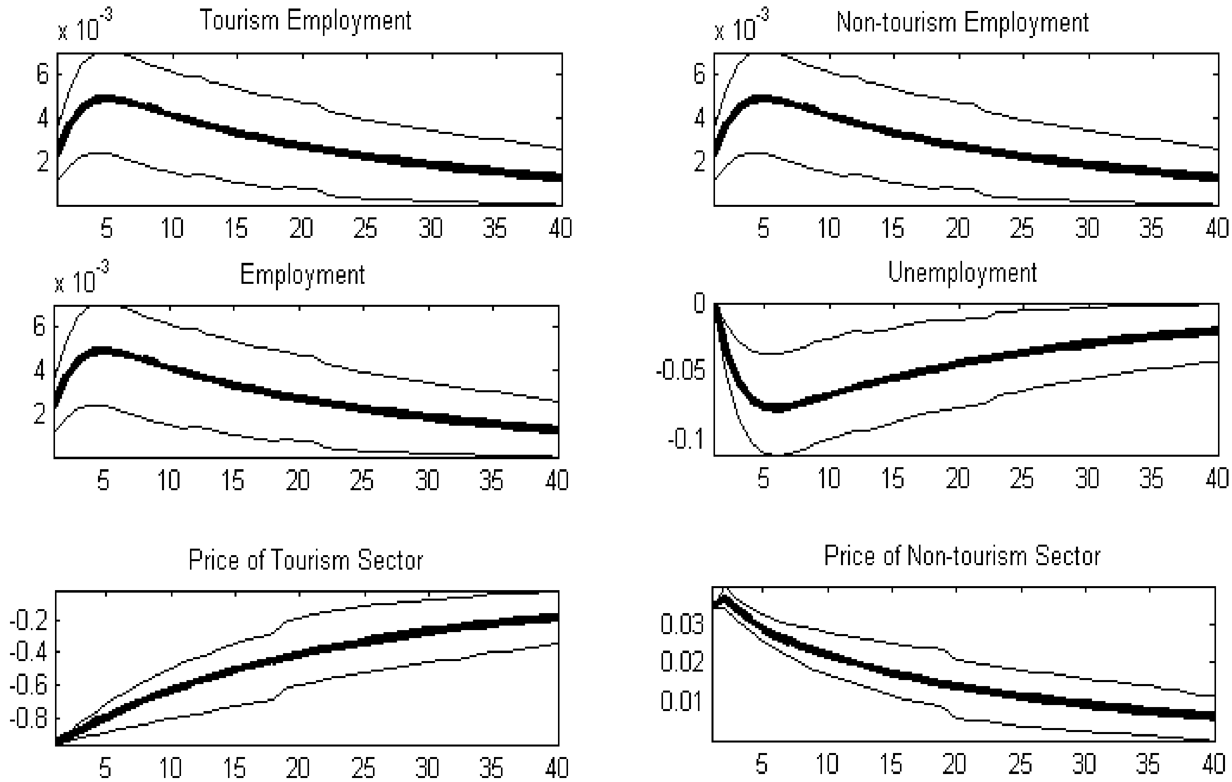


Figure 5.23 IRFs of the USA (%)

5.5.3.2 Impact of Inbound Tourism on the Contribution of Tourism to Economic Growth in the USA

Figure 5.24 demonstrates the impact of a productivity shock to the US economy with different values for inbound tourism price elasticity. The bold black line represents the baseline model, which has a posterior estimation of 1.369 for the price elasticity of international tourism demand. The other elasticity values, 0.218, 0.550 and 2.672 are estimated as posteriors given the priors of 0.5, 1 and 2, respectively.

As in the other three destinations, a 1% positive productivity shock leads to the expansion of tourism product supply and a decline in tourism product supply. As the price elasticity becomes larger, international tourists are more sensitive to changes in price. Thus, tourism exports increase the most when the absolute value of price elasticity is 2.672. The consumption of domestic tourism also expands due to the decrease in price. The rise in tourism exports and domestic tourism consumption are both the most significant when the absolute value of the price elasticity is 2.672, and thus the increase in the purchase of fixed investment is the lowest in this scenario. The changes in the other three scenarios are quite close. As a result, the most significant contribution of tourism to economic growth is achieved by the baseline model, which has a maximal increase of GDP for 0.48%, followed by the two scenarios with inelastic prices. Although the growth of exports and domestic tourism is the most when the elasticity is the largest, the contribution of tourism to economic growth is the lowest in this scenario, because the resources left for investment are the least, limiting the economic growth in the following periods.

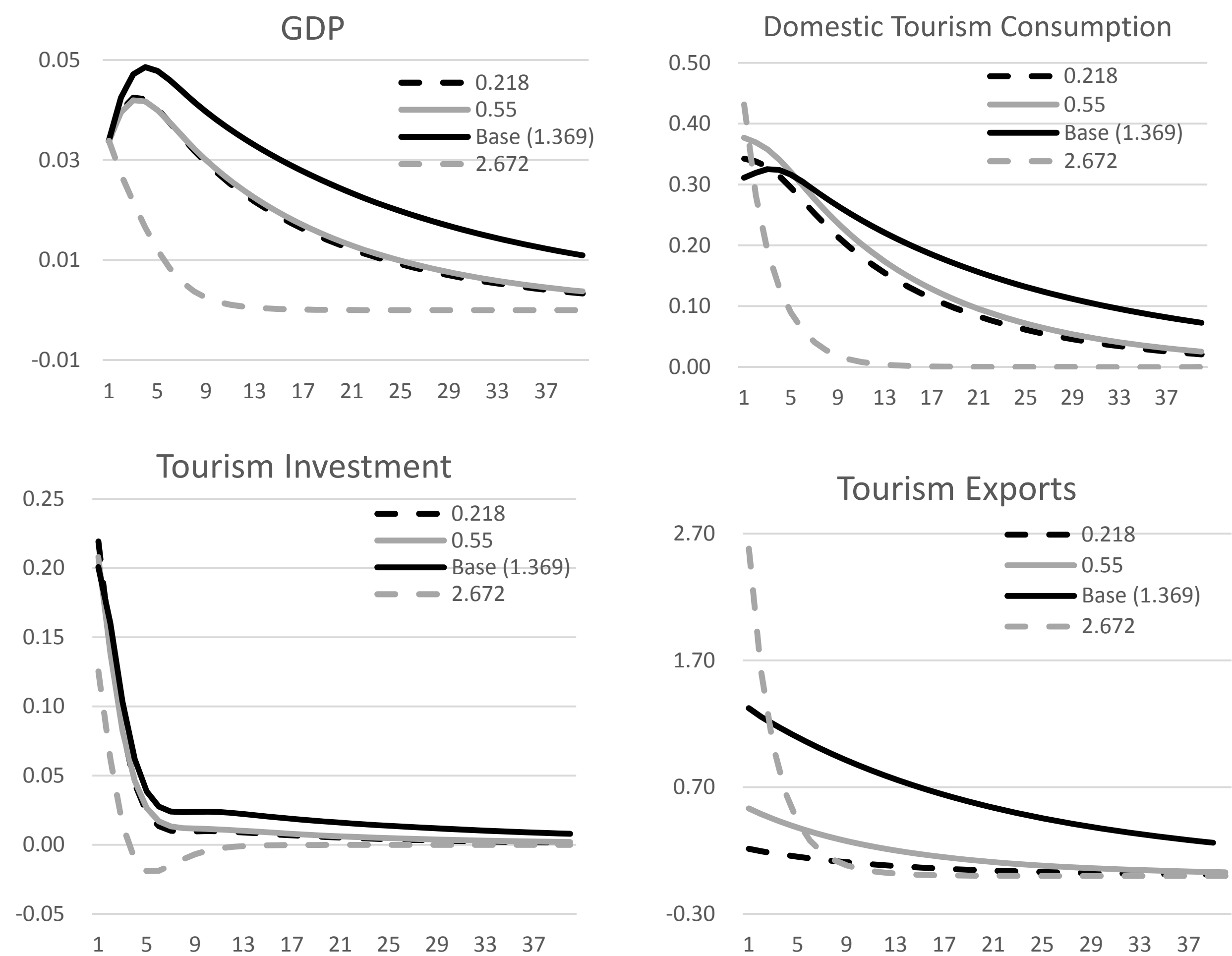


Figure 5.24 IRFs of Selected Variables with Different Inbound Tourism Price Elasticities of the US Model (%)

5.5.3.3 Impact of Domestic Tourism on the Contribution of Tourism to Economic Growth in the USA

The influence of domestic tourism on the impact of tourism on economic growth is shown in Figure 5.25. At first, the price of tourism products declines around 1% no matter what the market share of domestic tourism consumption is. However, the expansion of domestic tourism consumption ranges from 0.20 to 0.45%, indicating the various price elasticities of domestic tourism demand.

Another finding is that the price of tourism products converges to its original level at different speeds depending on the market share of domestic tourism. The price converges to the original level at its fastest speed when domestic tourism consumption is 40% of the consumption bundle, and is the slowest when the market share is 61.2 %, which is the baseline model. Thus, the price of tourism products is higher when the market share is 40% than in the other three scenarios. As a result, the expansion of tourism consumption and the aggregated consumption is the lowest in the 40% scenario.

Interestingly, although the contribution of tourism to economic growth is the largest when the market share is 80% in the first period, which is as same as the other three destinations, the responses in the following periods are quite different. Because the price of tourism production in the baseline model is lower than in the other three scenarios, more purchases occur in both domestic and international markets. As a result, the income of employees is improved most in this scenario, which in turn stimulates more consumption in non-tourism products and investment and finally results in the most significant contribution to the economic growth.

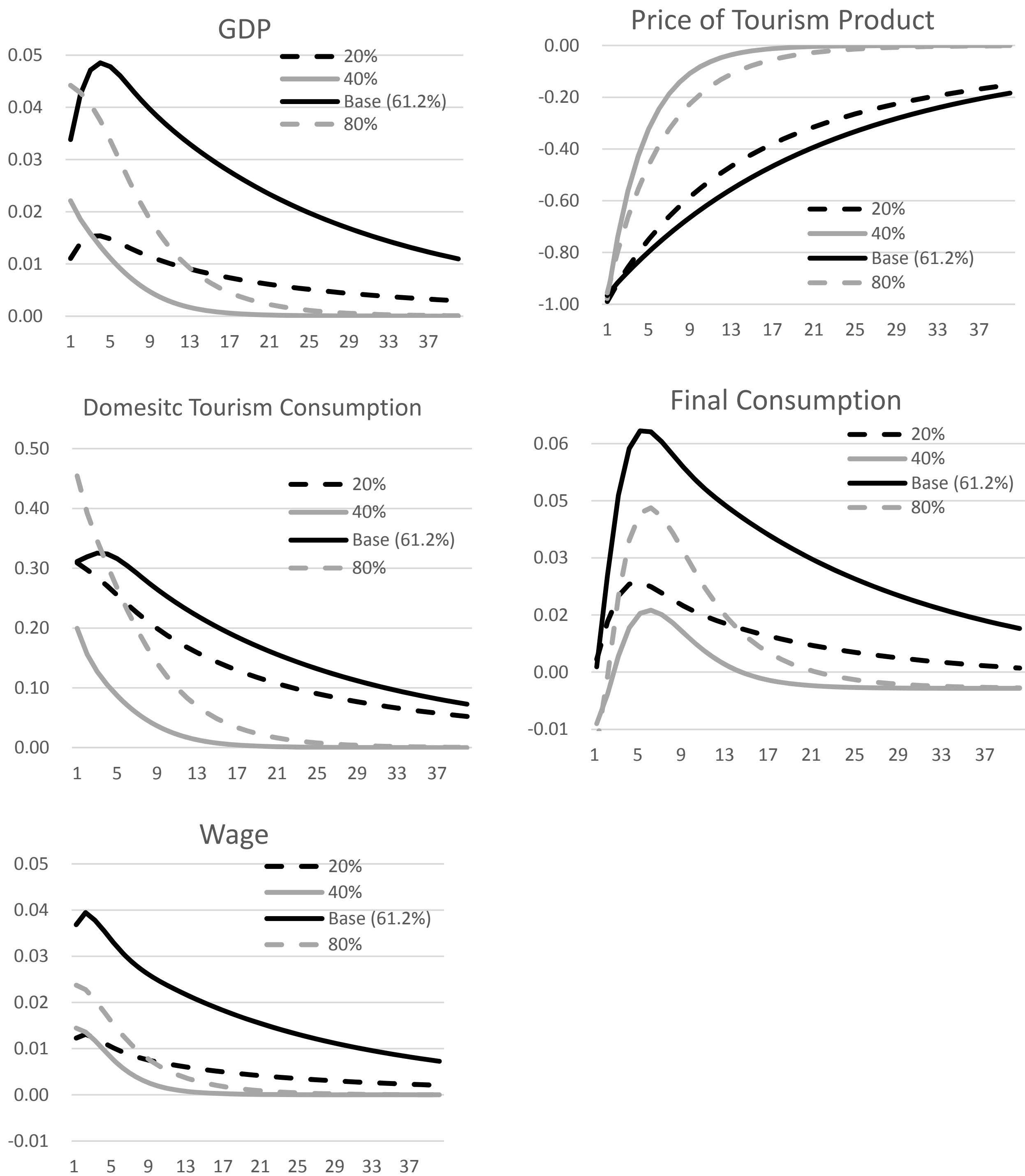


Figure 5.25 IRFs of Selected Variables with Different Shares of Domestic Consumption in Tourism Value Added of the US Model (%)

5.5.4 Summary of the US Model

Although many studies have focused on the relationship between tourism and economic growth in small and medium-sized countries, few studies have examined countries with large territories. In this section, a two-sector open DSGE model based on US data is estimated using the Bayesian method to simulate the contribution of tourism to economic growth.

The simulation results indicate that if the productivity of the tourism sector improves 1%, there is a positive effect on consumption, investment, tourism exports and employment. Although the 1% improvement only causes a 0.5% growth in GDP, considering the weak growth of the US economy in the last decade, a 0.5% growth is very significant. The scenario analysis shows that different values of price elasticity in inbound tourism demand and various shares of domestic tourism in tourism output may significantly affect the contribution of tourism to economic growth.

These findings suggest that tourism has a positive effect on economic growth in large destinations, although the impact is not as significant as in small destinations due to tourism's limited contribution to the whole economy. If the government encouraged more investment in the tourism sector, the contribution of tourism to economic growth would be stronger and more sustainable.

5.6 Comparison of Selected Destinations

The simulation results of the selected destinations are comparable. The IRFs of GDP that are triggered by a 1% improvement in tourism productivity in Mauritius, Spain, New Zealand and the USA are shown in Figure 5.26.

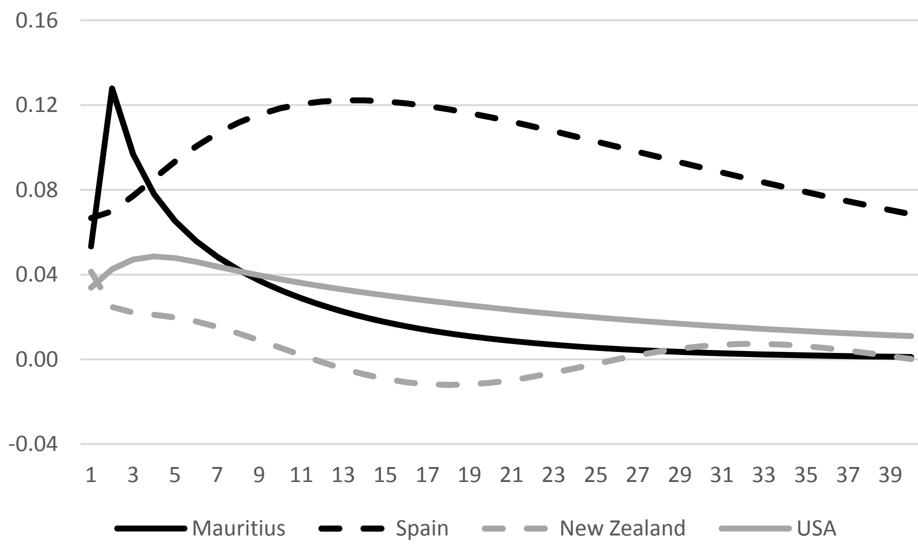


Figure 5.26 Comparison of the Impact of Tourism Productivity on GDP (%)

Figure 5.26 shows that a 1% improvement in productivity in the tourism sector leads to a growth in GDP from 0.04 to 0.12% maximally in the four destinations, indicating that tourism development has a positive effect on economic growth.

However, the GDP does not respond in the same way in all of the destinations. One difference is that the response rates of GDP to the productivity shock in the four destinations are diverse. In Spain, it takes 14 periods before the largest contribution to economic growth is seen, whereas growth in Mauritius and the USA peak in the second and fifth period and the growth rate of GDP starts to decrease after the second period in New Zealand. The fluctuation of the GDP growth rate is also different for the four destinations. The fluctuation in the USA is weaker than in the other three destinations.

Table 5.17 Intertemporal Substitute Elasticities of the Four Destinations

	Mauritius	Spain	New Zealand	USA
Intertemporal Substitute Elasticity	0.428	0.454	0.206	0.472

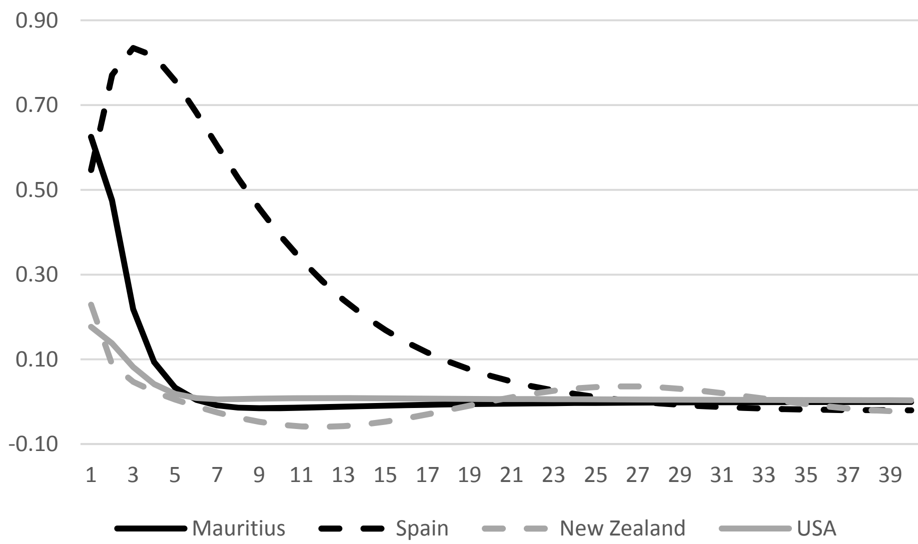


Figure 5.27 Comparison of the Impact of Tourism Productivity on Investment (%)

Figure 5.27 also shows that the patterns of investment are different in the four destinations. While the intertemporal elasticities of Mauritius, Spain and the USA are very close, the investment behaviour in Mauritius and Spain are similar to New Zealand. The reasons behind these figures are as follows.

As an island economy, Mauritius has limited resources. Thus, when the expansion of tourism requires more capital input, the households in Mauritius may not have enough resources to maintain the investment. As a result, the growth of investment in Mauritius starts to decline after the second period.

In contrast, as argued in Section 5.3, Spanish households prefer to decrease consumption in current periods and reallocate more resources to the capital market. As a result, the increase in investment and GDP lasts for longer periods than in other destinations.

Because the intertemporal elasticity of New Zealand is much lower, households do not reallocate as many resources as other destinations, so the growth of investment starts to decrease very soon.

Limited by the sector scale and its contribution to the whole economy, the development of tourism in the USA does not lead to the same amount of economic growth as in Mauritius and Spain; thus, the growth may not attract enough investment. This may explain the decline in investment growth in the USA. Caution is needed to explain the increase in the USA. Tourism value added only accounts for approximate 4.8% of GDP, which is a much smaller contribution than in the other three destinations. Thus, in the USA the ability of tourism to increase investment and economic growth is relatively limited and changes in tourism induce smaller fluctuations in the GDP than in other destinations, as shown in Figure 5.26.

Different patterns of investment result in different economic contributions and have different implications. First, this study confirms that tourism has a positive effect on economic growth in all four destinations. Thus, the governments of the four destinations could use the tourism sector to encourage economic growth. Second, the sector development strategies could be combined with other policies to further expand and sustain the contribution of tourism to economic growth. For example, the governments of Mauritius, New Zealand and the USA should encourage more domestic investment or invite more FDI to further support tourism-led economic growth. The Spanish government should encourage more domestic investment in the non-tourism sector to expand the impact of tourism on economic growth.

5.7 Chapter Summary

This chapter presents and discusses the study's main findings. The model developed in Chapter 4 is estimated with the Bayesian method using real data for Mauritius, Spain, New Zealand and the

USA. For each destination, the priors are calibrated before the estimation and the reliability of the estimation result is examined using diagnostic tests. The IRFs are conducted to simulate the impact of a 1% productivity improvement in the tourism sector on economic growth. Sensitivity tests demonstrate the influence of inbound and domestic tourism on the relationship between tourism and economic growth.

The main findings of this section are as follows. First, a 1% improvement in productivity in the tourism sector leads to economic growth in all four selected destinations, at a rate ranging from 0.04 to 0.12% maximally. Second, different sensitivities of international tourists to changes in price influence the contribution of tourism development to economic growth. Third, the market structure in terms of the relative size of domestic tourism in the consumption bundle influences the impact of tourism on economic growth. Last but not least, by comparing the simulation results of baseline models, it is found that households' willingness to postpone consumption also influences the relationship between tourism and economic growth.

6. Conclusions

6.1. Introduction

The conclusions of this study are summarised in this chapter. The key findings of the research are presented in Section 6.2, followed by a discussion of its contributions, limitations and future research directions.

6.2. Major Conclusions of the Study

To investigate the contribution of tourism to economic growth when there is a productivity shock in the tourism sector, a two-sector dynamic stochastic general equilibrium model is constructed using data from Mauritius, Spain, New Zealand and the USA. The search-matching theory is incorporated into the framework to address the problem of asymmetric information in the employment market. The model is estimated and simulated by the actual TSA and economic data of the selected destinations using the Bayesian method. The main findings of this research are as follows.

6.2.1. Contribution of Tourism to Economic Growth

The primary objective of this research is to examine the contribution of tourism to economic growth. It is found that with a 1% increase in tourism productivity, the GDP of Mauritius and Spain enjoy a strong growth of 0.13 and 0.12%, respectively, followed by the USA with an increase of 0.05%. The least growth is experienced by New Zealand with a maximal increase of 0.04%. These figures suggest that the contribution of tourism to economic growth is limited. However, if the average real annual growth rates of the selected destinations, which range from 0.30 to 4.13% for the 2005-2014 period, are taken into consideration, the contribution cannot be ignored. Thus, it can be concluded that tourism can lead to economic growth in Mauritius, Spain, New Zealand and the USA.

Although the impact of tourism on economic growth is positive and significant in the selected destinations, the responses of the GDP displayed different patterns. The maximal increase of GDP appears in the first period in New Zealand, whereas it shows up in the second, fifth and fourteenth period in Mauritius, the USA and Spain, respectively (See Figure 5.26).

When the productivity of the tourism sector improves, producers tend to increase future profit by postponing current consumption and allocating more resources to investment. The intertemporal substitute elasticity plays a key role in the allocation of resources between the current period and the future. The larger the elasticity, the more likely households are to postpone consumption and invest more in production.

The intertemporal elasticity of New Zealand is 0.206, indicating that households in New Zealand allocate the fewest resources to the investment of fixed assets. As a result, the production capacity cannot keep increasing and the growth rate starts to drop after the second period. Although households in Mauritius would like to invest more to expand the production capacity, the limited resources in an island economy mean they may not have resources to invest; this results in a decrease in economic growth after the third period. The most sustained growth is found in Spain, where economic growth increases until the fourteenth period due to the continued expansion of investment (See Figure 5.27). The contribution of tourism to GDP in the USA is not as significant as in Spain. As a result, the expansion of tourism may not attract as much inflow into the tourism sector as in Spain. Thus the economic growth in the USA is more moderate than in Spain or Mauritius.

The different patterns in the response of GDP have various practical implications. As the preferences of households are not easy to change, New Zealand needs to encourage more investment in the tourism sector with policies such as subsidies to producers in the tourism sector. A similar policy could help the USA attract more investment and enhance the contribution of tourism to economic growth. A more effective way to further expand the contribution of tourism to economic growth in Mauritius is to invite more FDI. With more investment, the production capacity of the tourism sector would be enlarged and the economic growth would be more sustainable. As the selected destinations cover both island and large economies, developing and developed countries and different tourism specialised destinations, the conclusion that tourism can lead to economic growth can be easily generalised to other destinations. This is the most important implication of this study for governments that are considering promoting economic growth through the development of tourism.

6.2.2. Impact of Inbound Tourism on the Contribution of Tourism to the Economic Growth

The sensitivity of international tourists to changes in price is one of the determinants of inbound tourism demand, thus it may also influence the contribution of tourism to economic growth. As the supply of a tourism product increases, its price drops. The more sensitive international tourists are to these price changes, the more tourism products they purchase. Domestic tourists also increase the demand for tourism products and households decisions about expanding their investments are based on changes in the producer’s surplus. As the increase in tourism output is fixed, various changes in tourism demand might affect the investment decisions of households, and thus affect future economic growth.

The four scenarios simulated for each destination in this study investigate how price elasticity modifies the impact of tourism on economic growth. For each destination, the absolute value of the estimated elasticities ranged between 0.2 and 2.7, covering both inelastic and elastic situations. For Mauritius and New Zealand, when the international tourists becomes more sensitive to the changes in price, they buy more tourism products from the selected destination. As a result, in the scenario with the largest price elasticity, there are the least resources for investment and the contribution of tourism to economic growth is also the least.

However, for Spain and the USA, the most significant economic growth is not observed in the most elastic scenario, because the price elasticity of inbound tourism is not the only factor influencing investment decisions and the values of the related parameters are different in the four destinations. Thus, there is no guarantee that there is a linear relationship between the price elasticity of inbound tourism and the impact of tourism on economic growth. Thus, it can only be concluded that the price elasticity of inbound tourists has an effect on the relationship between tourism and economic growth.

6.2.3. Impact of Domestic Tourism on the Contribution of Tourism to the Economic Growth

Domestic tourism also plays an important role in the value added of tourism, thus the proportion of tourism value added that comes from domestic tourism can also affect the contribution of tourism to economic growth. Four scenarios with ratios of 20, 40, 60 and 80% are simulated for each destination. The baseline model of each destination is used to substitute the scenario with the ratio that is closest to the real value. For example, in the baseline US model, domestic demand accounts for 61.2% of tourism value added. Thus, the scenarios for the USA are composed of simulations with domestic demand accounting for 20, 40, 61.2 and 80% of tourism value added.

It is found that as the proportion of domestic tourism increases in Mauritius, Spain and New Zealand, the contribution of tourism to economic growth becomes more significant. In Mauritius, the maximal growth of GDP increases from 0.16 to 0.24%. In Spain and New Zealand it increases from 0.05 to 0.20% and 0.02 to 0.07%, respectively, when the ratio of domestic tourism expands from 20% (17.5% in Mauritius as it is the baseline model) to 80%. As the ratio increases, the 1% growth of domestic tourism consumption is measured in volume, and thus leads to more significant economic growth for the destination.

However, the response of the GDP in the USA is different than in the other three destinations. No obvious trend is observed when the proportion of domestic tourism increases. Specifically, the strongest economic growth is achieved by the baseline model with a proportion of 61.2%. Compared to the other three scenarios, the price of tourism products converges to the original level more slowly in the baseline model. As a result, tourism demand expands and leads to a maximal 0.049% economic growth, which is the strongest of the four scenarios.

Like the impact of inbound tourism on the contribution of tourism to economic growth, there is no linear relationship between the ratio of domestic tourism to tourism value added and the influence of tourism on economic growth due to the complexity of the model.

Sections 6.2.2 and 6.2.3 show that although the GDP responds differently when the key parameters are assigned various values, the contribution of tourism to economic growth is always positive.

Thus, the sensitivity analysis has shown that the conclusion of this study that tourism leads to economic growth is robust to changes in the two parameters.

6.3. Contributions of the Study

This study's theoretical and practical contributions are as follows.

As argued by Song, Dwyer, Li and Cao (2012) and Pablo-Romero and Molina (2013), most studies of tourism and economic growth are empirical studies that use time series and panel data models to examine the TLEG hypothesis. The conclusions obtained by such methods can only show that in most destinations there is a positive relationship between tourism development and economic growth; they cannot show that the relationship is a casual relationship. The DSGE model, which is composed of a series of equations that describe the behaviour of different agents in the economy, is introduced in this study. The DSGE model can not only examine the impact of tourism on economic growth, it can also explain the mechanism that transforms the development of tourism into economic growth. The relationship confirmed by the DSGE model is a causal relationship operating in the real economy. Thus, this study complements the current empirical studies of tourism and economic growth.

Methodologically, this is the first study in the tourism economic field to use the search-matching theory and Bayesian estimation in a DSGE model. Search-matching theory provides a strong microeconomic foundation for the interaction between job hunters and employers by modelling the asymmetric information dynamically, which prevents instantaneous job matching in a labour market. The Bayesian method is a combination of calibration and traditional econometric methods, and integrates information from both prior published studies and real data. The introduction of these two techniques into the model brings the simulation results closer to reality. Thus, the conclusions of the study are more rigorous.

These findings confirm that tourism has a positive effect on economic growth in the four destinations. In other words, the development of tourism leads to economic growth. The model is very easy to be generalised to other destinations. Thus, the conclusion is a positive signal for governments that have taken or are going to take tourism as a pillar industry to stimulate economic growth.

Moreover, the patterns of economic growth vary depending on the destination's economic structure and the preferences of households and international tourists. Thus, by comparing the patterns of the selected destinations, it is suggested that if the development of tourism is combined with other policies such as subsidies or tax cuts, the impact of tourism on economic growth can be made more significant. The government and policy-makers could select appropriate policy combinations based on their own characteristics.

6.4. Limitations and Future Research Direction

This study has several limitations that can be addressed in future research. First, outbound tourism is excluded from the model. Because the selected destinations are the most popular destinations in the world, the tourist expenditure of outbound tourism is much smaller than the tourism receipts from inbound tourism. To simplify the model, the substitute elasticity between domestic and outbound tourism is omitted. However, if the framework is generalised to other destinations where outbound tourism is more significant, outbound tourism should be taken into consideration to address the outflow of tourist expenditure in the economy.

Second, there are only two sectors, tourism and non-tourism, in the model, so the flows between different sectors cannot be addressed. As argued in Chapter 2, the main aim of a DSGE model is to highlight the characteristics of aggregated variables rather than the interaction between sectors. Thus, one future research direction is to build a dynamic CGE model and use the data of the same destinations to simulate the impact of tourism on economic growth; this could examine the flows between sectors.

Last but not least, the study is limited by data availability. Because the tourism sector is split from the economy in the model, we use time series data from TSAs to represent tourism value added, domestic tourism consumption and tourism investment. Although there are many countries in the world that publish annual TSA data, few of them have produced TSAs with enough time periods to support a Bayesian estimation. With more data becoming available, more effort could be made to estimate the prior information of parameters through regression analysis, rather than just employing the values from other studies. This could improve the reliability of the simulation results. More importantly, when more TSA data are made available, additional destinations could be examined to test the framework developed in this study. The sufficient conditions of tourism could lead to economic growth may be identified based on the various findings from different destinations, which is more valuable for the government policymakers in planning the tourism development programmes.

Appendices

A.1 TLEG Studies Using Econometric Approach

Table A.1. 1 TLEG Studies Using Econometric Approach

1.	Data Type
	T: Time series; C: Cross-Section; P: Panel data
2.	Variables
	G:GDP; RG: Real GDP; GP: GDP per capita; RGP: Real GDP per capita; IPI: Industry Production Index; RIG: Real Income Growth GIP: Growth of Income per capita; RGCPW: Real GDP chain per worker; GRCPC: Real GDP chain per capita TR: Tourism receipt; RTR: Real tourism receipt; TRP: Tourism receipt per tourist ; RTRP: Real tourism receipt per tourist TA: Tourist arrivals; TAP: Tourist receipts per capita; TE: Tourism expenditure, RTE: Real tourism expenditure; NP: Night spent per tourists;
3.	Modelling Method
	AB: Dynamic panel data model by Arellano & Bond (1991) AIDS: Almost Ideal Demand System ECM: Error corrected model EG: Engle-Granger two steps cointegration test EGARCH-M: Exponential generalized autoregressive conditional heteroskedastic model in mean FE: Fixed effect model Granger: Granger causality test Johansen: Johansen cointegration test LSDV: Least square dummy variable estimation PC: Panel cointegration RE: Random effect model SGMM: System general method of moments

	TVC: Time-varying Coefficient VAR: Vector auto regression model VD: Variance Decomposition
4.	Data Frequency
	A: Annually; Q: Quarterly; M: Monthly
5.	TLGH
	C: Tourism-led Growth Hypothesis(TLGH) cannot be rejected; R: TLGH is rejected

Study	Data Type	Variable		Modelling Method	Period	Data Frequency	Country/Region	TLGH
		Economic	Tourism					
Time Series Data								
Balaguer & Cantavella-Jorda (2002)	T	RG	RTR	Johansen & Granger	1975-1997	Q	Spain	C
Lanza, Temple & Urga (2003)	T	Real expenditure	TE/real expenditure	Johansen & AIDS	1977-1992	A	13 OECD countries	C
Dritsaki (2004)	T	RG	TR	Johansen, VAR, VEC, & Granger	1960-2000	Q	Greece	C
Dubarry (2004)	T	RG	TRP	EG,ECM & Granger	1952-1999	A	Mauritius	C
Oh (2005)	T	RG	RTR	EG,VAR & Granger	1975-2001	Q	South Korea	R
Gunduza & Hatemi-J (2005)	T	RG	TA&TR/GDP	Bootstrap causality test	1963-2002	A	Turkey	C
Kim, Chen,& Jang (2006)	T	G	TA	Johansen & Granger	1971-2003 1956-2002	Q A	Taiwan	C
Nowak et al(2007)	T	RG	RTR	Johansen & Granger	1960-2003	A	Spain	C
Brida, Risso, & Carrea (2008)	T	RG	TE	Johansen & Granger	1980-2007	A	Mexico	C
Kaplan & Celik (2008)	T	RG	RTR	Johansen, VAR & Granger	1963-2006	A	Turkey	C
Lee & Chien (2008)	T	RG	TA&RTR	Johansen & Granger	1959-2003	A	Taiwan	C
Brida, Pereyra, Risso, Devesa, & Zapata-Aguirre (2009)	T	RGP	TE	Johansen & Granger	1990-2006	A	Colombia	C
Brida & Risso (2009)	T	RG	TE	Johansen & Granger	1988-2008	A	Chile	C
Chen & Song (2009)	T	RG	RTR	Johansen & EGARCH-M	1975-2007	Q	Taiwan South Korea	C
Katircioglu (2009a)	T	RG	TA	Bounds test & Johansen	1960-2006	A	Turkey	R

Katircioglu (2009b)	T	RG	TA	Bounds test, Johansen & Granger	1960-2005	A	Cyprus	R
Belloumi (2010)	T	RG	RTR	Johansen, Granger &VAR	1970-2007	A	Tunisia	C
Brida & Risso (2010)	T	RG	TA	Johansen & Granger	1980-2006	A	South Tyrolean	C
Brida, Barquet, & Risso (2010)	T	RG	RTR	Johansen & Granger	1980-2000	A	Trentino-Alto Adige	C
Brida, Lanziltta, Lionetti,& Risso (2010)	T	RGP	RTE	Johansen & Granger	1987-2006	Q	Uraguay	C
Kadir & Jusoff (2010)	T	Total Trade	TR	Johansen & Granger	1995-2006	Q	Malaysia	R
Katircioglu (2010a)	T	RG	TR	Johansen, Granger& ECM	1960-2007	A	Singapore	C
Katircioglu (2010b)	T	RG	TA	Johansen & Granger	1977-2007	A	North Cyprus	C
Kreishan (2010)	T	G	TR	Johansen & Granger	1970-2009	A	Jordan	C
Lean & Tang (2010)	T	Real IPI	TA	Rolling Subsample Granger	1989-2009	A	Malaysia	C
Arslanturk, Balcilar & Ozdemir (2011)	T	RG	RTR	TVC	1963-2006	A	Turkey	C
Brida, Punzo, & Risso (2011)	T	G growth	TE	Johansen & Granger	1965-2007	A	Brazil	C
	P			AB	1990-2005	A	27 states of Brazil	
Cortés-Jiménez, Nowak &Sahli (2011)	T	RG	RTR	Johansen, VECM & Granger	1975-2007	A	Tunisia	C
He & Zheng (2011)	T	G	TR	VAR & Granger	1990-2009	A	Sichuan, China	C
Husein & Kara (2011)	T	RG	TR	Johansen & Granger	1964-2006	A	Turkey	C
Jin (2011)	T	RG	TA	VAR	1982-2006	Q	Hong Kong	C (short-run)
Katircioglu (2011)	T	RG	TA	Bounds, Johansen & Conditional Granger	1960-2007	A	Singapore	C
Lord, Francis, & Drakes (2011)	T	RG	TA	Johansen & Granger	1974-2004	Q	Barbados	C
Schubernt et al (2011)	T	RG	RTR	Johansen & VECM	1970-2008	A	Antigua &Barbuda	C
Amaghionyeodiwe (2012)	T	G	TR	Johansen, VAR,& VD	1970-2005	A	Jamaica	C
Arslantürk & Atan (2012)	T	G	TR	Granger & VAR	1987-2009	A	Turkey	C
Chatziantoniou, Filis, Eeckels, & Apostolakis (2012)	T	IPI	TR	Structural VAR	2000-2010	M	4 Mediterranean countries	C
Eeckels, Filis,& Leon (2012)	T	RG	RTR	VAR	1976-2004	A	Greece	C
Kumar & Kumar (2012)	T	RGP	TR/GDP	Bounds test & Granger	1980-2008	A	Fiji	C
Hey & Khan (2013)	T	G	TR	Johansen & Bounds	1971-2008	A	Pakistan	C
Massidda & Mattana (2013)	T	RG	RTRP	Structural VECM	1987-2009	Q	Italy	C

Tang & Tan (2013)	T	IPI	TA	Johansen& Recursive Granger	1995-2009	M	Malaysia	C
Panel Data								
Eugenio-Martín, Morales, & Scarpa (2004)	P	GP	TAP	AB	1985-1998	A	Latin American	C(in low & medium income countries)
Sequeira & Campos (2005)	P	GP	TAP,TR/Export, TR/GDP	FE &RE	1980-1999	A	Drawn from the Penn World Table(2002)	C (in RE model) R(in FE model)
Fayissa, Nsiah & Tadasse (2007)	P	RGP	RTRP	FE,RE,&AB	1995-2004	A	42 Africa countries	C
Cortés-Jiménez (2008)	P	GP	NP	AB	1990-2000	A	Spain & Italy regions	C
Lee & Chang (2008)	P	GP	TAP&TRP	Pedroni cointegration test, & Granger	1990-2002	A	OECD & non-OECD	C
Proenca & Soukiazis (2008)	P	GP	TR	FE&RE	1990-2004	A	South European	C
Sequeiraa & Nunes (2008)	P	GP	TAP,TR/GDP &TR/export	LSDV&SGMM	1980-2002	A	Tourism specializations from World Development Indicator(2004)	C
Seetanah (2008)	P	RGP	TA	AB & Granger	1995-207	-	19 Island Economies	C
Narayan, Narayan, Prasad, & Prasad (2010)	P	G	Tourism Exports	PC & Panel Granger	1988-2004	A	4 Pacific Island Countries	C
Fayyisa, Nsiah &Tadesse (2011)	P	RGP	RTRP	AB	1990-2005	A	18 Latin American Countries	C
Holzner (2011)	P	GP	TR/GDP	PC & AB	1970-2007	A	134 countries	C
Liberto (2011)	P	GP	TR/GDP	AB	1980-2005	A	72 countries	C
Cağlayan, Sak,& Karymshakov (2012)	P	G	TR	Panel Granger	1995-2008	A	135 countries	C
Chang & Khamkaew (2012)	P	RGP,RGCPW, RGCPC	TA/popultaion,TR/GDP,TR/Exports	Panel Threshold	1989-2008	A	159 countries	C
Dritsakis (2012)	P	RGP	TRP &TAP	PC &fully modified ordinary least squares	1980-2007	A	7 Mediterranean countries	C
Ekanayake & Long (2012)	P	RG	RTR	PC & Panel Granger	1995-2009	A	140 Developing Countries	R

Aslan (2013)	P	RG growth	TR	Panel Granger	1995-2010	A	9 Mediterranean countries	C (7/9)
Castro-Nuño, Molina-Toucedo, & Pablo-Romero (2013)	P	-	-	Meta-Analysis	-	A	12 Panel Studies	C
Chou (2013)	P	RGP	TE	Panel Granger	1988-2011	A	10 transition countries	R (7/10)
Cross-sectional Data								
Brau, Lanza, & Pigliaru (2007)	C	RGP	TR/GDP	LSDV	1980-2003 annual averages	A	143 countries	C
Po & Huang (2008)	C	GP growth	TRP growth rate	Threshold non-linear regression	1995-2005 annual averages	A	88 countries	C
Figini & Vici (2010)	C	GIP	TR/GDP	LSDV	1980-2005 annual averages	A	150 countries	R

A.2 Estimation Results of the Priors of the Selected Parameters in the Models

The variables employed in the estimations are shown in Table A.2.1.

Table A.2.1 Variables in Regressions

Variable	Ex_t	Ex_nt	WGDP	RP	RER	U
Explanation	Tourism Exports	Non-tourism Exports	World GDP	Relative Price	Real Exchange Rate	Unemployment Rate

A.2.1 The Estimation Results of the Prior Parameters in the Mauritian Model

Table A.2.2 The Estimation Results of the Prior Parameter in the Mauritian Model

	Ex_t		**Ex_nt**		**RER**		**Inflation Rate**
Log(RP(-2))	-0.346 (-1.877)*	**Log(RP)**	-0.478 (-7.766)***	**Log(RER(-1))**	0.996 (144.357)***	**D(log(u))**	-0.692 (-0.974)
Log(WGDP(-1))	0.883 (6.483)***	**Log(WGDP(-1))**	0.512 (141.860)***			**Constant**	1.058 (16.510)***
D09	-0.218 (-4.029)***	**D09**	-0.260 (-5.720)***				
D14	0.143 (2.611)**	**D14**	0.302 (5.483)***				
Constant	-7.471 (-3.322)***						
R^2	0.965		0.856		-0.723		0.068

Notes: 1. Hereinafter, Log is the operator of nature logarithm; 2. Hereinafter, figures in parenthesis after the variables are the lagged order; 3. Hereinafter, *, **, and *** represent 10%, 5% and 1% significant level respectively; 4. D09 and D14 are dummies representing the Global Financial Crisis in 2009 and currency depreciation in 2014 respectively.

A.2.2 The Estimation Results of the Prior Parameters in the Spanish Model

Table A.2.3 The Estimation Results of the Prior Parameters in the Spanish Model

	Ex_t		Ex_nt		RER		Inflation Rate
Log(Ex_t(-1))	0.931 (12.800)***	**Log(Ex_nt(-1))**	0.864 (5.740)***				
Log(RP(-1))	-0.131 (-2.704)**	**Log(RP)**	0.845 (4.202)***	**Log(RER(-1))**	0.530 (2.761)**	**D(log(u))**	-0.024 (-1.737)
Log(WGDP)	0.232 (1.826)*	**Log(RP(-1))**	-0.919 (-4.214)***	**constant**	2.166 (2.450)**	**constant**	0.028 (11.870)***
D02	-0.119 (-2.619)**	**Log(WGDP)**	1.881 (6.292)***				
		Log(WGDP(-1))	-1.270 (-3.502)***				
		Log(WGDP(-2))	-0.281 (-1.390)				
R^2	0.932		0.964		0.337		0.168

Note: D02 represents the spill-over effect of 911 terrorist attack in 2001.

A.2.3 The Estimation Results of the Prior Parameters in the New Zealand Model

Table A.2.4 The Estimation Results of the Prior Parameters in the New Zealand Model

	Ex_t		**Ex_nt**		**RER**		**Log(Price)**
Log(Ex_t(-1))	0.610 (14.370)***	**Log(Ex_nt(-2))**	-0.563 (-2.054)*				
Log(RP(-1))	-0.374 (-8.755)***	**Log(RP)**	-0.850 (-5.201)***	**Log(RER(-1))**	0.860 (5.328)***	**Log(u)**	-0.438 (-0.930)
Log(WGDP(-1))	0.778 (5.448)***	**Log(RP(-2))**	-1.106 (-3.015)**	**constant**	0.657 (0.854)	**constant**	3.651 (1.744)
Log(WGDP(-2))	-0.294 (-2.384)**	**Log(WGDP(-1))**	1.482 (3.333)**				
D09	-0.100 (-6.678)***	**Log(WGDP(-2))**	1.564 (2.400)*				
		D09	-0.346 (-5.172)***				
		constant	-8.490 (-4.500)***				
R2	0.989		0.856		0.654		0.051

Note: D09 represents the impact of the Global Financial Crisis in 2009.

A.2.4 The Estimation Results of the Prior Parameters in the US Model

Table A.2.5 The Estimation Results of the Prior Parameters in the US Model

	Ex_t		**Ex_nt**		**Log(Price)**
Log(Ex_t(-2))	0.257 (3.708)***	**Log(Ex_nt(-2))**	0.257 (5.140)***		
Log(RP)	-1.203 (-1.650)	**Log(RP(-2))**	-1.206 (-5.277)***	**D(log(u))**	-0.054 (-0.761)
Log(WGDP(-1))	1.464 (3.375)***	**Log(WGDP)**	0.974 (14.157)***	**constant**	4.531 (157.010)***
D09	-0.215 (-4.102)***	**Log(WGDP(-2))**	0.483 (4.960)***		
		D09	-0.127 (-12.205)***		
		constant	-9.971 (-8.631)***		
R^2	0.983		0.999		0.008

A.3 IRFs of All the Variables in the Models

A.3.1 IRFs of the Mauritian Model

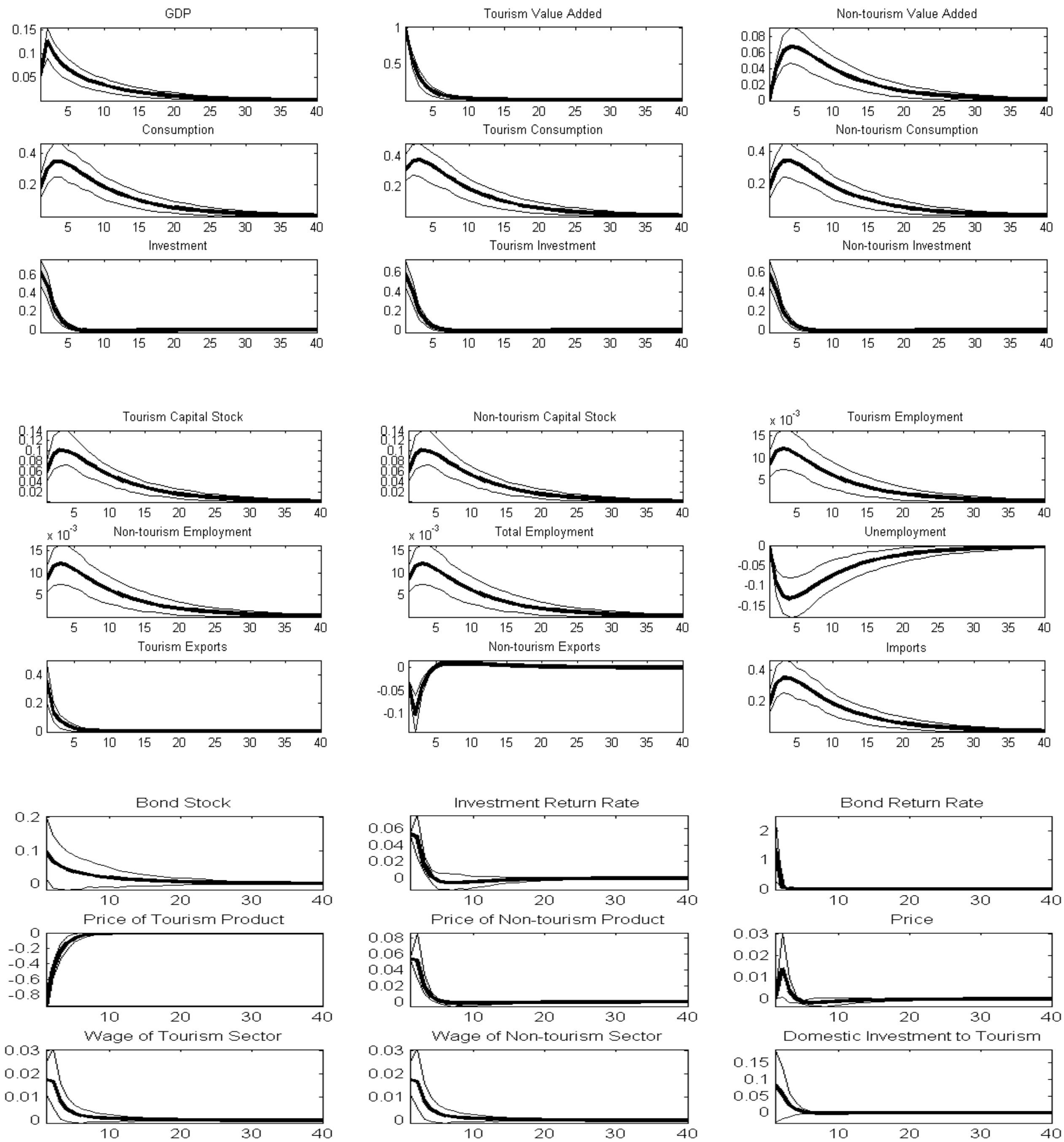


Figure A.3.1 IRFs of the Mauritian Model

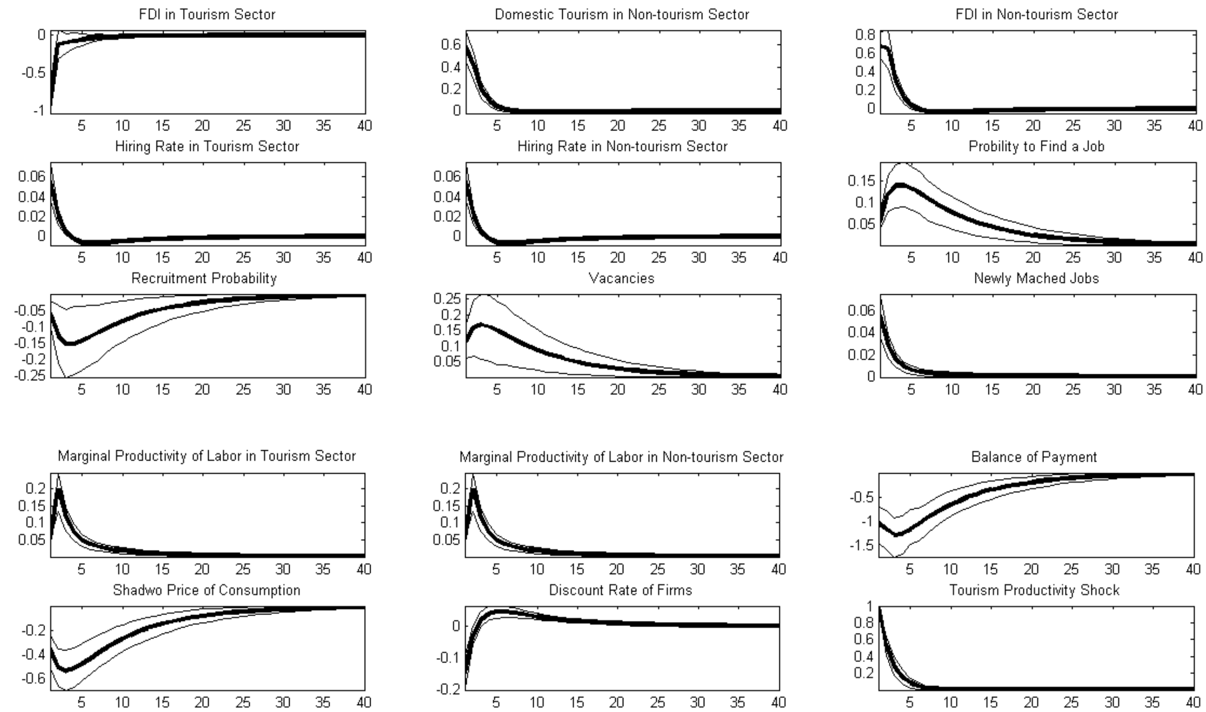


Figure A.3.1 IRFs of the Mauritian Model (Continued)

A.3.2 IRFs of the Spanish Model

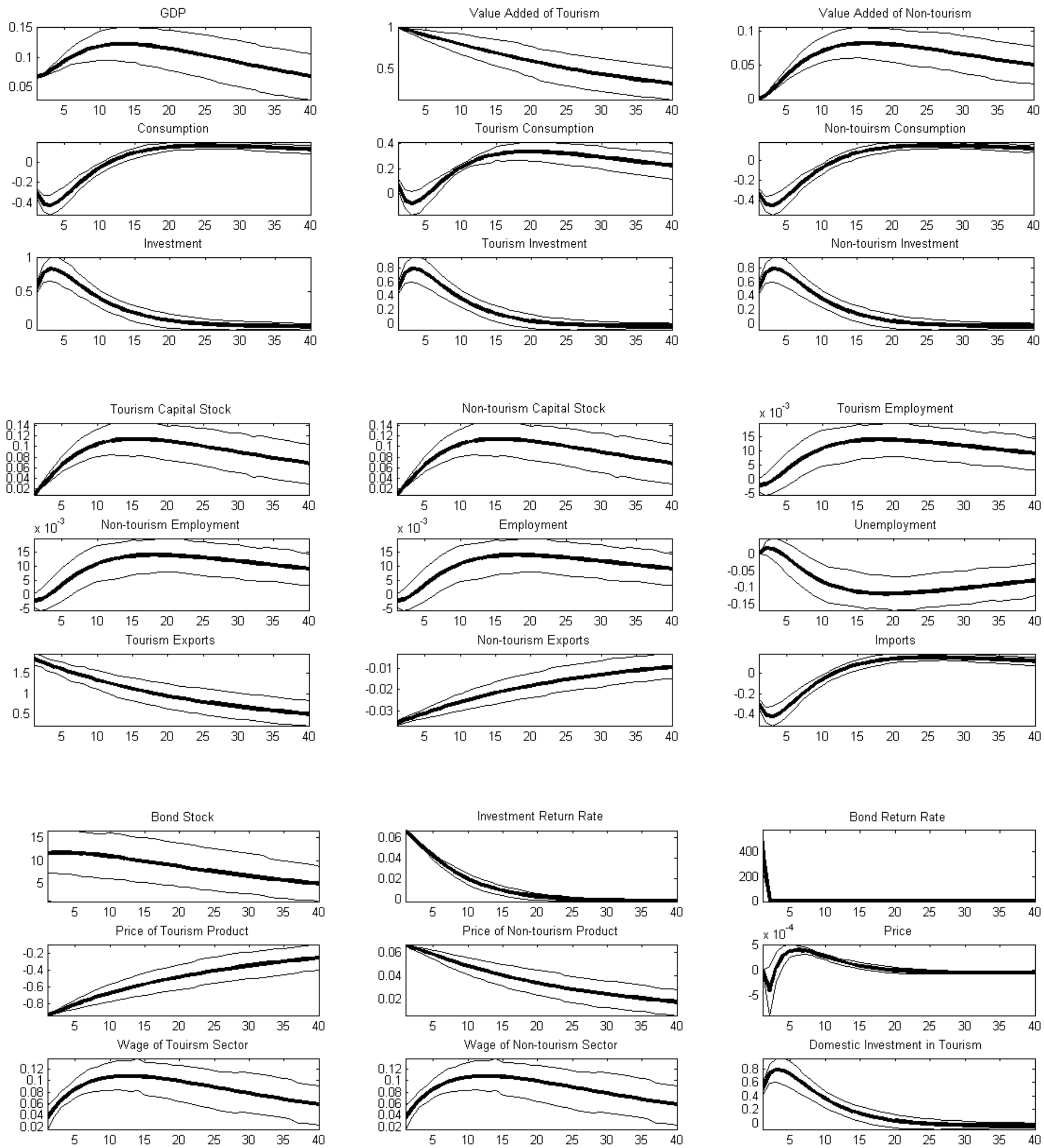


Figure A.3.2 IRFs of the Spanish Model

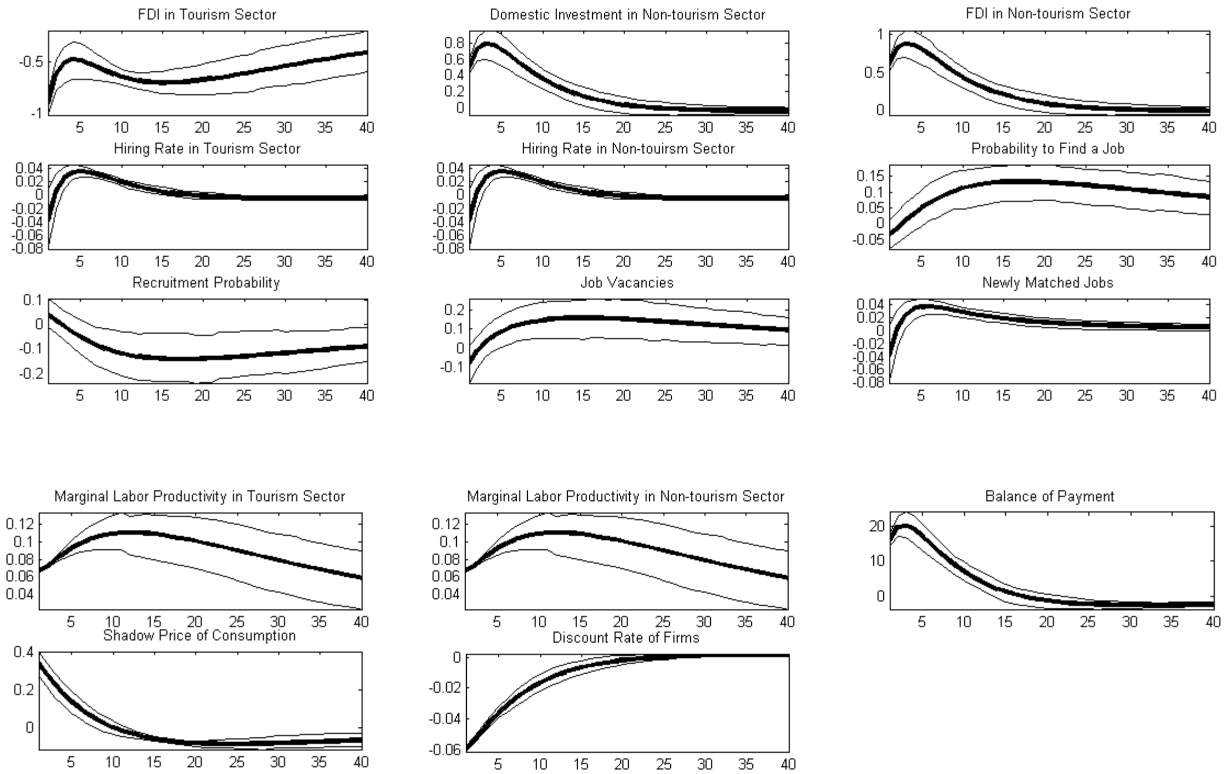


Figure A.3.2 IRFs of the Spanish Model (Continued)

A.3.3 IRFs of the New Zealand Model

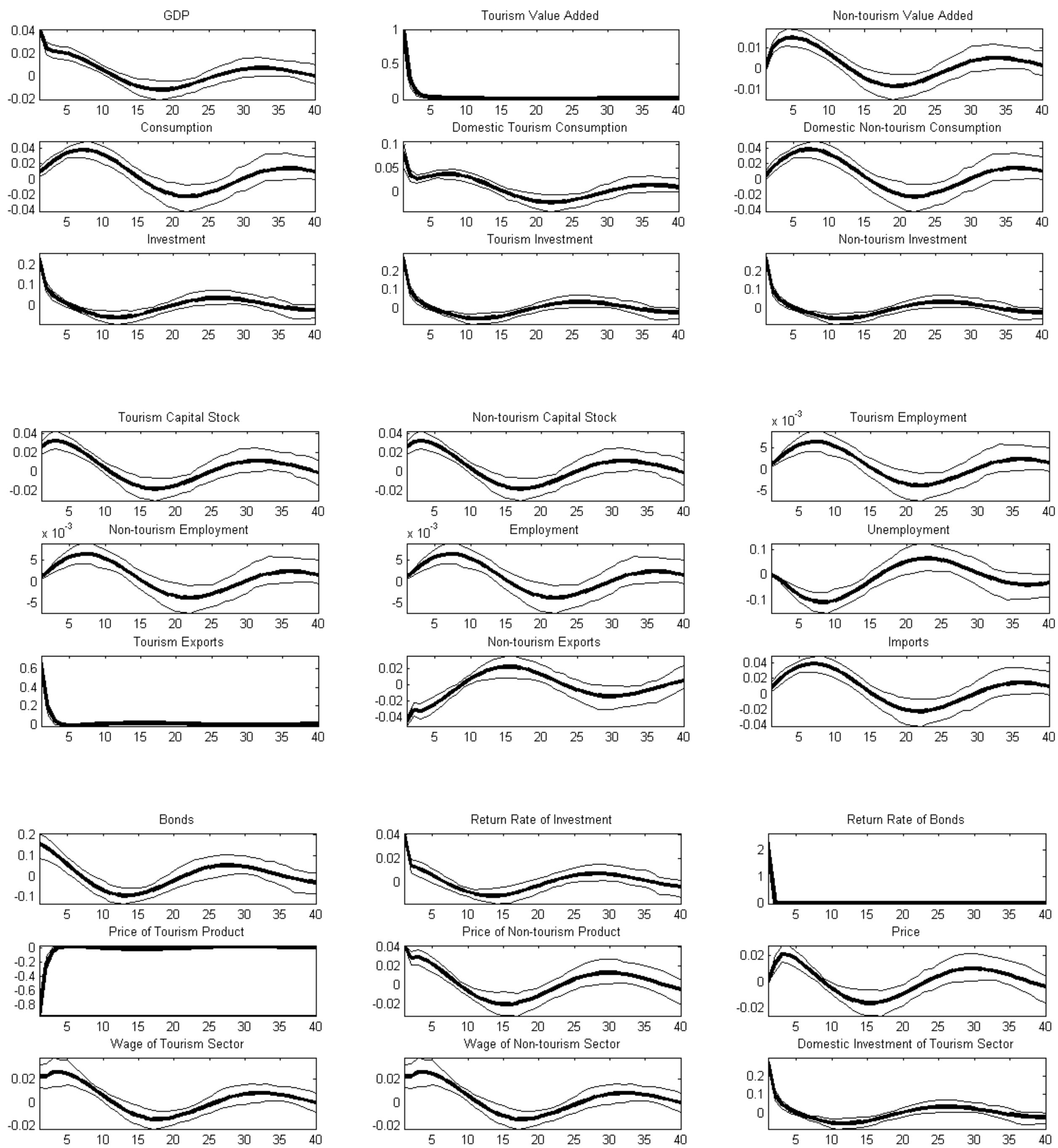


Figure A.3.3 IRFs of the New Zealand Model

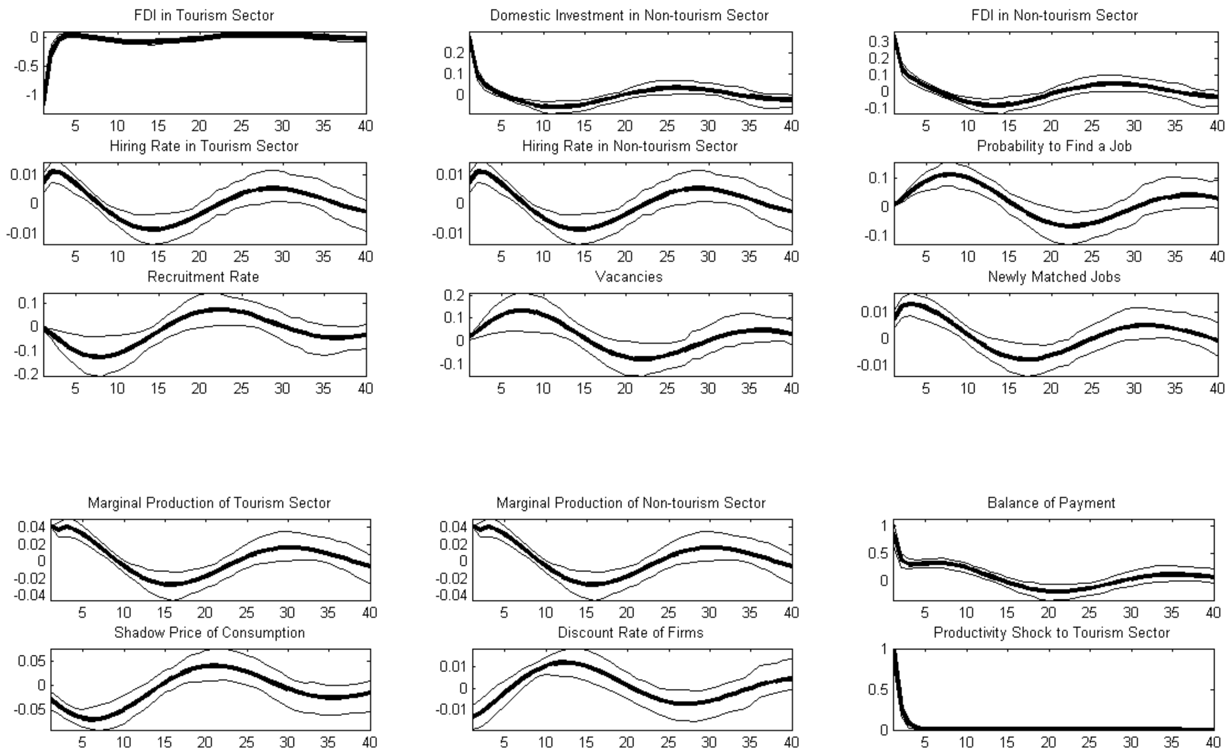


Figure A.3.3 IRFs of the New Zealand Model (Continued)

A.3.4 IRFs of the US Model

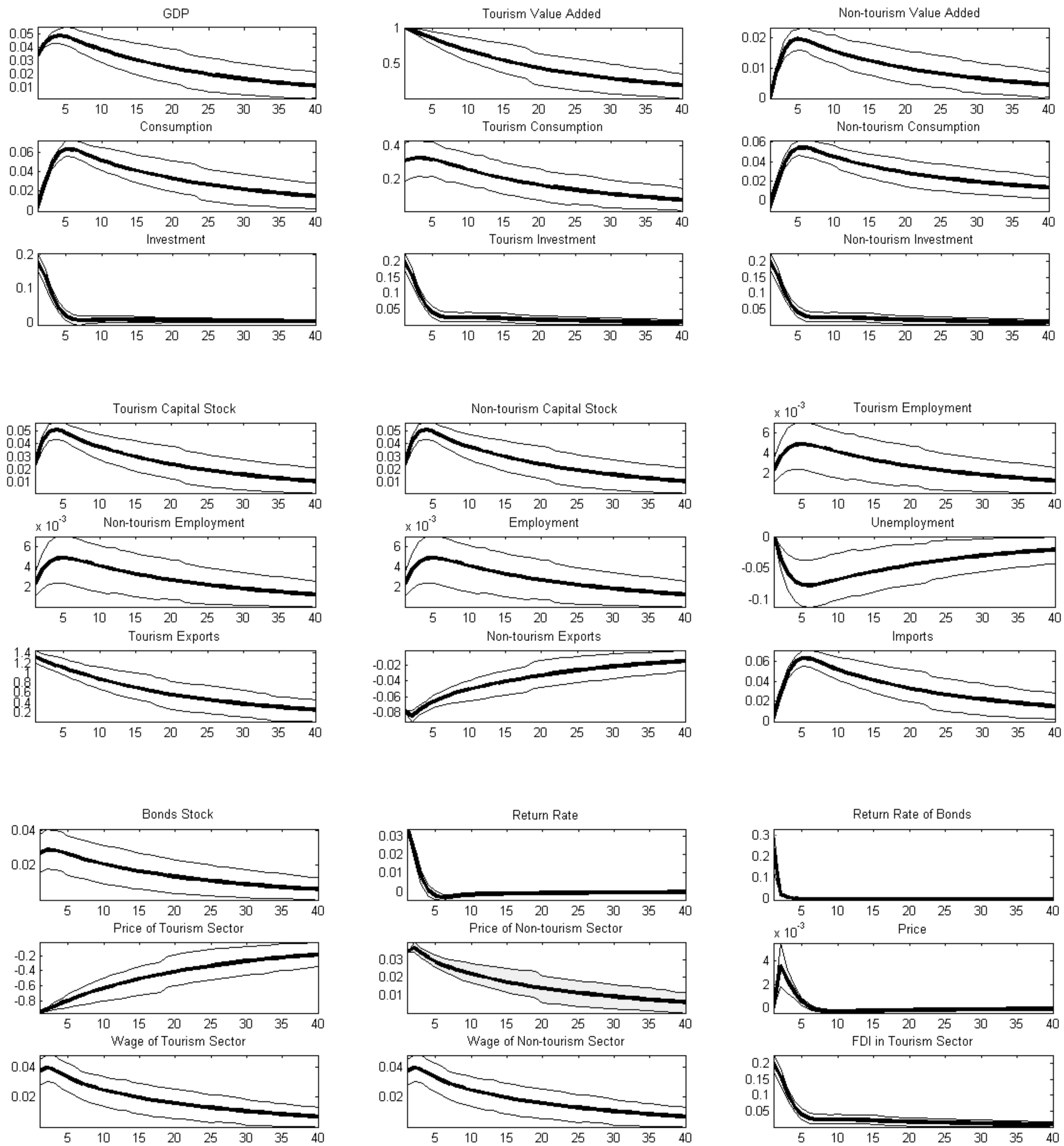
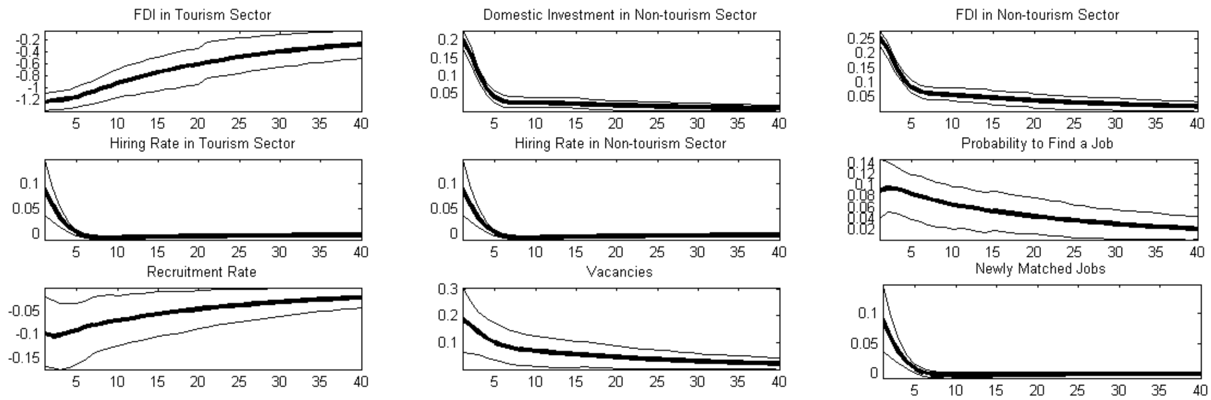


Figure A.3.4 IRFs of the US Model



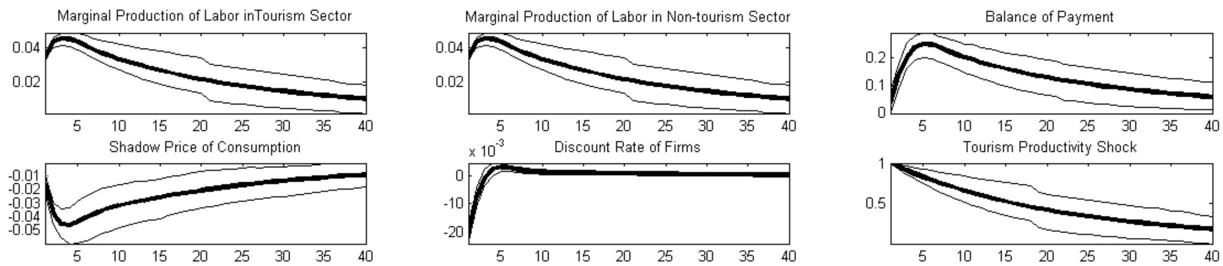


Figure A.3.4 IRFs of the US Model (Continued)

References

Acemoglu, D. (2010). Theory, General Equilibrium and Political Economy in Development Economics. *NBER Working Paper No. 15944*.

Adams, P. D., & Parmenter, B. R. (1995). An Applied General Equilibrium Analysis of the Economic Effects of Tourism in a Quite Small, Quite Open Economy. *Applied Economics, 27*(10), 985-994.

Adjemian, S., Bastani, H., Karame, F., Juillard, M., Maih, J., Mihoubi, F., . . . Villemot, S. (2014). Dynare: Reference Manual Version 4.4.2. *Dynare Working Paper 1*.

Ahlert, G. (2008). Estimating the Economic Impact of an Increase in Inbound Tourism on the German Economy Using TSA Results. *Journal of Travel Research, 47*(2), 225-234.

Álvarez- Díaz, M., González-Gómez, M., & Otero-Giráldez, M. (2012). Estimating International Tourism Demand to Spain Seperately by the Major Source Market. *Vigo University Working Paper 12/04*.

Álvarez-Albelo, C., & Hernández-Martín, R. (2007). Explaining High Economic Growth in Small Tourism Countries with a Dynamic General Equlibrium Model. *XREAP Working Paper No. 2007-6*.

Archer, B. H., & Fletcher, J. E. (1996). The Economic Impact of Tourism in the Seychelles. *Annals of Tourism Research, 23*(1), 32-47.

Arellano, M., & Bond, S. (2001). *Panel Data Estimation Using DPD.* Oxford: Nuffield University.

Arslantürk, Y., & Atan, S. (2012). Dynamic Relation between Economic Growth, Foreign Exchange and Tourism: An Ecomometric Perspective on Turkey. *Journal of Business,Economics and Finance, 1*(1), 30-37.

Arslanturk, Y., Balcilar, M., & Ozdemir, Z. A. (2011). Time-varying Linkages between Tourism Receipts and Economic Growth in a Small Open Economy. *Economic Modeling, 28*(1), 664-671.

Association of Southeast Asian Nationas (ASEAN). (2011). *ASEAN Tourism Marketing Strategy 2012-2015.* Jakarta: the author.

Balaguer, J., & Cantavella-Jordá, M. (2002). Tourism as a Long-run Economic Growth Factor: The Spanish Case. *Applied Economics, 34(7)*, 877-884.

Barro, R. J., & Sala-i-Martin, X. (2004). *Economic Growth* (2 ed.). London, UK: MIT Press.

Becken, S., & Lennox, J. (2012). Implications of a Long-term Increase in Oil Price for Tourism. *Tourism Management, 33*(1), 133-142.

Becker, G. S., Glaeser, E. L., & Murphy, K. M. (1999). Population and Economic Growth. *American Economic Review, 89*(2), 145-149.

Belloumi, M. (2010). The Relationship between Tourism Receipts, Real Effective Exchange Rate and Economic Growth in Tunisia. *International Journal of Tourism Research, 12*(5), 550-560.

Beneˇs, J., Binning, A., Fukaˇc, M., Lees, K., & Matheson, T. (2009). *K.I.T.T.: Kiwi Inflation Targeting Technology*. Reserve Bank of New Zealand.

Blake, A. (2000). *The Economic Effects of Tourism in Spain.* Norttinham: Christel DeHann Tourism and Travel Research Institute.

Blake, A. (2009). The Dynamics of Tourism's Economic Impact. *Tourism Economics, 15*(3), 615-628.

Blake, A., & Sinclair, M. T. (2003). Toursim Crisis Management: US Response to September 11. *Annals of Tourism Research, 30*(4), 813-832.

Blake, A., Arbache, J. S., Sinclair, M. T., & Teles, V. (2008). Tourism and Poverty Relief. *Annals of Tourism Research, 35*(7), 107-126.

Blake, A., Gillham, J., & Sinclair, M. T. (2006). CGE Tourism Analysis and Policy Modelling. In L. Dwyer, & P. Forsyth, *International Handbook on the Economics of Tourism* (pp. 301-315). Cheltenham & Northampton: Edward Elgar Publishing Limited.

Blake, A., Sinclair, M. T., & Sugiyarto, G. (2003). Quantifying the Impact of Foot and Mouth Disease on Tourism and the UK Economy. *Toursim Economcis, 9*(4), 449-465.

Blake, A., Sinclair, T. M., & Soria, J. C. (2006). Tourism Productivity: Evidence from the United Kingdom. *Annals of Tourism Research, 33*(4), 1099-1120.

Blanchard, O. J., & Kahn, C. M. (1980). The Solution of Linear Difference Models under Rational Expectations. *Econometrica, 48*(5), 1305-1311.

Brendon, P. (1991). *Thomas Cook: 150 Years of Popular Tourism.* London: Martin Secker & Warburg Ltd.

Briassoulis, H. (1991). Methodological Issues Tourism Input-Output Analysis. *Annals of Toursim Research, 18*(3), 485-495.

Brida, J. G., & Risso, W. A. (2009). Tourism as a Factor of Long-run Economic Growth: An Emprical Study for Chile. *European Journal of Tourism Research, 2*(2), 178-185.

Brida, J. G., & Risso, W. A. (2010). Tourism as a Determinant of Long-run Economic Growth. *Journal of Policy Research in Tourism, Leisure and Events, 2*(1), 14-28.

Brida, J. G., Lanzilotta, B., Lionetti, S., & Risso, W. A. (2010). The Tourism-led Growth Hypothesis for Uruguay. *Tourism Economics, 16*(3), 765-771.

Brida, J. G., Lionello, P., & Risso, W. A. (2011). Research Note: Tourism as a Factor of Growth – the Case of Brazil. *Tourism Economics, 17*(6), 1375-1386.

Brida, J. G., Pereyra, J. S., Risso, W., Devesa, M. J., & Zapata-Aguirre, S. (2009). The Tourism-led Economic Growth Hypothesis: Emprical Evidence from Colombia. *Tourismos:An International Multidisciplinary Journal of Tourism, 4*(2), 13-27.

Brida, J. G., Risso, W. A., & Carrea, E. J. (2008). Tourism's Impact on Long-run Mexican Economic Growth. *Economics Bulletin, 3*(2), 1-8.

Brooks, S. P., & Gelman, A. (1998). General Methods for Monitoring Covergence of Iterative Simulations. *Journal of Computational and Graphical Statistics, 7*(4), 434-455.

Bulter, R. (2006). The Concept of a Tourist Area Cycle of Evolution: Implications for Management of Resources. *The Tourism Area Life Cycle, 1*, 3-12.

Burriel, P., Fernández-Villaverde, J., & Rubio-Ramírez, J. F. (2010). MEDEA: A DSGE Model for the Spanish Economy. *SERIES, 1*, 175-243.

Cağlayan, E., Sak, N., & Karymshakov, K. (2012). Relationship between Tourism and Economic Growth: A Panel Granger Causality Approach. *Asian Economic and Financial Review, 2*(5), 591-602.

Carlstrom, C. T., & Fuerst, T. S. (1997). Agency Costs, Net Worth, and Business Fluctuations: A Computable General Equilibrium Analysis. *American Economic Review, 87*(5), 893-910.

Cass, D. (1965). Optimum Growth in an Aggregative Model of Capital Accumulation. *Review of Economic Studies, 32*(3), 233-240.

Castro-Nuño, M., Molina-Toucedo, J. A., & Pablo-Romero, M. P. (2013). Tourism and GDP: A Meta-analysis of Panel Data Studies. *Journal of Travel Research, 53*, 1-14.

ChangH.Gene. (2010). Principles of Computable General Equilibrium (CGE) Modeling and Programming (in Chinese). Shanghai: Gezhi Press & Shanghai People's Press.

Chao, C.-C., Hazari, B. H., Laffargue, J.-P., Sgro, P. M., & Yu, E. S. (2006). Tourism, Dutch Disease and Welfare in an Open Dynamic Economy. *The Japanese Economic Review, 57*(4), 501-515.

Chao, C.-C., Hazari, B. R., Laffargue, J.-P., & Yu, E. S. (2009). A Dynamic Model of Tourism, Employment and Welfare: The Case of Hong Kong. *Pacific Economic Review, 14*(2), 232-245.

Chen, C.-F., & Song, C.-W. Z. (2009). Tourism Expansion, Tourism Uncertainty and Economic Growth: New Evidence from Taiwan and Korea. *Tourism Management, 30*, 812-818.

Copeland, B. R. (1991). Tourism, Welfare and De-industriliazation of a Small Open Economy. *Economica, 58*(232), 515-529.

Cortés-Jiménez, I. (2008). Which Type of Tourism Matters to the Regional Economic Growth? The Cases of Spain and Italy. *International Journal of Tourism Research, 10*(2), 127-139.

Cortés-Jiménez, I., Nowak, J.-J., & Sahli, M. (2011). Mass Beach Tourism and Economic Growth: Lessons from Tunisia. *Tourism Economics, 3*, 531-547.

DeJong, D. N., & Dave, C. (2011). *Structural Macroeconometrics* (2 ed.). Princeton: Princeton University Press.

Dritsakis, N. (2004). Tourism as a Long-run Economic Growth Factor: An Empirical Investigation for Greece Using Causality Analysis. *Tourism Economics, 10*(3), 305-316.

Durbarry, R. (2004). Tourism and Economic Growth: the Case of Mauritius. *Tourism Economics, 10*(4), 389-401.

Dwyer, L., Forsyth, P., & Spur, R. (2007). Contrasting the Uses of TSAs and CGE Models: Measuring Tourism Yield and Productivity. *Tourism Economics, 13*(4), 537-551.

Dwyer, L., Forsyth, P., & Spurr, R. (2006). Economic Effects of the World Tourism Crisis on Australia. *Tourism Economics, 12*(2), 171-186.

Dwyer, L., Forsyth, P., Spurr, R., & Thiep, V. (2003). Tourism's Contribution to a State Eonomy: A Multi-Regional General Equilibrium Analysis. *Tourism Economics, 9*(4), 431-448.

Eadington, W. R., & Redman, M. (1991). Economics and Tourism. *Annals of Tourism Research, 18*(1), 41-56.

Ekanayake, E. M., & Long, A. E. (2012). Tourism Development and Economic Growth in Developing Countries. *The International Journal of Business and Finance Research, 6*(1), 51-63.

Engle, R. F., & Granger, C. W. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica, 55*(2), 251-276.

Eugenio-Martín, J. L., Morales, N. M., & Scarpa, R. (2004). Tourism and Economic Growth in Latin American Countries: A Panel Data Approach. *Nota Di Lavobo Working Paper 26.2004*.

Fayissa, B., Nsiah, C., & Tadasse, B. (2008). Impact of Tourism on Economic Growth and Development in Africa. *Tourism Economics, 14*(4), 807-818.

Fayissa, B., Nsiah, C., & Tadesse, B. (2008). The Impact of Tourism on Economic Growth and Development in Africa. *Tourism Economics, 14*(4), 807-818.

Fayissa, B., Nsiah, C., & Tadesse, B. (2011). Tourism and Economic Growth in Latin American Countries – Further Empirical Evidence. *Tourism Economics, 17*(6), 1365-1373.

Figini, P., & Vici, L. (2010). Tourism and Growth in a Cross Section Countries. *Tourism Economics, 16*(4), 789-805.

Forsyth, P., Dwyer, L., Spurr, R., & Pham, T. (2014). The Impacts of Australia's Depature Tax: Toursim versus the Economy. *Toursim Management, 40*, 126-136.

Frechting, D. C. (1999). The Tourism Satellite Account: Foundations, Progress and Issues. *Tourism Management, 20*(1), 163-170.

Frechtling, D. C. (2010). The Tourism Satellite Account: A Primer. *Annals of Tourism Research, 37*(1), 136-153.

Gerlter, M., & Trigari, A. (2006). Unemployment Fluctuations with Staggered Nash Wage Bargaining. *NBER Working Paper Series 12498*.

Gertler, M., Sala, L., & Trigari, A. (2008). An Estimated Monetary DSGE Model with Unemployment and Staggered Nominal Wage Bargaining. *Journal of Money, Credit and Banking, 40*(8), 1713-1764.

GhaliA.Moheb. (1976). Tourism and Economic Growth: An Empirical Study. Economic Development and Cultural Change, *24*(3), 527-538.

Gooroochurn, N., & Milner, C. (2005). Assessing Indirect Tax Reform in a Tourism-Dependent Developing Country. *World Development, 33*(7), 1183-1200.

Gooroochurn, N., & Sinclair, M. T. (2005). Economics of Tourism Taxation: Evidence from Mauritus. *Annals of Tourism Research, 32*(2), 478-498.

Granger, C. W. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica, 37*(3), 424-438.

Granger, S. C. (2004). *Time Series Analysis, Cointegration and Applications.* Retrieved 9 16, 2013, from UC San Diego: Department of Economics, UCSD: http://escholarship.org/uc/item/2nb9f668

Grossman, G., & Helpman, E. (1991). *Innovation and Growth in the Global Economy.* Cambridge: MIT Press.

Guerrón-Quintana, P. A., & Nason, J. M. (2013). Bayesian Estimation of DSGE Models. In N. Hashimzade, & M. A. Thornton, *Handbook of Research Methods and Applications in Empirical Macroeconomics* (pp. 486-515). Glasgow: Edward Elgar Publishing.

Havranek, T., Horvath, R., Irsova, Z., & Rusnak, M. (2015). Cross-country Heterogeneity in Intertemporal Substitution. *Journal of Internatioanl Economics, 96*(1), 100-118.

Hazari, B. R., & NG, A. (1993). An Analysis of Tourists' Consumption of Non-traded Goods and Services on the Welfare of the Domestic Consumers. *International Review of Economics and Finance, 2*(1), 43-58.

Hazari, B. R., & Sgro, P. M. (1995). Tourism and Growth in a Dyanmic Model of Trade. *The Journal of International Trade and Economic Development, 4*(2), 243-252.

Hazari, B. R., & Sgro, P. M. (2004). *Tourism, Trade and National Welfare: Contributions to Ecnomic Analysis.* Bingley: Emerald Group Publishing.

He, L., & Zheng, X. (2011). Empirical Analysis on the Relationship between Tourism Development and Economic Growth in Sichuan. *Journal of Agricultural Science, 3*(1), 212-217.

Heng, T. M., & Low, L. (1990). Economic Impact of Tourism in Singapore. *Annals of Tourism Research, 17*(2), 246-269.

Hey, Q. M., & Khan, R. E. (2013). Tourism-led Growth Hypothesis: A Case Study of Pakistan. *Asia Pacific Journal of Tourism Research, 18*(4), 303-313.

Holzner, M. (2011). Tourism and Economic Development: The Beach Disease? *Tourism Managment, 32*(4), 922-933.

Hong Kong Tourism Board (HKTB). (2013). *Hong Kong Tourism Commission.* Retrieved from Legislative Council Panel on Economic Development Hong Kong Tourism Board Work Plan 2013-2014: http://www.tourism.gov.hk/resources/sc_chi/paperreport_doc/legco/2013-02-28/edev0225cb1_565_3_sc.pdf

Hurlin, C. (2004). Testing Granger Causality in Heterogenous Panel Data Models with Fixed Coefficients. *Document de recherche LEO 5*.

Husein, J., & Kara, M. S. (2011). Research Note: Re-examining the Tourism-led Growth Hypothesis for Turkey. *Tourism Economics, 17*(4), 917-924.

IMF. (2003). *World Economic Outlook.* Washington D.C.: IMF.

Inchausti-Sintes, F. (2015). Tourism: Economic Growth, Employment and Dutch Disease. *Annals of Tourism Research, 54*, 172-189.

Jin, J. C. (2011). The Effects of Tourism on Economic Growth in Hong Kong. *Cornell Hospitality Quarterly, 52*(3), 333-340.

Johansen, L. (1974). *A Multi-sectoral Study of Economic Growth* (2 ed.). Amsterdam: North Holland.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and Control, 12*(2), 231-254.

Jones, C., & Munday, M. (2007). Exploring the Environmental Consequences of Tourism: A Satellite Account Approach. *Journal of Travel Research, 46*(2), 164-172.

Kadir, N., & Jusoff, K. (2010). The Cointegration and Causality Tests for Tourism and Trade in Malaysia. *International Journal of Economics and Finance, 2*(1), 138-143.

Kaplan, M., & Celik, T. (2008). The Impact of Tourism on Economic Performance: The Case of Tureky. *The International Journal of Applied Economics and Finance, 2*(1), 13-18.

Katircioglu, S. T. (2009a). Revisiting the Tourism-led-growth Hypothesis for Turkey Using the Bounds Test and Johansen Approach for Cointegration. *Tourism Management, 30*(1), 17-20.

Katircioglu, S. T. (2009b). Tourism, Trade and Growth: The case of Cyprus. *Applied Economics, 41*(21), 2741-2750.

Katircioglu, S. T. (2010). International Tourism, Higher Education and Economic Growth: The Case of North Cyprus. *The World Economy, 33*(12), 1955-1972.

Katircioglu, S. T. (2011). Tourism and Growth in Singapore: Nex Extension from Bounds Test to Level Relationships and Conditional Granger Causality Tests. *The Singapore Economic Review, 56*(3), 441-453.

KatirciogluTuranSalih. (2010). Research Note: Testing the Tourism-led Growth Hypothesis for Singapore-An Empirical Investigation from Bounds Test to Cointegration and Granger Causality Tests. Tourism Economcis, *16*(4), 1095-1101.

Kehoe, J. T., & Prescott, E. C. (1995). Introduction to the Symposium: The Discipline of Applied General Equilibrium. *Economic Theory, 6*(1), 1-11.

Kim, H. J., Chen, M.-H., & Jang, S. (2006). Tourism Expansion and Economic Development: The Case of Taiwan. *Tourism Management, 27*, 925-933.

Koop, G. (2003). *Bayesian Econometrics.* Chichester: John Wiley & Sons Ltd.

Koopmans, T. C. (1965). On the Concept of Optimal Economic Growth. *The Econometric Approach to Development Planning.* Amsterdam: North Holland, 1965.

Kreishan, F. M. (2010). Tourism and Economic Growth: The Case of Jordan. *European Journal of Social Sciences, 15*(2), 63-68.

Krugman, P. (1990). Increasing Return and Economic Geography. *NBER Working Paper No.3275*.

Kweka, J. (2004). Toursim and the Economy of Tanzania: A CGE Analysis. *The Centre for Study of Africa Economics Conference*, (pp. 21-38). London.

Kydland, F. E., & Prescott, E. C. (1982). Time to Build and Aggregate Fluctuations. *Econometrica, 50*(6), 1345-1370.

Lanza, A., & Pigliaru, F. (1999). Why Are Tourism Countries Small and Fast-growing. *CRENoS Working Paper 199906*.

Lanza, A., Temple, P., & Urga, G. (2003). The Implication of Tourism Specialization in the Long-run: An Econometric Analysis for 13 OECD Economies. *Tourism Management, 3*, 315-321.

Lanza, A., Temple, P., & Urga, G. (2004). The Implications of Tourism Specialisation in the Long Run: An Econometric Analysis for 13 OECD Economies. *Tourism Management, 24*(3), 315-321.

Lars, L. (2012). The New Palgrave Dictionary of Economics, 2012 Version. (2nd). (S. N. Durlauf, & B. E. Lawrance, Eds.) Retrieved from http://www.dictionaryofeconomics.com/article?id=pde2008_L000159&edition=current&q=lucas%20critique&topicid=&result_number=1

Lartey, E. K. (2008). Capital Inflows, Dutch Disease Effects, and Monetary Policy in a Small Open Economy. *Review of International Economics, 15*(6), 971-989.

Lean, H. H., & Tang, C. T. (2010). Is the Tourism-led Growth Hypotehsis Stable for Malaysia? A Note. *International Journal of Tourism Research, 12*(4), 375-378.

Lee, C.-C., & Chang, C.-P. (2008). Tourism Development and Economic Growth: A Closer Look at Panels. *Tourism Management, 29*, 180-192.

Lee, C.-C., & Chien, M.-S. (2008). Structural Breaks, Tourism Development, and Economic Growth:Evidence from Taiwan. *Mathematics and Computers in Simulation, 77*(4), 358-268.

Lee, C.-K., Moon, S., & Mjelde, J. W. (2010). Disentangling the Effects on the Korean Economy of the 9/11 Terriost Attacks from the Short-run Effects of Hosting the 2002 World Cup, Using the CGE Model. *Tourism Economics, 16*(3), 611-628.

Li, S., & Song, H. (2013). Economic Impacts of Visa Restrictions on Tourism: A Case of Twen Events in China. *Annals of Tourism Research, 43*(10), 251-271.

Li, S., Blake, A., & Cooper, C. (2011). Modelling the Economic Impact of International Tourism on the Chinese Economy: A CGE Analysis of the Beijing 2008 Olympics. *Tourism Economics, 17*(2), 279-303.

Libreros, M., Massieu, A., & Meis, S. (2006). Progress in Tourism Satellite Account Implementation and Development. *Journal of Travel Research, 45*(1), 83-91.

Lozano, J., Gómez, C. M., & Rey-Maquieira, J. (2008). The TALC Hypothesis and Economic Growth Theory. *Tourism Economics, 14*(4), 727-749.

Lucas, R. E. (1976). Econometric Policy Evaluation: A Critique. In K. Brunner, & A. Meltzer, *The Phillips Curve and Labor Market, Cambridge-Rochester Conference Series on Public Policy* (pp. 19-46). North Holland.

Lucas, R. E. (1988). On the Mechanics of Economic Growth. *Journal of Monetary Economics, 22*(1), 3-42.

Lucas, R. E., & Sargent, T. J. (1979). After Keynesian Macroeconomics. *Federal Reserve Bank of Minneapolis Quarterly Review, 3*(2), 295-319.

Massidda, C., & Mattana, P. (2013). A SVECM Analysis of the Relationship between International Tourism Arrivals, GDP and Trade in Italy. *Journal of Travel Research, 52*(1), 93-105.

Meis, M. S. (1999). The Canadian Experience in Developing and Using the Tourism Satellite Account. *Tourism Economics, 5*(4), 315-330.

Meng, X., Siriwardana, M., & Pham, T. (2013). A CGE Assessment of Singapore's Tourism Policies. *Tourism Management, 34*, 25-36.

Mortensen, D. T., & Pissarides, C. A. (1994). Job Creation and Job Destruction in the Theory of Unemployment. *The Review of Economic Studies, 61*(3), 397-415.

Narayan, P. K. (2003). Macroecnomic Impact of Nature Disasters on a Small Island Economy: Evidence from a CGE Model. *Applied Economics Letters, 10*(11), 721-723.

Narayan, P. K. (2004). Economic Impact of Tourism on Fiji's Economy: Empirical Evidence from the Computable General Equilibrium Model. *Tourism Economics, 10*(4), 419-433.

Narayan, P. K., Narayan, S., Prasad, A., & Prasad, B. C. (2010). Tourism and Economic Growth: a Panel Data Analysis for Pacific Island Countries. *Tourism Economics, 16*(1), 169-183.

Nash, J. (1950). The Bargaining Problem. *Econometrica, 18*(2), 155-162.

National Statisitcs Institute of Spain (NSIS). (2013). *Spanish Tourism Satellite Account. Base 2008 Series 2008-2012.* Madrid: the author.

National Statistics Institute of Spain (NSIS). (2004). *Spanish Tourism Satellite Account. Base 1995 Series 1995-2003.* Mardrid: the author.

National Statistics Institute of Spain (NSIS). (2010). *Spanish Tourism Satellite Account. Base 2000 Series 2000-2009.* Mardrid: the author.

Nordström, J. (1996). Tourism Satellite Account: Sweden. *Toursim Economics, 2*(1), 13-42.

Nowak, J.-J. (2007). Costal Tourism and 'Dutch Disease'in a Small Island Economy. *Tourism Economics, 13*(1), 49-65.

Nowak, J.-J., Sahli, M., & Cortės-Jimėnez, I. (2007). Tourism, Capital Good Imports and Economic Growth: Theory and Evidence for Spain. *Tourism Economics, 13*(4), 515-536.

Nowak, J.-J., Sahli, M., & Sgro, P. M. (2003). Tourism, Trade and Domestic Welfare. *Pacific Economic Review, 8*(3), 245-258.

Office of Travel and Tourism Industries (OTTI). (2014, Apr 9). *OTTI*. Retrieved from http://travel.trade.gov/research/programs/satellite/

Oh, C.-O. (2005). The Contribution of Tourism Development to Economic Growth in the Korean Economy. *Tourism Management, 26*, 39-44.

Orrego, F., & Vega, G. (2013). Dutch Disease and Fiscal Policy. *The Central Reserve Bank of Peru Working Paper (2013-21).*

Pablo-Romero, M. P., & Molina, J. A. (2013). Tourism and Economic Growth: A Review of Empirical Studies. *Tourism Management Perspectives, 8*, 28-41.

Pfeifer, J. (2014). An Introduction to Graphs in Dynare. Retrieved 8 26, 2015, from https://sites.google.com/site/pfeiferecon/dynare

Pizam, A. (1982). Tourism Manpower: The State of the Art. *Journal of Travel Research, 21*(2), 5-9.

Po, W.-C., & Huang, B.-N. (2008). Tourism Development and Economic Growth – A Nonlinear Approach. *Physica A, 387*(22), 5535-5542.

Pratt, S., & Blake, A. (2009). The Economic Impact of Hawaii's Cruise Industry. *Tourism Analysis, 14*(3), 337-351.

Pratt, S., Blake, A., & Swann, P. (2013). Dynamic General Equilibrium Model with Uncertainty: Uncertainty regarding the Future Path of the Economy. *Economic Modelling, 32*, 429-439.

Ramsey, F. P. (1928). A Mathematical Theory of Saving. *Economic Journal, 38*(152), 543-559.

Razzak, W. (2014). New Zealand Labor Market Dynamics: Pre-and Post-global Financial Crisis. *New Zealand Treasurry Working Paper 14/03*.

Ricardo, D. (1911). *Principles of Political Economy and Taxation.* New York: J.M. Dent & Sons.

Romer, P. M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy, 94*(5), 1002-1037.

Romer, P. M. (1987). Growth Based on Increasing Returns Due to Specialization. *American Economic Review, 77*(2), 56-62.

Romer, P. M. (1990). Endogenous Technological Change. *Journal of Pacific Economy, 98*(5), s71-s102.

Romer, P. M. (1992). Two Strategies for Economic Development: Using Ideas and Producing Ideas. *Annual Conference on Economic Development.* Wanshington DC.

Schubert, S. F., & Brida, J. G. (2009). Macroeconomic Effects of Changes in Tourism Demand: A Simple Dynamic Analysis. *Tourism Ecnomics, 15*(3), 591-613.

Schubert, S. F., & Brida, J. G. (2011). Dynamic Model of Economic Growth in a Small Tourism Driven Economy. *Tourism Economics, 17*(10), 149-168.

Schubert, S. F., Brida, J. G., & Risso, W. A. (2011). The Impacts of International Tourism Demand on Economic Growth of Small Economies Dependent on Tourism. *Tourism Management, 32*(2), 377-385.

Sequeira, T. N., & Campos, C. (2005). International Tourism and Economic Growth: A Panel Data Approach. *Nota Di Lavoro 141.2005*.

Sinclair, M. T. (1998). Tourism and Economic Development: A Survey. *The Journal of Development Studies, 34*(5), 1-51.

Sinclair, M. T., Blake, A., & Gooroochurn, N. (2005). Modelling Tourism Impact on Small Islands Economies: Evidence from Cyprus, Malta and Mauritius. *International Research Foundation for Development, World Forum on Small Island Developing States.*

Smeral, E. (2006). Tourism Satellite Account: A Critical Assessment. *Journal of Travel Research, 45*(1), 92-98.

Smets, F., & Wouters, R. (2002). An Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area. *International Seminar on Macroeconomics NO. 171.*

Smets, F., & Wouters, R. (2003). An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area. *Journal of the European Economic Association, 1*(5), 1123-1175.

Smith, S. (1995). The Tourism Satellite Account: Perspectives of Canadian Tourism Associations and Organizations. *Tourism Economics, 1*(3), 225-244.

Solow, R. (2010). Builing a Science of Economics for the Real World. *House Committee on Science and Technology Subcommittee on Investigations and Oversight*.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *Quartely Journal of Economics, 70*(1), 65-94.

Song, H., Dwyer, L., Li, G., & Cao, Z. (2012). Tourism Economic Research: A Review and Assessment. *Annals of Tourism Research, 39*(3), 1653-1682.

Song, H., Kim, J. H., & Yang, S. (2010). Confidence Intervals for Tourism Elasticities. *Annals of Tourism Research, 37*(2), 377-396.

Song, H., Li, G., Lin, S., Liu, A., & Qiu, T. (2015). *Asia Pacific Visitor Forecasts 2015-2019.* Bangkok: Pacific Asia Travel Association.

South Pacific Tourism Organization (SPTO). (2013). *Promoting Sustainable Development in Large Ocean States: Torism as a Pillar Economic Growth.* Retrieved from Pacific Islands Forum Secretariat: http://www.forumsec.org/resources/uploads/attachments/documents/2013FEMM_FEMT.06.pdf

Srinivasan, T. N. (1964). Optimal Savings in a Two-Sector Model of Growth. *Econometrica, 32*(3), 358-373.

Statistics New Zealand. (2013). *Tourism Satellite Account 1995-2013.* Wellington: the author. Retrieved from www.stats.govt.nz

Statistics Mauritius. (2015, 10 2). *Statistics Mauritius.* Retrieved 11 14, 2015, from http://statsmauritius.govmu.org/English/StatsbySubj/Pages/Historical-Series--Tourism.aspx

Sugiyarto, G., Blake, A., & Sinclair, M. T. (2003). Tourism and Globalization: Economic Impact in Indonesia. *Annals of Tourism Research, 30*(3), 683-701.

Swan, T. W. (1956). Economic Growth and Capital Accumulation. *Economic Record, 32*(2), 334-361.

Taylor, L., & Black, S. L. (1974). Practical General Equilibrium Estimation of Resources Pulls under Trade Liberalization. *Journal of International Economics, 4*(1), 37-58.

The Hong Kong SAR Government. (2013). *The 2013-14 Budget of Hong Kong SAR Government.* Hong Kong: the author.

The World Bank. (2014). *Global Economic Monitor.* Retrieved from The World Bank: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries?display=default

Tourism-Review. (2013). *Spanish Government Will Allocate EUR 221 Million to Tourism Business.* Retrieved from Tourism-Review.com: http://www.tourism-review.com/spain-government-will-grant-eur-221-million-to-tourism-businesses--news3966

Townsend, R. (2010). Financial Structure and Economic Welfare: Applied General Equilibrium Development Economics. *Annual Review of Economics, 2*, 507-546.

Uhlig, H. (1999). A Toolkit for Analyzing Non-linear Dynamic Stochastic Models Easily. In R. Marimon, & A. Scott, *Computational Methods for the Study of Dynamic Economics* (pp. 30-61). New York: Oxford University Press.

United Nations, the European Communities, Organization for Economic Cooperation and, Development, & World Tourism Organization. (2001). *TSA: Recommended Methodolocial Framework.* Mandrid: World Tourism Organiztion (herein TSA: RMF 2001).

Untied Nations, the European Communities, Organization for Economic Cooperation and , Development, & World Tourism Organization. (2008). *TSA: Recommended Methodolocial Framework.* Mandrid: World Tourism Organization (herein TSA: RMF).

Varian, H. R. (2009). *Intermediate Microeconomics-A Modern Approach* (8 ed.). New York: W. W. Norton & Company.

Wickens, M. (2012). *Macroeconomic Theory: A Dynamic General Equilibrium Approach* (2 ed.). London: Preceton University Press.

World Tourism Organization (UNWTO). (1999). *Annuaire Yearbook of Tourism Statistics 1994-1998.* Mardrid: the author.

World Tourism Organization (UNWTO). (2002). *Annuaire Yearbook of Tourism Statistics 2002.* Mardrid: the author.

World Tourism Organization (UNWTO). (2004). *Conpendium of Tourism Statistics 2004.* Mardrid: the author.

World Tourism Organization (UNWTO). (2006). *The Tourism Market Trend.* Madrid: the author.

World Tourism Organization (UNWTO). (2007a). *Annuaire Yearbook of Tourism Statistics 2007.* Mardrid: the author.

World Tourism Organization (UNWTO). (2007b). *Conpendium of Tourism Statistics 2007.* Mardrid: the author.

World Tourism Organization (UNWTO). (2011). *Annuaire Yearbook of Tourism Statistics 2011.* Mardrid: the author.

World Tourism Organization (UNWTO). (2012). *Conpendium of Tourism Statistics 2012.* Mardrid: the author.

World Tourism Organization (UNWTO). (2013). *The UNWTO World Tourism Barometer (vol.11).* Madrid: the author.

World Tourism Organization (UNWTO). (2014). *The UNWTO World Tourism Barometer (vol.12).* Madrid: the author.

World Tourism Organization (UNWTO). (2015). *The UNWTO Tourism Highlights 2015*. Madrid: the author.

World Tourism Organization. (2012b). Initial Findings of UNTWO Study on Domestic Tourism across Asia and the Pacific. *UNWTO Commision for East Asia and the Pacific 24th Joint Meeting.* Chiang Mai: UNWTO.

World Travel & Tourism Council (WTTC). (2013a). *Economic Impact of Travel & Tourism Mid-Year Update of 2013.* London: the author.

World Travel & Tourism Council (WTTC). (2013b). *Economic Impact Research: Key Definitions.* Retrieved from WTTC: http://www.wttc.org/research/economic-impact-research/methodology/

World Travel & Tourism Council (WTTC). (2013c). *Methodology for Producing the 2013 WTTC/Oxford Economics Travel & Toursim Economic Impact Research.* London: the author.

World Travel & Tourism Council (WTTC). (2014). *Economic Data Search Tool.* Retrieved from WTTC: http://www.wttc.org/research/economic-data-search-tool/

World Travel & Tourism Council (WTTC). (2014, 2 12). *Economic Data Search Tool.* Retrieved from WTTC: http://www.wttc.org/research/economic-data-search-tool/

Xinhua Net. (2011). *China Vows to Nurture Tourism into Pillar Industry over Next 5 Years.* Retrieved from Xinhua Net: http://news.xinhuanet.com/english2010/china/2011-04/11/c_13823828.htm

Xinhua Net. (2013). *China Focus: New Tourism Law Spurs Chinese Independant Travel.* Retrieved from Xinhua Net: http://news.xinhuanet.com/english/china/2013-10/03/c_132770477.htm

Yang, H.-Y., & Chen, K.-H. (2009). A General Equilibrium Analysis of Economic Impact of a Tourism Crisis: A Case Study of the SARS Epidemic in Taiwan. *Journal of Policy Research in Tourism, Leisure and Events, 1*(1), 37-60.

Zhang, W. (2013). Tourism and Economic Structure in a Small-Open Growth Model. *Journal of Environmental Management and Tourism, 3*(2), 76-89.

Zhou, D., Yanagida, J. F., Chakravorty, U., & Leung, P. (1997). Estimating Economic Impacts from Tourism. *Annals of Tourism Research, 24*(1), 76-89.