Modelling Economic Interdependencies of International Tourism Demand: The Global Vector Autoregressive Approach

by

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Declaration of Originality

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Abstract

Tourism demand is one of the major areas of tourism economics research. The current research studies the interdependencies of international tourism demand across 24 major countries around the world. To this end, it proposes to develop a tourism demand model using an innovative approach, called the global vector autoregressive (GVAR) model.

While existing tourism demand models are successful in measuring the causal effects of economic variables on tourism demand for a single origin-destination pair, they tend to miss the spillover effects onto other countries. In the era of globalisation, tourism destinations become interdependent on each other. Impacts of a distant event can be transmitted across borders and be felt globally. Hence, modelling international tourism demand requires one to go beyond a particular origin-destination pair, and take into account the interdependencies across multiple countries. The proposed approach overcomes the 'curse of dimensionality' when modelling a large set of endogenous variables.

The empirical results show that, to different extents, co-movements of international tourism demand and of macroeconomic variables are observed across all the 24 countries. In the event of a negative shock to China's real income level and that to China's own price level, it is found that in the short run, almost all countries will face fluctuations in their international tourism demand and their own price. But in the long run the shocks will impact on developing countries and China's neighbouring countries more deeply than on developed countries in the West.

The current research contributes to the knowledge on tourism demand. It models tourism demand in the setting of globalisation and quantifies the interdependencies across major countries. On the practical front, tourism policy makers and business practitioners can make use of the model and the results to gauge the scale of impacts of unexpected events on the international tourism demand of their native markets.

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Zheng Cao
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List of Abbreviations

ADF	Augmented Dickey-Fuller
ADLM	Autoregressive Distributed Lag Model
AGARCH	Asymmetric Generalised Autoregressive Conditional Heteroskedasticity
AGO	Accumulated Generation Operation
AI	Artificial Intelligence
AIC	Akaike Information Criterion
AIDS	Almost Ideal Demand System
ANN	Artificial Neural Network
APD	Air Passenger Duty
AR	Autoregressive
ARFIMA	Fractional Autoregressive Integrated Moving Average
ARIMA	Autoregressive Integrated Moving Average
ARIMAX	Autoregressive Integrated Moving Average model with explanatory variables
ARMA	Autoregressive Moving Average
BPM	Balance of Payments and International Investment Position Manual
BOP	Balance of Payments
BRICS	Brazil, Russia, India, China and South Africa
BSM	Basic Structural Model
CCC	Constant Conditional Correlation
CI	Co-Integration
CLSDV	Corrected Least Squares Dummy Variable
CPI	Consumer Price Index
CRS	Computerised Reservations Systems
DF	Dickey-Fuller test
DGP	Data Generating Process

DMO	Destination Marketing Organisation
EC	Error Correction
ECM	Error Correction Model
ECT	Error Correction Term
EGARCH	Exponential Generalised Autoregressive Conditional Heteroskedasticity
ES	Exponential Smoothing
FE	Fixed Effects
GA	Genetic Algorithms
GARCH	Generalised Autoregressive Conditional Heteroskedasticity
GATS	General Agreement on Trade in Services
GATT	General Agreement on Trade and Tariffs
GDP	Gross Domestic Product
GIR	Generalised Impulse Response
GMM	Generalised Method of Moments
GNP	Gross National Product
GVAR	Global Vector Autoregressive
HKTB	Hong Kong Tourism Board
H-O	Heckshcer-Olin
IATA	International Air Transport Association
ICP	International Comparison Programme
ILO	International Labour Organisation
IMF	International Monetary Fund
IOM	International Organisation of Migration
IPS	Im, Pesaran, and Shin
IV	Instrument Variable
JML	Johansen Maximum Likelihood
KF	Kalman Filter
KPSS	Kwiatkowski, Phillips, Schmidt, and Shin

LAIDS	Linear Almost Ideal Demand System
LCC	Latent Cycle Component
LES	Linear Expenditure System
LLC	Levin, Lin, and Chu test
LR	Long-Run
LSDV	Least Squares Dummy Variable
MA	Moving Average
MAE	Mean Absolute Error
MAPE	Mean Absolute Percentage Error
MGARCH	Multivariate Generalised Autoregressive Conditional Heteroskedasticity
ML	Maximum Likelihood
MLP	Multi-Layer Perceptron
NIE	Newly Industrialising Economies
NTB	Non-Tariff Barriers
OECD	Organisation for Economic Co-operation and Development
OIR	Orthogonalised Impulse Response
OLI	Ownership-Location-Internationalisation
OLS	Ordinary Least Square
ONS	Office for National Statistics
PP	Phillips-Perron
PPs	Persistence Profiles
RBF	Radial Basis Function
RMB	Renminbi (Chinese currency)
RMSE	Root Mean Square Error
ROW	Rest of the World
SARIMA	Seasonal Autoregressive Integrated Moving Average
SARS	Severe Acute Respiratory Syndrome
SBC	Schwarz Bayesian Criterion

SDR	Special Drawing Right
SME	Small and Medium-sized Enterprises
STSM	Structural Time Series Model
SURE	Seemingly Unrelated Regression Estimator
SVM	Support Vector Machine
SVR	Support Vector Regression
TGARCH	Threshold Generalised Autoregressive Conditional Heteroskedasticity
TKIG	Tourism exports-Capital goods imports-Growth
TLG	Tourism-Led-Growth
TNC	Transnational Corporations
TPI	Toruist Price Indices
TSLS	Two-Stage Least Squares
TVP	Time-Varying-Parameter
TVP-LRM	Time-Varying-Parameter Long-Run Model
UNWTO	United Nations World Tourism Organisation
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
VECMX	Vector Error Correction Model with exogenous variables
VISTS	Vector Innovations Structural Time-Series
VMA	Vector Moving Average
WB	Wickens-Breusch approach
WS-ADF	Weighted Symmetric Augmented Dickey-Fuller
WTO	World Trade Organisation
WTTC	World Travel & Tourism Council
XCV	Structural time series model with explanatory variables
3SLS	Three-Stage Least Square

Chapter 1. Introduction

1.1 Tourism in a Global Environment

Internatioanl tourism is one of the most important sectors for an open economy. It is a sector that is able to earn substantial foreign exchange, generate continuous employment to local residents, and boost the national economy. That is why the United Nations World Tourism Organisation (UNWTO) constantly describes tourism as a 'key to development, prosperity and well-being' (UNWTO, 2013, 2014a, 2015).

Despite occasional shocks, tourism has shown almost uninterrupted growth over the past few decades. International tourist arrivals have increased from 25 million globally in 1950, to 278 million in 1980, 527 million in 1995, and 1,133 million in 2014. Correspondingly, international tourism receipts earned by destinations worldwide have surged from US$ 2 billion in 1950 to US$ 104 billion in 1980, US$ 415 billion in 1995 and US$ 1,245 billion in 2014 (UNWTO, 2015). Table 1.1 summarises some key figures of tourism in the world.

Table 1.1 - Tourism in the World: Key Figures in 2014

Economic output	9% of GDP - direct, indirect and induced impact
Employment	1 in 11 jobs
International Trade	US$ 1.5 trillion in exports 6% of the world's exports
Movement of people	from 25 million international tourists in 1950 to 1,133 million in 2014 1.8 billion international tourists forecast for 2030

Source: Adapted from UNWTO (2015)

Major countries around the globe tend to actively engage in international tourism. They are usually top destinations receiving thousands of millions of tourists every year, while at the same time they are among the top spenders in overseas travel. Table 1.2, Table 1.3 and Table 1.4 show the major players in international tourism over the recent five years.

Table 1.2 - Top destinations in terms of international tourist arrivals

Ranking	2014	2013	2012	2011	2010
1	France	France	France	France	France
2	USA	USA	USA	USA	USA
3	Spain	Spain	China	China	China
4	China	China	Spain	Spain	Spain
5	Italy	Italy	Italy	Italy	Italy
6	Turkey	Turkey	Turkey	Turkey	UK
7	Germany	Germany	Germany	UK	Turkey
8	UK	UK	UK	Germany	Germany
9	Russia	Russia	Russia	Malaysia	Malaysia
10	Mexico	Thailand	Malaysia	Mexico	Mexico

Source: Tourism highlights (UNWTO, 2015, 2014a, 2013, 2012b, 2011a)

Table 1.3 - Top destinations in terms of international tourism receipts

Ranking	2014	2013	2012	2011	2010
1	USA	USA	USA	USA	USA
2	Spain	Spain	Spain	Spain	Spain
3	China	France	France	France	France
4	France	China	China	China	China
5	Macao	Macao	Macao	Italy	Italy
6	Italy	Italy	Italy	Germany	Italy
7	UK	Thailand	Germany	UK	Germany
8	Germany	Germany	UK	Australia	UK
9	Thailand	UK	Hong Kong	Macao	Hong Kong
10	Hong Kong	Hong Kong	Australia	Hong Kong	Turkey

Source: Tourism highlights (UNWTO, 2015, 2014a, 2013, 2012b, 2011a)

Table 1.4 - Top spenders in terms of international tourism expenditure

Ranking	2014	2013	2012	2011	2010
1	China	China	China	Germany	Germany
2	USA	USA	Germany	USA	USA
3	Germany	Germany	USA	China	China
4	UK	Russia	UK	UK	UK
5	Russia	UK	Russia	France	France
6	France	France	France	Canada	Canada
7	Canada	Canada	Canada	Russia	Japan
8	Italy	Australia	Japan	Italy	Italy
9	Australia	Italy	Australia	Japan	Russia
10	Brazil	Brazil	Italy	Australia	Australia

Source: Tourism highlights (UNWTO, 2015, 2014a, 2013, 2012b, 2011a)

From the above tables, it is obvious that the major tourism origin and destination countries are also major economies in the world. This is a suggestion of a close relationship between international tourism and local economic development. It is also observed that the top ten players in international tourism widely spread across continents, even though many of them are in Europe. International tourism, as a part of the world economy, involves an extensive area of countries.

As a sector that immensely engages with trade in goods and services, flows of foreign exchange and movement of people, international tourism entails all the main aspects of economic globalisation. It is through these three channels that the ties between tourism destinations are strengthened. With growing interconnections, countries are becoming more and more interdependent, especially economically.

As such, tourism businesses in a country are now operating in an increasingly global environment. Not only are the incoming tourists strikingly diverse, but also the choice of overseas destiantions for outgoing residents is becoming abundant. Moreover, more and more businesses (for example, hotel groups and airlines) are extending their geographical presence by forming multi-national corporations to reach out beyond their native market. Consequently, tourism businesses are inevitably facing a broad range of uncertainties at home and abroad. Uncertainties of macroeconomic environment will ultimately reflect on the performance of local tourism businesses, in terms of their revenues, costs, and profits.

On the one hand, tourism demand for a destination is greatly influenced by the economic situation in the tourist-generating countries. The economic performance of the destination is thus impacted on by the fluctuations in the origin countries. On the other hand, as the residents of the destination travel to other overseas countries, they further spillover the impacts. Hence, events in even a remote country can easily travel across borders and cause global implications. Turmoils, or shocks, such as the financial crisis in the USA, the great earthquakes in Japan and the political unrests in the Arabic countries, are no longer confined to a single region. They exert influences on other parts of the world as well.

Therefore, given the importance of tourism to economic development and the global nature of business environment, it is of particular interests to tourism policy makers as well as business practitioners to measure their interdependencies on other countries and gauge the impacts of events on their tourism demand.

1.2 Challenges for Tourism Economics Research

Tourism demand is one of the most researched areas in tourism economics. Relevant topics span from tourist behaviours at the micro level to tourist flows at the macro level. Quantitative methods are widely used to model the destination choices of tourists, to forecast the future levels of tourist flows and to assess the effects of specific factors/events.

At the macro level, tourism demand analysis is particularly relevant to both policy makers and business practitioners to monitor the trends of tourism demand. Tourism businesses form their decisions of procurement, investment and employment based on the expected values of future tourism demand and the expected effects of a change in tourism demand determinants. Hence, tourism demand studies have extensive practical significance.

Ever since the very early tourism demand studies in the 1960s, researchers have developed and adopted various econometric models to account for the causal effects of economic factors (in an origin country) on tourism demand (in a destination). While the models are able to generate accurate forecasts, the results are usually limited to a single origin-destination pair only. Aspects such as the effects on a destination's local economy and the spillovers to other destinations are thus not modelled. From a theoretical point of view, this limitation arises because most of the existing models only allow for a unidirectional causal relationship in one model. Although attempts have been made to include multiple origin-destination pairs (hence multiple causal relationships) in certain models, they tend to be hampered by the relatively large number of parameters against limited observations of data.

As a result, within the existing tourism demand modelling frameworks, it is difficult to properly quantify the interdependencies across countries in the world. In a globalising setting, tourism destintions are increasingly reliant on each other especially economically. Modelling tourist flows and gauging the impacts of a distant event require one to go beyond a particular origin-destination pair, and take into consideration the global interdependencies across countries.

Summing up the above points, a research gap is very clear that *no existing studies have modelled and analysed the economic interdependencies of tourism demand across a number of countries on a global level*. This can be further elaborated as follows:

1. There are no tourism studies that discuss in great details why and how international tourism sectors across different countries become interdependent on each other, from the demand perspective;
2. There are no tourism studies that scientifically quantify the magnitude of interdependencies across major countries in the world;
3. There are no tourism studies that simulate the impacts of a country-specific shock on the major countries in the world.

The current research is set out to develop a tourism demand model using an innovative modelling approach, which is able to overcome the limitations of existing models.

1.3 Research Aims and Objectives

By filling the research gaps identified above, the current research aims to extend the knowledge on international tourism demand. Specifically, the following questions are to be answered:

1. To what extent will a country’s international tourism demand and its local economy be affected by changes in its external world?
2. In the event of a shock to China, how much will the shock impact on other countries’ international tourism demand and their local economies?

Answering the first question provides a measure of the degree to which a country is integrated with the other parts of the world. The second question tests how deeply the events in China can impact on other countries. Answers to the second question not only indicates how closely the countries around the world are linked to each other, but are also a reminder of the increasingly important roles played by emerging economies.

To this end, an advanced modelling approach called global vector autoregressive (GVAR) model is proposed to be used. The approach was developed by Pesaran, Schuermann, and Weiner (2004) and further extended by Dee, Mauro, Pesaran, and Smith (2007). It was initially applied to macroeconomic studies on global economic linkages, and is appropriate for tourism demand studies in a global setting as well.

In view of the research gap and the research questions, the current research is intended to achieve the following objetives:

1. To quantify the interdependencies of international tourism demand across major countries;
2. To develop a tourism demand model using the GVAR approach;
3. To carry out simulations of China’s impacts on other countries’ international tourism demand in the event of shocks to the Chinese economy;
4. To draw policy implications for major countries.

1.4 Structure of This Research

The current research is organised into seven full chapters, with the first being the introduction and the last being the conclusions.

Chapter 2 to Chapter 4 are the literature reviews. Three main blocks of literature are of particular relevance. Chapter 2 presents the basic concepts of tourism demand, including the definitions and the measurement. Then much of the focus is placed on the influencing factors of tourism demand, especially those that have been evidenced by empirical models to play significant roles. In particular, the economic foundation to reason the importance of those influencing factors is discussed in great details. Chapter 3 then reviews the existing empirical models that feature in various tourism demand studies. The chapter follows the usual divide of models into two major groups. The first is econometric models, which account for the causal relationship between economic factors and tourism demand. The other is time series models, which only utilise information about the temporal characteristics of tourism demand itself. In addition to the two major groups, an alternative group of models is briefly introduced, which relies on artificial-intelligence (AI) techniques. Through introducing the different groups of models, their limitations are reflected as well. Chapter 4 focuses on the realistic background of the current research. Globalisation is regarded as a backdrop that governs cross-country relationships in contemporary times. As such, driving forces of globalisation and contesting scholarly views on the development of globalisation are presented at length. However, much of the emphasis is placed on the economic aspects and the interdependent nature of cross-country relationship. That is because the specifications of econometric model in the current research are informed in line with the reality of economic interdependencies across countries. To resonate with one of the research objectives, some basic facts of the Chinese economy will be presented. At the end of Chapter 4, the research gaps will be further elaborated to justify the significance of the current research.

Chapter 5 and Chapter 6 are the empirical parts. Chapter 5 illustrates the modelling process of GVAR approach and describes the data. Among the chapter's sub-sections, the model inference part is particularly important to understand the novelty of the GVAR approach. Chapter 6 reports the main empirical results, discusses the findings and draws the practical implications. The core results intended from the current research are the contemporaneous impact elasticities and the impulse responses, which answer the research questions.

In Chapter 7, the conclusions will be made with regard to the major findings, contributions and limitations of the current research. The chapter, as well as the whole research, will be concluded with some recommendations for future directions. It is intended that, the current research will generate both theoretical and practical contributions, and become a valuable addition to tourism economics literature.

Chapter 2. Tourism Demand and Its Influencing Factors

2.1 Introduction

Tourism demand has been one of the most researched areas in tourism economics. It directly links to the economic performance of the tourism sector in a destination. From a more practical point of view, modelling tourism demand constitutes a good starting point for policy analysis and business strategy, as decisions are often formed in an attempt to elicit or adjust to changes in tourism demand.

This chapter serves to understand the basic concepts of tourism demand, explore the logic behind the formation of tourism demand and identify its influencing factors, from both the theoretical and the empirical points of view. Section 2.2 highlights that international tourism is first and foremost an integrated part of international trade. The definition of tourism demand is thus delineated and contrasted based on the terminology used by international organisations such as the International Monetary Fund (IMF) and the United Nations World Tourism Organisation (UNWTO). Then Section 2.3 proceeds to discuss the measurements of tourism demand, with a view to revealing the implications behind each measure. Section 2.4 concerns tourists' decision-making process and identifies the influencing factors. Specifically, consumer demand theory is used to reason how consumers reach their travel decisions and what factors they consider. Two broad sets of factors, i.e., economic and socio-psychological, will be discussed accordingly. However, emphasis and elaboration will be placed on the economic factors. After all, the goal here is not to provide an exhaustive identification of the influencing factors, as this will tend to be inconclusive. Instead, the link to economic theory is stressed. Given their high relevance to the current research and certain pragmatic considerations in constructing statistical models, the economic factors that have been suggested by theory and that have recurrently been supported by empirical evidence will receive the major attention.

2.2 Concepts and Definitions

The notion of *tourism* is associated with the activities of visitors. A *visitor* is someone who takes a trip to a main destination outside his/her usual environment, for less than a year, and for any main purpose (business, leisure or other personal purpose) other than to be employed by a resident entity in the place visited (United Nations, 2010a, p.10). These trips taken by visitors qualify as tourism trips. Synonymously, the IMF uses the term *travel* to refer to *tourism* activities[1] (IMF, 2005, p.64). Since the literature from both the UNWTO and the IMF will be surveyed, the terms *travel* and *tourism* will be referred to interchangeably henceforth.

An *international visitor* is a traveller who is a non-resident travelling in the country of reference or a resident travelling outside of it on a tourism trip (United Nations, 2010a, p.16). Based on their length of stay, international visitors are disaggregated into two categories, i.e., *tourists* (or *overnight visitors*) and *same-day visitors* (or *excursionists*). Such a classification, as noted by United Nations (2010b), is helpful to identify their significantly different structures of consumption.

As a major category of international trade, tourism activities are normally recorded under the *current account* of the *balance of payments* (BOP), alongside other components such as the trade in goods, financial services and other business services. By nature, tourism is distinguishable from other trading activities in that it is a demand-oriented activity. A visitor moves to the location of the provider (organisations and residents of the economy visited) for the goods and services desired by the visitor (IMF, 2005, p.64). In this sense, tourism is not a specific type of service but an assortment of services consumed by visitors.

Broadly speaking, in relation to the country of reference, international tourism consists of *inbound tourism* and *outbound tourism*. *Inbound tourism* corresponds to the activities of a non-resident visitor within the country concerned on an incoming tourism trip, whereas *outbound tourism* consists of the activities of a resident visitor outside the country concerned either as part of an outward tourism trip or as part of a domestic tourism trip (United Nations, 2010a, p.15). In the latter case, i.e., part of a domestic trip, an example suggested by UNWTO (2014b, p.38) is that a person may have to travel to a domestic city for his/her flight departure before travelling abroad. While in that city he/she may stay there for a few days. This component of the whole trip would be measured as a domestic visit.

[1] It should be noted that conceptually there should be a distinction between *travel* and *tourism*. *Travel* usually covers trips for any purpose and for any duration, which indicates *tourism* should be a subset of *travel*. This is in accordance with UNWTO's (United Nations, 2010a) recommendation. But in IMF's manual of balance of payments (IMF, 2005), a narrow definition of *travel* is adopted, and no such distinction between *travel* and *tourism* is made.

In monetary terms, inbound tourism brings revenues into the local economy of the country concerned and thus is equivalent to *exports*, while outbound tourism constitutes financial leakage of the economy and thus is treated as *imports*. It is defined by IMF (2009, p.166) that *travel credits* (or *tourism exports* henceforth[1]) cover goods and services for own use or to give away acquired from an economy by non-residents during visits to that economy. *Travel debits* (or *tourism imports* henceforth) cover goods and services for own use or to give away acquired from other economies by residents during visits to these other economies. Based on the main purpose, the standard component breakdown of these items consists of *business* travel and *personal* travel, with supplementary data for groups of special interest, such as border, seasonal, and other short-term workers. As an example only, Table 2.1 provides a summary of trade in travel services, i.e. the travel items, adapted from UK's balance of payments (BOP).

[1] In balance of payments, receipts of payments from foreigners, e.g., exports of goods and services, are credits (+) to current account; likewise, payments to foreigners, e.g., imports of goods and services, are debits (-) to current account.

Table 2.1 - Summary of Trade in Travel Services, UK

		2007	2008	2009	2010	2011
						£ million
Exports						
Business						
Expenditure by seasonal & border workers	FJCQ	263	260	184	268	261
Other	FJNO	4 627	4 574	3 744	4 106	4 460
Total business travel	FJPG	4 890	4 834	3 928	4 374	4 721
Personal						
Health related	FJCX	81	83	69	132	113
Education related	FJDD	3 860	3 957	3 802	5 021	4 477
Other	FJDG	10 461	10 724	11 554	11 442	12 577
Total personal travel	FJTU	14 402	14 764	15 425	16 595	17 167
Total	FJPF	**19 292**	**19 598**	**19 353**	**20 969**	**21 888**
Imports						
Business						
Expenditure by seasonal & border workers	FJDO	222	228	221	123	245
Other	FJNP	5 142	5 282	4 408	4 502	4 700
Total business travel	FJQY	5 364	5 510	4 629	4 625	4 945
Personal						
Health related	FJDT	66	69	81	62	70
Education related	FJDV	179	187	159	223	223
Other	APPW	30 083	31 490	27 319	27 450	26 592
Total personal travel	APQW	30 328	31 746	27 559	27 735	26 885
Total	APQA	**35 692**	**37 256**	**32 188**	**32 360**	**31 830**
Balances						
Business						
Expenditure by seasonal & border workers	FJCR	41	32	-37	145	16
Other	FJCW	-515	-708	-664	-396	-240
Total business travel	FJSS	-474	-676	-701	-251	-224
Personal						
Health related	FJCY	15	14	-12	70	43
Education related	FJDE	3 681	3 770	3 643	4 798	4 254
Other	FJDH	-19 622	-20 766	-15 765	-16 008	-14 015
Total personal travel	FJTW	-15 926	-16 982	-12 134	-11 140	-9 718
Total	FJSR	**-16 400**	**-17 658**	**-12 835**	**-11 391**	**-9 942**

Source: ONS, adapted from Office for National Statistics (2012), p.52.

Closely linked to the travel items in BOP, the concept of *tourism expenditure* has a more inclusive meaning. It covers the amount paid for the acquisition of consumption goods and services, as well as valuables, for own use or to give away, for and during tourism trips (United Nations, 2010a, p.31). Typically its breakdown includes accommodation, food and beverage, shopping, sightseeing, transportation, etc. Compared to the items in BOP, tourism expenditure corresponds to the value of the *travel item* plus that of the *passenger transport item*[1] (UNWTO, 2012a). The two items from BOP consistute the basis for the secondary data to be collected in the current research. Figure 2.1 provides a comparison between the concepts used by IMF and UNWTO. The consistency between IMF's BOP and UNWTO's data is acknowledged by the World Travel and Tourism Council (WTTC, 2015).

2.3 Measurement of Tourism Demand

The concept of *tourism demand* originates from the classical definition of demand in economics, namely the desire to possess a commodity or to make use of a service, combined with the ability to purchase it (Song, Li, Witt, & Fei, 2010). It is seen as a special form of demand in that a tourism product is a bundle of complementary goods and services (Morley, 1992; Song, Li, Witt, & Fei, 2010).

There are four measurement criteria for all types of travel and tourism demand. As summarised by Song, Li, Witt, and Fei (2010), these are (1) a doer criterion: such as the number of tourist arrivals, the number of tourist visits and the visit rate; (2) a pecuniary criterion: for example the level of tourist expenditure (receipts) and the share of expenditure (receipts) in income; (3) a time-consumed criterion: such as tourist-days, tourist-nights; and (4) a distance-travelled criterion: for instance, the distance travelled in miles or kilometres. In empirical tourism demand studies, the measures that stand out are the first three criteria, i.e., tourist arrivals, tourism expenditure (receipts) and length of stay, with each characterising the *spatial*, *monetary* and *temporal* dimension of tourism, respectively. Predominantly, the level of tourism expenditure (or sometimes *tourism receipts*[2]) and the number of arrivals

[1] The travel item in BOP only records the spending in the country being visited. In this sense, it covers international visitors' transportation within the destination. However, the international transportation that moves visitors between countries is recorded by a separate item in BOP called *transportation*, which includes the carriage of passengers, the movement of goods (freight), rentals (charters) of carriers with crew, and related supporting and auxiliary services (IMF, 2005, p.61; UNWTO, 2012a, p.576).

[2] For destination, the monetary flow is receipts; for tourists (or country of origin), it is expenditure.

(or sometimes *departures*[1]), along with their variations in per capital terms, are the most often seen in literature (Song, Li, Witt, & Fei, 2010; Song, Witt, & Li, 2009). In the meantime, efforts have been found to analyse the length of stay more thoroughly in recent studies (e.g., Barros & Machado, 2010; Gokovali, Bahar, & Kozak, 2007; Martínez-Garcia & Raya, 2008). Table 2.2 provides an overview of the use of different tourism demand measures in previous studies.

Table 2.2 - Tourism demand measures identified in previous review studies

Unit: number of studies

	Crouch (1994)	**Lim (1997)**	**Li *et al* (2005)**
Tourist arrivals (departures)	51	51	53
Tourist expenditure (receipts)	40	49	24
Length of stay	3	6	0
Nights spent at tourist accommodation	6	4	1
Others	5	9	10
Total studies reviewed*	80	100	84
Periods of publications under review	1961-1992	1961-1994	1990-2004

Source: adapted from Song, Li, Witt, & Fei (2010)

**: Some studies use more than one measure of tourism demand*

[1] For destination, the visitor flow is arrivals; for country of origin, it is departures.

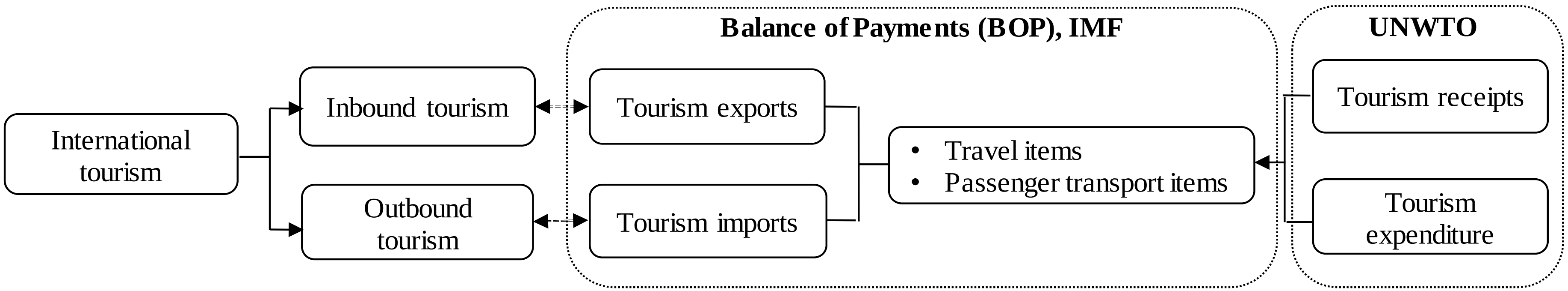

Figure 2.1 - Comparison between concepts

Source: Summariesd by the author

2.3.1 Tourism Expenditure

As defined by the United Nations (2010a, p.31), tourism expenditure covers all the consumption of goods and services, as well as valuables, for and during tourism trips by visitors. The concept therefore includes potentially all individual items deemed as consumption goods and services by *National Accounts*. The use of tourism expenditure measure, as noted by Song, Witt and Li (2009, p.27), is often associated with system demand models, such as the linear expenditure system (LES) and the almost ideal demand system (AIDS). On the practical front, tourism expenditure is a straightforward measure of a destination's economic performance, which is highly relevant to destination competitiveness assessments (Li, Song, Cao, & Wu, 2013).

The primary data on tourism expenditure are usually surveyed at the border. Tourism expenditure is often disaggregated into a variety of product categories. For example, the United Nations (2010b, p.51) recommends a breakdown that encompasses accommodation, food and beverage, transport, travel agency services, cultural services, and etc. Once the questionnaire is set up, border surveys could be carried out on a periodic basis. However, as with many other surveys, the data collected inevitably suffer from certain biases, such as recall bias and memory effects (Frechtling, 2006). This poses a question mark on how accurate the data of tourism expenditure can be. Examples of empirical studies that employ surveyed expenditure data are Li, Song, Cao, and Wu (2013) and Wu, Li, and Song (2012), both of which used the annual tourism expenditure data reported by the Hong Kong Tourism Board (HKTB).

An alternative estimation method would probably be using central bank data, by borrowing trade in services figures from the balance of payments (BOP). Gray (1966) and Artus (1972) are among the earliest and the few which analyse travel exports and imports. Continuous efforts can be found in the studies by Smeral (2004), Smeral and Weber (2000), and Smeral and Witt (1996), where tourism demand was defined as *real tourism exports* and/or *real tourism imports* at base year (1985) price in US dollar terms. The current research follows the same practice of using trade figures of tourism as raw data.

One merit of trade figures is their high relevance to policy making. The balance between exports and imports is often a government's policy target, given that it will have implications on other key indicators such as exchange rates, consumer price index (CPI) and interest rates. Indeed, seeing international tourism as a form of service trade also puts the sector into a bigger perspective. The trade figures of tourism from the BOP can be directly compared to other figures such as exports and imports of goods, commodities, and other services. This comparison helps macroeconomic policy makers to gauge the developments across different sectors and each sector's competitiveness in a global environment.

In spite of the rich implications, the use of tourism exports and tourism imports statistics is not without problem. As discussed by Frechtling (2006) and Stabler, Papatheodorou and Sinclair (2010, pp.49-50), the validity of central bank data in measuring tourism demand depends on how accurately and properly the foreign exchange transactions related to tourist consumptions are recorded. For example, tourists may pre-pay for an all-inclusive package in the origin, therefore spending recorded at the destination may not fully reflect the tourists' actual expenditures. The problem will be more apparent in the case of a monetary union, where the boundary of a nation remains but the different denominations of currency are removed.

2.3.2 Tourist Arrivals

As shown in Table 2.2, the tourist arrivals measure enjoys slightly more popularity than the tourism expenditure measure. International visitor arrivals are usually recorded at the border controls. Visa requirements, which although may impede international tourism, could facilitate the collection of accurate statistics (Stabler, Papatheodorou, & Sinclair, 2010, p.49). Such a measure of international travel is often complemented with surveys of visitors at the border (or in its vicinity), especially in the cases where no visa restrictions exist or the border controls have disappeared (for example, movements within the Schengen area in Europe). Where surveys of visitors at the border cannot be implemented, these could instead be conducted at places of accommodation, as recommended by the United Nations (2010a, p.18). Researchers can extract citizenship details from the registration form filled by tourists when checking in, and also the number of nights spent in the accommodation. However the accuracy of this method is often challenged, due to the exclusion of day-trippers[1] and the existence of tourists staying with friends or relatives and illegal (or unregistered) lodgings (Song, Witt, & Li, 2009, p.3; Stabler, Papatheodorou, & Sinclair, 2010, p.49).

As opposed to tourism expenditure, the visitor arrivals measure usually enjoys more immediate availability as well as higher frequency (such as quarterly and monthly). But as pointed out by Song, Li, Witt and Fei (2010), when the economic impact of tourism is of concern, the tourist arrivals statistics cannot meet policy makers' needs.

2.3.3 Length of Stay

The temporal definition of tourism demand, as shown in Table 2.2, has long been underrepresented in the literature. It is seen as an alternative measure of tourism demand (Song, Witt, & Li, 2009, p.2). Of all the studies surveyed by different researchers at different periods, those that use the length of stay or nights spent as a measure of tourism demand account for only around 10%, whereas the rest 90% were shared between tourist expenditure and tourist arrivals measures (see Table 2.2).

In fact, the *number of nights* spent *in tourist accommodation* can directly measure the demand for the hospitality sector, and thus has huge business implications. But the exclusion of stays with friends or relatives often undermines the completeness of the tourist nights spent statistics. A more inclusive measure, *the length of stay*, which reflects the number of nights *in the destinations* and visitor days, is an alternative. It is proposed that the length of stay has a crucial role in deciding total tourist spending. The longer a tourist stays in a destination, the more money he/she is likely to spend there. However, according to Gokovali, Bahar and Kozak's (2007) survey of literature, such a relationship between the length of stay and the money spent has not been well established by empirical evidence. Hence, whether the length of stay can be a robust measure of tourism demand is still debatable.

Nevertheless, more and more attention has recently been paid to accounting for the determinants of length of stay (e.g., Barros, Butler, & Correia, 2010; Gokovali, Bahar, & Kozak, 2007; Martínez-Garcia & Raya, 2008). Quantitative models such as duration models (or survival models) are designed to investigate the roles of tourists' socio-demographic profiles, holiday characteristics as well as economic factors in

[1] It is worth reiterating that, as introducted in Section 2.2, an international visitor is categorised as either a tourist (or overnight visitor) or a same-day visitor (or excursionist).

determining tourists' length of stay. A number of factors with positive and/or negative effects have been identified from those models. It is expected that those studies will help better understand tourists' behaviour, and hence the temporal dimension of tourism demand.

2.4 Influencing Factors of Tourism Demand

The influencing factors of tourism demand are, in the first instance, identified in relation to tourists' decision-making process. Without discussing this process, it is not possible to form a solid ground to suggest what factors and how they encourage or deter tourism participation. By and large, two sets of factors, i.e., *economic* and *socio-psychological*, are considered by theories. It is because of their utmost relevance that economic factors will become the main focus of the current research.

2.4.1 Economic Framework and Socio-Psychological Framework

Tourism demand has predominantly been analysed on the basis of conventional economic theory (Goh, 2012). Specifically, the backbone is consumer demand theory, which interprets consumers' decision-making process as solving utility maximisation problems. On the one hand, in deciding how much to consume, the consumer demand theory assumes a consumer will face a *budget constraint*, which is determined by the *income/budget* available to him/her, and the *prices* of alternative products. Hence, the budget constraint is directly related to *objective* (economic) factors. On the other hand, the consumer is also influenced by his/her own preferences and tastes, which are represented by a set of parallel indifference curves, with each of them denoting a specific level of utility for the consumer. Apparently, the shaping of indifference curve(s) is influenced by personal level *subjective* (non-economic) factors such as socio-psychological factors and by perceptions of external attributes related to destinations. The utility maximisation is then derived by finding the point where graphically an indifference curve is tangent to the budget constraint (which will be discussed in details in Section 2.4.2), which means the consumer gains the maximal level of utility within his/her attainable financial means. The tangent point hence denotes the consumption decision for alternative products.

2.4.1.1 Economic Framework: the Omission of Non-Economic Factors

Although the consumer demand theory does not rule out the influences of consumer's preferences, it is observed that econometric analysis of tourism demand predominantly focuses on objective factors only, such as income and consumer prices (e.g., Artus, 1972; Lim, 1997; Li, Song, & Witt, 2005; Morley, 1998; Song, Witt, & Li, 2009). Thereafter, the *economic framework* is narrowly defined as one that only concerns economic factors and the associated budget constraints. On the one hand, the narrower framework examines tourism demand principally at the aggregate level. Even if the income and the consumption patterns are rather heterogeneous at the individual level, it is observable that aggregate demand exhibits coherent responses towards economic fluctuations. From a practical point of view, comparable cross-country data are regularly available at the macroeconomic level. This convenience undoubtedly enables in-depth analyses of tourism demand from an macroeconomic perspective. On the other hand, a major reason for omitting the non-economic factors is the lack of available data and the difficulty in obtaining exact measures for these factors (Goh, 2012). Goh (2012, p.1863) further argues that, '*perhaps the true reason for the omission of more determining factors lies in the expense incurred in developing increasingly complex models in exchange for their inclusion*'. Indeed, compared to human behaviour, statistical models are rather restrictive and sometimes too simple. The accuracy of statistical estimation largely depends on the degrees of freedom, which are proportional to the number of observations in the sample and inversely related to the number of parameters to be estimated. To accommodate an extensive range of factors, a statistical model will easily exhaust the degrees of freedom, making the estimation problematic. Besides, all statistical models follow certain assumptions, the breach of which will result in biases. For example, most models require explanatory variables to be exogenous to the dependent variable and no multicollinearity among the explanatory variables. In other words, there should not be any feedback influences from the dependent variable to the explanatory variables, and the explanatory variables themselves should not be interrelated. Such assumptions can be too rigid when socio-psychological factors are considered, as they tend to be interactive. Moreover, the influence of certain non-economic factors may have already been well captured by the economic factors indirectly. For example, a nation's income level is associated with the age structure as well as the average education level of the society. If income, age and education are included in one model, it is likely to create multicollinearity problem and yield biased results.

2.4.1.2 Socio-Psychological Framework

Despite the difficulties in incorporating non-economic factors into tourism demand models, efforts have been made to develop a *socio-psychological framework* that deals with the shaping of a consumer's preferences and tastes. It states that people have unlimited wants and that these wants are turned into motives by certain stimuli, which in turn become demand when backed by buying power (Goh, 2012).

Following Um and Crompton (1990), destination choice is influenced by *internal inputs* and *external inputs*. *Internal inputs* are the socio-psychological set of a traveller's personal characteristics (socio-demographics, life-style, personality, and situational factors), motives, values, and attitudes. For example, a classic idea by Stanley Plog, as reviewed by Stabler, Papatheodorou, and Sinclair (2010, p.40), is that tourists can be categorised on a spectrum ranging from 'allocentric' to 'psychocentric', with the former referring to those who are more adventurous and self-confident whereas the latter referring to those who prefer familiar and reassuring locations and social interactions. *External inputs* can be viewed as the sum of social interactions and marketing communications to which a potential traveller is exposed. Furthermore, the external inputs can be classified into *significative stimuli* (which emanate from actually visiting the destination), *symbolic stimuli* (which are the words and images in promotional material by the travel industry), and *social stimuli* (which emanate from other people in face-to-face interactions) (Um & Crompton, 1990). An important conceptual framework which is based on the destination attributes (equivalent to the *significative stimuli*) is the Lancaster's characteristics framework, which was proposed by Lancaster (1966) and Gorman (1980). The idea is that products themselves do not give utility to the consumer; they possess certain characteristics; it is the consumption of these characteristics that gives utility (Goh, 2012; Stabler, Papatheodorou, & Sinclair, 2010, pp.36-39). In tourism research, the characteristics that are often under consideration are generally related to destination attractions (natural and built) and facilities (e.g., hotels, airports, and ancillary services) (Stabler, Papatheodorou, & Sinclair, 2010, pp.36-39).

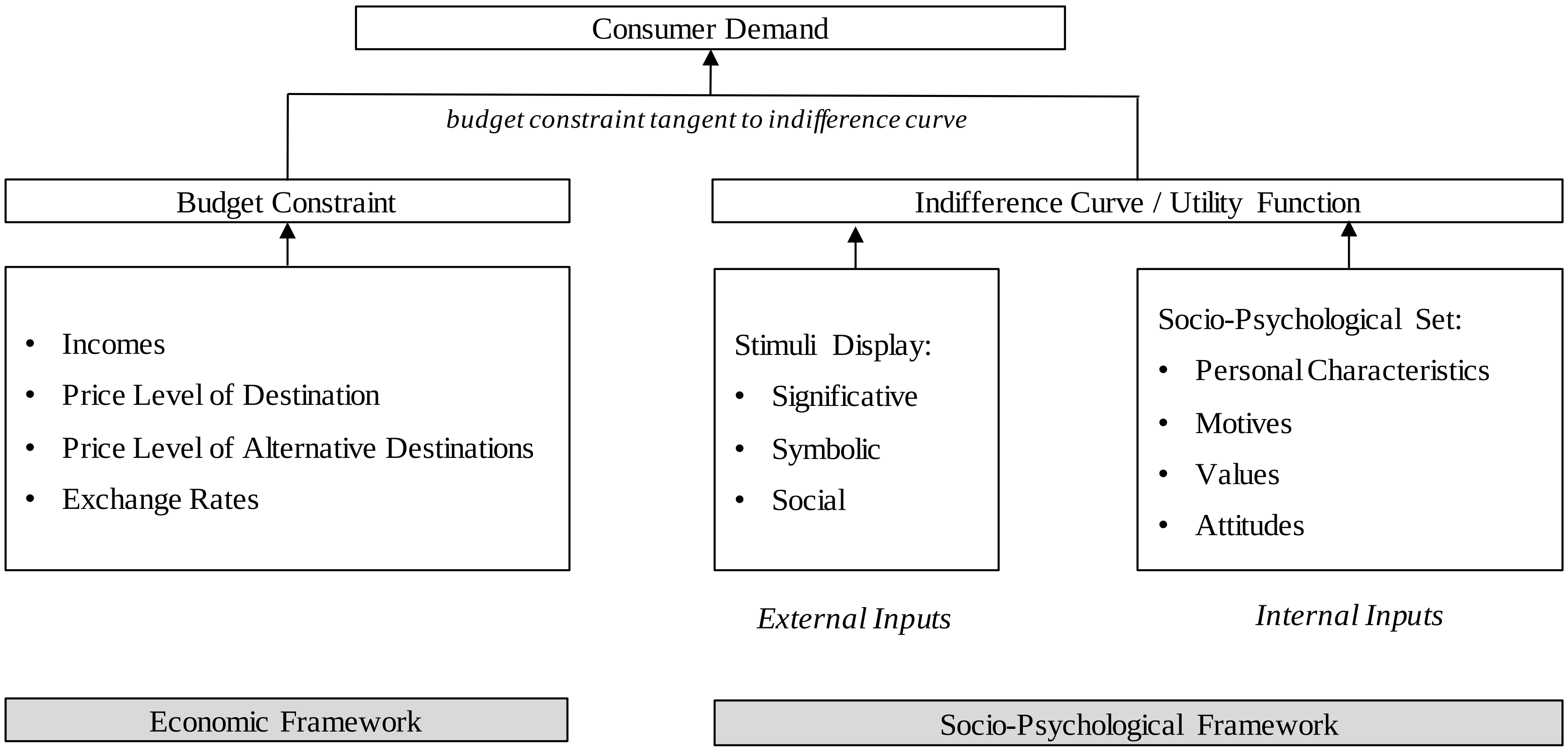

Figure 2.2 - The economic and the socio-psychological framework

Source: Adapted from Goh (2012) and Um and Crompton (1990)

2.4.1.3 Which Framework to Follow: Methodological Considerations

Admittedly, a comprehensive study of tourism demand should involve both the economic and the socio-psychological aspects. Figure 2.2 summarises the building blocks of the economic and socio-psychological frameworks, based on Goh (2012) and Um and Crompton (1990). The *economic framework* is often criticised for ignoring demographic differences (Morley, 1995) and for its limited success in explaining human behaviour (Goh, 2012). In an ideal world, when studying tourism demand, non-economic factors should take the same weightings as their economic counterparts (Goh, 2012). In reviewing the theoretical studies of people's motivation for travelling, Stabler, Papatheodorou, and Sinclair (2010, p.40) comment, the studies of motivation *'seek to explain the reasons for behaviour which economists observe only from preferences which are revealed in terms of expenditure on goods and services in the market. In this respect, the study of motivation assists in making more accurate explanations and forecasts of the level and pattern of tourism demand*'.

However, such a combination of both frameworks has to be taken very cautiously. On the one hand, while the *economic framework* allows for analysis at both the aggregate and the individual level (as long as the relevant data are available at that level[1]), the *socio-psychological framework* stimulates studies mainly from the perspective of individuals (e.g., Crouch, Devinney, Louviere, & Islam, 2009; Lyons, Mayor, & Tol, 2009; Wu, Zhang, & Fujiwara, 2013). On the other hand, the economic factors indicated by the *economic framework* are generally well justified by economic theory, whereas the interpretation of non-economic factors tends to be less theory-based. For example, in the log-log form of demand models, the coefficients on economic factors (such as income and prices) can be easily interpreted as demand elasticities, while the interpretation of the coefficients on non-economic factors is usually not that straightforward. Hence, the inclusion of non-economic factors into an econometric (causal) model tends to be challenged for lack of a firm theoretical underpinning.

From a more pragmatic perspective, the feasibility of constructing a robust stastistical model has also to be taken into consideration. As discussed earlier on, the omission of non-economic factors in some studies is often associated with statistical

[1] This can usually be met, as specialised databases for micro- and/or macro-economic data are generally accessible to academics.

considerations, such as the degrees of freedom, the exogeneity assumption and the multicollinearity problem. To follow a combined framework, the potential statistical issues have to be carefully considered beforehand. Simply gathering a large set of socio-psychological factors does not guarantee valid and meaningful statistical results.

Perhaps the last but not the least consideration is the data structure. This can be briefly described as an issue of *temporal versus spatial*. Economic data are generally available in the form of time series, i.e., observations over a period of time, and also in the form of cross-sectional series, e.g., cross countries/industries. This flexibility allows economic data to be analysed by different types of models, such as time series models and panel data regression models. On the contrary, socio-psychological data are in general arranged cross-sectionally, because these factors are relatively time-invariant or it would be difficult to obtain observations over a long time span. For example, social surveys to measure non-economic factors (e.g., the disability rates of the population, for accessible tourism) are not necessarily conducted continuously over a long period of time, and no time series of non-economic factors are available. Hence, it would be more realistic to apply only certain types of models to socio-psychological data, such as simple regression and cross sectional data regression. In other words, when the temporal dimension of variables (say, the fluctuations of tourism demand over time) is of concern, it would be more appropriate to follow the economic framework. In that case, leaving out socio-psychological factors will not cause much loss of information, because these factors and their effects will remain stable.

Admittedly, the data to be gathered and the model to be used should be dictated by the theoretical framework, rather than the other way round. The discussions above only intends to show that, successful modelling will involve certain statistical restrictions, which in turn act as *constraints* onto the choice of theoretical framework.

The setting of the current research is a global environment, where from year to year tourism markets face economic turbulences. Tourism itself, as a principal part of international trading activities, intertwines with the globalisation process extensively. As such, interdependencies between tourism demand across different destinations are observable in the form of co-movements. Hence, to address the interdependent relations of tourism demand, economic variables are in the pivotal position to explain the linkages between destinations. Logically, the current research and the following review will thus be largely based on the economic framework.

2.4.2 Microeconomic Foundations

Tourism demand is usually studied at the aggregate level (for example, the number of tourist arrivals to a certain country). A tendancy in macroeconomics is to seek microeconomic foundations, which facilitates better understanding of the mechanism underpinning macroeconomic phenomena. Likewise, the economic analysis of aggregate tourism demand also needs to be built on rigorous micro-groundings. As Backhouse (2010, p.121) remarks,

> *"macroeconomic relationships are the outcome of decisions by millions of individuals, which means that if the subject (macroeconomics) is to be rigorous, it must be based on a theory of how individuals behave."*

To understand the determinants of tourist flows, it is crucial to take account of the factors that a tourist needs to weigh up when he/she makes travel decisions. Having said that, on the one hand, it does not imply all the *idiosyncratic* factors surrounding individuals must appear in a tourism demand model. Indeed, only a small number of the factors, which influence people universally, will be of concern. The search for microeconomic foundations (or micro-foundations), in the context of tourism research, is to tackle the logic behind the influences of those 'universal' factors on tourism demand. On the other hand, it does not imply that the parameters estimated from a tourism demand model perfectly match every individual's behaviour. The models can only be meaningful in the aggregate sense, depicting the behaviour of people as a group rather than as individuals. This relationship between the aggregate level and the individual level is referred to as aggregation bias.

2.4.2.1 The Multi-Stage Budgeting Process

Following the consumer demand theory, the demand for tourism is determined by people's preferences and their budget constraints. The microeconomic foundations of tourism demand first and foremost concern an individual's decision making process.

To arrive at his/her travel decision, a tourist is assumed to undergo a multi-stage process. He/she firstly trades off paid time[1] against unpaid time. Paid work results in income for consumption, hence decides the budget that can be spent in unpaid time. Then he/she compares the prices of tourism products and those of other goods/services, and decides the optimal combination of tourism products and other goods/services. Once the budget on tourism products is allocated, the next step for him/her is to decide which destination(s) to go, by comparing the prices of a number of alternative destinations. It stands out that this multi-stage process is largely constrained by economic factors such as income and prices. Nevertheless it should not be overlooked that the exact combination that the tourist ends up with (for example, how much paid work to take, how many nights of holiday to go) is down to his/her personal preferences.

To elaborate the multi-stage process, certain simplifying and restrictive assumptions are made, which are the *composite commodity theorem*[2] and the *separability of preferences* (Candela & Figini, 2012, p.142; Smeral & Weber, 2000; Stabler, Papatheodorou, & Sinclair, 2010, p.27). The *composite commodity theorem* states that various products can be aggregated into broad bundles of products. Each bundle can be treated as if it were a single product, provided that prices within the bundle move in parallel (i.e., the relative prices of products within it remain unchanged). Indeed, it is reasonable to assume that a consumer perceives a broad group of relevant products as a unity, since it is unlikely for him/her to be fully aware of the difference of price changes in each individual product. The other assumption, the *separability of preferences*, states that preferences within one bundle are independent of those in another. For example, a consumer's choice of food can arguably be determined in isolation from his/her consumption of clothes. In multi-stage budgeting, this implies that the budget allocation at the former stage will not affect the latter. A total utility can be achieved by summing up all the values of sub-utilities from each stage. Though restrictive, both the composite commodity theorem and the separability of preferences are devised to simplify the simulation of the real decision-making process, so that only the most relevant elements of the process are dealt with.

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[1] This could result from paid work. Employees may be entitled paid holiday, which is associated with their paid work.
[2] It is called the *aggregation theorem* in some references (e.g., Candela & Figini, 2012, p.142)

With the above in mind, the multi-stage budgeting process can be elaborated using the budget constraint and the indifference curve(s) as an analytical tool. The first stage is about how much leisure time to take. Apparently, the more time for leisure, the less is for work. The less time spent at work, the less income made available to the tourist, which ultimately limits his/her affordability of leisure activities. Just as Stabler, Papatheodorou and Sinclair (2010, p.24) comment,

> "*there is, however, a tension as income is often required to undertake leisure pursuits (including tourism) so that the latter have an imputed 'price' or opportunity cost.*"

The situation is often associated with the so-called '*leisure paradox*' (Cooper, Fletcher, Gilbert, Fyal, & Wanhill, 2005, p.117), which depicts the negative relationship between time and discretionary income in an individual's life cycle. Figure 2.3 illustrates the different combinations of consumption and unpaid time that a tourist may have. Line CB is the *budget constraint* facing the individual, as it represents all the maximal combinations that are affordable. Point C (perhaps a workaholic) means all his/her time is devoted to work and thus he/she earns the highest level of income, among all his/her options on line CB. Point B means all his/her time is devoted to unpaid activities, thus there is no income from work but only the unemployment benefits at level C^*. Any other combinations of consumption and unpaid time, such as point E and D, are financially feasible and ultimately depend on the position of the individual's *indifference curve* (e.g., I_1, I_2 for two different individuals), which is entirely associated with his/her personal preferences. The indifference curves are actually a set of parallel curves unique to each individual, denoting different levels of utility for the individual. The farther away it is from point O, the higher the utility is. Therefore, the intersection of the budget constraint line CB and the indifference curve I_1 (or I_2) represents the optimal level of consumption combination, because point E (or D) is the highest level of utility that Individual 1 (or 2) can achieve and still within his/her budget. In Figure 2.3, point E is achieved by someone who values work highly, and point D by someone who enjoys free time more in spite of lower consumption level attained.

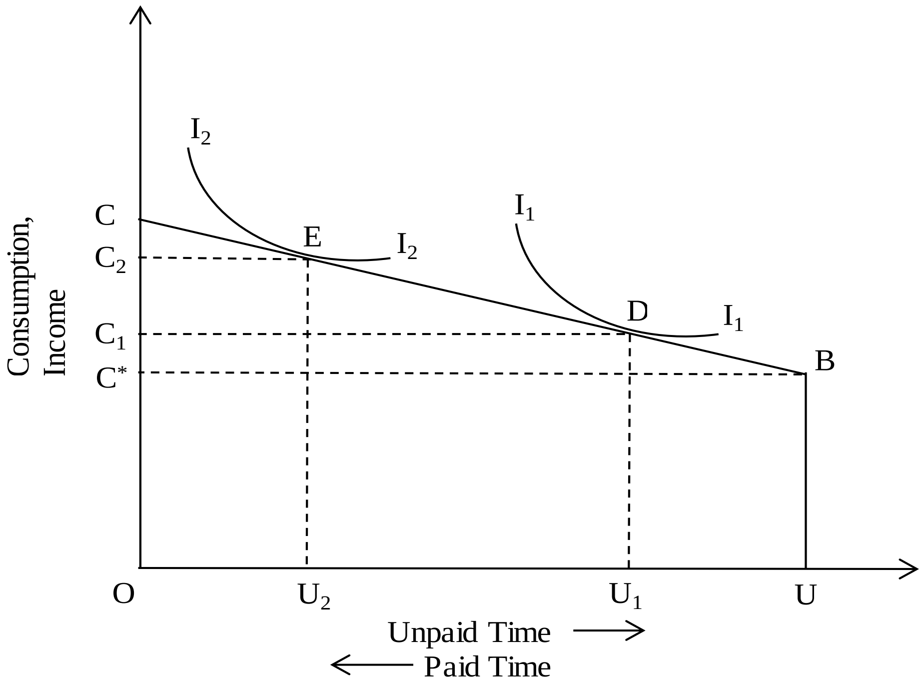

Figure 2.3 - Trade-off between paid work and unpaid time

Source: Adapted from Stabler, Papatheodorou, & Sinclair (2010, p.25)

Here, the slope of line CB (i.e., how steep the line is) is apparently down to the wage rate. With total time (line OU) being fixed (24 hours at maximum, and do not forget one needs time for sleep), and the unemployment benefits being relatively stable (i.e., C^* and B are fixed), the higher the wage rate, the higher point C will be, and hence the steeper the line. Therefore, the *wage rate*, hence the *disposable income*, and the possible unemployment benefits, are crucial factors in the tourist's budgeting process.

The second stage is about the allocation of income (resulting from the previous stage) to tourism and other goods/services. As illustrated in Figure 2.4, line TDG contains all affordable combinations, with point T representing the maximum quantity of tourism products to be consumed, and point G the maximum of other products. Here, all products other than tourism are aggregated as if they were one product, which follows the composite commodity theorem.

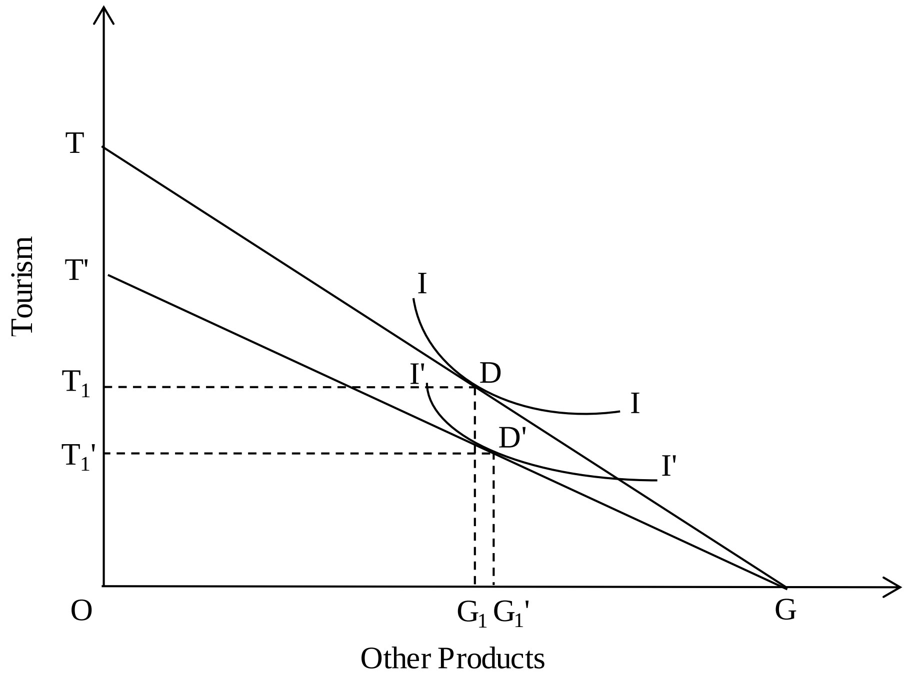

Figure 2.4 - Consumption of toursim and other products

Source: Adapted from Stabler, Papatheodorou, & Sinclair (2010, p.27)

Just as the previous illustration, the exact combination the tourist can attain is where the indifference curve I intersects the budget constraint line TDG, i.e., point D. The key here is the *relative prices* of the two products, which determine line TDG's slope. When the price of tourism product goes up (relative to that of other products), the maximum amount of tourism product that the tourist can consume will be less (point T being lower). Hence line TDG becomes less steep. As a result, the maximum consumption of tourism declines from T to T'. Accordingly the consumption of other goods changes from G_1 to G_1', although whether $G_1 > G_1$' or $G_1 < G_1$' depends on the *substitution effect* and the *income effect*. Following Figure 2.4 (i.e., consider only tourism product and other products), the substitution effect states that, when the price of tourism product (as against that of other products) goes up, people will shift some of the consumption from tourism product to other products. Hence the consumption of other products will *increase* under the substitution effect. The income effect states that, when the price of tourism product (as against that of other products) increases, people's purchasing power will be eroded (the total quantity of goods people can buy becomes less). As a result, the consumption of other products will *decline* under the income effect. In sum, as long as price change takes place on either of the two products, both the substitution effect and the income effect will be present, although the magnitude of either effect may vary from case to case.

The third stage of the multi-budgeting process is to choose the combination of tourism products, such as different destinations, different types of tourism (cultural, adventure, medical, etc.). The process is exactly the same as the illustration in Figure 2.4, with the vertical and the horizontal axes respectively denoting different tourism products. Again, the relative prices of destinations or tourism types play a pivotal role in deciding the optimal combination of consumption. Based on the separability of preferences, once the budget to be spent on tourism is allocated at the second stage, the choice of a specific tourism product is an entirely independent decision, irrespective of how much to be spent on other products. The budgeting process can continue through subsequent stages with regard to the consumption of sub-products at the destination, such as sightseeing, food and beverage, accommodation, and transport.

2.4.2.2 The Aggregation Problem

Since the microeconomic foundations mainly concern the influencing factors at the individual level, a link between the individual demand and the aggregate demand needs to be addressed. This helps to justify why the factors recognised at the micro level are appropriate for aggregate tourism demand models.

Traditionally in macroeconomics, the aggregation problem is understood using the notion of 'representative agent', which is a typical decision-maker of a certain group of identical agents. More broadly, the 'representative agent' concept is also deemed appropriate even if the agents are heterogeneous, as long as they act in such a way that the sum of their choices is mathematically equivalent to the decision of one individual or many identical individuals. Though restrictive, the notion places emphasis on the similarity of people's decision-making. So 'representative' factors are appropriate for aggregate models. Empirically, Blundell and Stoker (2005) survey a number of econometric models that involve treatments of heterogeneity and nonlinearity at the individual level, in the areas of consumer demand analysis, consumption growth and wealth, and labour participation and wages.

Mathematically, the aggregation problem can be addressed given certain assumptions. Consider an economy with N consumers, each has a unique demand function $q_i(p, w_i)$, where p denotes a vector of prices for L goods and everyone faces the same prices, w_i is the income level of individual i (w_i can also denote the wealth level, which is the accumulation of income over time). The relationship between aggregate demand and individual demand follows:

$$q(p, w_1, \cdots, w_N) = \sum_{i=1}^{N} q_i(p, w_i) \tag{1.1}$$

If individual i's income, w_i, is generated by a process that is only related to prices (p) and aggregate income (alternatively, aggregate wealth, denoted by w), then $w_i = w_i(p, w)$. This can be justified by the fact that people's income is mainly determined by wage rate (or 'price' of leisure) and by taxes and/or government transfers (which may entirely depend on aggregate income level). Then

$$\sum_{i=1}^{N} \boldsymbol{q_i(p, w_i)} = \sum_{i=1}^{N} \boldsymbol{q_i(p, w_i(p, w))} = \sum_{i=1}^{N} \boldsymbol{q_i(p, w)} = \boldsymbol{q(p, w)} \tag{1.2}$$

Hence, if a certain distribution rule $w_i = w_i(p, w)$ exists, it is appropriate to model aggregate demand as a function of prices and aggregate income.

Morley (1995) discusses the aggregation problem in the context of tourism. He proposes an alternative approach, which was based on a random utility model. The central idea is to assume that the utilities are not fully determined but have a random element, which results from errors in the individual's perceived values of relevant variables, the impact of variables other than those explicitly incorporated into the utility function and/or the effect of random events. Assuming that the individual demand is mutually independent and that the Central Limit Theorem applies, the aggregate demand (i.e., the add-up of individual demand) is shown to be a function of individual level factors. Hence, it justifies the applicability of variables at the micro level for aggregate analysis.

2.4.3 Income

Based on the microeconomic foundations of tourism demand, it is not surprising that income enters a tourism demand model as a key variable. Of the 100 studies reviewed by Lim (1997), 84 studies employ income as one of the explanatory variables, topping the list of all variables used. The measures (or proxies) of income can vary.

Disposable income, GDP and GNP, in nominal or real terms and in their per capita form, can all be considered. As a rule of thumb, if holiday visits or visits to friends and relatives are being studied, the appropriate form of variable is private consumption or personal disposable income; if the focus is on business visits, a more general income variable such as national income should be used (Witt & Witt, 1995).

It is acknowledged that tourism demand is not only influenced by the current income level, but also by its lagged level (i.e., its past value), since it takes time for changes in income to affect tourism demand (Lim, 1997). This brings up an issue whether consumer behaviour is backward-looking or forward-looking. If tourists are backward-looking (i.e., they care about how much they have earned), lagged values of income would be relevant to their decision making; if they are forward-looking (i.e., they base their consumption decision on the expectation of future income), the present value of their future income would affect their current demand (Stabler, Papatheodorou, & Sinclair, 2010, p.52). In practice it is, however, more common that lagged income variables are included, which is in line with the backward-looking perspective. The forward-looking aspect of tourist behaviour is much less explored, which could be due to the additional information required such as the prediction of future income and the appropriate interest rate to discount future income.

2.4.4 Prices

Prices of products are crucial factors in forming tourists' budget constraint, for any changes in prices can result in rotation of the budget constraint and hence changes in the optimal combination of consumptions (see Figure 2.4). In empirical studies, the price variable should basically contain two elements: the cost of travel to the destination and the cost of living once at the destination (Witt & Witt, 1995). It is often on the grounds of potential multicollinearity problems and lack of available data that researchers choose to omit the travel cost variable (Witt & Witt, 1995). Discussions on the travel cost variable will be conducted in next section.

Cost of Living at a Destination

The tricky part about the price variable (precisely, the cost of living at a destination) is that the data of ideal measure are in most cases unavailable. It is desirable to have indices (for example, tourist price indices, TPI) constructed using a basket of goods/services purchased by tourists (Lim, 1997). However, such indices are only published for certain countries and major towns (Witt & Witt, 1995). Dwyer, Forsyth, & Rao (2000), in estimating Australia's price competitiveness, develop a basket for tourist price index based on 14 expenditure categories of goods/services from Australia's International Visitor Survey, and further compute the index with the price data from World Bank's International Comparison Programme (ICP). The problem is, though it is feasible to construct tourist price indices, it is largely done on an *ad hoc* basis. Continuous and consistent figures of TPI are still lacking. As a result, a typical practice is to use the general consumer prices in the destination (consumer price index, CPI) as proxies. An inevitable limitation is that it implicitly assumes the spending structure of tourists will be the same as that of a representative household in that destination. Nevertheless, literature review conducted by Witt and Witt (1995) suggests that consumer price index, adjusted by relevant exchange rate, is a reasonable proxy for the cost of tourism.

Exchange Rates

Another important dimension of the price variable is the exchange rates between the origin country and alternative destinations. The inclusion of exchange rates into demand models is justified by the fact that tourists are more aware of exchange rate movements than destination costs of living (Lim, 1997; Witt & Witt, 1995). However, it is not a common practice to use exchange rate on its own, for even though the exchange rate of a destination becomes more favourable, this advantage could be offset by a relatively high inflation in the destination (Witt & Witt, 1995). The use of exchange rates is hence usually in combination of CPI variables, to generate exchange-rate-adjusted consumer price indices.

Own Price Variable

Following the microeconomic foundations of tourism demand, the prices of a destination and its competing destinations are key factors affecting tourist's decision-making process. In empirical studies (e.g., Mangion, Durbarry, & Sinclair, 2005; Song, Wong, & Chon, 2003), the price of the destination concerned is defined by the *relative price* variable, which is constructed from the destination's exchange-rate-adjusted CPI relative to that of the source market. Using the relative price, the impacts of inflation and exchange rate movements can be measured through one variable. Since it denotes the price level in the destination, the relative price variable is also called *own price* variable (from the perspective of the destination concerned). Empirically, the most often used form of the own price variable is constructed as follows (e.g., Choyakh, 2008; Halicioglu, 2010; Seetaram, 2010; Song, Wong, & Chon, 2003):

$$\ln P_i = ln(\frac{CPI_{dest.}/EX_{dest.}}{CPI_i/EX_i}) \tag{1.3}$$

where *ln* means the natural logarithm; $CPI_{dest.}$ is the CPI index of the destination concerned; CPI_i is the CPI index of the origin country *i*; $EX_{dest.}$ and EX_i are the exchange rates against US dollar for the destination and the origin *i*. It is common that these elements are in the form of indices which take a value of 100 for the specified base year.

Substitute Price Variable

Similarly, the prices of alternative destinations, i.e., *substitute prices*, are also constructed by using the exchange-rate-adjusted CPIs. Where there is more than one alternative destination in consideration, to save the degrees of freedom, a weighted average index of the adjusted CPIs across different destinations is specified. A disadvantage of the weighted average index is its inefficiency in distinguishing the different strengths of effects among alternative destinations (Song, Witt, & Li, 2009, p.29). Based on Li, Wong, Song, and Witt (2006) and Song, Wong, and Chon (2003), the substitute price variable for origin country *i* can be written as:

$$\ln P_{s,i} = \sum_{j=1}^{k} w_j \cdot \ln(\frac{CPI_j/EX_j}{CPI_i/EX_i}) \tag{1.4}$$

where *ln* means the natural logarithm; k is the number of alternative destinations; CPI_j is the CPI index for a particular alternative destination *j*; CPI_i is the CPI index for the origin country, *i*; EX_j is the exchange rate against US dollar for destination *j*; EX_i is the exchange rate against US dollar for origin country *i*; w_j is defined as the share of tourism demand for destination *j*, among all the *k* alternative destinations. As with the construction of own price variable P_i, CPI and exchange rates can also be in the form of indices.

2.4.5 Travel Costs

As part of the tourism prices, travel costs are also often considered as a determinant of tourism demand. This is due to the fact that tourists have to be transported to the destination in order to consume tourism products, rather than in the reverse direction. Hence the demand for transportation is a type of derived demand (Lim, 1997). The measure of travel costs is usually approximated by the economy airfares between main cities in the origin country and the destination country and/or the private gasoline costs (Lim, 1997; Song, Witt, & Li, 2009, p.29).

However, the inclusion of travel costs variable is not prevalent in the literature. Of the 100 empirical studies reviewed by Lim (1997), only 55 include the travel costs as explanatory variable. This observation is further confirmed by Li, Song and Witt (2005), who find that only 24 of 84 post-1990 publications used this variable. As argued by Stabler, Papatheodorou and Sinclair (2010, p.57), the inclusion or exclusion of the travel costs variable is complicated. On the one hand, the price variables constructed from exchange-rate-adjusted CPIs only focus on the tourism costs once at the destination(s), with the transport costs between the origin and the destination(s) left out. Hence, there is a reason for including the travel costs variable. On the other hand, there are other justifications for omitting this variable. These include potential multicollinearity between travel costs and real income, and the relative travel costs being approximately constant as they are largely determined by oil price movements, which affect all transport costs in a similar manner (Crouch, 1994; Smeral & Witt, 1996).

A convincing evidence to conclude the issue would be to test the significance of this variable in empirical models. As summarised by Sinclair (1998) and Song, Witt and Li (2009, p.29), empirical results however do not always support the significant effects of travel costs on tourism demand. One explanation is that the precise measurement of travel costs is lacking at the aggregate level (Li, Song, & Witt, 2005). The structure of airfares is complex due to the existence of different fare levels according to the pre-booking time, length of stay and the class (Lim, 1997; Song, Witt, & Li, 2009, p.29; Stabler, Papatheodorou, & Sinclair, 2010, p.58) and air travel is not necessarily the only means of travel. Hence, before concluding whether it is useful to add a travel costs variable to the model, it should be firstly addressed what is the appropriate measurement.

As a much less used proxy, the gasoline price or the oil price occasionally features in studies (e.g., Di Matteo & Di Matteo, 1993; Garín-Munoz, 2006; Kulendran & Wong, 2011; Ledesma-Rodriguez, Navarro-Ibanez, & Perez-Rodriguez, 2001, and Wang, 2009). It is seen as a convenient and practical proxy, considering the complex structure of transport fares and the unavailability of data on fares (Garín-Munoz, 2006; Onafowora & Owoye, 2012; Wang, 2009). While tourism demand is in some cases detected to be influenced by the gasoline price variable, it is generally inelastic (Garín-Munoz, 2006; Ledesma-Rodriguez, Navarro-Ibanez, & Perez-Rodriguez, 2001; Onafowora & Owoye, 2012; Wang, 2009). The inelasticity of gasoline price may reflect the fact that gas is not always highly correlated with real travel cost. People are less sensitive to the gasoline price if they pay a lumpsum for transport tickets (railway, air, cruise, etc.). Gasoline price is generally more volatile than the price of transport tickets. Hence there is also uncertainty in terms of the lag effects of gasoline price on real travel cost.

2.4.6 Other Factors

As discussed in Section 2.4.1, apart from the economic factors discussed above, there are a number of non-economic factors that influence tourism demand. Even though the majority of studies follow the economic framework, non-economic factors can be presented in the modelling exercises.

Deterministic Trend, Seasonality and Dummy Variables

A widely used set of non-economic factors are special events, deterministic trends and seasonality (Lim, 1997; Song, Witt, & Li, 2009, pp.30, 79-81). They are intended to capture the qualitative information.

Deterministic trend is often used to represent a steady change in the popularity of a destination due to changing tastes and/or to capture the time-dependent effects of all other explanatory variables not included in the model (Goh, 2012). It has been argued, though, that the use of deterministic trend is indeed ambiguous and inadequate to capture the changing consumer preferences since detailed aspects are not explicitly accounted for (Goh, 2012). There are also concerns about multicollinearity with other variables, as trends are also present in variables such as income and prices.

Dummy variables can be used to capture the seasonality (in the form of seasonal dummies) and the impacts of special events. They are basically included into the tourism demand models along with the economic variables. The idea is that after controlling for the economic factors such as income and prices, which are supposed to explain the variation of tourism demand under 'normal' situations, the leftover or the 'abnormal' part of tourism demand is explained by dummy variables. In general, the special events that have been considered are associated with major political changes, economic changes, natural disasters, or mega events (sports, exhibitions, etc.). These include, for example, the oil crises in 1973 and 1979, the global economic recession in the mid-1980s, the Gulf War in the early 1990s, the Asian financial crisis in 1997, the terrorist attacks in New York on 11 September 2001, and the SARS epidemic in Asia in 2003 (Li, Song, & Witt, 2005; Song, Witt, & Li, 2009, p.30). In terms of geographical distribution, while some events tend to have global or regional influence, others, such as the Olympic Games and the world EXPO, are mainly limited to certain countries only (e.g., Sydney Olympics in Athanasopoulos & Hyndman, 2008; Beijing Olympics in Song, Gartner, & Tasci, 2012).

Non-Economic Factor: Distance

Compared to the factors such as income and prices, the distance between the origin and the destination is much less used in tourism demand models. It mainly features in spatial models, or more specifically *gravity models*. These models are based on the gravity law of spatial interaction, which states that the degree of interaction between two countries varies directly with the populations in the two places and inversely with the distance between them (Witt & Witt, 1995). The idea is rooted at the belief by early social physicists that social phenomena could be explained by physical laws and analogy with Newton's gravitational law was appropriate. Examples using gravity models are Deng and Athanasopoulos (2011), Eryigit, Kotil, and Eryigit (2010), Khadaroo and Seetanah (2008), Massidda and Etzo (2012), and Seetanah, Durbarry, and Ragodoo (2010). One problem with gravity models, as remarked by Witt and Witt (1995), is the lack of a firm theoretical foundation (perhaps the theory is drawn from physics, rather than social science).

The omission of the distance variable, as with many socio-psychological factors, perhaps lies in the fact that it is constant over time. If a model aims to explore the reasons behind the variations of tourism demand, as in many tourism demand studies (which employ time series data), the inclusion of distance variable indeed does not help to add explanatory power. If a model aims to explain the difference of tourism demand for various destinations, it will be appropriate to include the distance variable and use cross-sectional or panel data set.

Other Non-Economic Factors

Other non-economic factors include socio-psychological attributes of tourists (e.g., gender, age and education) and the characteristics of destination (e.g., climate, culture and history) (Lim, 1997). As summarised in the socio-psychological framework, these are the internal and external inputs in shaping people's travel decision.

A notable conceptual framework that is based on the destination attributes, as introduced in Section 2.4.1, is the Lancaster's characteristics framework. This framework, although as illustrated by Papatheodorou (2001) could be used to study the choice among different destinations, often leads to the investigation of the pricing of tourism products such as tour packages and hotel rooms. The idea is that the observed price of a product is the sum of unobserved prices of the attributes associated with it, and the objective is to obtain the implicit prices for the individual attributes (Chen & Rothschild, 2010). This research strategy is termed as 'hedonic price analysis'. It is found that the choices of tour operators, resorts, hotel star rating and hotel facilities are important attributes in the pricing of holiday packages (Sinclair, Clewer, & Pack, 1990). With respect to hotel prices, attributes such as location, facilities and amenities, service quality, star rating, atmosphere and seasonality are found to be of importance (Chen & Rothschild, 2010). Research has also been extended to consider the role of public good components such as cultural legacy, public safety and public infrastructure (e.g., Rigall-I-Torrent & Fluvia, 2007, 2011). Another approach closely associated with the socio-psychological (as well as the Lancaster's characteristics) framework is choice modelling (Stabler, Papatheodorou, & Sinclair, 2010, p.73). This type of models intends to imitate individual's decision making based on a set of economic and non-economic factors (for example, socio-demographic factors, destination attributes, and facilities, see Albaladejo-Pina, & Díaz-Delfa, 2009; Crouch, Devinney, Louviere, & Islam, 2009; Eugenio-Martin, & Campos-Soria, 2010; Figini, & Vici, 2012; Nicolau, & Más, 2008;

Lacher, Oh, Jodice, & Norman, 2013; Lyons, Mayor, & Tol, 2009; Wu, Zhang, & Fujiwara, 2013), and see how they determine the probability of an individual choosing to participate in tourism.

The problems facing the characteristics framework are the selection of appropriate explanatory variables and potential multicollinearity among variables (Song, Dwyer, Li, & Cao, 2012). On the one hand, there are a rich variety of attributes that can be considered, but the guidelines for selecting appropriate attributes are lacking (Andersson, 2000; Chen & Rothschild, 2010). On the other hand, the attributes tend to be highly correlated (for example, hotel star rating and hotel facilities), which creates multicollinearity in the model and leads to biased estimation (Sinclair, Clewer, & Pack, 1990; Thrane, 2005).

2.5 Conclusion

Tourism demand can generally be measured by tourism expenditure (receipts), tourist arrivals and length of stay, with each of them describing its monetary, spatial and temporal dimension, respectively. In empirical studies, tourism expenditure and tourist arrivals are the most commonly used measures. To explain the formation of tourism demand, two lines of thinking have been developed, namely the economic framework and the socio-psychological framework. But in empirical quantitative studies, economic factors such as tourists' income and prices of a destination as well as its competing destinations, rather than socio-psychological factors, are primarily considered. Even though such practice is often criticised for limiting the scope of analysis, there are pragmatic justifications behind it. First, the inclusion of economic factors is appropriate for models at both the aggregate level and the individual level, whereas the non-economic factors can mainly apply to individual level investigation. Second, the temporal nature of economic data also allows for the use of dynamic models. Hence the fluctuations of tourism demand can be modelled. Meanwhile, the time-invariant nature of many non-economic factors implies that only cross-sectional analysis is appropriate when using these factors. There are also less availabilities of time series data for non-economic factors. More pragmatically, the multicollinearity problem that often exists among socio-psychological factors inevitably creates biased estimates and sometimes even unfeasible modelling. Last but not the least, while the roles of economic factors in deciding tourism demand are well grounded, the inclusion of specific non-economic factors tends to be less theory-based.

Chapter 3. Tourism Demand Modelling

3.1 Introduction

One of the most exciting developments with regard to tourism demand analysis has been the advancement in tourism demand models. It is generally accepted that the models can broadly be divided into two sub-categories: the causal *econometric models* and the non-causal *time series models* (Goh & Law, 2011; Song & Li, 2008; Witt & Witt, 1995). In recognizing the recent adoption of artificial intelligence (AI)-based techniques, Goh and Law (2011) further extend the review of tourism demand models to include a new sub-category called *AI-based methods*.

This chapter goes over various modelling approaches that appear in the existing literature. While it is not possible to cover all the models, emphasis will be placed on the major types in order to reflect the depth and breadth of tourism demand model development. In accordance with the categories identified in previous review papers, this chapter will be segmented in three major sections, namely econometric models (Section 3.2), time series models (Section 3.3) and other quantitative models (Section 3.4). Among all the sub-categories, econometric models will be placed in the centre, as they are able to capture the causal effects of various explanatory variables on tourism demand and thus are the most insightful. On the contrary, time series models do not aim to account for the roles of explanatory variables, but rather aim to capture the intrinsic evolution of tourism demand series. Hence, they are suitable for demand forecasting exercises. An emerging modelling approach, the AI-based methods are derived from computer science. The use of them is also mainly in forecasting.

Through revisiting the different models, focus is placed on identifying the limitations of each approach. After all, it is these limitations that create a research gap to be filled. By overcoming the limitations, the scope of tourism demand analysis can be broadened, allowing for new insights into the tourism sector and stimulating informed policy and business decisions.

3.2 Econometric Models

The econometric models are a type of models which quantify the causal relationship between tourism demand (the dependent variable) and certain influencing factors (explanatory variables) by using an equation or multiple equations. They basically follow two approaches, i.e., single-equation and system-of-equations (Sinclair, Blake,

& Sugiyarto, 2003). With different choices of variables and different numbers of equations in the model, the econometric models offer a variety of sophisticated model specifications that are able to accommodate different theories and to test against their validity.

As Clements and Hendry (1998, p.16) comment, the advantage of econometric analysis is that it "*fulfils many useful roles other than just being a device for generating forecasts; for example, such models consolidate existing empirical and theoretical knowledge of how economies function, provide a framework for a progressive research strategy, and help explain their own failures*".

3.2.1 The Single-Equation Approach

As a starting point to illustrate tourism demand modelling, the single-equation approach involves, first, theorising the determinants of tourism demand, and then using the multivariate regression technique to estimate the relationship between tourism demand and each of the determinants. A basic tourism demand model is typically described as follows (Lim, 1997; Stabler, Papatheodorou, & Sinclair, 2010, p.48):

$$Q_{ij} = f(Y_i, P_{ij/s}, E_{ij/s}, T_{ij/s}, QF) \tag{3.1}$$

where Q_{ij} is the tourism demand for destination *j* by origin *i*, Y_i is the income level of origin *i*, $P_{ij/s}$ is the prices origin *i* relative to destination *j* and competing destinations *s*[1], $E_{ij/s}$ is the exchange rates between origin *i* and destination *j* and competing destinations *s*, $T_{ij/s}$ is the cost of transport between origin *i* and destination *j* and competing destinations *s*, *QF* is any qualitative (non-economic) factor that may affect the demand flow. These are the factors that have been discussed in Section 2.4. The *f* in front of the brackets means the factors inside the brackets, i.e, $Y_i, P_{ij/s}, E_{ij/s}, T_{ij/s}, QF$, follow a certain functional relationship, or model specification.

[1] The number of competing destinations can be determined arbitrarily. It depends on the study context. When multiple competing destinations are chosen, a common practice is to take weighted average of all the prices of the competing destinations to construct an average substitute price variable. So in the model specification, it looks as if there were only one competing destination. As explained in Section 2.4.4, this treatment is to save degrees of freedom when running regression. An illustration can be found in the study by Song, Wong, & Chon (2003).

While the ultimate concern of tourism demand modelling lies in the factors themselves, it is the development of the model specification *f* that manifests the power of demand modelling, as the more advanced models are devised to yield more reliable results. Briefly speaking, there are two sub-categories under the umbrella of the single-equation approach, i.e., static models and dynamic models.

3.2.1.1 Single-Equation Static Models

The standard static model has the following specification:

$$Y = \beta_0 + \sum_{(i)} \beta_i X_i + \varepsilon \qquad (3.2)$$

where Y is the dependent variable (in the context of tourism demand models being the tourism demand), X_i is the value of the i^{th} explanatory variable (as shown in Eq. (3.1), X_i typically being income, prices, exchanges rates, qualitative factors, etc.), ε is the error term that can account for any other factors not represented in the model, and is assumed to be normally distributed with zero mean and constant variance σ^2, i.e., $\varepsilon \sim N(0, \sigma^2)$. X_i. β_0 and β_i are the coefficients to be estimated.

In terms of the functional form, a common practice is to use the log-linear form. That is to take logarithm of both Y and X_i, which transforms the data into a smaller scale. It smoothes fluctuations of the data, hence may reduce the order of integration from $I(2)$ to $I(1)$, which is conducive to standard cointegration analysis (Li, Song, & Witt, 2005). In addition, models estimated in the log-linear form produce relatively low residual variance when compared to other functional forms (Goh & Law, 2011). More importantly, the coefficient β_i now has a practical interpretation as the demand elasticity of the corresponding variable. Under the log-linear form, Eq. (3.2) can be written as[1]

$$lnY = \beta_0 + \sum_{(i)} \beta_i lnX_i + \varepsilon \qquad (3.3)$$

Hence, in Eq. (3.3), $\beta_i = \frac{dlnY}{dlnX_i} = \frac{dY/Y}{dX_i/X_i}$, which is in line with the exact definition of elasticity.

[1] It should be noted that, β_0, β_i, ε in Eq. (3.3) are not equivalent to those in Eq. (3.2), as the dependent variable in Eq. (3.2) is Y, the explanatory variables are X_i s; but in Eq. (3.3), the dependent variable is lnY and the explanatory variables are lnX_i s.

Given the advantages, the predominance of log-linear models in tourism demand studies has been observed over the last few decades (Goh & Law, 2011; Li, Song, & Witt, 2005; Sinclair, Black, & Sugiyarto, 2003).

The ease of implementation of the static model renders the model a handy tool for modelling purposes. Many early tourism demand models, such as Gray (1966) and Artus (1972), were static ones in which the current value of tourism demand is related only to the current values of explanatory variables (Song, Witt, & Li, 2009, p.48). Even in the most recent literature, the static model is still being adopted, such as Mao, Ding, and Lee (2010) and Schiff and Becken (2011).

However, the static models often face criticism for their inherent limitations. In tourism demand modelling, time series data[1] of tourism demand and economic variables are commonly used. It is assumed that ideally both the dependent variable (Y) and the explanatory variables (X_i) are stationary, which implies that the mean and variance of the series do not change over time, so that the linear relationship modelled is valid for the sample period. A practice based on this assumption is the Engle and Granger two-stage cointegration analysis, in which the first stage requires estimation of a static model to capture the long-run equilibrium relationship between variables (Song & Witt, 2003; Song, Witt, & Li, 2009, pp.90-91). But this assumption can be restrictive, especially when the data cover a long period of time, as structural change is possible at some point. Moreover, the error term (ε) in static tourism demand models has generally been found to be highly autocorrelated (Song, Witt, & Li, p.48). Autocorrelation indicates that there is correlation between values of the same series at different times. As a result of autocorrelation, the standard deviation of the estimated coefficients will be biased, which leads to bias in t-statistics as well as other crucial statistical indictors (Stock & Watson, 2012, pp.368-369). Another concern indicated by the high autocorrelation is spurious regression (Goh & Law, 2011; Song, Witt, & Li, 2009, p.48), which describes that high R-square may wrongly indicate a causal relationship while in fact Y and X_i are independent of each other. This can often happen when both the dependent variable and the explanatory variables are integrated,

[1] Time series is a sequence of data points observed within a certain period at particular time intervals. For example, a country's GDP data over a ten-year period at annual or quarterly frequency.

or plainly speaking follow some other underlying trends; but the dependent variable and explanatory variables themselves do not have any relationship.

In an attempt to solve the problems with static models, dynamic effects, such as the lagged value of the dependent and explanatory variables, were introduced into tourism demand models (Song, Witt, & Li, 2009, p.48). This leads to the development of dynamic models.

3.2.1.2 Single-Equation Dynamic Models

It is believed that dynamic models are more realistic, because they take account of the lagged effect of explanatory variables, rather than simply the instantaneous effect (Goh & Law, 2011). The inclusion of lagged variables as regressors, while in the first place has to do with solving the problems inherent in static models, has also strong economic justifications. As summarised by Morley (2009), these are:

- lags in implementing a decision to travel (for example, making travel decisions in advance)
- information lags (for example, using historical prices to anticipate the costs of living at destination)
- as a way of recognising supply rigidities
- to account for long-term adjustment dynamics
- word-of-mouth recommendations (for example, influenced by a previous visitor) and
- repeat visitors.

In practice, the above justifications suggest that both the lagged values of the dependent variable and those of the explanatory variables appear in a dynamic model.

Autoregressive Distributed Lag Model (ADLM)

The Model

By including the lagged dependent and explanatory variables, the standard static model Eq. (3.2) can be extended into the following specification, which is the general form of an autoregressive distributed lag model (ADLM)

$$Y_t = \beta_0 + \sum_{i=1}^{k} \sum_{j=0}^{p} \beta_{ij} X_{i,t-j} + \sum_{j=1}^{q} \lambda_j Y_{t-j} + \varepsilon_t \qquad (3.4)$$

where *t* denotes the time or period of data; *j* indices time lags, and up to *p* and *q* lags; *k* is the number of explanatory variables X_i; λ_j is the coefficient on Y_{t-j} and needs to be estimated (Morley, 2009; Song, Witt, & Li, 2009, p.47). The rest of the notation has the same meaning as that of Eq. (3.2). The model can also be more specifically called ADLM (*p*, *q*). To determine the lag length *p* (or *q*), a general guide is that *p*=1 for annual data, *p*=4 for quarterly data, *p*=6 for bimonthly data, and *p*=12 for monthly data. A more scientific determination can be based on the Akaike information criterion (AIC) or Schwarz information criterion (SBC) (Song, Witt, & Li, 2009, p.42).

Model Estimation: General-to-Specific Approach

The estimation of Eq. (3.4) can follow one of the two strategies: *simple-to-general* approach and *general-to-specific* approach. The *simple-to-general* approach starts with a relatively simple specification (usually a low lag length *p*), then the model is re-specified by introducing new explanatory variables or higher order of lags if the residuals of the simple specification exhibit heteroscedasticity, autocorrelation or lack of normality. The final model may be achieved until the re-specified model is theoretically sound and statistically acceptable (Song, Witt, & Li, 2009, p.47). The *simple-to-general* approach is often criticised for its excessive data mining, as different researchers may obtain different model specifications based on the same data set (Song & Witt, 2003).

Alternatively, the *general-to-specific* approach can be followed, which is a 'top-down' modelling strategy. It starts with a general model which contains as many variables suggested by economic theory as possible. The general model is then estimated to see whether all the variables included are statistically significant or not. The next step is to eliminate the least significant variable according to the t-statistics. With one less variable now, the model is re-estimated and the elimination process is carried out until a statistically acceptable specification with 'correct' signs of coefficients predicted by economic theory is reached (Song, Wong, & Chon, 2003). It should be noted that, sign changes of coefficients and varying estimation of coefficients can be observed during the course of variable elimination. This may indicate that the estimates are not very robust. It may be related to the suppression effect where the correlationship between variables is changed by suppressor. Hence, the final model needs to be tested by a set of diagnostic statistics in order to find out whether there is any misspecification in the model. These typically include the tests for autocorrelation, heteroscedasticity, non-normality, and structural instability, etc. (Song, Witt, & Li, 2009, pp.52-59).

The *general-to-specific* approach can also be implemented in a pre-specified manner. As the general dynamic model Eq. (3.4) contains as many variable as possible, it can be reduced to a number of specific models by imposing certain restrictions on the coefficients β_{ij} and λ_j. Based on Song and Witt (2003) and Song, Witt, and Li (2009, p.48), Table 3.1 summarises the specific models, assuming *p*=*q*=1. It is discernible that the static model, which is introduced as Eq. (3.2), can be seen as a specific model of the ADLM. The *general-to-specific* approach that pursues one or more specific models described in Table 3.1 hence again starts with estimating the general model. Then the restrictions of the specific models are imposed on the coefficients in the general model and restriction tests are carried out. Last but not least, diagnostic tests are performed on the specific models in order to select the most suitable one(s) for policy evaluation and/or forecasting purposes (Song & Witt, 2003).

Table 3.1 - Variations of the autoregressive distributed lag model

General Model: $Y_t = \beta_0 + \sum_{i=1}^{k} \sum_{j=0}^{1} \beta_{ij} X_{i,t-j} + \lambda_1 Y_{t-1} + \varepsilon_t$	
Specific Model	Restrictions
1. Static	$\beta_{11} = \beta_{21} = \cdots = \beta_{k1} = 0, \lambda_1 = 0$
2. Autoregressive (AR)	$\beta_{10} = \beta_{20} = \cdots = \beta_{k0} = 0, \beta_{11} = \beta_{21} = \cdots = \beta_{k1} = 0$
3. Growth Rate	$\beta_{10} = -\beta_{11}, \beta_{20} = -\beta_{21}, \ldots, \beta_{k0} = -\beta_{k1}, \lambda_1 = 1$
4. Leading Indicator	$\beta_{10} = \beta_{20} = \cdots = \beta_{k0} = 0, \lambda_1 = 0$
5. Partial Adjustment	$\beta_{11} = \beta_{21} = \cdots = \beta_{k1} = 0$
6. Finite Distributed Lag	$\lambda_1 = 0$
7. Dead Start	$\beta_{10} = \beta_{20} = \cdots = \beta_{k0} = 0$
8. Error Correction	No restriction

Note: The lag length of the general model is set to be 1.

Source: Adapted from Song, Witt, and Li (2009, p.48).

With lagged values of the dependent variable and/or explanatory variables included in the ADLM, the autocorrelation and spurious regression problem that often plagues the static model (i.e., Eq. (3.2)) can be overcome (Li, Song, & Witt, 2005; Song & Li, 2008). More specifically, as pointed out by Song and Witt (2003), it is well documented that the error correction model is the proper solution.

Cointegration (CI) and Error Correction Model (ECM)

The Model

A dynamic model like Eq. (3.4) can be re-parameterised into an error correction form

$$\Delta Y_t = \sum_{i=1}^{k}\sum_{j=0}^{p-1} b_{ij}\Delta X_{i,t-j} + \sum_{j=1}^{q-1} a_j \Delta Y_{t-j}$$

$$-(1-\phi_1)\left(Y_{t-1} - c_0 - \sum_{i=1}^{k} c_i X_{i,t-1}\right) + \varepsilon_t \qquad (3.5)$$

Note that the notation of the coefficients in Eq. (3.5) is different from that in Eq. (3.4).

The idea of cointegration is that, if a pair of non-stationary economic variables, X_t and Y_t, belongs to the same economic system, there should be an *attractor* or *cointegrating relation* that prevents the two from drifting away from each other. That is, there is a *force of equilibrium* that keeps the two variables moving together in the long run (Song, Witt, & Li, 2009, p.72). Moreover, in the case of multiple explanatory variables $X_{i,t}$, if $X_{i,t}$ and Y_t are cointegrated in the long run, they can be modelled using a static model:

$$Y_t = c_0 + \sum_{i=1}^{k} c_i X_{i,t} \qquad (3.6)$$

The disequilibrium error of the above model is

$$e_t = Y_t - c_0 - \sum_{i=1}^{k} c_i X_{i,t} \qquad (3.7)$$

Compared Eq. (3.7) with Eq. (3.5), it is obvious that the disequilibrium error e_t has been incorporated into the error correction model. $\left(Y_{t-1} - c_0 - \sum_{i=1}^{k} c_i X_{i,t-1}\right)$ in Eq. (3.5) is called the error correction term (ECT).

Eq. (3.5) is interpreted to have covered both the long-run and short-run relationships between economic variables: the coefficients on the level terms Y_{t-1} and $X_{i,t-1}$, i.e., c_0

and c_i, are related to the long-run demand elasticities whereas the coefficients on the first differenced terms ΔY_{t-j} and $\Delta X_{i,t-j}$, i.e., a_j and b_{ij}, reflect the short-run dynamics. The term $-(1-\phi_1)\left(Y_{t-1}-c_0-\sum_{i=1}^{k} c_i X_{i,t-1}\right)$ represents the error correction mechanism. ϕ_1 is a positive number between 0 and 1. Therefore the coefficient $-(1-\phi_1)$ is between -1 and 0, which means the system will adjust itself towards equilibrium by removing $(1-\phi_1)$ of a unit from the error made in the previous period (Smeral, 2010; Song, Witt, & Li, 2009, p.89). The larger the $(1-\phi_1)$, the faster the adjustment is.

Model Estimation

The estimation of an ECM typically starts with deciding the order of integration of the variables, using the unit root tests such as Augmented Dickey-Fuller (ADF) tests, Phillips-Perron (PP) tests and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) tests. The order of integration of a time series reports the minimum number of differences required to obtain a stationary series. For example, if no difference is needed and the series is stationary itself, the order of integration is zero, or the series follows an $I(0)$ process. If the series is differenced once to become stationary, then it follows an $I(1)$ process, and it is said the series contains a unit root. For a cointegrating relation to be detected, all the variables concerned should be integrated of order one, i.e., $I(1)$ (Song, Witt, & Li, 2009, p.84). Therefore, unit root tests are essential to decide whether an ECM can be implemented for modelling purposes.

After the unit root tests, the coefficients of the ECM can be estimated following different procedures. Briefly speaking, these include the Engle-Granger two-stage approach, the Wickens-Breusch (WB) one-stage approach, the Pesaran, Shin, and Smith ADLM bounds testing approach and the Johansen maximum likelihood (JML) approach (Halicioglu, 2010; Song & Lin, 2010; Song, Witt, & Li, 2003; Song, Witt, & Li, 2009, pp.90-93).

The Engle-Granger approach involves first testing for a cointegrating relation based on the static long-run equilibrium regression, i.e., Eq. (3.6). If the estimated residual term (or error correction term) Eq. (3.7) is stationary, then the cointegrating relation is accepted. In the second stage the ECM is estimated, with the error correction term coming from the first stage included. As opposed to the Engle-Granger approach, which may be biased in small samples (Song, Witt, & Li, 2009, p.91), the Wickens-Breusch (WB) approach directly estimates the ECM in one step, without explicitly accounting for the cointegrating relation:

$$\Delta Y_t = b_0 + \sum_{i=1}^{k}\sum_{j=0}^{p-1} b_{ij}\Delta X_{i,t-j} + \sum_{j=1}^{q-1} a_j \Delta Y_{t-j} + \lambda_0 Y_{t-1} + \sum_{i=1}^{k} \lambda_i X_{i,t-1} + \varepsilon_t \quad (3.8)$$

A more recent development in the ECM estimation field is the Pesaran, Shin, and Smith ADLM *bounds testing approach* (Pesaran, Shin, & Smith, 2001). It has been extensively used in most of the recent studies that adopted the ECM, for example Halicioglu (2010), Onafowora and Owoye (2012), Song, Gartner, and Tasci (2012), Song, Lin, Witt, and Zhang (2011), and Wang (2009). The advantage of this approach is its ability to detect cointegrating relation and solve the small sample problem irrespective of whether the dependent and independent variables are purely *I*(1), purely *I*(0), or a mixture of both (Song, Gartner, & Tasci, 2012; Wang, 2009). Rather than using a new specification, the bounds testing approach basically follows Eq. (3.8), and finishes the estimation in one step. The bounds testing is based on an *F*-test performed on the level terms in Eq. (3.8). Specifically, the null hypothesis (H_0: $\lambda_0 = \lambda_1 = \cdots = \lambda_k = 0$) states that there is no cointegration among the variables, whereas the alternative hypothesis (at least one of λ_i is non zero) suggests there exists cointegration. The *F-statistic* is then compared with two sets of critical values reported in Pesaran, Shin, and Smith (2001). If the *F-statistic* exceeds the upper critical bounds value, then H_0 is rejected, indicating there is a cointegrating relation. If the *F-statistic* falls below the lower critical bounds value, then H_0 is accepted and no integration is found. If the *F-statistic* lies between the upper and lower bounds value, then it is inclusive regarding the existence of cointegration (Halicioglu, 2010; Onafowora & Owoye, 2012). Moreover, if H_0 ($\lambda_0 = \lambda_1 = \cdots = \lambda_k = 0$) is rejected, a further t-test is often used to confirm the existence of cointegration (Seetaram, Song, & Page, 2013; Song, Gartner, & Tasci, 2012; Song & Lin, 2010). This t-test is performed on the coefficient on the lagged level term of the dependent variable Y_{t-1}, i.e., λ_0. Again, the t-test assumes the null hypothesis of no cointegration (H_0: $\lambda_0 = 0$) with respect to the tourism demand. Pesaran, Shin, and Smith (2001) generated the upper bounds and lower bounds values for this t-test, and the interpretation is similar to that for the *F*-test.

Another popular estimation procedure of ECM is the Johansen maximum likelihood (JML) approach. It is, however, based on a different modelling framework, i.e., system-of-equations. For the Engle-Granger approach, the WB approach and the bounds testing approach, the detection of cointegration is based on a single equation, which implicitly assumes that there is only one cointegrating relation among all the variables. In contrast, the JML approach allows for multiple cointegrating relations, and subsequently multiple ECMs can be obtained (Song, Witt, & Li, 2003). Discussions on the JML approach will be followed in Section 3.2.2.1.

3.2.1.3 Applications and Limitations

Elasticity Analysis: Point Estimates versus Intervals

Based on the coefficients estimated from the single-equation models (static models, dynamic models such as ADLM and ECM), it is a common practice to derive both the long-run and short-run demand elasticities, which measure the responsiveness of tourism demand towards one unit change in specified influencing factors, i.e., $\frac{dY/Y}{dX_i/X_i}$. As there is one set of coefficients yielded from the estimation, only point estimates of elasticities can be derived accordingly. This poses two limitations that concern the researchers. The first is that the elasticities are assumed to be time-invariant. That is, over the whole sample period tourism demand will increase/decrease in response to say, one unit change in tourists' income, by the same percentage. This assumption is very rigid. As argued by Song, Witt, and Li (2009, p.138), the parameters of the demand model may vary over time, due to structural instability in the underlying data generating process. Such structural change is mainly related to important social, political and economic policy changes. To relax the constancy restriction on the parameters to be estimated in a traditional fixed-parameter econometric model, an advance called the time-varying-parameter (TVP) model has been adopted (Li, Wong, Song, & Witt, 2006; Song, Witt, & Li, 2009, pp.138-148). Discussions will follow in Section 3.2.3. The second limitation of point estimates is that the single value of elasticity is not informative enough to assess whether it is statistically significant and whether it truly represents elastic demand. The reasons are that there is no information about the degree of variability; elasticity is often a non-linear function of other parameters; the sampling distribution of a point elasticity estimator is likely to follow a non-normal distribution, which renders conventional statistical inference based on normal approximation problematic (Song, Kim, & Yang, 2010). To overcome the second limitation, it is argued that a confidence interval of the elasticity will be more useful, and some recent studies, such as Otero-Giráldez, Álvarez-Díaz, and González-Gómez (2012), Song, Kim, and Yang (2010) and Song and Lin (2010), have followed this practice.

Applications

As noted at the beginning of Section 3.2, the econometric tourism demand models aim to build a causal link between tourism demand and its influencing factors. That is, trying to account for the variations of tourism demand[1] with a range of factors. To this end, the single-equation approach (both the static models and the dynamic models) offers a tractable solution, as variables are arranged in a clear-cut manner and the implementation of estimation is straightforward. Therefore, the single-equation approach of modelling has been extensively applied in the tourism demand studies since the very earliest days (e.g., Artus, 1972; Gray, 1966), and this trend can still be observed.

Given its tractability, the applications of the single-equation approach (static and dynamic) are versatile. A major strand of studies is centred on identifying the influencing factors and quantifying their effects on tourism demand. Much of the attention has been paid to economic factors, such as income, prices and exchange rates (e.g., Smeral, 1988; Song, Witt, & Li, 2003; Song, Wong, & Chon, 2003). A less often considered but recurrent factor is marketing expenditures (Crouch, Schultz, & Valerio, 1992; Lim, 1997; Song, Witt, & Li, 2009, p.30), which appeared in the literature as early as 1980s (Stabler, Papatheodorou, & Sinclair, 2010, p.58). Accompanying the modelling exercise, demand elasticities are generally derived for analysis purposes. For example, the marketing expenditure elasticity can be used as an indication of how successful the marketing campaigns of a destination are (Kulendran & Dwyer, 2009; Zhang, Kulendran, & Song, 2010). More recently, research has been extended to quantifying the effect of non-economic factors, such as meteorological

[1] Tourism demand is often observed within a certain time frame, and the data on tourism demand are mostly time series. Hence the focus of tourism demand modelling is mainly on the variation of demand over time. Nevertheless, the spatial dimension of tourism demand attracts sufficient attention too. Spatial models are developed to account for the difference of tourism demand between destinations.

factors (e.g., Goh, 2012; Otero-Giráldez, Álvarez-Díaz, & González-Gómez, 2012) and media messages (Stepchenkova & Eales, 2011).

Apart from identifying the influencing factors, another strand of studies places the emphasis on the impact of special events or policies. Some of the analyses rely on dummy variables in the model. The logic is that the coefficients on dummy variables represent the difference of tourism demand between the scenario where no special event/policy takes place and the scenario where the event/policy occurs. Examples following this logic are Song, Gartner and Tasci (2012), which estimated the loss of China's tourism industry due to visa restrictions imposed on international visitors, and Wang (2009), which calculated the impacts of a series of natural and economic crises on Taiwan's inbound tourism. Some other studies based the analysis on generic economic variables. One way is to include new variable(s). For example, Seetaram, Song, and Page (2013) included a tax variable in an ADLM and estimated the demand elasticity on Air Passenger Duty (APD), in order to analyse the sensitivity of UK's outbound tourism towards policy changes in tourism taxes. Another way is to use third-party forecasts of economic variables (such as IMF, UNWTO) to generate forecasts of tourism demand. As the third-party forecasts have already incorporated information about the special event/policy, the forecasts of tourism demand would thus be able to reflect the influence of the event/policy. Examples are the studies by Smeral (2010), Song and Lin (2010), Song, Lin, Witt, and Zhang (2011), which aimed to gauge the impacts of the worldwide economic crisis since 2008.

Limitations: the Assumption of Exogeneity

Despite their versatile capabilities, the single-equation econometric models are not without problem. Fundamental limitations of the single-equation approach are often the target of criticism.

As pointed out by Stabler, Papatheodorou and Sinclair (2010, p.59), one problem that the approach faces is that explanatory variables are often selected on a fairly *ad hoc* basis. This will result in misspecification of the equation and biased estimation. In a tourism demand model, apart from the factors that have been justified by relevant economic theory (i.e., tourists' income level, relative prices in the destination concerned and in substitute destinations, exchange rates), there are often other specific factors being considered, such as marketing expenditure, monetary supply, and even immigration crime rate (Li, Song, & Witt, 2005). Although the *general-to-specific* procedure (Song, Witt, & Li, 2009, pp.46-69) can help to exclude those that are irrelevant, the question still remains that how well justified it is to include certain variables. After all, the inclusion is largely dictated by the theme of the research rather than by rigorous theory. The model itself does not judge the appropriateness of the variables appearing in it.

A more fundamental concern of the single-equation approach is about its assumption of *exogeneity*, which requires all the explanatory variables to be decided by factors outside the model. As such, any randomness in the data generating process (DGP) of the explanatory variables is independent of the error term in the DGP for the dependent variable (Davidson & Mackinnon, 2003, p.89). Take the simplest univariate static regression as an example,

$$Y_i = \beta_0 + \beta_1 X_i + u_i, i = 1, \dots, n \quad (3.9)$$

the exogeneity means

$$E(u_i | X_i) = 0 \quad (3.10)$$

Correspondingly, if the explanatory variables and the error term are not independent, i.e., $cov(X_i, u_i) \neq 0$, then the explanatory variables are said to be *endogenous*.

The exogeneity assumption is of utmost importance to the single-equation approach, because the breach of Eq. (3.10) will result in biased ordinary-least-square (OLS) estimation (Davidson & Mackinnon, 2003, pp.88-90).

As discussed by Stock and Watson (2012, p.462), the breach of Eq. (3.10) (i.e., existence of correlation between X_i and u_i) can stem from omitted variables, measurement errors in the regressors, and simultaneous causality. While the former two sources cannot be completely avoided even with other modelling approaches, the latter one tends to plague the single-equation approach more. Simultaneous causality is a situation where the causality runs not only from the explanatory variables to the dependent variable (i.e., X_i causes Y_i), but also in the reverse direction (i.e., Y_i causes X_i). Put it in the context of tourism demand modelling, simultaneous causality implies that not only the tourism demand for destination *j* is influenced by the prices in destination *j* and the origin country *i*'s income level, but also the tourism demand can have feedback impact on *j*'s local prices and even country *i*'s income level. In reality, it is not uncommon to see the influx of tourists has caused demand pressure on destination's local economy. For example, using the data for 45 European cities, Albalate and Bel (2010) find that the additional demand for public transport by tourists imposed external costs on local residents due to the congestion caused by a supply constraint, even though the tourism receipts could provide some additional funding for the transport services. In the same vein, the demand pressure can be extended to affect generic goods/services and result in inflation (i.e., price increase) in a local economy, especially when the supplies are not perfectly elastic to meet the demand. Therefore, the feedback impact of tourism demand on its economic determinants is an important dimension of tourism demand modelling, which in fact has often been overlooked. Few studies using the single-equation approach to modelling have tried to account for the simultaneous causality between tourism demand and its influencing factors, or even mention the limitations of the single-equation approach.

3.2.2 The System-of-Equations Approach

In view of the limitations of the single-equation approach, mainly the *ad hoc* model specification and the exogeneity assumption, systems of equations have been put forward and adopted in tourism demand modelling.

There are three major types of models, which are the vector autoregressive (VAR) model, the almost ideal demand system (AIDS), and the panel data analysis model. Just like the single-equation approach, all the three types of systems of equations can also accommodate the dynamic features of tourism demand. Although the specifications of the three types of systems can be distinctly different, the backbone of them (that is the individual equation in it) is just similar to Eq. (3.2) for a static specification, and Eq. (3.4) and Eq. (3.5) for a dynamic form.

3.2.2.1 Vector Autoregressive (VAR) Model

The Model

The development of the vector autoregressive (VAR) model mainly aims to relax the assumption of exogeneity that is implicitly imposed on the single-equation models. To allow for endogeneity in the model, it was popular to use the simultaneous-equation approaches within the context of structural macroeconomic modelling, which dated back to the 1950s and 1960s (Song & Witt, 2006). These approaches often required *a priori* restrictions to be imposed on the parameters of the equations. Many of the restrictions, as argued by Sims (1980), were ‘incredible’. In order to bypass the need of structural modelling (i.e., one that depends on the imposition of incorrect prior information), Sims developed a VAR model that treated all variables as endogenous, except for the deterministic variables such as trend, intercept and dummy variables (Song & Witt, 2006). A general VAR(p) model, where p is the lag length, can be written as

$$\boldsymbol{Y}_t = \sum_{l=1}^{p} \boldsymbol{A}_l \boldsymbol{Y}_{t-l} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t + \boldsymbol{U}_t \tag{3.11}$$

$$\boldsymbol{U}_t \sim IID(\boldsymbol{0}, \boldsymbol{\Sigma}) \tag{3.12}$$

where $\boldsymbol{Y}_t$ is a $k \times 1$ vector of endogenous variables, $\boldsymbol{A}_l$ is a $k \times k$ matrix of coefficients to be estimated, $\boldsymbol{C}_0$ is a $k \times 1$ vector of intercepts, $\boldsymbol{C}_1$ is a $k \times 1$ vector of coefficients on the trend, $\boldsymbol{U}_t$ is a $k \times 1$ vector of innovations or shocks. In addition, dummy variables can also be added to Eq. (3.11) in the same manner as the trend terms. Hence, there are in total k equations to be estimated. Assuming $\boldsymbol{U}_t$ to be contemporaneously correlated but not autocorrelated, each equation in the system can be individually estimated with OLS estimator or the seemingly unrelated regression estimator (SURE) (Song & Witt, 2006).

The variables in $\boldsymbol{Y}_t$ are endogenous variables (either justified by theory, or simply due to lack of evidence of exogeneity) in a system, which implies that one variable can correlate with one or some of the rest of the variables. The idea of VAR model is that each variable in $\boldsymbol{Y}_t$ is regressed on its lags and all other endogenous variables. Hence, for each variable, there is a unique equation capturing the causal relationship running from the rest of the endogenous variables to the variable itself. In the context of tourism demand modelling, the vector $\boldsymbol{Y}_t$ typically include, as in Eq. (3.1), the tourism demand variable, the price variables of the destination concerned as well as those of the competing destinations, the exchange rate variables and the travel cost variables[1].

More generally, the VAR model can be extended to include exogenous variables

[1] The inclusion of non-economic factors as endogenous variables is rare and has to be taken with caution. Deterministic variables such as trend, seasonality and dummy variables typically enter a VAR system as exogenous variables.

$$\boldsymbol{Y}_t = \sum_{l=1}^{p} \boldsymbol{A}_l \boldsymbol{Y}_{t-l} + \boldsymbol{B}\boldsymbol{Z}_t + \boldsymbol{C}_0 + \boldsymbol{C}_1 t + \boldsymbol{U}_t \quad (3.13)$$

where $\boldsymbol{Z}_t$ is a $d \times 1$ vector of exogenous variables; $\boldsymbol{B}$ is a $k \times d$ matrix of coefficients to be estimated. Unlike Eq. (3.11), where there are *k* equations explaining the causal relationships among *k* endogenous variables, Eq. (3.13) uses *k*+*d* variables (*k* endogenous ones, plus *d* exogenous ones) to explain *k* relationships. Furthermore, the VAR model Eq. (3.11) can incorporate the CI/ECM analysis, which is more specifically called vector error correction model (VECM) and has very similar structure to Eq. (3.5)

$$\Delta\boldsymbol{Y}_t = \sum_{l=1}^{p-1} \boldsymbol{A}_l \Delta\boldsymbol{Y}_{t-l} + \boldsymbol{\Pi}\boldsymbol{Y}_{t-1} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t + \boldsymbol{U}_t \quad (3.14)$$

where $\boldsymbol{\Pi}\boldsymbol{Y}_{t-1}$ is the error correction vector; if the elements of $\boldsymbol{Y}_t$ are *I*(0), $\boldsymbol{\Pi}$ will be a full rank $k \times k$ matrix; if the elements of $\boldsymbol{Y}_t$ are *I*(1) and not cointegrated, then $\boldsymbol{\Pi} = \boldsymbol{0}$ and a VAR model in first differences will be more appropriate than a VECM; if the elements of $\boldsymbol{Y}_t$ are *I*(1) and cointegrated with rank($\boldsymbol{\Pi}$) = *r* (0<*r*<*k*), then $\boldsymbol{\Pi}$ can be expressed as $\boldsymbol{\Pi} = \boldsymbol{\alpha}\boldsymbol{\beta}'$. In the last case, both $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are $k \times r$ full column rank matrices, and there will be *r* cointegrating relations, i.e., $\boldsymbol{\xi}_t = \boldsymbol{\beta}'\boldsymbol{Y}_t$, which are *I*(0). $\boldsymbol{\xi}_t$ captures the deviations from equilibrium, and $\boldsymbol{\alpha}$ is the matrix of adjustment or feedback coefficients measuring how strongly the deviations from equilibrium feedback onto the system (Garratt, Lee, Pesaran, & Shin, 2012, pp.117-118). The *r* individual cointegrating relations are also called cointegration vectors.

While $\boldsymbol{\Pi}$ can be estimated unrestrictedly, the determination of $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ is not necessarily unique. It is possible to choose any non-singular $r \times r$ matrix, $\boldsymbol{Q}$, and write $\boldsymbol{\Pi} = \boldsymbol{\alpha}\boldsymbol{\beta}' = (\boldsymbol{\alpha}\boldsymbol{Q}'^{-1})(\boldsymbol{Q}'\boldsymbol{\beta}') = \boldsymbol{\alpha}_*\boldsymbol{\beta}'_*$, so that $\boldsymbol{\alpha}_* = \boldsymbol{\alpha}\boldsymbol{Q}'^{-1}$ and $\boldsymbol{\beta}_* = \boldsymbol{\beta}\boldsymbol{Q}$ constitute observationally equivalent alternative structures. To identify $\boldsymbol{\beta}$, at least r^2 restrictions need to be imposed, formed from r restrictions on each of the *r* cointegrating relations (Garratt, Lee, Pesaran, & Shin, 2012, p.36). A normalisation scheme of imposing an $r \times r$ identity matrix on $\boldsymbol{\beta}'$ is often used for identification purpose in statistical packages such as EViews.

However, this does not rule out other subjective identification schemes. In fact, it is recognised that the restrictions are drawn from economic theory and other *a priori* information, so that the cointegrating relations can make sense economically as well as statistically (Garratt, Lee, Pesaran, & Shin, 2012, pp.36-37; Juselius, 2006, p.120). Models following this rationale are called Structural VAR (SVAR).

Model Estimation: the JML Approach to Identifying Cointegrating relations

From Eq. (3.14), it is allowed that there are more than one cointegrating relations among all the variables, the number of which is specified as *r*. As discussed by Song, Witt, and Li (2009, p.127), the possibility of multiple cointegrating relations renders the Engle-Granger two-stage approach to identifying cointegrating relations too restrictive. What the Engle-Granger approach detects is only an 'average' cointegrating vector over a number of cointegration vectors. Besides, as it is a two-stage procedure, any error introduced in the first stage will be carried over to the second stage. To overcome these problems, the Johansen (1988) maximum likelihood (JML)[1] estimator is developed, and becomes a standard procedure in the recent studies (e.g., Lim & McAleer, 2001a; Seetanah & Khadaroo, 2009; Torraleja, Vázquez, & Franco, 2009).

Briefly speaking, the Johansen procedure is an extension of the univariate Dickey-Fuller (DF) test to a multivariate VAR framework (Song, Witt, & Li, 2009, p.127). To decide the number of cointegrating vectors, the key is to look at the significance of the characteristic roots of matrix **Π** (Song, Witt, & Li, 2009, p.129). The rank of a matrix is the same as the number of characteristic roots that are different from zero. There are two statistics that can be used

$$\lambda_{trace} = -T \sum_{i=r+1}^{m} \ln(1 - \hat{\lambda}_i) \tag{3.15}$$

$$\lambda_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \tag{3.16}$$

where $\hat{\lambda}_i$ are the estimated values of the characteristic roots or eigenvalues from the matrix **Π** in Eq. (3.14) and *T* is the total number of observations.

The first test statistic λ_{trace} comes from the trace test. The null hypothesis is that there are at most *r* cointegrating relations, i.e., $\text{rank}(\mathbf{\Pi}) \leq r$, whereas the alternative hypothesis is there are more than *r* cointegrating relations, i.e., $\text{rank}(\mathbf{\Pi}) > r$. The second test statistic λ_{max} is known as the maximal eigenvalue test. Its null hypothesis

[1] This is one of the three approaches to identifying cointegrating relations, along with the Engle-Granger two-stage approach and the Wickens-Breusch one-stage approach.

is that the rank of $\mathbf{\Pi}$ is *r*, and the alternative hypothesis is that the rank is *r*+1. Despite that both tests are crucial references in deciding the number *r*, it does happen that they suggest different numbers of cointegrating relations. In addition, as discussed in Juselius (2006, pp.140-142), size and power distortions of the statistic can be resulted in when the sample is small. Juselius (2006, p.142) further points out that '*the cointegration rank is not in general equivalent to the number of theoretical equilibrium relations derived from an economic model*'. Hence, the point is, in determining the number of cointegrating relations, not only the sample size and the test statistic, but also the economic interpretability need to be taken into consideration.

Model Estimation: Five Cases of Incorporating the Deterministic Components

In describing the cointegrating relations, the term $\boldsymbol{\beta}'\boldsymbol{Y}_t$, which is *I*(0) if the variables of $\boldsymbol{Y}_t$ are cointegrated, only considers the endogenous variables. It is well possible that the deterministic terms, which are the intercept $\boldsymbol{C}_0$ and the trend $\boldsymbol{C}_1 t$ in Eq. (3.14), may be components of the cointegrating relations.

Following Juselius (2006, pp.95-100), let

$$\boldsymbol{C}_0 = \boldsymbol{\alpha}\boldsymbol{\beta}_0 + \boldsymbol{\gamma}_0 \tag{3.17}$$

$$\boldsymbol{C}_1 = \boldsymbol{\alpha}\boldsymbol{\beta}_1 + \boldsymbol{\gamma}_1 \tag{3.18}$$

where $\boldsymbol{\alpha}$ has the same meaning as in $\mathbf{\Pi} = \boldsymbol{\alpha}\boldsymbol{\beta}'$. The derivation of $\boldsymbol{\beta}_0,\ \boldsymbol{\beta}_1,\ \boldsymbol{\gamma}_0,\ \boldsymbol{\gamma}_1$ is explained by Juselius (2006, pp.95-99) in details.

Five cases with regard to how Eq. (3.17) and Eq. (3.18) could be incorporated into the VECM Eq. (3.14) have been discussed by Juselius (2006, p.100) and Song, Witt, and Li (2009, pp.129-130):

Case I: $\boldsymbol{Y}_t$ does not have deterministic trends and the cointegration equations do not have intercepts, i.e., $\boldsymbol{C}_0 = 0, \boldsymbol{C}_1 = 0$. Hence, $\mathbf{\Pi}\boldsymbol{Y}_{t-1} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t = \boldsymbol{\alpha}\boldsymbol{\beta}'\boldsymbol{Y}_{t-1}$.

Case II: $\boldsymbol{Y}_t$ does not have deterministic trends but the cointegration equations have intercepts, i.e., $\boldsymbol{\beta}_0 \neq 0, \boldsymbol{\gamma}_0 = 0, \boldsymbol{C}_1 = 0$. Hence, $\mathbf{\Pi}\boldsymbol{Y}_{t-1} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t = \boldsymbol{\alpha}(\boldsymbol{\beta}'\boldsymbol{Y}_{t-1} + \boldsymbol{\beta}_0)$.

Case III: $\boldsymbol{Y}_t$ *has deterministic trends but the cointegration equations only have intercepts, i.e.,* $\boldsymbol{\beta}_0 \neq 0, \boldsymbol{\gamma}_0 \neq 0, \boldsymbol{C}_1 = 0$. *Hence,* $\boldsymbol{\Pi Y}_{t-1} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t = \boldsymbol{\alpha}(\boldsymbol{\beta}'\boldsymbol{Y}_{t-1} + \boldsymbol{\beta}_0) + \boldsymbol{\gamma}_0$.

Case IV: $\boldsymbol{Y}_t$ *has deterministic trends, and the cointegration equations have intercepts and deterministic trends, i.e.,* $\boldsymbol{\beta}_0 \neq 0, \boldsymbol{\gamma}_0 \neq 0, \boldsymbol{\beta}_1 \neq 0, \boldsymbol{\gamma}_1 = 0$. *Hence,* $\boldsymbol{\Pi Y}_{t-1} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t = \boldsymbol{\alpha}(\boldsymbol{\beta}'\boldsymbol{Y}_{t-1} + \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 t) + \boldsymbol{\gamma}_0$.

Case V: $\boldsymbol{Y}_t$ *has quadratic trends, and the cointegration equations have intercepts and deterministic trends, i.e.,* $\boldsymbol{\beta}_0 \neq 0, \boldsymbol{\gamma}_0 \neq 0, \boldsymbol{\beta}_1 \neq 0, \boldsymbol{\gamma}_1 \neq 0$. *Hence,* $\boldsymbol{\Pi Y}_{t-1} + \boldsymbol{C}_0 + \boldsymbol{C}_1 t = \boldsymbol{\alpha}(\boldsymbol{\beta}'\boldsymbol{Y}_{t-1} + \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 t) + \boldsymbol{\gamma}_0 + \boldsymbol{\gamma}_1 t$.

Of the five cases, *Case III* and *Case IV* are the most commonly considered in economics.

Granger Causality Analysis

Based on the VAR model (Eq. (3.11) and Eq. (3.14)), it is often of researchers' interest to test for causality between variables. One of the major applications of the VAR model is the Granger causality analysis.

Summarised by Song, Witt and Li (2009, p.112), the concept of Granger causality states that the past values of a time series, say $y_{2,t}$, is helpful to forecast the current and future values of another series, say $y_{1,t}$. For example, in a bivariate VAR model case

$$y_{1,t} = \alpha + \sum_{i=1}^{n} \beta_i y_{1,t-i} + \sum_{i=1}^{n} \gamma_i y_{2,t-i} + \varepsilon_t \tag{3.19}$$

The Granger test is an *F* test on the joint significance of $\gamma_1 = \gamma_2 = \cdots = \gamma_n$. If the null hypothesis $\gamma_1 = \gamma_2 = \cdots = \gamma_n = 0$ is accepted, it is said that $y_{2,t}$ does not Granger cause $y_{1,t}$. Otherwise, if the null hypothesis is rejected, then $y_{2,t}$ Granger causes $y_{1,t}$. In estimating Eq. (3.19), deterministic terms such as trend and dummy variables can also be included. To test for the Granger causality from $y_{1,t}$ to $y_{2,t}$, another *F* test needs to be conducted, with $y_{2,t}$ being the dependent variable in Eq. (3.19).

In the case where more than two variables are involved, the *block Granger causality* test (or sometimes referred to as the *block exogeneity* test), which is usually an *LR* statistic, should be used (Song, Witt, & Li, 2009, p.113). For example, if there are three variables, $y_{1,t}$, $y_{2,t}$ and $y_{3,t}$, and the concern is whether $y_{3,t}$ Granger causes $y_{1,t}$ and/or $y_{2,t}$. The test is thus to impose the restrictions that all of the coefficients of the lagged $y_{3,t}$ in the system are zero.

From the explanation above, it is often argued that the concept of the Granger causality is very different from the 'causality' in everyday life, where one factor/event has impact on another factor/event (Song, Witt, & Li, 2009, p.112; Stock & Watson, 2012, p.580). The rationale behind the Granger causality is that, if an event, say $y_{2,t}$ is the cause of another event, say $y_{1,t}$, then the former should precede the latter. Hence, what the Granger causality test does is to only gauge the predictability of a time series and see if $y_{2,t}$ precedes $y_{1,t}$, without touching the underlying mechanism of the causation. This is one of the limitations of Granger causality analysis.

Impulse Response Analysis

One advantage of VAR modelling is that it is well suited to policy simulation through impulse response analysis (Song, Witt, & Li, 2009, p.108). The idea is that, a shock to the i^{th} variable not only directly affects the i^{th} variable but is also transmitted to all other endogenous variables via the dynamic structure of the VAR model. In the context of tourism, impulse response analysis can be used to answer questions such as how 'shocks' to the price level in a destination and/or 'shocks' to the income level in the origin country would affect tourism demand for the destination.

Consider a VAR(*1*) model

$$\boldsymbol{Y}_t = \boldsymbol{A}_1 \boldsymbol{Y}_{t-1} + \boldsymbol{U}_t \tag{3.20}$$

By iterative substitution for *n* times, Eq. (3.20) can be rearranged as follows

$$\boldsymbol{Y}_t = \sum_{i=0}^{n} \boldsymbol{A}_1^i \boldsymbol{U}_{t-i} + \boldsymbol{A}_1^{n+1} \boldsymbol{Y}_{t-n+1} \tag{3.21}$$

If the time series data are stationary, i.e., $0 < |\boldsymbol{A}_1| < 1$, then $\lim_{n\to\infty} \boldsymbol{A}_1^n = 0$, and Eq. (3.21) can be written as

$$\boldsymbol{Y}_t = \sum_{i=0}^{\infty} \boldsymbol{A}_1^i \boldsymbol{U}_{t-i} \tag{3.22}$$

Eq. (3.22) is called a *vector moving average* (VMA) form, where the vector of dependent variables is represented by an infinite sum of lagged random errors weighted by an exponentially diminishing coefficient. Hence the endogenous variables of $\boldsymbol{Y}_t$ can be expressed by sequences of 'shocks' to the system. As a result, the formula captures the impacts of unitary changes in the error terms ('shocks') on the dependent variables, which are often of policy makers' concern.

Applications

An important feature of the VAR model is its ability to account for the endogeneity between dependent and explanatory variables. Hence simultaneous causality, as explained in Section 3.2.1.3, or bidirectional causation, can be properly modelled within the VAR framework. As a result, the aspects of tourism demand that can be explored have been substantially extended. Briefly speaking, the applications of the VAR model centre on two areas: the first is the interactions/interdependencies of tourism demand between destinations, and the second is the interactions/bidirectional causation between tourism demand and its influencing factors.

The interdependencies between tourism demand for different destinations are one of the latest topics that receive continuous attention from researchers. Studies are found published basically after 2009. As noted by Song, Dwyer, Li, and Cao (2012, p.1658), the idea is that '*tourism demand in one destination tends to be affected by demand for alternative destinations due not only to cultural and environmental similarities and geographic proximity, but also to similarity in the economic determinants that underpin destination choice*'. Torraleja, Vázquez and Franco (2009) conduct one of the earliest studies that look into the interrelations between tourism markets. They used monthly data on visitors to hotels in five major coastal regions in Spain to construct a VECM. Granger causality analysis and impulse response analysis were performed to find out whether the tourist flow to one destination was Granger caused by that to another destination, and the extent to which the tourism demand for one destination would be affected by one unit shock that happened to other destinations. Following similar approaches, but taking the perspective of a country's outbound tourism, Seo, Park and Boo (2010) investigate the Granger causal relations between Korea's demand for seven major overseas destinations by using a standard VAR(p) model. One of the objectives that both Torraleja, Vázquez and Franco (2009) and Seo, Park and Boo (2010) aim to achieve is to reveal one (or more) leading tourism flow(s), if any, that could act as an indicator of general tourism trends. It is, however, problematically interpreted by Seo, Park and Boo (2010) that the Granger causality can be identified as causal relationship. Moreover, both studies only include tourism demand variables in the VAR model, leaving out the influencing factors such as income, consumer prices, and exchange rates. It is argued by Seo, Park and Boo (2010) that the causal relationship between tourism demand and economic variables had already been well accounted for in many other studies, and in addition the influence of economic variables had already been reflected in the outbound demand patterns, so their focus was on the potential causal relationship between tourism demand variables. However, based on Granger causality analysis, while it is reasonable to claim that changes in tourism demand for one destination can be a *signal* of changes in demand for other destinations, it is by no means appropriate to conclude that changes in tourism demand for one destination are the *reason* for changes in the demand for another destination. As discussed earlier on, the concept of Granger causality only concerns the sequence of occurrence of events, rather than the underpinning of causation. Therefore, without including the economic variables in the VAR model, it is not possible to properly model the causal relationship that underlies the interdependencies between tourism demand. Critical information has been left out regarding how the linkages between tourism destinations are affected by the economic climate.

In addition to exploring the interdependencies between destinations, the VAR model has been applied to explaining the interactions between tourism demand and its influencing factors, for example Halicioglu (2010) and Song and Witt (2006). In this case, each VAR model is specified for one destination and a set of relevant explanatory variables. One topic that has undergone continuous debates is the tourism-led-growth (TLG) hypothesis. It states that the international tourism can generate employment, spur local investments and diffuse technical knowledge, and thus promote wealth (Schubert, Brida, & Risso, 2011). A number of studies since early-2000s have been conducted to test for the validity of the hypothesis. Again, the Granger causality test was carried out to confirm whether tourism receipts (or arrivals) cause GDP growth in a local economy (e.g., Akinboade & Braimoh, 2010; Balaguer & Cantavella-Jorda, 2002; Belloumi, 2010; Dritsakis, 2004; Durbarry, 2004; Kim, Chen, & Jang, 2006; Oh, 2005; Schubert, Brida, & Risso, 2011). However, the mechanism by which the tourism sector improves the aggregate welfare was not well reflected in the model specifications. In view of this inadequacy, Nowak, Sahli and Cortes-Jimenez (2007) propose the TKIG hypothesis (tourism exports → capital goods imports → growth), which recognises that tourism receipts can help to finance capital goods imports and thus increase domestic output level. Empirically, the hypothesis has been tested in a way which resembles that for the TLG, with the variable of imports of industrial machinery included in the VAR model (e.g., Cortes-Jimenez, Nowak, & Sahli, 2011; Nowak, Sahli, & Cortes-Jimenez, 2007).

Apart from economic growth, the VAR model has also been widely used to study the relationship between tourism and other aspects of an economy, such as international trade (e.g., Khan, Toh, & Chua, 2005; Shan & Wilson, 2001), foreign direct investment (e.g., Tang, Selvanathan, & Selvanathan, 2007), and transportation capital (e.g., Seetanah & Khadaroo, 2009).

One interesting finding from the literature is that few studies proceeded to conduct the impulse response analysis, which is designed to quantify the effects of shocks. Exceptions are Chen (2007), Schubert, Brida, and Risso (2011), Song and Witt (2006), and Torraleja, Vázquez and Franco (2009). This may well reflect researchers' tendency to concentrate on the longer horizon and long-run equilibrium, rather than short-run fluctuations. It may also be associated with the fact that international tourism has witnessed a steady expansion over the past few decades, despite some disturbances such as the September 11 terrorist attacks and the SARS epidemic. However, the ongoing economic downturn unequivocally calls for more efforts to reveal the implications of short-run economic fluctuations for the international tourism sector.

Limitations: Curse of Dimensionality

With each endogenous variable explained by the rest of the endogenous variables in an individual equation, the VAR model brilliantly handles the endogeneity problem among variables. However, one serious limitation facing the model is the number of endogenous variables that can be accommodated in one VAR model. Briefly speaking, with more variables included in the model, the number of parameters to be estimated will grow exponentially. Given that the observations for each variable over a certain span of time will be limited, the more parameters in the model, the less the degrees of freedom will be available for estimation. The power of cointegration tests will thus be affected. This situation is called ‘overfitting’ in statistical terms. It is often referred to as ‘curse of dimensionality’, a term coined by Richard Bellman (Bussière, Chudik, & Sestieri, 2009).

Consider a standard VAR(p) model, (for simplicity) excluding the intercepts, deterministic trends as well as exogenous variables:

$$\boldsymbol{Y}_t = \sum_{l=1}^{p} \boldsymbol{A}_l \boldsymbol{Y}_{t-l} \qquad (3.23)$$

where the vector $\boldsymbol{Y}_t$ contains k endogenous variables, and the lag length is p.

For each equation in the model, the number of parameters to be estimated is k *(variables)* × p *(lags)* = kp. The number of parameters in the model is thus k *(equations)* × k *(variables)* × p *(lags)* = k^2p. If the number of endogenous variables increases from k to k+1, the number of parameters will rise up to $(k+1)^2p = k^2p + (2k+1)p$. The degrees of freedom are related to the number of observations (in the case of time series data, the number of periods, T), and the number of parameters to be estimated. Although it is desirable to use high frequency data (monthly, weekly, or daily) in order to obtain a large number of observations, the appropriate lag length p will accordingly increase, which in return results in more parameters.

For estimations that involve only one particular origin-destination pair, the VAR model can accommodate both the tourism demand variable and a small number of economic variables. For example, in modelling the international tourist flows to Macao, Song and Witt (2006) include four endogenous variables, i.e., the tourism demand, the relative tourism prices in Macao, the relative tourism prices in substitute destinations and the income level of the origin country. In other applications which involve one particular country, a similar number of endogenous variables are contained in the model, about three variables (e.g., Durbarry, 2004; Nowak, Sahli, & Cortes-Jimenez, 2007; Oh, 2005; Schubert, Brida, & Risso, 2011).

However, in the case where there are multiple origin-destination pairs, it is almost impossible to include both tourism demand and economic variables. Suppose there are five countries, and each country has three endogenous variables. Let the lag length p be two. Then the number of endogenous variables k will be 3 (variables) × 5 (countries) = 15. Accordingly, in each equation of the VAR model, there at least will be 15 (variables) × 2 (lags) = 30 parameters to be estimated, which requires a huge amount of observations to ensure enough degrees of freedom. For all the individual equations, the number of parameters in the model will be at least 15 (equations) × 30 (parameters per equation) = 450. Hence, it does not look surprising that, in modelling the interdependencies between tourism demand, Seo, Park and Boo (2010) and Torraleja, Vázquez and Franco (2009) choose to include only the tourism demand variables of seven and five destinations, respectively (even though they indicated some other justifications for the choice of destinations).

One way of reducing the number of parameters is to impose certain restrictions on the variables in the VAR model, based on economic theories and other *a priori* information. This is the Structural VAR (SVAR) approach. For example, zero (exclusion) restrictions on the elements of $\boldsymbol{\beta}$; linear restrictions between the elements of $\boldsymbol{\beta}$. However, there have to be relevant theories out there, which are able to assign a definitive value to each restriction. Besides, restrictions are not always met statistically. Tests on restrictions have to be carried out. Thus, the usefulness of SVAR in handling the curse of dimensionality deeply hinges on the availability of theories underpinning the restricions.

Consequently, the curse of dimensionality poses a dilemma in front of the researchers who are keen to properly model the interdependencies between tourism demand for different destinations. On the one hand, as remarked earlier on, to examine how tourism demand is interrelated between markets, Granger causality analysis is only able to predict the sequence or direction of influence, rather than the real cause-effect relationship. To thoroughly understand the interrelations between destinations, economic variables are indispensable in the model. On the other hand, the VAR model will easily get over-parameterised if both the tourism demand and economic variables for multiple countries are included.

Given the limitations, it is no wonder that applications of VAR model are often limited to a relatively small system, with one origin-destination pair or a few countries dealt with. From a globalisation point of view, the interrelations should take place on a global scale. To this end, a global system that contains as many countries as possible would be more appropriate and insightful.

3.2.2.2 Almost Ideal Demand System (AIDS)

The Model

As discussed in Section 3.2.1.3, the single-equation approach often faces criticism for lacking a strong underpinning of economic theory. As a result, the variables included in a single-equation model tend to be selected on an *ad hoc* basis. Instead, the development of the almost ideal demand system (AIDS), originated by Deaton and Muellbauer (1980), aims to incorporate the consumer demand theory into the model in an explicit manner.

According to the microeconomic foundations laid in Section 2.4.2, consumers (or tourists) are assumed to undergo a multi-stage budgeting process to make consumption decisions. The process involves a choice among a group of products, based on the relative prices of each product and constrained by consumers' budget. There exists a certain degree of interdependence between the consumption of one product and another. An increase in the price of one product may well result in less consumption of it and more consumption of its substitutes. Apparently, the single-equation approach cannot adequately model the influence of a change in the price of one product on the demand for other products.

In addition to the multi-stage budgeting process, there are certain 'axioms of consumer choice' that consumers are assumed to follow (Stabler, Papatheodorou, & Sinclair, 2010, p.61). Specifically, these state that an increase in price will result in decreased demand (negativity); that the budget is completely used so the sum of expenditures on individual categories is equal to total expenditure (the adding-up condition); that consumers do not exhibit money illusion so a proportional change in all prices and expenditure has no effect on demand (homogeneity), and the consumer's choices are consistent (symmetry) (Song, Witt, & Li, 2009, pp.169-170; Stabler, Papatheodorou, & Sinclair, 2010, p.61). Furthermore, if the axioms are valid reflections of behaviour at the individual level, generalisations to the aggregate level are more likely to be appropriate (Stabler, Papatheodorou, & Sinclair, 2010, p.61).

Incorporating the multi-stage budgeting process and the axioms of consumer choice, the AIDS model is commonly used to estimate the allocation of expenditure between a range of products, or in the context of tourism, a number of destinations. Suppose there are *n* products (or destinations) to which the budget needs to be allocated, the AIDS model is generally specified as follows (Li, Song, & Witt, 2005), which is the equation about the expenditure on the i^{th} product/destination

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(x/P^*) + u_i \quad (3.24)$$

where w_i is the budget share for the i^{th} product/destination; p_j is the price of the j^{th} product/destination; price for each product/destination, from 1 through *n*, should be added up; *x* is the total budget (or total expenditure) on all products/destinations in the system; P^* is the aggregate price index for all products/destinations in the system, and is often defined as the Stone's price index in the form of $\log P^* = \sum_{i=1}^{n} w_i \log p_j$; u_i is the error term; α_i, β_i and γ_{ij} are the coefficients to be estimated. With the aggregate price index specified as Stone's price index, the AIDS model has a linearly approximated specification, and Eq. (3.24) is termed as linear AIDS (LAIDS). As there are *n* products/destinations in total, the whole AIDS system should consist of *n* equations.

As with the models presented in the previous sections, the AIDS model can also be extended to consider the error correction mechanism (Li, Song, & Witt, 2004)

$$\Delta w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \Delta \log(x/P^*) + \lambda_i ECT_{i,t-1} + u_i \quad (3.25)$$

where $ECT_{i,t-1}$ is the error correction term that is estimated from the corresponding cointegrating relation; λ_i is the coefficient to be estimated, in addition to α_i, β_i and γ_{ij}. The model Eq. (3.25) is also denoted as EC-LAIDS.

Model Estimation

Since the sum of all budget shares in the LAIDS model is equal to unity, the residual variance-covariance matrix will be singular. It is a common practice to delete one equation from the system and estimate the remaining equations. The coefficients in the deleted equation can be calculated in accordance with the adding-up restrictions.

The estimation of LAIDS model can use the ordinary least square (OLS) estimator, the maximum likelihood (ML) estimator, or the seemingly unrelated regression estimator (SURE). The SURE method is used most often, because it performs more efficiently than OLS in the system with the symmetry restriction, and it will converge to the ML estimator if the residuals are distributed normally (Li, Song, & Witt, 2005).

To comply with the axioms of consumer choice, restrictions can be imposed on the estimated coefficients. It is desirable that with the restrictions imposed, the model will still generate meaningful and logical estimation results. Specifically, the restrictions are written as the following formulas (Li, Song, & Witt, 2004)

Adding-up restrictions: $\sum_{i=1}^{n} \alpha_i = 1$, $\sum_{i=1}^{n} \gamma_{ij} = 0$, *and* $\sum_{i=1}^{n} \beta_i = 0$;

Homogeneity: $\sum_{j=1}^{n} \gamma_{ij} = 0$;

Symmetry: $\gamma_{ij} = \gamma_{ji}$;

Negativity: all the compensated own-price elasticities must be negative.

The adding-up restrictions and the negativity condition can be easily checked by examining the relevant coefficients and the signs of elasticities. The homogeneity condition and the symmetry condition need to be tested using such as the Wald test, *LR* test, Lagrange multiplier test, or the more specific sample-size corrected statistics defined as follows (Li, Song, & Witt, 2004; Song, Witt, & Li, 2009, p.170)

$$T_1 = \frac{tr(\Omega^R)^{-1}(\Omega^R - \Omega^U)/q}{tr(\Omega^R)^{-1}\Omega^U/(n-1)(N-k)} \quad (3.26)$$

$$T_2 = \frac{tr(\Omega^R)^{-1}(\Omega^R - \Omega^U)}{tr(\Omega^R)^{-1}\Omega^U/(n-1)(N-k)} \quad (3.27)$$

where Ω^R and Ω^U are the estimated residual covariance matrices with and without restrictions imposed, respectively; *n* is the number of equations in the system; *N* is the number of observations for each equation; *k* is the number of estimated parameters in each equation; *q* denotes the number of restrictions. T_1 is approximately distributed as $F(q, (n\text{-}1)\cdot(N\text{-}k))$ under the null hypothesis, and T_2 follows an asymptotic chi-square distribution with *q* degrees of freedom.

The purpose of imposing and testing the restrictions is to derive the most appropriate version of LAIDS model for further analysis. The unrestricted LAIDS (i.e., without any restrictions imposed) acts as a basic model. Adding the homogeneity and/or the symmetric restrictions, the LAIDS model becomes: the homogeneous LAIDS, and the homogeneous and symmetric LAIDS. The latter version is the most theoretically sound. However, in the case where any of the restrictions is rejected, the unrestricted LAIDS or homogeneous LAIDS may still be considered (Song, Witt, & Li, 2009, p.170).

From the estimated LAIDS model, the demand elasticities that have standard interpretations can be calculated as follows (Song, Witt, & Li, 2009, pp.171-172).

Expenditure elasticity: it measures the sensitivity of demand for product/destination i in response to changes in expenditure

$$\varepsilon_{ix} = 1 + \frac{\beta_i}{w_i} \tag{3.28}$$

Uncompensated price elasticities: they measure how a change in the price of one product affects the demand for this product and for other products, with the total expenditure and other prices held constant

$$\varepsilon_{ii} = \frac{\lambda_{ii}}{w_i} - \beta_i - 1 \tag{3.29}$$

$$\text{and} \quad \varepsilon_{ij} = \frac{\lambda_{ij}}{w_i} - \beta_i \frac{w_j}{w_i} \tag{3.30}$$

Compensated price elasticities: they measure the price effects on the demand assuming the real expenditure x/P^* is constant

$$\varepsilon_{ii}^* = \frac{\gamma_{ii}}{w_i} + w_i - 1 \tag{3.31}$$

$$\text{and } \varepsilon_{ij}^* = \frac{\gamma_{ij}}{w_i} + w_j \tag{3.32}$$

Applications

Although the AIDS model was introduced to tourism demand studies in as early as the 1980s, it has not attracted much attention until late 1990s (Li, Song, & Witt, 2005; Sinclair, Black, & Sugiyarto, 2003). Built on strong economic underpinnings, the AIDS model is often applied to model a specific stage of the budgeting process.

Many of the studies using AIDS model focus on the relatively early stage of budgeting, where the tourists face with the allocations of expenditure within a group of destinations. For example, De Mello, Pack, and Sinclair (2002) use a static AIDS model to examine the UK demand for three neighbouring destinations, namely France, Spain and Portugal. Similar approach is taken by Divisekera (2003), who, in an attempt to generate a broad picture of international tourism, applies four individual systems to model the tourism demand for Australia and selected international destinations by residents from the UK, the USA, New Zealand and Japan. Dynamic AIDS model, such as EC-LAIDS, gained popularity from mid-2000s. Examples are Cortés-Jiménez, Durbarry, and Pulina (2009), Durbarry and Sinclair (2003), and Li, Song, and Witt (2004), which model the outbound demand from Italy, France and the UK, respectively.

Since the tourists are assumed to allocate their budget over a specified set of destinations, tourism demand for the destinations in the system exhibits certain level of interdependence. Specifically, the cross-price elasticities can denote whether destinations are substitutes (positive elasticities) or complements (negative elasticities). As remarked by Sinclair, Blake, and Sugiyarto (2003), the cross-price elasticities are useful in indicating the degree of competitiveness or complementary between different destinations. Studies that exploited the AIDS model's capability of gauging destination competitiveness are found sporadically after mid-2000s, such as Li, Song, Cao, and Wu (2013), Mangion, Cooper, Cortés-Jimenez, and Durbarry (2012), and Mangion, Durbarry, and Sinclair (2005).

Apart from modelling the allocations of budget over different destinations, the AIDS model can also be used to analyse tourists' consumptions of a range of products in a particular destination, which correspond to a later stage of budgeting process. Tourism expenditures are usually classified into five broad categories, namely, accommodation, sightseeing/entertainment, food & beverage, shopping, and transport. The AIDS model is used to reveal tourists' sensitivities towards prices. Studies emerged in the more recent literature include Wu, Li, and Song (2011), which specify eight demand systems for eight major source markets to Hong Kong and compared the elasticities of tourists from different markets. Other examples are Divisekera (2009), Divisekera (2010b), and Wu, Li, and Song (2012).

Limitations

Although AIDS model is recognised for its rigorous economic underpinning and is believed to generate more accurate estimates (especially regarding demand elasticities), it faces criticism for not being able to account for endogeneity between variables (Sinclair, Blake, & Sugiyarto, 2003). In an AIDS model, the dependent variable in each equation is the share of expenditure on a particular destination/product, whereas the explanatory variables are the price of each destination/product and tourist's total budget. Although interdependence between the expenditures on different destinations/products is allowed, in the sense that a price change in one destination/product will result in a change in the demand for that particular destination/product as well as that for other destinations/products in the same system, provided there exist substitution or complement relationships between destinations/products. However, as with the single-equation models, the AIDS model only allows for a one-way causal relationship running from prices and total budget to expenditure share. The underlying assumption for the explanatory variables is still that they are exogenous to the system. Such issues, as suggested by Sinclair, Blake, and Sugiyarto (2003), can be resolved by using the VAR model to test if the AIDS specification is appropriate, in that if both models yielded similar results, then with confidence the AIDS model is not spurious.

Another issue with AIDS model is the over-parameterisation problem, which arises when more destinations/products are added into the system. This is similar to the curse of dimensionality that plagues VAR model, although the explosion of parameters in AIDS model is not as serious as that of VAR model. From the standard static model Eq. (3.24), adding one more destination/product will result in an additional equation, and an additional price term for that destination/product in each equation for other destinations/products in the same system. For example, if the number of destinations/products increases from n to n+1, the additional parameters to be estimated are $\alpha_{n+1}, \beta_{n+1}, \lambda_{n+1}$ and $\gamma_{n+1,j}$ $(j = 1, 2, \dots, n)$ in the (n+1)$^{\text{th}}$ equation, and $\gamma_{i,n+1}$ $(i = 1, 2, \dots, n)$ in the other equations (the 1^{th} to n^{th} equation). Such an increase of parameters can exhaust the degrees of freedom easily, given that the observations (especially tourist expenditure data) typically cover a short time span. Besides, an implication of the over-parameterisation is that the restriction tests are more likely to be rejected, since the pattern of consumption (or the tourists' behaviour) may not strictly follow the axioms of consumer choice if there are too many destinations/products in question. Hampered by the over-parameterisation problem, the AIDS model is only suitable for modelling a small demand system, just as the VAR model.

A further limitation concerning the AIDS model is its relatively rigid specification. Due to its rigorous economic underpinning, the choice of explanatory variables has been well reasoned. As a result, the regressors in the model are constructed exclusively from price variables and total budget variable, together with deterministic terms such as intercepts, trend and/or dummies. Hence, as mentioned, although the AIDS model allows for interdependence between destinations/products, such relations can only be interpreted as results of the substitution effect and income effect associated with price changes. Consequently, the connotation of 'interdependencies' under the AIDS framework is narrowly defined, leaving out the aspects such as the feedback impact of tourism demand on local economy and the spillover effect on foreign economies. It is also impossible to include new explanatory variables, apart from the price and budget variables, since it would be deemed as lack of justification under the neoclassical consumer theoretical framework, where the AIDS model draws its theoretical grounding. In a word, the rigid specification of AIDS model limits the scope of implications that can be drawn.

3.2.2.3 Panel Data Analysis

The Model

The panel data analysis is an advanced modelling approach which can be seen as an extension of the single-equation models, and is able to accommodate the cross-sectional dimension of data. Briefly speaking, there are three types of data structure. The most often used in tourism demand modelling is time series data, as noted at the beginning of Section 3.2.1. Time series data are continuous observations of variables for a particular entity over a period of time (for example, a series of the UK's GDP figures from 2001 to 2013). The concern of using time series data is often about the intrinsic characteristics of the entity's evolution, or its dynamics. Another type of structure is cross-sectional data, which are observations of variables for different entities at a particular point of time (for example, a set of GDP figures of each of the European Union member states in 2013). The concern of using cross-sectional data is usually about the difference between the entities. A combination of the temporal dimension and the cross-sectional dimension of data results in the third type of data structure, i.e., the panel data (for example, a panel of GDP figures of each of the European Union member states from 2001 to 2013).

Apparently, one of the advantages of panel data analysis is its relatively large number of observations and the consequent increase in degrees of freedom (Song, Witt, & Li, 2009, p.149). Moreover, from a modelling point of view, the use of panel data can reduce collinearity problems, which are likely to arise when certain socio-demographic variables (e.g., age structure, gender and education) are included in the model, because of lack of variations in these variables over time (Song, Witt, & Li, 2009, p.149).

A standard static panel data regression model can take the same form as its single-equation counterpart, i.e., Eq. (3.2). Specifically, the model Eq. (3.2) can be written compactly as

$$Y_{i,t} = \alpha_i + \boldsymbol{\beta}_i' \boldsymbol{X}_{i,t} + \varepsilon_{i,t} \tag{3.33}$$

where *i* = 1, …, *N*, and *t* = 1, …, *T*; so the observations for $Y_{i,t}$ and $\boldsymbol{X}_{i,t}$ are across *N* sections and over *T* periods; $Y_{i,t}$ is the dependent variable, say, tourism demand; $\boldsymbol{X}_{i,t}$ is a *K* × 1 vector of *K* explanatory variables; α_i (1 × 1) and $\boldsymbol{\beta}_i$ (*K* × 1) are the coefficients to be estimated; $\varepsilon_{i,t}$ is the error term, $\varepsilon_{i,t} \sim IID(0, \sigma_\varepsilon^2)$, $\forall\, i, t$.

As the data of cross sections are literally 'pooled' into one model specification, a prior test for poolability is needed to ensure that such treatment is appropriate. The procedure is described by Song, Witt, and Li (2009, pp.150-151). Based on Eq. (3.33), the poolability test starts with estimating a restricted model in which both the intercept α_i and the slope coefficients $\boldsymbol{\beta}_i'$ are assumed homogeneous across sections, i.e. $Y_{i,t} = \alpha + \boldsymbol{\beta}' \boldsymbol{X}_{i,t} + \varepsilon_{i,t}$ (3.34)

An *F* test is used to test for the significance of the restrictions, which is

$$F_1 = \frac{(RSS_{R1} - RSS_U)/[(N-1)(K+1)]}{RSS_U/[N(T-K-1)]} \tag{3.35}$$

where RSS_{R1} and RSS_U are the residual sums of squares of the restricted and unrestricted models, respectively, and (*N*-1)(*K*+1) and *N*(*T*-*K*-1) are the degrees of freedom.

If the calculated statistics of F_1 is smaller than the critical value, the null hypothesis of homogenous slopes and intercepts across the *N* sections should be accepted, meaning the panel data modelling approach is appropriate. If the *F* test is rejected, then another *F* test should be proceeded to test for homogenous slopes, i.e., $\boldsymbol{\beta}'$, and heterogeneous intercepts, i.e., α_i (*i* = 1, …, *N*)

$$F_2 = \frac{(RSS_{R2} - RSS_U)/[(N-1)K]}{RSS_U/[N(T-K-1)]} \tag{3.36}$$

where RSS_{R2} is the residual sum of squares for the restricted model where the intercepts are allowed to vary across sections but the slope coefficients are equal.

If the calculated value of F_2 is smaller than the critical value, the null hypothesis of homogeneous slopes $\boldsymbol{\beta}$ and heterogeneous intercepts α_i will be accepted. In that case, the use of panel data for modelling is appropriate.

Further to the F_2 test, it is possible to test the null hypothesis of homogeneous intercepts conditional on homogeneous slopes by a third *F* test, which is

$$F_3 = \frac{(RSS_{R1} - RSS_{R2})/(N-1)}{RSS_{R2}/(NT-N-K)} \tag{3.37}$$

If the intercept term, α_i, is assumed to be heterogeneous (according to the results of the *F* tests), appropriate dummy variables will be needed to account for the section-specific difference. There are two models that can be considered, which are the fixed effects (FE) model and the random effects (RE) model.

Specifically, the error term in Eq. (3.33) can be re-specified as

$$\varepsilon_{i,t} = u_i + e_{i,t} \tag{3.38}$$

where u_i denotes the *unobservable* section-specific effects and $e_{i,t}$ is the usual disturbance term, which varies across sections and period (Song, Witt, & Li, 2009, p.152).

The difference between the fixed effects (FE) model and the random effects (RE) model lies in the assumptions made about u_i. The FE model assumes that u_i is correlated with explanatory variables $\boldsymbol{X}_{i,t}$, whereas the RE model assumes that u_i is uncorrelated with $\boldsymbol{X}_{i,t}$. *A priori* considerations suggest that the FE model is one from which inferences can be made conditional on the observed sample. Hence, if the focus is on the sample itself, the FE model is appropriate. But if the concern is about drawing inferences with regard to the population based on the sample, then the RE model is more appropriate (Song, Witt, & Li, 2009, p.152).

As with the single-equation approach, dynamics of the data can also be incorporated into panel data analysis through inclusion of lagged dependent variable, which is often interpreted as a measure of habit persistence and/or word-of-mouth effect of tourism demand[1] (Garín-Munoz, 2006; Naude & Saayman, 2005; Seetaram, 2010). Following Eq. (3.34) and Eq. (3.38), a dynamic panel data regression model can be written as

$$Y_{i,t} = \alpha + \gamma Y_{i,t-1} + \boldsymbol{\beta}'\boldsymbol{X}_{i,t} + u_i + e_{i,t} \tag{3.39}$$

where γ is the coefficient to be estimated, in addition to $\boldsymbol{\beta}$.

Model Estimation

The procedure of panel data regression is very similar to that of the single-equation models. It starts with the tests for cointegrating relation, which involve both the unit root tests and the cointegration tests. As noted by Seetanah, Durbarry, and Ragodoo (2010), the commonly used unit root tests, such as the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), have low power in distinguishing the unit root null from the stationary alternatives in the context of panel data. Special panel unit root tests have thus been devised.

The development of panel unit root tests basically centres on two issues: heterogeneity and cross-sectional dependencies (Hurlin & Mignon, 2007). Specifically, the panel unit root tests proposed in early literature assumed *cross-sectional independence*, which means there is no potential correlation across residuals of panel units. These tests are generally termed as the *first generation* panel unit root tests, for instance, Levin, Lin, and Chu (2002), Im, Pesaran, and Shin (2003), Maddala and Wu (1999), Choi (2001) and Hadri (2000). The *first generation* tests are divided with regard to whether the panel is homogeneous or heterogeneous across sections. In other words, the question is if the same model can be used to test the unit root hypothesis on various individual sections. A positive answer means that the panel is homogeneous. For instance, the Levin, Lin, and Chu (LLC) and the Hadri tests assume that there is a common unit root process, so the autoregressive parameter in the test model is identical across sections. On the contrary, if each section is

[1] As cited in Section 3.2.1.2, Morley (2009) pointed out a few justifications for including lagged terms of variables in a model. Hence, the lagged terms have rich underpinning and the interpretation should not be limited to habit persistence only.

characterised by its unique dynamics, the panel is then heterogeneous and the unit root tests have to account for the heterogeneity. The Im, Pesaran, and Shin (IPS), Fisher-type ADF and PP tests (Maddala & Wu, 1999; Choi, 2001) allow for individual unit root processes, so the autoregressive parameter may vary across sections. The tests are characterised by the combining of individual unit root tests to derive a panel-specific result. In the tourism demand studies that adopted dynamic panel data analysis, the latter category of panel unit root tests, which take the heterogeneity into consideration, is often chosen (e.g., Ledesma-Rodriguez, Navarro-Ibanez, & Perez-Rodriguez, 2001; Seetanah, Durbarry, & Ragodoo, 2010; Seetaram, 2010).

As opposed to the *first generation* panel unit root tests, the *second generation* tests relax the cross-sectional independence assumption. It is argued that the cross-sectional independency hypothesis is rather restrictive and somewhat unrealistic in the majority of macroeconomic applications where co-movements of economies are often observed (Hurlin & Mignon, 2007). In attempting to exploit the co-movements across sections in order to define new test statistics, two main approaches have been followed. The first one specifies the cross-sectional dependencies as a common factor model, for example, the Bai and Ng (2004), Phillips and Sul (2003), Moon and Perron (2004), Choi (2006), and Pesaran (2007) tests. The second approach imposes few or none restrictions on the covariance matrix of residuals, for example, Chang (2002).

After the panel unit root tests, panel cointegration tests are performed to confirm the long-run relationship among variables. Commonly used methods are residual-based panel cointegration tests such as those proposed by Kao (1999) and Pedroni (1999, 2004). Examples using these methods are Falk (2010), Seetanah, Durbarry, and Ragodoo (2010), and Seetaram (2010). The Pedroni's tests rely on four panel statistics (equivalent to the unit root statistics against homogeneous alternatives) and three group mean panel statistics (analogous to the panel unit root tests against heterogeneous alternatives) to test the null hypothesis of no cointegration against the alternative of cointegration (Breitung & Pesaran, 2005; Seetanah, Durbarry, & Ragodoo, 2010).

Once the panel cointegration tests have been conducted, an appropriate estimator has to be chosen to estimate the panel data regression model. As widely acknowledged, the traditional ordinary linear squares (OLS) estimator will generate biased and inconsistent estimates when applied to a dynamic panel data model specification (Ledesma-Rodriguez, Navarro-Ibanez, & Perez-Rodriguez, 2001; Naude & Saayman, 2005; Seetaram, 2010). Another standard estimator for panel data, least squares dummy variable (LSDV), is also problematic in the presence of lagged dependent variables (Deng & Athanasopoulos, 2011). The problem occurs because of the correlation between the lagged dependent variable and the error term of the regression model; that is the regressors are not exogenous. It is only when there is a large number of observations in the temporal dimension that the problem of biased and inconsistent estimates will be alleviated (Deng & Athanasopoulos, 2011; Garín-Muñoz & Montero-Martín, 2007; Seetaram, 2010).

To properly estimate the dynamic panel, early literature (e.g., Ledesma-Rodriguez, Navarro-Ibanez, & Perez-Rodriguez, 2001) used the instrument variable (IV) type of estimators, such as the two-stage least squares (TSLS) and the three-stage least squares (3SLS), where two period lagged values of the dependent variable are used as the IV. However, this approach leads to consistent but not efficient estimates, because it does not make use of all the variable moment conditions (Garín-Muñoz & Montero-Martín, 2007). More efficient estimators have been developed under the generalised method of moments (GMM) framework based on the studies by Arellano and Bond (1991) and Arellano and Bover (1995), who used high order of lagged dependent variables as IV, and this approach has become the most popular (Deng & Athanasopoulos, 2011). Examples using the GMM type estimators include Balli, Balli, and Cebeci (2013), Garín-Muñoz and Montero-Martín (2007), Khadaroo and Seetanah (2008), Massidda and Etzo (2012), Naude and Saayman (2005), Rodríguez, Martínez-Roget, and Pawlowska (2012). However, as noted by Seetaram (2010), if the time span of the data is small, the bias persists even if the GMM estimator is applied. It is argued that the corrected LSDV (CLSDV) estimator proposed by Kiviet (1995) will be more efficient when T is small, although it is only applicable to balanced panel data.

Applications

As introduced, panel data analysis can accommodate both the temporal and spatial (or cross-sectional) dimensions of tourism demand data. Therefore, it is suitable for models of which the data cover a shorter time span and have different cross sections. Despite the advantages of panel data, their applications were rarely seen when Song and Li (2008) conduct a thorough survey in the mid-2000s. It is until more recently (the late-2000s) that this modelling approach has been more frequently exploited and become a favoured choice for certain research topics.

A primary application is modelling tourism demand and measuring the effects/elasticities of relevant determinants. This has appeared in studies majorly since the early 2000s. For example, Ledesma-Rodriguez, Navarro-Ibanez, and Perez-Rodriguez (2001) estimate both short-run and long-run elasticities of demand for Tenerife tourism, based on a panel of arrival figures to thirteen source countries. Other examples are Falk (2010), Garín-Muñoz and Montero-Martín (2007), Naude and Saayman (2005), and Seetaram (2010). The ability of panel data to handle the collinearity problems associated with the relatively time-invariant socio-demographic data allows studies to include these variables and extend the scope of research (e.g., Nerg, Uusivuori, Mikkola, Neuvonen, & Sievanen, 2012).

One time-invariant factor that especially attracts researchers' attention is distance. A range of studies have been based on the *gravity models* to analyse tourism flows. The idea of gravity models was originally derived by analogy with Newton's gravitational law. It states (in the tourism context) that the degree of interaction between two geographic areas varies directly with the degrees of concentration of persons in two areas and inversely with the distance separating them (Witt & Witt, 1995). The basic form of gravity models is

$$T_{ij} = a(P_i^{b_1} P_j^{b_2} / d_{ij}^{b_3}) \qquad (3.40)$$

where T_{ij} denotes the number of trips taking between node i and node j; P_i and P_j are the population at node i and node j; d_{ij} is the distance between node i and node j; and a, b_1, b_2 and b_3 are constants.

When used in empirical studies, the model specifications often include explanatory variables such as income, prices as well as other socio-economic factors, thus closely resembling usual consumer theory-based demand function. Despite that the gravity model was recognised to be well suited to studying international trade (Khadaroo & Seetanah, 2008), its applications in tourism demand research were not widely observed, nor was it surveyed systematically in review papers, except for Witt and Witt (1995). Nevertheless, it emerges that gravity models have become an often choice in recent literature using panel data, for example, Deng and Athanasopoulos (2011), Eryigit, Kotil, and Eryigit (2010), Khadaroo and Seetanah (2008), Massidda and Etzo (2012), and Seetanah, Durbarry, and Ragodoo (2010).

Limitations

The primary issue with panel data analysis is on the poolability assumption, which needs to be tested before modelling exercise is carried out. As remarked by Song, Witt, and Li (2009, p.149), '*the choice of an appropriate model depends inter alia on the degree of homogeneity of the intercept and slope coefficients and the extent to which any individual cross-section affects are correlated with the explanatory variables*'. Although it is allowed that the intercepts to be heterogeneous by employing the fixed effect or random effect models, the slope coefficients are generally set to be identical in the setting of panel data analysis. An observation about the studies since the early 2000s shows that, however, the poolability tests are generally left out. The model specifications (e.g., fixed effect or random effect models) are often determined on *a priori* basis. This will inevitably cause concerns about the rigor underlying the models.

Based on the existing literature, it is found that another issue which limits the applications of panel data analysis is exactly the one that troubles the models introduced in previous sections – exogeneity. The specifications of panel data regression models, i.e., Eq. (3.33) and Eq. (3.39), resemble those of the single-equation models. Following Eq. (3.39), which considers the fixed effect or random effect, several assumptions about the error terms $e_{i,t}$ and the unobserved heterogeneity terms u_i are made. As summarised by Seetaram (2010), these state that (i) the error terms are not correlated to one another over the sample period and across sections; (ii) the unobserved heterogeneity is random; (iii) the unobserved heterogeneity is uncorrelated within the sections and with the error terms; (iv) the explanatory variables are strictly exogenous, i.e., not correlated with the error terms; and (v) the unobserved heterogeneity may be correlated with predetermined variables. Therefore, bidirectional causation is not allowed under the panel data setting.

Endogeneity among dependent and explanatory variables cannot be modelled under the existing panel data analytical framework.

3.2.3 Other Econometric Model

Time Varying Parameters (TVP) Model

As raised in Section 3.2.1.3, the single-equation approach rigidly assumes that the coefficients to be estimated are constant over the whole sample period. The consequence is that the demand elasticities calculated accordingly will be constant as well. It would be unrealistic to assume that people's consumption behaviour remains the same consistently, especially if tourism market and local economy have undergone radical changes during the sample period.

One of the recurrent features of the econometric models has been predictive failure, which is normally associated with model structure instability, i.e., the parameters of the demand model vary over time (Song, Witt, & Li, 2009, p.138). There are generally two reasons for structural instability. The first is that our knowledge about the structure of model is limited. Hence, when a predictive failure occurs, new information should be added to the knowledge base, which is used to produce a better model that encompasses both the new and earlier information (Song, Witt, & Li, 2009, p.138). This leads to the use of recursive-OLS, which is to re-specify the model every time a new observation from the sample is added. The second reason for structural instability is that it is a reflection of underlying structural change in the data generating process (DGP). This may be related to important social, political and economic changes (Song, Witt, & Li, 2009, p.138). To account for the underlying changes embedded in the data, time varying parameter (TVP) model has been proposed and also applied to tourism demand studies.

The TVP model can be specified in the following state space form

$$y_t = x_t \alpha_t + \varepsilon_t \quad (3.41)$$

$$\alpha_{t+1} = T_t \alpha_t + R_t \eta_t \quad (3.42)$$

where y_t is the dependent variable; x_t is a row vector of k explanatory variables; α_t is a column vector of k state variables known as the *state vector*; T_t is a $k \times k$ matrix; R_t is a $k \times g$ matrix; ε_t refers to the temporary disturbance, $\varepsilon_t \sim N(0, H_t)$; η_t is $g \times 1$

vector of permanent disturbance, $\eta_t \sim N(0, Q_t)$; both ε_t and η_t are Gaussian disturbances, which are serially uncorrelated and independent of each other at all time points (Li, Wong, Song, & Witt, 2006). Eq. (3.41) is called the system equation or observation equation, while Eq. (3.42) is called the transition equation or state equation (Li, Wong, Song, & Witt, 2006; Song, Witt, & Li, 2009, pp.142-143). The equations can easily be extended to accommodate a vector of dependent variables, and in that case, both y_t and ε_t become a vector accordingly.

The components of the matrix T_t in Eq. (3.42) can equal unity. The transition equation then becomes a *random walk*:

$$\alpha_{t+1} = \alpha_t + R_t\eta_t \tag{3.43}$$

In most of the economic applications, it is assumed that α_t follows a random walk process (Li, Wong, Song, & Witt, 2006). Other specifications of the transition equation can be determined by experimentation. The criteria are the goodness of fit and the predictive power of the model (Song, Witt, & Li, 2009, p.143). Once the model (both the system equation and the transition equation) is formulated, it can be estimated with the Kalman filter (KF), which is a recursive procedure for calculating the optimal estimator of the state vector given all the information available at time *t*.

Despite the advantages of TVP model, its applications in tourism research is still relatively limited. Song and Wong (2003) applied the model to examine the demand for Hong Kong tourism from six major countries of origins. In their assessment of the impacts of the global economic crisis and swine flu on the demand for UK tourism, Page, Song, and Wu (2012) construct a TVP model to yield *ex post* forecasts of demand under the no-impact and economic-impact scenario, and estimated the events' impacts by comparing the two scenarios. It was justified by the fact that the external shocks, such as economic crisis and global pandemic, would cause structural change to tourists' behaviour.

TVP model is also used in combination with other models, in order to achieve superior performance. Li, Wong, Song, and Witt (2006) is the first study in the context of tourism demand forecasting to apply the TVP-LRM and TVP-ECM to modelling the demand for European destinations by UK residents. The models were then compared with a number of fixed-parameter models, including naïve, ARIMA, ADLM, VAR, ECM. It was found that the TVP-ECM consistently outperformed the fixed-parameter econometric models and time series models. The combination of TVP model and other models is not limited to single-equation models only. Li, Song, and Witt (2006) develop the TVP-LAIDS models in both long-run (LR) form, i.e., TVP-LR-LAIDS, and error correction (EC) form, i.e., TVP-EC-LAIDS. Based on the figures of UK's outbound tourists to Western Europe, both the TVP versions and their fixed-parameter counterparts were estimated and compared. The results suggested that the unrestricted TVP-LR-LAIDS and TVP-EC-LAIDS outperformed their fixed-parameter counterparts in the overall evaluation of demand level forecasts. Wu, Li, and Song (2012) apply the TVP-EC-LAIDS model to analyse the consumption behaviour of tourists to Hong Kong.

3.3 Time Series Models

In contrast to the econometric models, time series models require standalone series of the variable only. For example, to model tourism demand, a series of demand figures (e.g., tourist arrivals or tourism expenditure) covering a certain time span will be the only input. Explanatory variables can be entirely omitted in the model. Particular attention is thus paid to exploring the historic trends and patterns (such as cycle and seasonality) of the series and to predicting the future values of the series based on the properties identified[1] (Song & Li, 2008), rather than pursuing the underlying causal relations. As a result, the use of time series models is closely associated with forecasting exercise, and the models under this category often become contenders for forecasting competition.

As less inputs are required in time series models, the data collection process can thus be greatly shortened, provided sufficient number of observations is available. Although it is desirable to obtain high frequency data[2] (e.g., monthly, weekly, and daily) as the number of observations will be larger, the associated sophistication of patterns will increase the difficulty of modelling.

A critical limitation of time series models, in comparison with the econometric models, is that no causal relationship can be modelled. Hence, it is not possible to

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[1] It is assumed that past trends and/or features of a time series will repeat in the future. Hence, the model that identifies the intrinsic properties of historic data can be used for forecasting exercise.
[2] Apparently, 'high frequency' in the context of tourism demand modelling is not comparable to that used in the field of finance, where data be generated every day, hour, minute, or second.

incorporate economic theory and/or tourism theory into the model. It will also be difficult to attach a practical meaning to the parameters estimated, except that they reveal certain intrinsic attributes of the data. Nevertheless, time series models are still popular with tourism researchers, due to its relatively easy implementation process and potential use as benchmarks for forecast competition. Given that the current research will be conducted under the framework of econometric models, time series models are less relevant. Hence the following review will be conducted in a succinct manner.

3.3.1 Autoregressive Integrated Moving Average (ARIMA) Models

Time series models have been widely used for tourism demand modelling. Among others, the autoregressive integrated moving average (ARIMA) model, which was proposed by Box and Jenkins in the 1970s, is the most popular (Goh & Law, 2011; Song & Li, 2008). This is because, as remarked by Lim and McAleer (2002), it can handle any stationary or non-stationary time series, both with and without seasonal elements.

The ARIMA model accommodates both autoregressive (AR) process and moving average (MA) process. Briefly speaking, the AR process specifies that the dependent variable depends linearly on its own past values, whereas the MA process suggests that the current value of dependent variable is a linear combination of current and previous white noise error terms. A general representation of an ARIMA (*p*, *q*, *d*) model is

$$\left(1-\sum_{i=1}^{p}\phi_i L^i\right)(1-L)^d X_t = \left(1+\sum_{i=1}^{q}\theta_i L^i\right)\varepsilon_t \qquad (3.44)$$

where L is the lag operator; X_t is the variable under study; ε_t is the error term; ϕ_i (i = 1, 2, …, p) are the parameters of the AR part of the model; θ_i (i = 1, 2, …, p) are the parameters of the MA part of the model; correspondently, p is the order of the AR process and q the MA process; i is the order of integration of the time series; d denotes the order of differencing applied to the series. If d=0, the model is equivalent to an ARMA model.

In addition to the ‘simple’ ARIMA outlined above, variations and extensions of the ARIMA model have also been introduced. They are sometimes categorised as ‘ARMA-based’ models (Chu, 2009) or ‘ARIMA-based’ models (Tsui, Balli, Gilbey,

& Gow, 2014). One of the most often seen variations is the seasonal ARIMA (SARIMA) model, which is applied when seasonal data are used and seasonal effects are suspected. Seasonal differencing is performed up to order *D*. Seasonal parameters of the AR part and the MA part are incorporated into the model. Another variation that regularly features in the recent tourism demand literature is the fractional ARIMA (ARFIMA) model. It is a generalisation of the ARIMA that incorporates long-range dependence. In an ARFIMA model, the differencing parameter *d* is allowed to be a non-integer, denoting the fractional order of integration (Chu, 2009). A further variation of ARIMA model is the ARAR model. The idea is that a time series is transformed from a long-memory AR filter to a short-memory filter. It explicitly questions the practice of differencing to achieve stationary and has an advantage of utilizing information contained in the data, normally lost when differencing (Chu, 2009).

Given the range of variations, it is seldom that an ARIMA model will be employed as a standalone model. Comparison is often involved between alternative models. In modelling and forecasting the international tourism demand for Australia, Lim and McAleer (2002) compared the forecast performance of both ARIMA and SARIMA model. Chu (2009) compared the forecast performance of SARIMA, ARAR and ARFIMA model, based on the international arrival figures to nine major destination countries in Asia-Pacific region. It is found that the ARFIMA model in general outperformed the other two. Shen, Li, and Song (2009) extend the scope of comparison, to include econometric models (e.g., ECM) as alternatives. The results showed that no single model could consistently outperform the others on all occasions, though. Some other examples are Chu (1998), Chu (2008a), Chu (2008b), Goh and Law (2002), and Nowman and Van Dellen (2012).

3.3.2 Generalised Autoregressive Conditional Heteroskedasticity (GARCH) Models

Volatility models have been very popular with empirical research in finance and econometrics since the early 1990s (Coshall, 2009). The models are based on the influential papers by Engle (1982) and Bollerslev (1986). At the root of volatility modelling is the distinction between conditional (stochastic) and unconditional (constant) errors. The models contain a ‘mean equation’, which is commonly a standard ARIMA or regression model, and a ‘variance equation’, which models the conditional variance (Coshall, 2009).

One of the most widely used volatility models is the generalised autoregressive conditional heteroscedasticity (GARCH) model. The conditional variance is modelled as

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i e_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \qquad (3.45)$$

where σ_t is the conditional variance of the error terms; e_t is the error term from the mean equation; $\alpha_0 > 0$, $\alpha_i \geq 0$, $\beta_j \geq 0$ to eliminate the possibility of a negative variance. Eq. (3.45) is referred to as GARCH (p,q). It allows for the conditional variance to be dependent on past short-run shocks e_i^2 and past longer-run conditional variances σ_j^2 (Coshall, 2009). Variations of GARCH models have also been developed, in response to the potential problem created by the standard GARCH model that it presumes ‘symmetric’ impacts of positive and negative shocks. As argued by Coshall (2009), a negative shock to tourism movement may cause volatility to rise by more than would a positive shock of the same magnitude. Examples of ‘asymmetric’ volatility models that often appear in tourism literature are the threshold GARCH (TGARCH) (or GJR model; Glosten, Jaganathan, & Runkle, 1993) and the exponential GARCH (EGARCH).

In the tourism context, applications of GARCH models appear mainly from the mid-2000s onward. Similar to the case of ARIMA models, the use of GARCH models typically involves more than one particular specification. For example, the GARCH, GJR and EGARCH models are employed by Bartolomé, McAleer, Ramos, and Rey-Maquieira (2009), Divino and McAleer (2010) and Kim and Wong (2006) to investigate the volatility of tourism demand for a particular destination and the effects of (positive as well as negative) shocks. The GARCH models have also been applied to generate forecasts. Coshall (2009) is the first to assess the forecasting capability of these models in the tourism field. Highly accurate forecasts were generated, especially when combined the forecasts from exponential smoothing models.

Some studies extended the scope to examine interdependencies between a number of destinations, based on the more advanced variations of GARCH models. Chan, Lim, and McAleer (2005) apply three multivariate volatility models, namely symmetric

CCC-MGARCH, symmetric vector ARMA-GARCH and asymmetric vector ARMA-AGARCH model, to investigate the volatility of demand for Australian tourism by four leading source markets. Presence of cross-country dependence was detected among the four markets, in the sense that the conditional variance of a particular country was affected by previous short- and long-run shocks from other countries. Other similar applications include Chang, Khamkaew, Tansuchat, and McAleer (2011) and Seo, Park, and Yu (2009).

It is, however, argued that the interdependencies detected (or defined) under the GARCH model framework are rather narrow, because essentially only the spillover effect of shocks to tourism demand is modelled. As with the other time series models, causal relationships between tourism demand and economic factors are missed in the GARCH model. Hence, the effect of shocks to the underlying economic variables cannot be studied using the GARCH model, let alone the feedback impact of tourism demand on the economic factors.

Another criticism for the GARCH models comes from Morley (2012), who challenged that '*it is indeed difficult to conceive of a theoretical justification for models like ARCH in tourism*'. No reason was provided why tourism time series would be likely to have volatility issues similar to financial time series, or why these specific models would be relevant to tourism data. In its absence, researchers simply announced that the models will be used, as if the technique's existence were sufficient justification and rationale in itself (Morley, 2012).

3.3.3 Other Time Series Models

The Naïve Model

The naïve model represents a rather simple way of understanding historic trend. It assumes data evolve based on certain static growth rate. Hence, future is only a simple repeat of history. The model is often used for forecasting purposes and acts as a benchmark against more sophisticated models.

Generally there are two naïve models used in the tourism demand literature. The naïve 1 model is a no-change model, which states that the future value will be equal to the latest available value, i.e., $\hat{y}_t = y_{t-1}$. In the case where seasonal data are used, the naïve 1 model can become $\hat{y}_t = y_{t-4}$. So the forecast value for a certain quarter is exactly the value of the corresponding quarter in the previous year.

The naïve 2 model is a constant growth rate model, which suggests that the value of a variable will grow at constant rate, hence the future values can be deduced based on the growth rate, i.e., $\hat{y}_t = y_{t-1}[1 + (y_{t-1} - y_{t-2})/y_{t-2}]$. Again, if seasonal data are used, the model becomes $\hat{y}_t = y_{t-4}[1 + (y_{t-4} - y_{t-8})/y_{t-8}]$.

The naïve models widely feature in demand forecasting studies. They often offer baseline forecasts for comparison (e.g., Chu, 2008; Shen, Li, & Song, 2009); or they constitute one of the components of combined forecasts (e.g., Cang, 2011; Shen, Li, & Song, 2008; and Shen, Li, & Song, 2011).

Exponential Smoothing (ES) Model

Exponential smoothing (ES) is a commonly used technique to produce smoothed data for presentation, or to make forecasts. It essentially follows the moving average method. Forecasts of future values are based on the weighted averages of the past values, with the highest weight assigned to the most recent observation and the weights decreasing exponentially for more distant observations (Lim & McAleer, 2001b).

In its simple (or single) form of the ES model, the forecast in period t is based on weighting the observation in period t by a smoothing factor α, and the most recent forecast by $(1 - \alpha)$. The single exponential smoothing method is appropriate only for stationary and non-seasonal time series with no structural change. More advanced algorithms, such as double exponential smoothing, Holt's method and Holt-Winter's method, have been developed and applied in the tourism literature. The forecast performance of the various exponential smoothing methods has often been discussed. For example, based on the quarterly figures of arrivals to Australia over the last 25 years of the 20th century, Lim and McAleer (2001b) find that the Holt-Winters addictive and multiplicative seasonal models outperformed the single, double, and the Holt-Winters non-seasonal ES models in forecasting. Cho (2003) compares the Winters multiplicative ES model with an ARIMA and an artificial neural networks (ANN) model, in order to predict the travel demand for Hong Kong. The results from the ANN model were more favourable, though. However, using data on tourism arrivals to Greece, Gounopoulos, Petmezas, and Santamaria (2012) reveal that although the ARIMA model outperformed the double ES model and the Holt's ES model in capturing the directional change, the Holt's ES model was the best performing model as a point forecasting tool according to measures such as the mean absolute error (MAE), mean absolute percentage error (MAPE) and root mean square error (RMSE). In addition, extensions of the ES model from its univariate versions to multivariate versions are applied in tourism demand research. Athanasopoulos and de Silva (2012) propose a set of multivariate stochastic models that capture time-varying seasonality within the vector innovations structural time-series (VISTS) framework, which encapsulate exponential smoothing methods in a multivariate setting. They evaluate the forecasting accuracy of these models using international tourist arrival figures to Australia and New Zealand. The results show improved forecasting accuracy against the univariate models.

The Basic Structural Model (BSM)

The basic structural model (BSM) is a type of structural time series models. The model is written in the state space form and estimated by the Kalman filter (Li, Song, & Witt, 2005). The idea is to decompose the time series into several components, i.e., trend, seasonal, cycle and irregular terms:

$$Y_t = \mu_t + \gamma_t + \Psi_t + \varepsilon_t \tag{3.46}$$

where Y_t is the time series under concern; μ_t is the trend component; γ_t is the seasonal component; Ψ_t is the cyclical component; and ε_t is the irregular component.

It is recognised that BSM is able to produce good short-term forecasts (Kulendran & Witt, 2003; Turner & Witt, 2001). In comparing BSM with other modelling methods, Turner and Witt (2001) find that the BSM outperformed the naïve 1 model; Kulendran and Witt (2003) confirm the superior performance of BSM in short-run forecasting, compared with ARIMA, ECM and naïve 1 model; however, Ouerfelli (2008), using quarterly arrival numbers in Tunisia, suggests that forecasts from BSM were not as precise as those from ECM, and similar results are obtained by Shen, Li, and Song (2009) based on UK outbound tourism demand.

3.3.4 Time Series Models Augmented With Explanatory Variables

An emerging trend of tourism demand research has been the introduction of the advanced time series techniques into the econometric (or causal) regression framework (Li, Song, & Witt, 2005). By integrating both methods, the merits of econometric models and time series models are combined. Two notable examples of this category are the autoregressive integrated moving average model with explanatory variables (ARIMAX) and the structural time series model (STSM).

ARIMAX Model

The AR(I)MAX model is an extension of the pure time series model AR(I)MA, by including additional exogenous independent variables. Given the favourable performance of time series in tourism demand forecasting, it has been recommended that including causal variables in a time series formulation will improve the model. It can also be taken that adding time series terms to a causal model is likely to yield better performance (Morley, 2009).

The general ARIMAX model can be written as

$$\left(1-\sum_{i=1}^{p}\alpha_i L^i\right)(1-L)^d Y_t = \sum_{i=0}^{r}\boldsymbol{\beta}_i' L^i \boldsymbol{X}_t + \left(1+\sum_{i=1}^{q}\gamma_i L^i\right)\varepsilon_t \tag{3.47}$$

where L is the lag operator; Y_t is the dependent variable; $\boldsymbol{X}_t$ is a $k \times 1$ vector of explanatory variables; ε_t is the white noise error term; α_i, β_i and γ_i are the parameters to be estimated; *p*, *q* and *r* are the lag length of the AR part, MA part and the explanatory variables, respectively; *d* is the differencing parameter. It is advised that the ARIMA model that doesn't include explanatory variables needs to be identified before constructing the ARIMAX model (Kuo, Chen, Tseng, Ju, & Huang, 2008).

Several applications of the AR(I)MAX model have emerged since the mid-2000s. Akal (2004) specifies an ARMAX model to forecast Turkey's tourism revenues between 2002 and 2007. The number of international arrivals was used as an explanatory variable for the tourism revenue figures, although it is questionable whether such choice of explanatory variable is appropriate because essentially both the arrival figures and the revenue figures are indicators of the same thing and they are endogenous to each other. Other applications are, for example, Lim, Min, and McAleer (2008), who model the effects of income on Japan's outbound tourism demand; Kuo, Chen, Tseng, Ju, and Huang (2008), who assess the impacts of SARS and avian flu on the international tourism demand to Asia; Yang, Pan, and Song (2013), who predict the hotel demand based on the web traffic volume of a destination marketing organisation (DMO). Morley (2009) compares the ARIMAX model with a range of dynamic tourism demand models such as ADLM, ECM, and found the specification of ARIMAX was better than other dynamic models based on the adjust R-squared.

Structural Time Series Model (STSM)

Similar to the AR(I)MAX model, explanatory variables can also be added to the basic structural model (BSM), which then yields the structural time series models (STSM). It has been shown to generate relatively accurate forecasts compared with ECM. Furthermore, it does not suffer from spurious regression problem (Turner & Witt, 2001). As with the BSM, the STSM is also specified in the state space form and estimated by the Kalman filter. The general form of a STSM is

$$Y_t = \mu_t + \gamma_t + \Psi_t + \lambda_1 X_{1,t} + \lambda_2 X_{2,t} + \cdots + \lambda_k X_{k,t} + \varepsilon_t \quad (3.48)$$

where μ_t is the trend component; γ_t is the seasonal component; Ψ_t is the cyclical component; $X_{1,t}, \dots, X_{k,t}$ are k explanatory variables; $\lambda_1, \dots, \lambda_k$ are the parameters to be estimated; ε_t is the irregular component which is normally distributed with zero mean and constant variance.

As pointed out by Cortés-Jiménez and Blake (2011), STSM has the advantages of being able to estimate relationships between the dependent and independent variables that change over time and be able to consider different seasonality, cycle, and dummy variables each with values that change over time.

STSM has been applied to tourism demand studies since the early 2000s. For modelling purposes, Cortés-Jiménez and Blake (2011) employ the model to yield a range of demand elasticities according to the purpose of visit and the country of origin. Turner and Witt (2001) are among the earliest to explore the forecast performance of the model. They perform forecasts using univariate and multivariate STSM based on inbound tourism figures of New Zealand. Their results show that STSM, compared with BSM, did not generate more accurate forecasts. Jackman and

Greenidge (2010) apply both univariate and multivariate STSM using inbound tourist flows data of Barbados. They find that STSM outperforms the seasonal naïve model. A broader comparison, with both time series models as well as econometric models, is conducted by Shen, Li, and Song (2009). They find that the inclusion of explanatory variables in a STSM did not seem to greatly improve the forecast accuracy.

Lately, extensions of the STSM have appeared in tourism literature. In modelling the relationship and the delay between tourism cycle and macroeconomic (overall) business cycle, Guizzardi and Mazzocchi (2010) base their analysis on two STSMs, one combined with a latent cycle component (LCC) and another with weakly exogenous explanatory variables replacing the cyclical component (XCV). To model the changing seasonal patterns of tourism demand, Song, Li, Witt, and Athanasopoulos (2011) combine the TVP model and the STSM. The resulting TVP-STSM was shown to outperform other models such as ADLM, basic and causal STSMs, and TVP model. A more recent development is the vector innovations structural time series (VISTS) framework by De Silva, Hyndman, and Snyder (2010). It is able to encapsulate multivariate exponential smoothing models and provide better forecasting performance than other conventional structural time series models (STSMs).

3.4 Other Quantitative Methods

An emerging trend of tourism demand studies, especially demand forecasting studies, has been the use of alternative quantitative methods, predominantly the *artificial intelligence (AI)-based techniques* (Goh & Law, 2011; Song & Li, 2008). According to the review by Song and Li (2008), the AI-based techniques were derived from rule-based and logic programming systems, while the current interest has been focused on less precise heuristic methods, notably the artificial neural networks, the fuzzy logic, the genetic algorithms, and the support vector machines. The main advantage of AI-based techniques is that it does not require any preliminary or additional information about data such as distribution and probability.

Among the AI-based methods that appeared in tourism demand studies, the *artificial neural network* (ANN) is the most often used. A neural network is a computational technique that models the learning properties of a human brain (Law, 2000). The model consists of a set of nodes (i.e., neurons) for processing input data and a set of connections for 'memorising' information. Thus a neural network model learns from examples and provides desired results by generating new information (Uysal & El Roubi, 1999). The ANN models are basically derived from two learning methods, *supervised* (multi-layer perceptron or MLP, radial basis function or RBF, and Bayesian or BAYN) and *unsupervised* (Kohonen network), and two architectures, *feed-forward* and *feedback* recall (Kon & Turner, 2005; Uysal & El Roubi, 1999). The MLP (also known as a feed-forward neural network) is the most widely used in applied work (Palmer, José Montaño, & Sesé, 2006). In the tourism context, the ANN models have attracted certain attention since the mid-1990s. Examples are Law (2000), Alvarez-Diaz and Rossello-Nadal (2010), Cang (2011), Kon and Turner (2005), Law and Au (1999), Palmer, José Montaño, and Sesé (2006), Tsaur, Chiu, and Huang (2002), and Uysal and El Roubi (1999). A more recent attempt is Claveria, Monte, and Torra (2015), who compare the forecasting performance of three ANN techniques on tourist arrivals to Catalonia, and find that MLP and RBF models outperform Elman networks.

Another commonly used AI-based method is the *rough set* approach, which is a decision rule induction method to model the relations that exist among a set of *hybrid data* – a data set that contains both quantitative and qualitative variables (Goh, Law, & Mok, 2008; Song and Li, 2008). Specifically, this approach can handle vague and imprecise data. As described by Goh, Law, and Mok (2008), using this approach, a vague or imprecise concept is replaced by a pair of precise concepts called the lower and upper approximation. The lower approximation consists of all objects that with certainty belong to the concept, while the upper approximation consists of all objects that have a possibility of belonging to the concept. The difference between the upper and lower approximation constitutes the boundary region of an imprecise concept, which is called a rough set (Au & Law, 2000; Goh, Law, & Mok, 2008). One of the most important features of the approach is the generation of decision rules, or induction, that can identify data patterns hidden in an IT that link the value of specific condition attributes (independent attributes) with an outcome (decision attribute) (Au & Law, 2002). Applications of the rough set approach can be found in, for example, Au and Law (2000), Au and Law (2002), Goh and Law (2003), Goh, Law, and Mok (2008), Law and Au (2000).

Other AI-based methods include the *fuzzy time-series*, the *grey theory* and the *genetic algorithms*. As described by Yu and Schwartz (2006), the *fuzzy time-series* model was originally designed to forecast processes with linguistic value observations. It deals with the first-order difference of the time series. Plainly speaking, that is the variation between this year (*t*) and the previous year (*t*-1). It is assumed that the variation of the current year follows the trend of recent years and especially that of the previous year. In addition, the predicted variation is within a certain range that is determined by the historical variations. Building a *fuzzy time-series* model involves human judgement when a decision about two parameters needs to be made. The fuzzy time-series method has strengths in analysing a short time series with limited past observations (Song & Li, 2008). Similarly, the *grey theory* focuses on modelling uncertainty and information insufficiency. According to Yu and Schwartz (2006), the *grey theory* is a generic theory that deals with the systems that have poor, incomplete and uncertain information. It reduces randomness by using the accumulated generation operation (AGO) form. An exponential function is fitted based on a differential equation to estimate the future trend. A major advantage of this method is that it can be constructed based on a very short time series and no assumption about the statistical distribution of the data is necessary. Examples using the *fuzzy time-series* method and the *grey theory* are Hadavandi, Ghanbari, Shahanaghi, and Abbasian-Naghneh (2011), Huarng, Moutinho, and Yu (2007), Wang (2004), Yu and Schwartz (2006). The *genetic algorithms* (GAs) are adaptive heuristic search algorithms premised on the evolutionary ideas of natural selection and genetics (Song & Li, 2008). The method is generally recognised as an optimisation approach. It is seen in the literature that the method has been applied in combination with a neural network technique, *support vector regression* (SVR), to tourism demand forecasting (e.g., Chen & Wang, 2007). The SVR is based on a neural network algorithm called *support vector machine* (SVM), which is a learning machine based on statistical learning theory, and which adheres to the principle of structural risk minimisation, seeking to minimise an upper bound of the generalisation error, rather than to minimise the prediction error on the training set (Chen & Wang, 2007). The SVR has also been applied by Cang (2011) to generate individual forecasts for UK's inbound tourism demand, which then were combined with forecasts from other traditional time series models.

Despite the unique advantages of the AI-based techniques and some empirical evidence of relatively high degrees of forecast accuracy, the techniques still face important limitations. Derived from computer science, the AI-based techniques generally lack a theoretical underpinning, which makes it unable to interpret the models from the economic perspective and therefore they provide very little help in policy evaluation (Song & Li, 2008). This inevitably restricts the scope of practical applications in tourism demand analysis.

3.5 Conclusion

Tourism demand models are generally divided into causal econometric models and non-causal time series models, although an emerging strand of studies have borrowed techniques from computer science and formed the AI-based approach.

Predominantly tourism demand analysis is based on the econometric models to model the causal relationship. The single-equation approach provides a tractable tool to analyse the effects of individual explanatory variables and at the same time account for the dynamic properties embedded in the variables. The system-of-equations approach is often able to incorporate some economic theory in the model specification. However, the majority of the existing tourism demand models implicitly impose the assumption of exogeneity on the explanatory variables, which prohibits any bidirectional causations between tourism demand (dependent variabe) and its influencing factors (independent variables). Although the vector autoregressive (VAR) model has been devised to allow for endogeneity between variables, it is prone to the ‘curse of dimensionality’, which means it can accommodate only a small number of variables. Hence, if cross-country interactions between tourism demand and the feedback impacts of tourism demand on economies are to be investigated on a global scale, the conventional VAR model will be incapable.

Therefore, an important implication drawn from the literature review is that there is an urgent need to advance the models, so that it is possible to model the interdependencies of tourism demand across a number of countries.

Chapter 4. Interdependencies of Tourism Demand

4.1 Introduction

Given the discussions in the previous chapter, it is of interest to tourism economics researchers to incorporate the interdependent nature of tourism demand into the econometric modelling exercises. This is an area that has not been touched before, and also one that extends tourism demand research.

This chapter serves to lay out the context of the current research from a more practical perspective. The focus is on globalisation and its relevance to the tourism sector. In Section 4.2, firstly, the concept and the theoretical dimensions of globalisation will be delineated. Then in Section 4.3, the economic aspect of globalisation will be highlighted through explanations of its driving forces and the areas where economic globalisation is manifested. In Section 4.4 and Section 4.5, discussions will be extended to the tourism sector by outlining how tourism exports and tourism imports interact with the economic factors at home and abroad, and by showing how dynamic interrelationship between tourism countries is formed via complementary as well as substitutive effects. At the end of the chapter, the empirical and theoretical implications of globalisation will be addressed in Section 4.6.

4.2 Understanding Globalisation

The environment in which tourism businesses are operating is fast changing. One of the most remarkable developments that the tourism sector has been facing is a more and more integrated world economy. Globalisation has profound implications on tourism businesses and tourism research.

4.2.1 Globalisation, Globalism and Interdependence

'***Globalisation***' is a widely used term to describe a variety of economic, cultural, social, and political changes that have shaped the world over the past five decades (Guttal, 2007). In essence, globalisation is a complex and multifaceted phenomenon, and it has been accorded multiple definitions from different perspectives (Guttal, 2007; McGrew, 2011, p.277; Tribe, 2011, p.362). Table 4.1 summarises some of the definitions in the literature.

Table 4.1 - Definitions of globalisation

Author	Definition
Giddens (1990, p.21)	*'The intensification of worldwide social relations which link distant localities in such a way that local happenings are shaped by events occurring many miles away and vice versa.'*
Robertson (1992, p.8)	*'The compression of the world and the intensification of consciousness of the world as a whole…concrete global interdependence and consciousness of the global whole in the twentieth century.'*
Friedman (1999, pp.7-8)	*'The inexorable integration of markets, nation-states, and technologies to a degree never witnessed before – in a way that is enabling individuals, corporations and nation-states to reach around the world farther, faster, deeper and cheaper than ever before, the spread of free-market capitalism to virtually every country in the world.'*
Hirst and Thompson (1999, p.1)	*'A…global economy…in which distinct national economies and, therefore, domestic strategies of national economic management are increasingly irrelevant.'*
Garrett (2000, p.941)	*'The international integration of markets in goods, services, and capital.'*
Scholte (2000, p.46)	*'De-territorialization – or…the growth of supraterritorial relations between people.'*

Source: Adapted from Ravenhill (2011, p.278) and Tribe (2011, p.362)

A prevailing view is that globalisation is set in motion by the economic dynamics of the international division of labour (Panić, 2003, p.6). Within the political economy literature, globalisation is even taken to be synonymous with a process of intensifying worldwide *economic integration* (McGrew, 2011, p.277). However, these initial, purely economic developments have evolved into a much more complex process that is driven by the interaction of economic integration and cultural harmonization (Panić, 2003, pp.6-7). Accordingly, globalisation is now understood from a broader range of perspectives. The various definitions shown in Table 4.1 exactly embody the complex and inclusive nature of globalisation. In an ideal world, a comprehensive study on globalisation should endeavour to look into a wide range of aspects, such as economics, politics, technology and culture, wherever possible.

In parallel with the concept of globalisation, '*interdependence*' (also written as '*interdependency*') is another buzzword that often features in the literature. To understand the difference between '*globalisation*' and '*interdependence*', if any, Keohane and Nye Jr (2000, pp.75-76) introduce the term '*globalism*'. They point out that, on the one hand, *interdependence* refers to a condition, a state of affairs, which can either increase or decline; on the other hand, *globalisation* implies that something is increasing and there is more of it. The 'something' in the *globalisation* setting, according to Keohane and Nye Jr (2000, p.75), is *globalism*, which is a state of the world involving networks of *interdependence* at multi-continental distances. Hence, *globalism is a special type of interdependence*. In contrast to *interdependence* which could exist in the form of single reciprocal linkages, *globalism* involves multiple connections (networks). For instance, there could be economic or military interdependence between the United States and Japan, but not globalism between the two countries. To be considered 'global', the network of relationships that globalism entails must involve multi-continental (long) distances, even though any sharp distinction between multi-continental and regional distance could be arbitrary (Keohane & Nye Jr, 2000, p.76).

All in all, with the term 'globalism', *globalisation* and *deglobalisation* are understood as the increase and decline of *globalism* respectively, whereas *globalism* is a special type of *interdependence* that occurs between multiple countries.

Admittedly, it is obvious that '*globalisation*' entails far richer connotations than '*interdependence*' (or '*interdependency*'). But precisely speaking, the current research only measures the economic *interdependencies* between tourism demand across different countries, because it is more appropriate to interpret the empirical results as '*interdependence*' (or '*interdependency*'). Nevertheless, '*globalisation*' lays out the vital context of the whole research.

4.2.2 The Globalisation Debate: Three Theses

Given the difference between definitions of globalisation, it is of researchers' interests to delve into the underlying methodological disagreements about how complex historical and social phenomena can be best analysed (McGrew, 2011, p.277). In rethinking globalisation theory in the context of tourism, Munar (2007) revisits the three theses (or three schools of thoughts) summarised by Held, McGrew, Goldblatt, and Perraton (1999), to classify the different tendencies in interpreting globalisation. The three theses are referred to as the *hyperglobalizers (or hyperglobalists)*, the *sceptics (or traditionalists)* and the *transformationalists*. In spite of possible disagreements, all theses reflect a general set of arguments and conclusions about globalisation with regard to its conceptualisation, causal dynamics, socio-economic consequences, implications for state power and governance, and historical trajectory (Held, McGrew, Goldblatt, & Perraton, 1999, p.3).

The *hyperglobalizers* take a *linear* view of social changes, in that globalisation is seen as a *particularity*, or a singular *condition* of human society (Munar, 2007). Globalisation is a new époque in human history which brings about a single global market and a 'denationalization' of economies through the establishment of transnational networks of production, trade and finance (Held, McGrew, Goldblatt, & Perraton, 1999, p.3). Within this framework, there is a normative divergence between the *positive hyperglobalizers* (i.e., the neoliberals), who welcome the triumph of individual autonomy and the market principle over state power, and the *negative hyperglobalizers* (i.e., the radicals, or neo-Marxists), for whom contemporary globalisation represents the triumph of an oppressive global capitalism (Held, McGrew, Goldblatt, & Perraton, 1999, pp.3-4; Munar, 2007). However, despite the divergent ideological convictions, the belief that an increasingly integrated global economy exists today is shared by both camps (Held, McGrew, Goldblatt, & Perraton, 1999, p.4). Regarding the driving forces, the hyperglobalizers argue that the main motor of globalisation is formed by the changes and developments of the world economy, and that the basis of globalisation lies in the restructuring of the worldwide economic system through further international integrations of markets (Munar, 2007). Consequently, a global civil society is emerging. It is a 'one-size-fits-all' model of civilization. People are becoming increasingly aware of many common interests and common problems. The state power is thus losing control over the development of society and the national economy (Munar, 2007).

In contrast to the hyperglobalizers, the *sceptics* argue that globalisation is by no means a reality. Based on statistical evidence, they maintain that the global market is not perfectly integrated in accordance with the law of one price and there are no market interactions throughout the *entire* globe (Munar, 2007). Hence in the opinion of the sceptics, rather than globalisation, the historic evidence at best confirms only heightened levels of internationalization (Held, McGrew, Goldblatt, & Perraton, 1999, p.5). Nonetheless, the logic of the sceptics in understanding globalisation is also primarily *economistic*, equating it with a perfectly integrated global market (Held, McGrew, Goldblatt, & Perraton, 1999, p.5). Again, globalisation is conceived as a *particularity*. By showing evidence that the current levels of economic integration fall short of this 'ideal type' and that the world economy is much less integrated than in the nineteenth century (i.e., the classical Gold Standard era), the sceptics argue that the extent of contemporary 'globalisation' is wholly exaggerated (Held, McGrew, Goldblatt, & Perraton, 1999, p.5). For most sceptics, it is more appropriate to conclude that the world economy is undergoing a significant 'regionalisation' as it evolves in the direction of three major financial and trading blocs (i.e., Europe, Asia-Pacific, and North America) (Held, McGrew, Goldblatt, & Perraton, 1999, p.5). On the socio-economic changes, many sceptics recognise that the world, instead of forming cultural homogenization and a global culture, is fragmenting into civilizational blocs such that the 'clash of civilizations' exposes the illusory nature of 'global governance' (Held, McGrew, Goldblatt, & Perraton, 1999, p.6). Furthermore, the sceptics reject the popular 'myth' that the state power is being undermined today by economic internationalization. Governments are not the passive victims of internationalization but, on the contrary, its primary architects (Held, McGrew, Goldblatt, & Perraton, 1999, p.6).

Taking a more inclusive view, the *transformationalists* argue that globalisation intertwines with all the key domains of human activities. As such, the transformationalists are not responding to a *linear* logic (which can be found among the hyperglobalizers and the sceptics), as they make no claims about the future trajectory of globalisation nor do they seek to evaluate the present in relation to some single, fixed ideal type of 'globalised world'. Globalisation is conceived as a long-term historical process, and the contemporary processes of globalisation are historically unprecedented (Held, McGrew, Goldblatt, & Perrraton, 1999, p.7). The driving forces of globalisation are not only economistic and technological, but also political and cultural (Munar, 2007). Regarding the socio-economic consequences of globalisation, the world has become so interconnected and interdependent that events, decisions and activities in one region of the world can come to have significance for individuals and communities in distant regions (Held, McGrew, Goldblatt, & Perraton, 1999, p.15; Munar, 2007). However, this does not grant a greater convergence or homogeneity between peoples. People's conscious attention on the world implies that the local and the global are not to be understood as two mutually exclusive features. *Glocalisation* becomes the new norm, in that the contradictory elements of universalism and particularism, connection and fragmentation, happen at the same time in human history, glocally (Munar, 2007). As a result, the nation states are in a process of reconstruction and reinvention. They have to share the monopolistic power with other political structures both at transnational and local levels (Munar, 2007). At the core of the transformationalist thesis is a belief that the contemporary globalisation is reconstituting or 're-engineering' the power, functions and authority of national governments, and it is associated with a transformation of the relationship between sovereignty, territoriality and state power (Held, McGrew, Goldblatt, & Perraton, 1999, p.8).

4.2.3 Spatio-Temporal Dimensions of Globalisation[1]

Despite a proliferation of definitions in the contemporary discussion, as pointed out by Held, McGrew, Goldblatt, and Perraton (2000, p.67), '*there is scant evidence in the existing literature of any attempt to specify precisely what is "global" about globalisation'*, as many definitions are at the same time quite compatible with far more spatially confined processes such as the spread of national or regional interconnections. In seeking to remedy this conceptual difficulty, Held, McGrew, Goldblatt, and Perraton (2000, pp.67-68) delineate the concept of globalisation from the *transformationalist* viewpoint by introducing its *spatio-temporal* dimensions,

[1] Many of the discussions in this section are based on Held, McGrew, Goldblatt, and Perraton (1999, 2000). However, the understanding of the dimensions of globalisation is intrinsically diverse, and is not limited to those presented in the current section.

> *'The concept of globalisation implies, first and foremost, a* ***stretching*** *of social, political, and economic activities across frontiers such that events, decisions and activities in one region of the world can come to have significance for individuals and communities in distant regions of the globe. In this sense, it embodies transregional interconnectedness, the widening reach of networks of social activity and power, and the possibility of action at a distance. Beyond this, globalisation implies that connections across frontiers are not just occasional or random, but rather are regularized such that there is a detectable* ***intensification****, or growing magnitude, of interconnectedness, patterns of interaction and flows which transcend the constituent societies and states of the world order. Furthermore, growing extensity and intensity of global interconnectedness may also imply a* ***speeding up*** *of global interactions and processes as the development of worldwide systems of transport and communication increases the potential velocity of the global diffusion of ideas, goods, information, capital and people. And the growing* ***extensity****,* ***intensity*** *and* ***velocity*** *of global interactions may also be associated with a deepening enmeshment of the local and global such that the* ***impact*** *of distant events is magnified while even the most local developments may come to have enormous global consequences.'*

By referring to the four elements, i.e., *extensity*, *intensity*, *velocity* and *impact*, as the '*spatio-temporal*' dimensions of globalisation, Held, McGrew, Goldblatt, and Perraton (2000, pp.67-68) further caution that a satisfactory understanding of globalisation must capture all the four elements and examine them thoroughly, and they remark that '*without reference to such expansive spatial connections, there can be no clear or coherent formulation of this term*'.

Precisely speaking, the four elements describe the characteristics of *globalism*, which is a state rather than a dynamic process. When they are referred to as the dimensions of *globalisation*, dynamics are added to their original meaning, which is now the increase in the four elements along with the increase of globalism (i.e., the process of globalisation). Nevertheless, when *globalisation* and *globalism* are used colloquially, they are somewhat interchangeable. The following discussions in this section use the original terms in the existing literature, i.e., the term 'spatio-temporal dimensions of *globalisation*'.

Building on the above framework, the *historic forms of globalisation*[1] can be described and compared with regard to (Held, McGrew, Goldblatt, & Perraton, 2000, p.69):

[1] The *extensity* of global networks;

[2] The *intensity* of global interconnectedness;

[3] The *velocity* of global flows;

[4] The *impact* propensity of global interconnectedness.

Globalisation, as the transformationalists maintain, is a *historical process*, rather than a fixed state. As with the sceptics, the transformationalists perceive globalisation as by no means a novel phenomenon. However, it is allowed in the transformationalist thesis that the particular form of globalisation may differ between historical eras, i.e., there are multiple potential forms of globalisation (Held, McGrew, Goldbaltt, & Perraton, 2000, p.69). Hence, it is the novel features in any epoch that define the *historical forms of globalisation*. This is the *temporal* sense of the above four dimensions. Accordingly, the spatio-temporal dimensions constitute a systematic framework for comparative analysis of globalisation over time. Such a framework provides the basis for both a *quantitative* and a *qualitative* assessment of the historical developments of globalisation. It avoids the current tendency to presume either that globalisation is fundamentally new, or that there is nothing novel about the contemporary levels of global economic and social interconnectedness because they appear to resemble those of the prior periods (Held, McGrew, Goldblatt, & Perraton, 2000, p.69).

With the above in mind, the shape of contemporary globalisation can be determined by mapping the global flows, networks and relations based on their four fundamental spatio-temporal dimensions, i.e., *extensity*, *intensity*, *velocity* and *impact*. It is understood that *high extensity* refers to interregional/intercontinental networks and flows, and *low extensity* denotes localised networks and transactions (Held, McGrew, Goldblatt, & Perraton, 1999, p.21). Under the configuration of *high extensity*, four

[1] This can actually be understood as the *historic forms of globalism*. Here, the term *globalisation* implies the four dimensions are evolving under a certain form of globalisation.

potential shapes/types of globalisation can be identified. Figure 4.1 sets out a simple typology of globalisation.

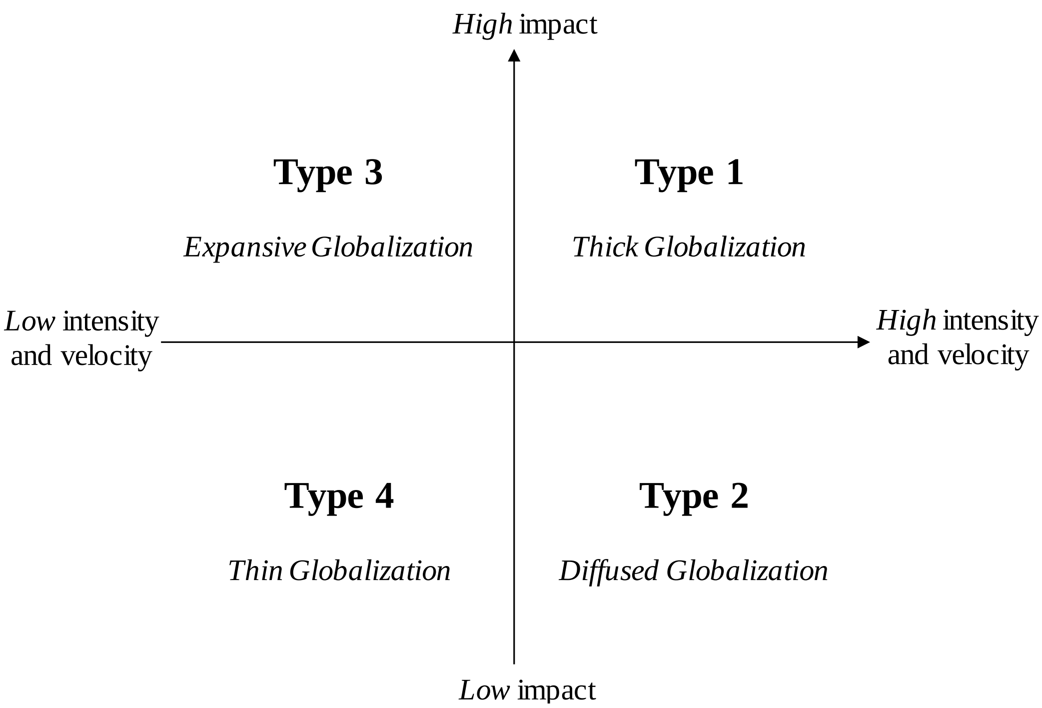

Figure 4.1 - Four potential forms of globalisation

Source: Adapted from Held, McGrew, Goldblatt, and Perraton (1999, p.25)
Note: Extensity is set to be high under all the four types.

As explained by Held, McGrew, Goldblatt, and Perraton (1999, pp.21-22), *Type 1* is labelled *thick globalisation*. It represents a world where the extensive reach of global networks is matched by their high intensity, high velocity and high impact propensity across all domain of social life. The late nineteenth-century era of global empires is seen as close to this type. *Type 2* is labelled *diffused globalisation*, where highly extensive global networks are combined with high intensity and high velocity but low (mediated and regulated) impact propensity. It has no historical equivalents, but might be an ideal form for those who are critical of the excesses of contemporary economic globalisation. *Type 3* is labelled *expansive globalisation*, which is characterised by the high extensity of global interconnectedness, low intensity, low velocity but high impact propensity. The early modern period of Western imperial expansion in which

European empires had acquired a tentative global reach with considerable intercivilizational impacts comes closest to this type. *Type 4* is labelled *thin globalisation* in so far as the high extensity of global networks is not matched by a similar intensity, velocity or impact propensity. The early silk and luxury trade circuits connecting Europe with China and the East have close parallels with this type. It is worth noting that, even though the four types are somehow segregated in Figure 4.1, globalisation could transit from one form to another over time. In other words, every era of globalisation builds on others, since absolute discontinuities do not exist in human history. Hence there is an implicit temporal dimension to Figure 4.1. Keohane and Nye Jr (2000, p.77) even argue that *globalisation is the process by which globalism becomes increasingly (from thin to) thick.*

Figure 4.1 only presents four broad types of globalisation, while not leaving out many different configurations within each type. The actual historical form of the contemporary globalisation, or its exact position on Figure 4.1, depends on the values of each spatio-temporal dimension. Hence, *quantitative* research is appropriate for making the enquiry into the magnitude of each dimension, as long as the measurement is clearly defined.

Recalling that the current research primarily concerns the concept of '*interdependence*' (or '*interdependency*'), the *intensity*, *velocity* and *impact* propensity dimensions are particularly relevant to empirical models. Adding the *extensity* dimension, highly extensive interdependence would be a good interpretation of globalism.

4.3 Economic Globalisation

Albeit a multidimensional phenomenon, globalisation is first and foremost understood from the economic perspective. According to Panić (2003, p.4), the contemporary process of globalisation that has gathered momentum since the 1970s is dominated by *economic* considerations and developments, and it is associated with the economic aspects of what is regarded as an irreversible trend towards *greater* international integration and interdependence. Nevertheless, as Hirst and Thompson (2003, p.99) suggest, '*we can only begin to assess the issue of globalisation if we have some relatively clear and rigorous model of what a global economy would be like*'. The current research thus place emphasis on the economic perspective, from which the empirical econometric model (see Chapter 5) will be constructed.

Economic globalisation is generally specified in reasonably precise terms as '*the emergence and operation of a single, worldwide economy*' (McGrew, 2011, p.278). It is measured by referencing to the growing *extensity*, *intensity*, and *velocity* of worldwide economic interactions and interconnectedness, from trade, through production and finance, to migration (McGrew, 2011, p.278). Economic globalisation entails not only the openness of national economies, but also the integration and interdependence between economies, although the concepts of *openness*, *integration* and *interdependence* are highly compatible with spatially confined (or compressed) occasions (i.e., the three concepts can also be applied to regional settings).

4.3.1 The Driving Forces

Economic globalisation can be seen following two interrelated paths of development (see Panić, 2003, p.5). The first one is labelled *institutional integration*, where the widespread liberalisation of international trade and capital flows has been initiated by governments. The other one is labelled *spontaneous integration*, where the international division of labour is achieved mainly through the actions of transnational enterprises in pursuit of their corporate interests and objectives. It is claimed that what distinguishes the contemporary globalisation from its earlier versions is the *spontaneous integration*, since the world economy is now dominated by transnationals and the penetration of transnationals into virtually every sector of economies is far greater than before 1970s (Panić, 2003, p.5).

Whatever the pathway through which economic globalisation evolves is, the process is driven by certain underlying forces, without which cross-countries interaction and integration would not be made possible. Identifying the engines (or *the prerequisites*) of economic globalisation, especially in the contemporary context, can be difficult and tricky. As McGrew (2011, p.297) remark, '*to date, no discrete or singular globalisation theory – which seeks to provide a coherent and systematic account of its causes, consequences, and developmental trajectory – can be said to exist*'. Generally, explanations of economic globalisation centre on three deeply interrelated forces, namely *technics* (technological change and social organisation), *economics* (markets and capitalism), and *politics* (ideas, interests, and institutions) (McGrew, 2011, p.295). In addition, *culture* (cultural and demographic trends) is also considered as a distinct force by Fayed and Fletcher (2002).

Technics Technics is vital to any account of globalisation. The developments of modern communication and transport technologies allow time and space to be compressed, so that a 'shrunk' globe can be formed (McGrew, 2011, p.295). Specifically, the advancements in communication technologies have helped to spread information and knowledge throughout the world, at much lower costs especially since the 1980s (Azarya, 2004; McCann, 2008). As noted by Fletcher and Westlake (2006) in the context of tourism, communication and information are the lifelines of an industry that sells its product on faith and whose service providers are geographically dispersed. Take computerised reservations systems (CRS) as an example, they are believed to enhance small and medium-sized enterprises' (SMEs) profitability (Fletcher & Westlake, 2006). The use of modern communication and information technologies in connection with various forms of integration (e.g., vertical, horizontal) extends the value chain of airline, hotels and tour operators (Smeral, 1998). Meanwhile, the improved transportation facilities and services make it more feasible and less costly for physical movements of not only goods (Fayed & Fletcher, 2002) but also people between countries (Neumayer, 2006). More profoundly, the technological change has driven liberalisations especially in the financial sector, where financial markets scattered around the world are connected and transactions are carried out 24/7 on a real-time basis. In a word, *technics* has substantially facilitated international trade and shaped the transnational and global organisation.

Economics The logic of economics explains globalisation from the perspective of the market dynamics and the imperatives of capitalism (McGrew, 2011). On the one hand, drawing on the neoclassical economic theories, the market dynamics logic considers globalisation as a direct consequence of market competition. Briefly speaking, free trade allows countries to maximise their welfare based on their comparative advantages, whereas market forces and global competition enable goods and services to be produced efficiently at a minimum cost. Consequently, vertical integration is becoming commonplace. Meanwhile, economic convergence ensures the key financial indicators such as interest rates to become equalised so that the cost of financial leverage will be similar across countries. On the other hand, the logic of capitalism follows the Marxist tradition that economic globalisation is driven by profit seeking. The structural contradictions of capitalism – the tendency for overproduction combined with the relative impoverishment of workers – and the insatiable requirement for capital accumulation result in the expansion of corporations. Therefore, from an economic perspective, globalisation is motivated by the continual search for new markets, cheaper labour and new sources of profitability (McGrew, 2011). One fine example is the hospitality sector, where a hotel may pursue new markets outside the local area, if it achieves the optimum share of a local or national market and is faced with overcapacity (Fletcher & Westlake, 2006).

It is worth pointing out that, the expansion of economic activities is not without backlash. One of the obstacles or counter-trends to the globalisation process is the economic crises in recent years (Cohen, 2012). To bring the government finances under control, austerity programmes have been instituted, which have been met with severe popular protests around the globe, even as a growing distrust of, and resentment against, the leading financial institutions of the prevailing capitalist system (Cohen, 2012). The economic forces (the market dynamics and the imperatives of capitalism) are by no means isolated from other forces. They are indeed set in motion alongside such changes in the political and ideological domain as liberalisation (see for example, Fayed & Fletcher, 2002; Stabler, Papatheodorou, & Sinclair, 2010; Steger, 2005).

Politics The politics primarily concerns the ideological infrastructure of globalisation. As noted by McGrew (2011, p.296), almost all accounts of contemporary globalisation make reference to the rise and dominance of neoliberal ideology throughout the OECD world, along with its associated policies of liberalisation, deregulation and privatisation. Since the 1970s, the dominant political trend in OECD states has been towards the liberalisation of national economies and the easing of restrictions on capital mobility (McGrew, 2011, p.296). Governments, or rather states, have been instrumental in establishing the necessary national political conditions and policies – not to mention the vital regional and global institutions, agreements and policies. Promoted and advocated by a powerful configuration of domestic and transnational coalitions and lobbies, economic globalisation is very much a political construction or project (McGrew, 2011, p.296). Fayed and Fletcher (2002) place the emphasis on the liberalisation in trade and investment, which is embodied by the establishment of the General Agreement on Trade and Tariffs (GATT), the General Agreement on Trade in Services (GATS), and policies promoting free current and capital account transactions by International Monetary Fund (IMF). Economic convergence is thus facilitated by the establishment of these political infrastructures (Stabler, Papatheoorou, & Sinclair, 2010, p.251). Furthermore, McGrew (2011, pp.296-297) highlights the hegemonic power and role of the United States in economic globalisation by extending its strategic interests and domestic politics. Nevertheless, globalisation may also help developing countries exit the poverty trap (Stabler, Papatheodorou, & Sinclair, 2010, pp.251-252). Prominent examples include the emerging economies in East Asia and Southeast Asia, and the BRICS countries.

However, the ongoing trend of liberalisation and deregulation is not without resistance, especially with respect to the mobility of people. Despite some political initiatives (e.g., the right to free movement of the European Union nationals[1]) to facilitate the movement of people, in the meantime visa restrictions are ironically implemented by governments to deter some unwanted foreigners as well as the influx of immigrants from certain countries (Cohen, 2012; Neumayer, 2006). In consequence, detrimental impacts of visa restrictions can be observed in the domains of trade, investment as well as tourism (Neumayer, 2011; Song, Gartner, & Tasci, 2012).

Culture Culture also plays a vital role (Fayed & Fletcher, 2002), in addition to the *technics*, *economics* and *politics*. The growth in population since World War II has created a demand for all kinds of economic goods, and the fact that the population increases have not been evenly spread among countries implies trade opportunities (Fayed & Fletcher, 2002). Cultural factors, including cultural exposure (e.g., the demonstration effect through media sources), have led to some degree of homogenisation. This is sometimes termed as 'McDonaldisation', which according to George Ritzer is 'the process whereby the principles of the fast-food restaurant are coming to dominate more and more sectors of American society as well as the rest of the world' (Pieterse, 1996). An ostensible interpretation of the term would immediately centre on the primacy of American culture, from films, music and modern art to casual clothing, fast food and sports (Lieber & Weisberg, 2002). Such

[1] http://ec.europa.eu/social/main.jsp?catId=457

primacy is more evident alongside the spread of (American) English as an international lingua franca (Lieber & Weisberg, 2002; Steger, 2013). In one way or another, this American primacy is merely a manifestation of the United States' hegemonic power in the cultural sphere, and it is bound to evoke resistance, conflicts and even clashes between cultures. Anti-globalisation advocates celebrate the cultural difference and allege that the biodiversity and the richness of human culture are destroyed by the American corporate interests (Lieber & Weisberg, 2002; Pieterse, 1996).

As an activity intrinsically involving cultural exchange, tourism can generate awareness of cultural difference by increasing cross-cultural communication (Pieterse, 1996), while cultivating cultural hybridisation that allows for the cohabitation and integration of different cultures. Cultural exploration can be regarded as a dimension of visiors' motives to attend festival events (Crompton & McKay, 1997), though culture itself is a key pull factor.

4.3.2 Manifestation of Economic Globalisation

Economic globalisation can be observed across various economic activities. '*It is the confluence of secular trends and patterns of world trade, capital flows, transnational production, and migration that for globalists affirms the validity of the globalisation tendency*' (McGrew, 2011, pp.279-280). Among others, *trade, finance* and *migration* are the three domains where economic globalisation takes place, as widely recognised by Abel, Bernanke and Croushore (2008, p.476), McGrew (2011, pp.279-290), Stabler, Papatheodorou, and Sinclair (2010, p.251) and Tribe (2011, p.363).

International trade is seen as a source for developing countries to accumulate profits; it helps to fuel economic growth and capital formation and also boosts employment (Stabler, Papatheodorou, & Sinclair, 2010, p.251). Over the post-war period, international trade has experienced unprecedented growth. According to the World Trade Organisation (WTO)'s figures, world exports, measured as a proportion of world output, were three times bigger in 1998 than in 1950; the ratio was estimated to be 29% in 2001 and about 27% in 2005, compared to 17% in 1990 and 12.5% in 1970 (McGrew, 2011, p.280). A contrast took place in 2008-2009, when the world trade collapsed tremendously. In comparison with 2008, the value of world trade in 2009 fell by an unparalleled 33% and volume by 22%, according to WTO and the World

Bank's figures (McGrew, 2011, p.280). All major exporters, especially Japan and China, recorded export declines by more than 20%, and few economies escaped the collapse (McGrew, 2011, p.280). This reality in turn reflects *the penetration of international trade into a larger number of countries and sectors than at any time before*. Alongside the booming of international trade is the shift of manufacturing capabilities from developed/industrialised economies to the newly industrialising economies (NIEs) such as East Asia, while most OECD economies have increased their trade in services dramatically (McGrew, 2011, p.281). These structural shifts constitute a new pattern of specialisation (or division of labour), where production is fragmented or outsourced such that firms can draw on worldwide networks of suppliers that produce at the greatest economies of scale (McGrew, 2011, p.281). Through such a mechanism, *economies in different regions become more tightly integrated*. However, the global market is far from a perfectly integrated one yet. Based on convergence tests borrowed from economic growth theories, Chortareas and Pelagidis (2004) find that the degree of openness converged faster across countries within a given region rather than at the global level. It indicates that trade integration is still more of a 'regional' phenomenon than a 'global' one. One account is protectionism, which is manifested by the existence of non-tariff barriers (NTBs), even though tariffs among major countries have been greatly reduced by successive trade agreements under the General Agreement on Tariffs and Trade (GATT) (McGrew, 2011, p.282; Winham, 2011, p.139).

International finance used to be an adjunct to trade, as a necessary mechanism enabling the exchange of goods and services. This direct association between trade and finance began to dissolve in the nineteenth century and even started to become irrelevant in the twenty-first century (McGrew, 2011, p.283). As a multiple of world merchandise trade, annual foreign exchange turnover in 1973 was equivalent to twice the value of annual world trade, whereas by 2008 it was equivalent to more than sixty times (McGrew, 2011, p.283). Indeed, the expansion of global capital flows is unparalleled. In comparison to trade, which had a compound growth rate of almost 10% over the period 1964-2001, trans-border financial flows grew at a compound rate of almost 19% (Bryant, 2003, p.141, cited by McGrew, 2011, p.283). However, the trans-border financial flows are highly uneven. The access to world financial markets is predominantly open to developed economies and major emerging market economies, while many of the poorest economies remain subject to, rather than active participants in, the operations of these markets (McGrew, 2011, p.284). Despite such unevenness, the empirical evidence still supports the trend of financial integration. Econometric studies by Obstfeld and Taylor (1999, 2003, 2004) identify, among others, a narrowing of interest-rate differentials between the major OECD economies after 1960, as might be expected under conditions of high capital mobility and openness (McGrew, 2011, p.284). Furthermore, there is considerable evidence that capital controls have declined significantly since the 1970s for OECD states and the 1980s for most developed economies, in association with the shift to a floating exchange rate regime after the dissolution of the Bretton Woods System (Obstfeld & Taylor, 2004, p.165, cited by McGrew, 2011, p.285). Hence, even capital is by no means perfectly mobile across countries, *the dominant tendency has been in the direction of greater, rather than less, financial integration*. Accompanying such tendency is a process of financial deepening (in terms of contagion of financial crisis, or *the synchronisation of financial markets and business cycles*) (Obstfeld & Taylor, 2004, cited by McGrew, 2011, p.285). Not only the increasing synchronisation of the major stock markets and stock market returns since the 1970s, but also the rapidity with which the 2008 financial crisis spread across the globe together with its dramatic consequences for almost all economies, have unequivocally manifested the significant deepening of global financial integration over the past few decades (McGrew, 2011, p.285).

Compared to capital and goods, labour is relatively immobile. The movement of people, or *migration,* has been one of the less spectacular dimensions of globalisation (Tribe, 2011, p.363). Nevertheless, as noted in an International Organisation of Migration (IOM) report, ‘no country remains untouched by international migration’ (McGrew, 2011, p.289). The direction of flows of people is primarily from developing countries to the developed ones. In 2005, migrants totalled around 190 million of the world’s population, more than twice the level of 1970 (at 82.5 million), making up some 3% of the global workforce, but 9% of the workforce in the developed world (Freeman, 2006, cited by McGrew, 2011, pp.289-290). Moreover, the huge expansion of temporary workers moving between countries/regions, facilitated by low-cost transport infrastructures, is additional to the official figures and is of growing importance to certain sectors (e.g., construction and agriculture) in many developed economies (Freeman, 2006, cited by McGrew, 2011, p.290). These developments of migration reflect the tendencies towards the integration of distant labour workers and are expected to produce convergence in wage rates (McGrew, 2011, p.290; Stabler, Papatheodorou, & Sinclair, 2010, p.251), which may happen particularly for the skilled workers, and to produce overall a divergence between rates for skilled and unskilled workers will be observed.

All in all, it is worth reiterating the role of the four driving forces of globalisation. Without the advancement of technology, the expansion of the corporations, the liberalisation of political infrastructure and the exchange of cultures, cross-country interconnections would lose their momentum. So would the process of globalisation.

4.4 Globalisation and the Tourism Sector

International tourism has been regarded as an important aspect of *international trade*, through which globalisation is manifested. Over the past six decades, tourism has experienced continued and almost uninterrupted expansion – from 25 million international arrivals in 1950, to 278 million in 1980, 527 million in 1995, and 1,133 million in 2014 – and become one of the largest and fastest-growing economic sectors in the world (UNWTO, 2015). Fayed and Fletcher (2002) report that, tourism ranks among the top five export categories for 83% of countries covering Europe, the Middle East and the Americas. According to the World Bank's World Development Indicator database[1], tourism receipts accounted for 5.5% of worldwide total exports in 2011, and tourism expenditures accounted for 5.2% of worldwide total imports in that year, although the percentages were even higher in 2005, at 6.5% and 6.2% for receipts and expenditures, respectively.

Given the vital role of tourism in the world economy, it is no wonder that the *hyperglobalist* position can often be found in tourism research (for example, Fayed & Fletcher, 2002; Hjalager, 2007; Sugiyarto, Blake, & Sinclair, 2003; Vanhove, 2001). In *Encyclopedia of Tourism*, globalisation is mainly interpreted from an economic perspective: tourism is perceived to have long been 'global' in that tourists have visited other countries, and in that the boom in mass tourism in the modern context has been facilitated by transnational corporations (such as airlines and hotel chains)

[1] World Development Indicators: Travel and Tourism, World Bank (http://wdi.worldbank.org/table/6.14)

and the liberalisation of economic policies (such as foreign exchange); the result of globalisation is elaborated through the economic benefits/loss of tourism (Jafari, Baretje, & Buhalis, 2000, pp.254-256). For the hyperglobalizers, tourism is a force working in favour of the global market and the global society (Munar, 2007). Tourists are, in their opinion, consumers that bring the culture of consumerism to developing countries. As such, tourism becomes the recipe for economic growth and facilitates the forming of a global market. Tourism also contributes to the rising of a global society, and is seen as a force of homogenization of the world. For the pessimist camp of the hyperglobalizers, tourists help to expand a global society that represents the Western culture dominating the world (Munar, 2007).

However, as in the globalisation debates, the existence of a global tourism market is yet to confirm. The *sceptic* position in tourism research, though less prominent when compared with the hyperglobalist, characterises international tourism from the perspective of regionalisation, or even localisation. It is noted that, based on Vellas and Bécherel (1995), tourism movements were dominantly domestic, and especially in Europe the travel flows concentrated on intra-Europe on destinations (Munar, 2007). In much of the tourism literature, there is a preference for the use of *international tourism*, rather than *global tourism*, in order to stress the importance of the national framework (Munar, 2007). In the absence of a global market, tourists are thus perceived as homogenised consumers of one country, and national typification applies to tourists when they travel abroad.

From a *transformationalist* point of view, tourism is understood as an expression of modernity, in which the root to globalisation is present (Munar, 2007). As cited by Munar (2007), Urry (1995, p.141) argues that '*central to the idea of modernity is that of movement, that modern societies have brought about striking changes in the nature and experience of motion or travel…in many ways the modern world is inconceivable without these new forms of long-distance transportation and travel*'. As such, 'global' and 'tourism' are not two separate entities, but part and parcel of the same set of complex and interconnected processes (Urry, 2002, p.144, cited by Munar, 2007). Tourism, as with the globalisation, is deeply rooted in history. It is the increase in *intensity* and in *extensity* of tourism that makes a difference between different époques of human history (Munar, 2007). On the concept of tourist, the transformationalist position sees tourists as global citizens, where citizenship moves to where the person moves. Their rights and duties are not rooted but mobile; they are not only consumers, and not only national representatives of their country of residence (Munar, 2007).

In the context of globalisation, the development of international tourism is generally observed from either the demand side or the supply side. The forms of international tourism demand in history, as exemplified in the *Encyclopedia of Tourism*, include medieval pilgrimages, grand tours of Europe in the eighteenth century, package tours of Europe in the mid-nineteenth century, and ship-based travel in the early twentieth century to remote destinations. Tourism demand grew even massively following the advent of jet airplanes in the early 1960s (Jafari, Baretje, & Buhalis, 2000, p.255).

In response to the increasing tourism demand, national economies at destination countries are heavily impacted. On the one hand, the *economic leakages* through outbound tourism (i.e., *tourism imports*) by residents from developed countries often bring in a net loss on the country's tourism account (i.e., *trade deficit* on the balance of payments). On the other hand, many developing countries receive net currency inflows (i.e., *trade surplus*) as a result of diversifying their industries into tourism or a result of attempting to gain additional tourism receipts (i.e., *tourism exports*) by attracting more tourists from abroad (Stabler, Papatheodorou, & Sinclair, 2010, p.239). The flows of tourists, accompanied by the commodity flows and monetary flows, embody the extensive interactions between countries in the era of contemporary globalisation. Hence, from an economic perspective, international tourism can raise or lower a country's *dependence* upon other countries and can particularly be of importance to developing countries (Jafari, Baretje, & Buhalis, 2000, p.255; Stabler, Papatheodorou, & Sinclair, 2010, p.237). It is well recognised, at least in theory, that international tourism can bring in income, create jobs, spur local investments, diffuse technologies and thus promote economic growth (Fayed & Fletcher, 2002; Schubert, Brida, & Risso, 2011; Stabler, Papatheodorou, & Sinclair, 2010, p.237).

As the national economy of a country can benefit from and even rely on its international tourism sector, it is of interest to explain in the first place why and under what circumstances a country chooses to specialise in international tourism. Stabler, Papatheodorou, and Sinclair (2010, pp.238-243) revisit the traditional international trade theories on *comparative advantage*, namely the Ricardian theory and the

Heckshcer-Olin (H-O) theorem. According to the Ricardian theory, the pattern of trade is determined by the differences in the *relative efficiencies* of production between different countries. The notion of *comparative advantage* states that, even if a country is more efficient in absolute terms in producing a range of goods than another country, gains from trade can be obtained if it focuses on the production and export of the goods in which it has relatively higher efficiency. The Heckscher-Olin (H-O) theorem, rather than exploring the efficiencies of production, posits that it is a country's *endowments of factors of production* (such as labour, capital, land and natural resources) that determine its comparative advantage. Hence, it is theoretically predicted that countries with a large supply of labour and with abundant land and natural resources are more likely than those with less labour and natural resources to specialise in tourism.

From the supply side, the boom in mass tourism has led to and been facilitated by the increased involvement by transnational corporations (TNCs), including airlines, hotels, tour wholesalers, tour operators, travel agents and car rental companies, which are characterised by high levels of vertical and horizontal integration (Jafari, Baretje, & Buhalis, 2000, p.255). Particularly, evidence has been found to support the view that international fragmentation of production is prevalent in tourism service production, and to resonate with the explanation for tourism specialisation based on comparative advantages (Nowak, Petit, & Sahli, 2009). In exploring the motives for expanding business overseas, Stabler, Papatheodorou, and Sinclair (2010, pp.253-254) follow the OLI theoretical framework. The 'O' represents ownership, which argues the underlying reason why a company extends its presence abroad is to enjoy ownership advantages. These include capital and human resource endowments, intellectual property rights and patents. The 'O' allows a company to access into product and factor markets and exercise its oligopolistic and oligopsonistic power. It is also associated with a company's effort in diversifying business risk. The 'L' means location, which concerns with the access to specific foreign country resources and positive business environments such as high-quality/low-cost labour force, adequate infrastructure, tax concessions and government funding. The presence in foreign markets also assist in overcoming trade barriers and/or other protectionist impediments and in reducing the cognitive and psychological distance. The 'I' refers to internalisation. It allows a company to drastically reduce transaction costs in acquiring inputs and to minimise uncertainty by exercising direct control over its intangible assets, such as logos, image and brand names.

As noted in *Encyclopedia of Tourism* (Jafari, Baretje, & Buhalis, 2000, p.255), international tourism is dominated in both demand and supply sides by developed countries. Most tourist flows originate and take place between developed countries, while tourism developing countries is dominated by tourists from developed countries (Keller, 2000; Jafari, Baretje, & Buhalis, 2000, p.255). As a result, the economic policies and the state of the economy in developed countries have profound impacts on destinations around the globe, though the dominance of developed countries in the international tourism sector is facing challenges from emerging countries. Given the economic benefits brought by international tourism, the impact of tourism on developing countries in the context of globalisation is therefore worth highlighting.

4.5 Economic Interdependencies of International Tourism Demand

Principally categorised as a form of international trade (Artus, 1972; Gray, 1966; Smeral & Witt, 1996), in the first place international tourism involves movements of people. It is the consumers instead of the goods or services that are transported across borders, and tourism consumption/transaction occurs simultaneously with tourism production (Song, Li, Witt, & Fei, 2010). The three domains of globalisation, i.e., international *trade*, international *finance* and *migration*, are deeply and inherently embedded in tourism activities. As far as tourism demand is concerned, tourism markets (or countries) are highly interconnected and interdependent. The implications is, as described by Panić (2003, p.8) in the context of economic integration, '*When international economic interdependence reaches a certain level, what happens in one group of economies may have a major impact on another group – even when the volume of direct trade between the two is small – through the effect on a third group with which both these groups trade heavily*.' To model and forecast tourism demand for destination countries in a global setting, the understanding of the interdependencies between tourism demand is a prerequisite.

While economic globalisation sets out the backdrop, it is the economic independencies that become the focus of the current research, as mentioned in Section 4.2. The following sections provide a detailed interpretation of economic interdependencies in the context of international tourism.

4.5.1 Impacts of Inbound Tourism

From the perspective of a destination country, international tourism has long been perceived to have active impacts on the local economy and communities. The economic impact of tourism is primarily understood in terms of *income* and *employment* generation. This is often associated with the *multiplier effect*, which is used to capture the economy-wide final benefits (sales, output, income, employment, etc.) in comparison to the initial change of tourism demand. In brief, the expenditure by inbound tourists not only brings direct economic benefits (i.e., *direct effects*) to tourism-related businesses (e.g., hotels, restaurants and attractions), but also *indirect* and *induced effects* onto the local economy (Stabler, Papatheodorou, & Sinclair, 2010, pp.209-211). The indirect effects capture the economic benefits that local suppliers to the tourism-related businesses (e.g., farmers, manufacturers and public utilities) receive via the backward linkages between sectors. The income received through direct and indirect involvement in tourism will then be re-spent by both the tourism-related businesses and the suppliers for their own consumption as well as leisure activities, creating knock-on effects on the local economy (i.e., *induced effects*). Hence, considering the *indirect* and *induced* effects, the initial *direct* economic benefits are *multiplied*.

Apart from income and employment generation, other economic impacts at the macro-level are also discussed in the literature, mainly concerning the causal relationship between *inbound tourism demand* and local *economic growth*. The logic has generally been that, tourism is a significant *foreign exchange* earner; it plays an important role in spurring investments in infrastructure and indirectly stimulates other industries in the economy; it can cause positive exploitation of economies of scale; it is also an important factor of diffusion of technical knowledge (Schubert, Brida, & Risso, 2011). These beliefs that *inbound tourism* can promote local *economic growth* are termed the *Tourism-Led-Growth (TLG)* hypothesis. Numerous empirical studies have been put forth to investigate the validity of this hypothesis (for example, Balaguer & Cantavella-Jorda, 2002; Belloumi, 2010; Kim, Chen, & Jang, 2006; Narayan, Narayan, Prasad, & Prasad, 2010; Schubert, Brida, & Risso, 2011; Seetanah, 2011). The results are, however, rather inconclusive. While many studies confirm a unidirectional causality running from inbound tourism demand to real GDP growth in certain countries (and even find evidence of bidirectional relationship, for example, Kim, Chen, & Jang, 2006), in some other studies no co-integration relation can be detected (for example, Katircioglu, 2009). A similar thread of research follows the so-called TKIG hypothesis, which is a variation of the TLG hypothesis by adding capital formation as a channel of stimulating economic growth, i.e., tourism exports → capital goods → imports growth (for example, Nowak, Sahli, & Cortes-Jimenez, 2007). Again, the hypothesis is not always supported by empirical evidence, and its validity is conditional on the country under study (Song, Dwyer, Li, & Cao, 2012).

A straightforward implication of the mixed empirical results is that tourism does not always contribute to local economic growth. In fact, it is not uncommon to find studies that discuss the detrimental effects of tourism on local economy. Since the early literature, researchers have noted that a tourism boom may lead to 'de-industrialisation' (Copeland, 1991; Holzner, 2011; Nowak & Sahli, 2007). This phenomenon is often termed the 'Dutch Disease' effect. It is indicated that tourists mainly consume local amenities and non-tradable goods, such as heritage and cultural facilities, nightlife, restaurants and shopping amenities. A tourist boom tends to raise the demand for and hence the *prices* of these non-tradable goods, expanding their production at the expense of the tradable sectors and, in particular, the manufacturing sector (Chao, Hazari, Laffargue, Sgro, & Yu, 2006; Stabler, Papatheodorou, & Sinclair, 2010, p.207). In addition, in the case where supplies of the non-tradables as well as the tradables are relatively inelastic (for example, under full employment and imperfect factor mobility, factors of production are not able to shift between sectors in the short and medium term), the extra demand resulting from an expansion of tourism would inevitably push up local prices of all goods and services. Furthermore, when the local prices go up to a certain level, the attractiveness of the destination diminishes. The case of demand pressure caused by tourists is exemplified by Albalate and Bel (2010), who based their study on data of 45 European cities. They found that if there was supply constraint, the additional demand for public transport by inbound tourists could impose extra costs on local residents due to congestion, even if the tourism receipts could provide some additional funding for the services.

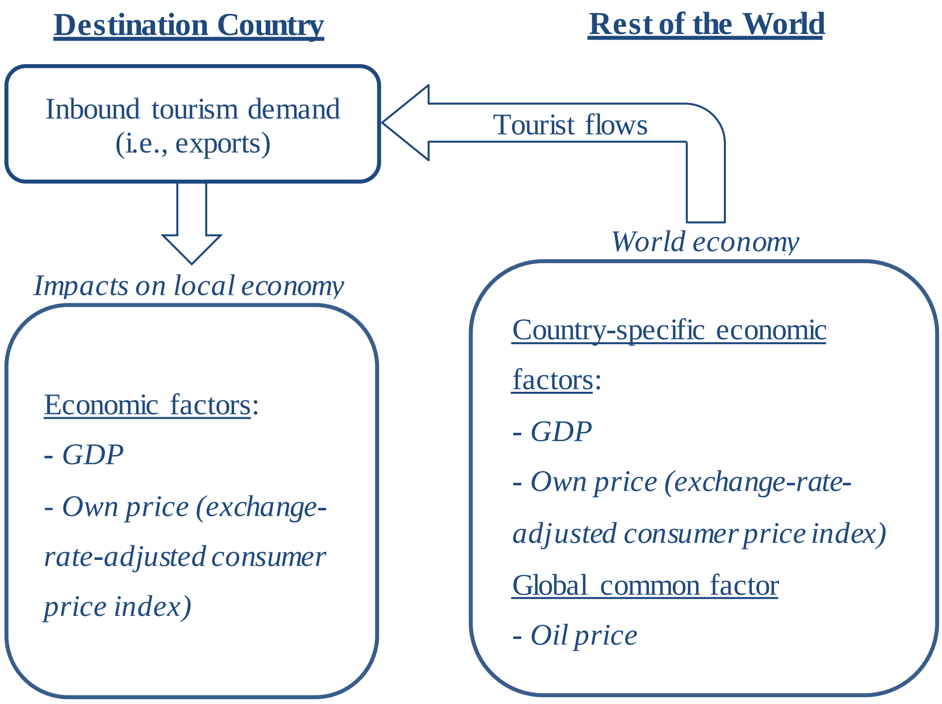

Figure 4.2 - Impacts on local economy by inbound tourism

Source: the author

Given the profound impacts of tourism on destination countries' economy and the fact that tourist flows are heavily influenced by economic factors in the source countries (as informed in Chapter 2), it is implied that *destination countries' tourism sector and the overall economic performance can be susceptible to external economic climate*. Figure 4.2 visualises the role of tourism in connecting the world economy to destination country's economy. Tourists from a specific source country are subject to such underlying influencing factors as income (denoted by GDP), consumer prices and exchange rate in their own country and also oil price (a global common factor that proxies the travel cost). Even though to a large extent the evolution of GDP, consumer prices, and exchange rates follows a trajectory that differs from country to country, the reality that countries are now more and more *interconnected* indeed gathers these individual economic developments towards a (more or less) *unified* direction. As such, the fluctuations of country-specific economic factors tend to synchronise across borders, contributing to the forming of worldwide economic climate[1]. The

[1] This is related to the synchronisation of business cycles and will be dealt with in Section 4.6.1.

consequence is that a destination country inevitably faces a *collective* external force[1] which affects both its tourism sector and local economy, whereas in turn it has no or only marginal influence over the external economic environment. From a theoretical point of view, the collective external force (i.e., world economy) is said to be *exogenous* to the local economy of the destination country.

The Assumption of Small Economies

In close association with the dominant influence of external environment on a destination country is the concept of *small economies*, which constitutes a major assumption for economic analysis. It is generally understood that *a small economy takes its external environment as pre-determined, and it has no control or influence over the evolution of the external environment*. In practice, it is difficult to find a single yet satisfactory definition of *small economies*, be it population, geographical size or GDP, because size (big or small) is a relative concept (Commonwealth Secretariat, 2000, p.3). However, certain characteristics and implications of small economies tend to be shared between a great many countries, such that even partial possession of those attributes is often sufficient to justify the appropriateness of this assumption in theoretical and empirical discussions.

The report by Commonwealth Secretariat (2000, p.5) lists seven common characteristics among small economies, i.e., *remoteness and insularity*, *susceptibility to natural disasters*, *limited institutional capacity*, *limited diversification*, *openness*, *access to external capital*, and *poverty*. Specifically, it is worth highlighting some of the implications with regard to *limited diversification* and *openness* of small economies. As mentioned by Commonwealth Secretariat (2000, p.10) and Schubert, Brida, and Risso (2011), small economies often opt for tourism as their development strategy, because of their lack of diversification resulting from resource scarcity. Citing World Bank's data in the late 1990s, Commonwealth Secretariat (2000, p.10) find that the exports in the Pacific and the Caribbean islands tended to concentrate on services in tourism, with it constantly accounting for the highest or second highest

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[1] Here and hereafter, world economy, worldwide economic climate and external force are generally synonymous in the current research. It can be represented by the aggregate of each country's economic factors, although the method of aggregation is open to discussion. Nevertheless, a weighted average of each country's economic factors (such as GDP and CPI) would be a simple and appropriate proxy. The technical treatment of how to capture the worldwide economic climate will be discussed in the next chapter.

percentages of total exports. The active involvement in international tourism reflects the fact that small economies are highly open to trade, which means that they have a large stake in a stable, rule-based, world trade environment. Even minor disruptions in world markets (such as fluctuating demand and prices for exports) can have a significant impact on their economies (Commonwealth Secretariat, 2000, p.9). Accordingly, the extreme openness of small economies may entail a high degree of vulnerability to external shocks, *which is attributable to interrelated geographic, demographic and economic factors*, and inevitably attract income volatility (Ocampo, 2002; Schubert, Brida, & Risso, 2011).

In tourism economics research, small economies (particularly island economies) are often the subject as well as the setting of studies (for example, Chen & Chiou-Wei, 2009; Narayan, Narayan, Prasad, & Prasad, 2010; Santana-Gallego, Ledesma-Rodríguez, & Pérez-Rodríguez, 2011; Schubert, Brida, & Risso, 2011; Seetanah, 2011). This is not surprising, because the specialisation in and dependence on international tourism are not uncommon among small economies[1]. They are thus perfect samples to test for the causal relationship between tourism and economic growth, for example, the Tourism-Led-Growth (TLG) hypothesis.

Within the 'cohort' of small economies, it is worth noting that not all of them are alike. They can range in population from fewer than 50,000 people to more than 1 million people; in per capita income, from less than US$400 to more than US$9,000 (Commonwealth Secretariat, 2000, p.3). Hence, by nature *small economies* is rather loosely defined and inclusive. Given that in reality many countries are open economies with only limited influence over the worldwide economic climate, in most cases it is appropriate to apply the *small economies* assumption when conducting macroeconomic analysis, except for the case of USA due to its economic and political dominance. In addition, admittedly extra care needs to be taken when applying the assumption to major countries such as China, Germany, Japan and the UK, as these economies are very active in shaping the worldwide economic landscape. Nevertheless, the small economies assumption generally provides a convenient yardstick to describe the setting in which a great many economies are operating.

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[1] However, logically the association between small economies and tourism indicates neither that all small economies are tourism-oriented, nor that countries with a vigorous tourism sector are all small economies.

Therefore, as is acceptable in macroeconomics studies (for example, Bussière, Chudik, & Sestieri, 2009; Dees, Mauro, Pesaran, & Smith, 2007), the small economies assumption is suitable for tourism demand analysis as well.

4.5.2 Spillovers via Outbound Tourism

From the perspective of a source country, outbound tourism has been an effective channel through which the country contributes to the shaping of the world tourism market and the worldwide economic climate. The mechanism is principally the same as that described in Figure 4.2, although in the reverse direction.

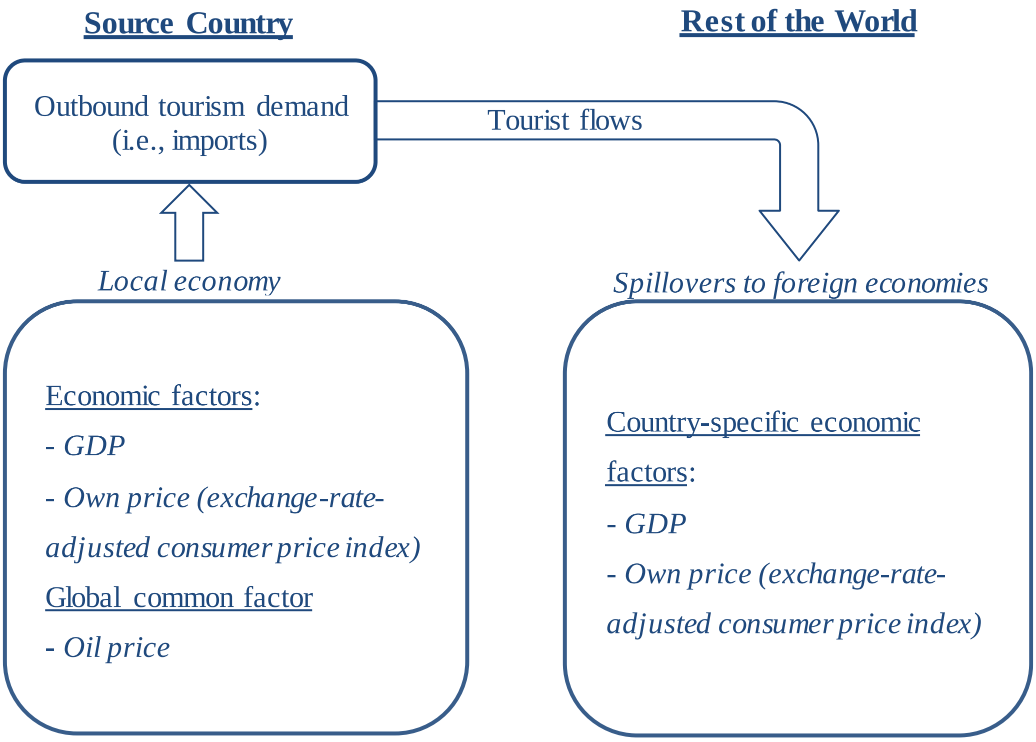

Figure 4.3 - Spillover effects of outbound tourism demand

Source: the author

One of the direct implications in relation to outbound tourism demand is that, *the economic situation in the source country can be transmitted across borders via the outbound tourist flows*. For example, a temporary *adverse* shock (i.e., unexpected event) to the source country's GDP or unusual turbulences in the foreign exchange market can result in contracted outflows of tourists. Consequently the destination countries will feel the shock that originally takes place in the source country, because less tourism income is registered. The theoretical inference of this welfare-decreasing mechanism is shown by Schubert and Brida (2009), using a dynamic macroeconomic equilibrium model. In short, the shock to the source country can be said to spillover to foreign economies. Figure 4.3 visualises the process of spillover.

Still, cautions are worth to be taken that the effects of spillover on foreign economies never be overstated under the *small economies* setting. It is in general not expected that a shock to a 'standard' small economy would be able to create catastrophic effects, unless it triggers a major economy that has more weights in the world economy[1]. In fact, the spillover effects from a source country of tourists should be understood in twofold. On the one hand, for the destination countries that are related to the particular source market, the spillover directly affects their local economy, the strength of which is commensurate with the market share of the source country. On the other hand, for the countries that do not receive tourists from the particular source market, the spillover contributes to the evolution of the generic worldwide economic climate and becomes an *integrated* part of it, which ultimately impacts on all other open economies around the globe. As such, if all the economies are seen as an integrated *ecosystem*, then a source country can be said to be, to a certain extent, *endogenously* related to the tourism sector as well as local economy of the other countries.

The Balance between Outbound Demand and Inbound Demand

As a country can be a tourist receiving country and a tourist generating country at the same time, an issue is raised that from a holistic point of view the outbound tourism demand (i.e., *tourism imports*) relates to and to a certain extent co-moves with the inbound demand (i.e., *tourism exports*). Figure 4.4 combines both Figure 4.2 and Figure 4.3, showing the inherent connection between inbound and outbound tourism.

For country *i*, a small open economy, on the one hand the volume of tourist inflows (i.e., *inbound tourism demand*) is *exogenously* determined by the world economy, which represents the *combination* of each country's economic factors. Hence, country

[1] The on-going Eurozone debt crisis since late 2009 is an example where the sovereignty debt crisis in small economies, such as Greece and Ireland, renders the threat that the crisis could be transmitted to France and thus have disastrous implications to the world economy.

i's inbound tourism demand *co-moves* or fluctuates along with the prevailing world *business cycles*[1]. On the other hand, given the impacts of inbound tourism on local economic factors, which in turn determine the outflows of residents (i.e., *outbound tourism demand*), it can be implicated that, the higher the volume of tourist inflows to country *i*, the higher the income (or GDP) and price level that country *i* may achieve, making it more favourable for residents in country *i* to conduct outbound tourism, and *vice versa*. In this sense, the fluctuations of outbound tourism demand are *correlated to* those of the inbound tourism demand. Furthermore, the consumption of outbound tourists becomes the medium through which country *i*'s business cycle is spilled over to foreign economies and integrates with the world business cycle. However, despite the underlying logic, co-movements between inbound and outbound tourism demand may not necessarily be observable at all times, as the inflows and outflows of tourists can be deterred by non-economic factors, such as visa restrictions.

All in all, the inbound tourism demand and outbound tourism demand embody the extent to which a country *depends on* and *is depended on by* other countries. The balance between inbound tourism demand and outbound tourism demand, i.e., the balance of tourism services trade, indicates a country's position against the others in an interconnected world.

In the era of globalisation, the more integrated each economy is with another, the higher level of *co-movements between inbound and outbound tourism demand* may be observed, no matter whether within a particular country or across various countries. *Interdependencies* are thus understood as an intrinsic attribute of the world tourism market in the contemporary context. The implication of this reality is that, as with the generic macro economies where *synchronisation of business cycles* can be observed on a global scale, similar patterns of synchronisation may exist among the international tourism sectors across different countries. This issue will be dealt with in Section 4.6.1.

[1] *Business cycle* refers to the short-run to medium-run *fluctuations* in aggregate production, trade and other economic activities. It is generally depicted as the periods of expansions and contractions in the level of economic activities (often in terms of GDP) around a long-run growth trend.

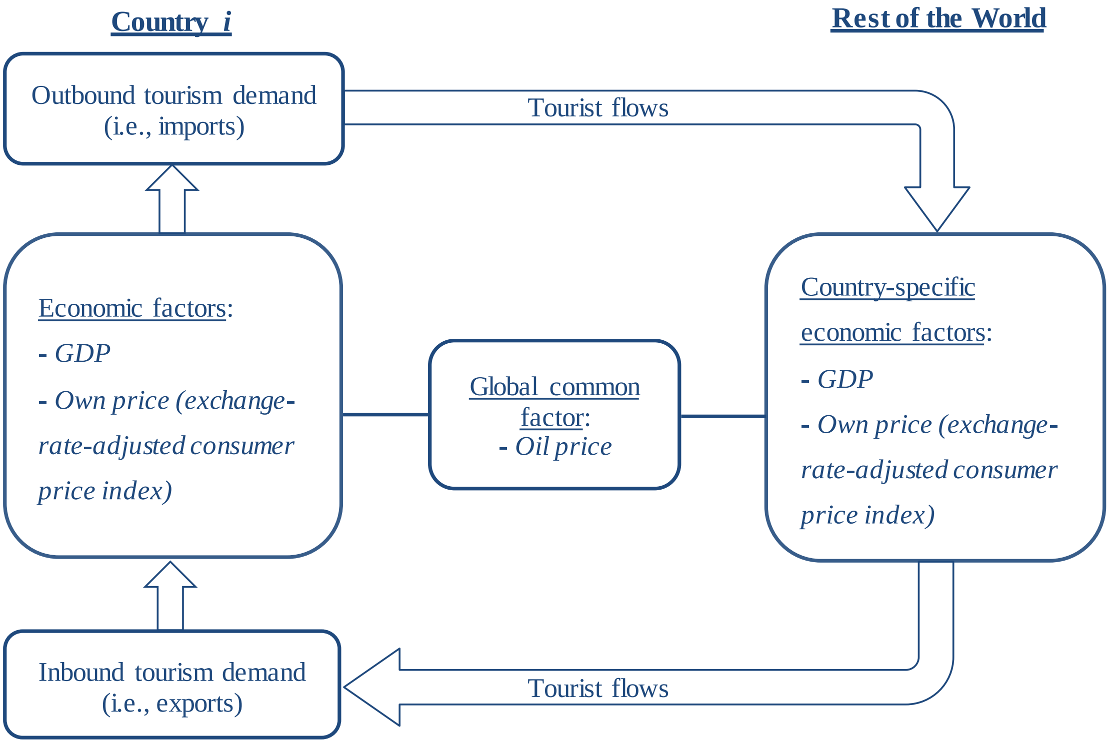

Figure 4.4 - Correlation between outbound demand and inbound demand

Source: the author

4.5.3 Complementary and Substitutive Relations between Tourism Demand

Apart from the dynamics between tourism demand and economic factors, as described in Section 4.5.1 and Section 4.5.2, there exists mutual influence of tourism demand between different destination countries. In brief, such mutual influence is understood from the perspective of *complementary effect* and/or *substitution effect*.

In generic economic theory that concerns consumer demand, it follows that goods/services are to some extent *interrelated*. They can be either *complements* or *substitutes* to each other[1] (Pindyck & Rubinfeld, 2013, pp.24-25; Snyder & Nicholson, 2012, pp.171-172). On the one hand, if the consumption of one good is accompanied by that of another good (for example, printers and ink cartridges, tea and

[1] In the case where no interrelation exists, that is the change in price of one good has no effect on the demand for another, it is said that the two goods are *independent*.

milk), it is said that the two goods are *complements*. More formally, a complementary good is often defined as a good with a negative *cross-price elasticity* of demand, which means the *demand* for the good is inversely related to the *price* of its complement (for example, more ink cartridges would be sold if the printers become cheaper)[1]. On the other hand, if the consumption of one good can be replaced by another without compromising much in terms of quality and utility (for example, margarine and butter, tea and coffee), it is said that the two goods are *substitutes*. Accordingly, a substitute good is often associated with a positive *cross-price elasticity* of demand, so that the *demand* for the good changes in the same direction as the *price* of its substitute (for example, more tea would be consumed if the coffee becomes more expensive).

In the context of international tourism, similar interrelations can be observed among destination countries. Some destinations are *complements*, and the price drop in one country may result in an increase of visitor arrivals to several neighbouring countries because they can be visited on the same trip. One explanation can be that some destinations are often bundled in a holiday package. One of these examples is the bundle of Singapore, Malaysia and Thailand, which has been constantly popular with Chinese tourists. Another explanation can be that some countries adopt a common visa policy and abolish border control at their common borders, hence enabling a cross-country trip during a single visit. The Schengen Area that comprises 26 European countries is a notable example. In contrast, the interrelationship of other destination countries contains some elements of competition, because they are somewhat perceived as *substitutes*. For example, the Spanish islands (Balearic, Canary, etc.) and the Greek islands (Crete, Corfu, etc.) are both alluring places for summer holidays, while in the winter, Austria, France and Switzerland are all 'hot' destinations for skiing. Tourists may well choose a destination after a price hike in the alternative ones. Apparently, although defined by the cross-price elasticity, the determination of the interrelationship between destination countries can be inherently associated with *non-economic factors* that are supply side (destination) related and tend to fall into the category of *external inputs* in Figure 2.2, for example, climate,

[1] It is assumed that both goods are *ordinary goods*, which means for either good itself, the higher its own price, the lower the demand for it. The same assumption applies to the case of substitute goods.

geographical proximity, cultural similarity, destination attractions/facilities, and/or simply political reasons (e.g., visa policy).

Given the interrelationship between destination countries, it is implied that the inbound tourism demand may be numerically *correlated* to one another. Tourist inflows to a destination country tend to increase alongside an increase of demand for its complements and/or a decline for its substitutes. In the literature, such interrelationship between a destination and its alternatives can be explicitly modelled. In many studies, a *substitute price* (or *cross price*) variable is constructed and included in the tourism demand model, as explained in Section 2.4.4[1]. For example, France, Greece, Italy, Portugal and Spain are chosen by Li, Wong, Song, and Witt (2006) as alternative destinations for UK's outbound tourism; Indonesia, Malaysia, Philippines, Singapore and Thailand are seen as substitutes by tourists from several developed countries in Song, Witt, and Li (2003). The sign and value of *the coefficient on the substitute price variable*, which represents the *cross-price elasticity*, reveal the relationship between these alternative destinations ('+' means *substitutes*, '-' means *complements*) and its magnitude. Generally, empirical evidence suggests that the relationship is perceived differently from one origin country to another, and its magnitude can evolve over time (for example, Li, Wong, Song, & Witt, 2006; Song, Witt, & Li, 2003). Some other studies take a closer look at the *substitution effect*, as this to a large extent reflects how keen the competition between destination countries can be (Dwyer, Forsyth, & Dwyer, 2010, p.51; Li, Song, Cao, & Wu, 2013; Mangion, Durbarry, &Sinclair, 2005). It is suggested that the cross-price elasticity can be essential information for formulating pricing strategy, which in turn helps to enhance a destination country's competitiveness.

In sum, depending on the nature of their relationship, tourism demand for one destination can be expected to co-move with that for another either directly or inversely. In this sense, there exists certain levels of *interdependencies* between destination countries that may ultimately be underpinned by non-economic factors.

[1] To recapitulate, a substitute price variable is a weighted average index of prices in alternative destinations.

4.6 Empirical and Theoretical Implications

The discussions in Section 4.5 delineate the mechanism behind the interdependencies between tourism countries. In brief, these are driven by the interactions between tourism demand and economic factors at home and abroad, and the complementary/substitute nature of the relationship between tourism countries.

The understanding of the interdependencies, as stated at the outset of Section 4.5, sheds some light on a more accurate tourism demand modelling practice. In the meantime, it illuminates a better analysis of the current economic affairs that should have far-reaching implications across borders.

4.6.1 Business Cycle Synchronisation

Interdependencies between countries, as described in great details in Section 4.5, imply certain level of *co-movements* of economic activities on the global scale. Similar co-movements can also be observed in the international tourism sector in the wake of the recent global recession, even though there were additional disturbances playing their parts at the same time.

Business Cycle Synchronisation

In general, business cycle refers to the fluctuations in aggregate economic activities, which are usually in terms of gross domestic product (GDP), employment and so on, over the short term (Mankiw, 2006, p.252). It comprises periods of expansions, followed by recessions and revivals, in the level of output around the economy's long-term growth trend for more than one year and up to ten or twelve years (Abel, Bernanke, & Croushore, 2008, pp.283-284; Sørensen & Whitta-Jacobsen, 2010, pp.358-359).

In the era of increasing economic integration, the conventional wisdom is that cross-border interdependences should lead to convergence of business cycles, although an alternative view indicates the opposite, i.e., more asynchronous output fluctuations, because the production of goods is highly specialized and country-specific (Canova, & Ciccarelli, 2012). An explanation is, as summarised by Canova and Ciccarelli (2012) and Derviş (2012), production cycles could be completely idiosyncratic since they are linked to relatively long-term supply-side factors (e.g., capital accumulation, technological catch-up, and demographics) while consumption cycles are perfectly correlated since they are linked more to shorter-term demand-side factors.

Many studies under the labels of business cycle synchronisation, international transmission mechanism, decoupling and recoupling and international contagion can be found in generic economic literature (e.g., Artis, Fidrmuc, & Scharler, 2008; Canova & Ciccarelli, 2012; Hamori, 2000; Sayek & Selover, 2002). In short, contradictory evidence has been found. A notable study is conducted by Kose, Otrok, and Prasad (2012). Based on the data for 106 countries over the period of 1960-2008, they find that there has been a substantial convergence of business cycles *among* industrial economies and *among* emerging market economies, but there has also been a concomitant divergence (or decoupling) of business cycles *between* these two groups of countries.

To explain the mechanism behind the transmission of business cycles (i.e., the trigger and the path of transmission), two main hypotheses have been put forth: *locomotive hypothesis* and *common shocks* (Bagliano, & Morana, 2010; Sayek, & Selover, 2002; Selover, 1999). In economics, *shocks* refer to unexpected or unpredictable events that have regional or global implications (either positive or negative) on the economy. The concept of '*shocks*' is often associated with business cycles, since it is the fluctuations that are of interest. The *locomotive hypothesis* assumes that business cycles are transmitted across countries via *trade flows*, capital movements, labour migration and technological transfer. The impacts of income shocks, price shocks and interest rate shocks have been examined under this hypothesis (Sayek & Selover, 2002). The *common shocks hypothesis* concerns about the shocks that affect the majority of countries worldwide, such as technological advancement and commodity supply shocks (e.g., oil crisis in the 1970s). Regardless of which hypothesis to follow, it is implied that a shock to any variable in a particular country can have impacts over other variables in both the national economy and foreign economies.

Empirically, business cycles are often studied using the vector autoregression (VAR) model (for example, Abildgren, 2012; Bagliano & Morana, 2010; Hamori, 2000; Sayek & Selover, 2002). As reviewed in Section 3.2.2.1, one advantage of the VAR model is that it is able to simulate the impacts of a shock through *impulse response analysis*. In brief, an impulse response describes how one economic variable reacts over time to a shock (or *exogenous impulse*) in another variable within a system that involves a number of other variables as well.

A notable recent development in the VAR modelling practice has been the global VAR (GVAR) model. It is first proposed by Pesaran, Schuermann, and Weiner (2004). The novelty of GVAR lies in its ability to link up a large number of regional systems into a unified global system, while avoiding the '*curse of dimensionality*' discussed in Section 3.2.2.1. By treating variables as endogenously determined, the model explicitly allows for the interdependencies that exist between national and international factors. The applications of the GVAR model have been modelling the international transmission mechanism via generic economic variables such as real GDP, inflation, interest rates and exchange rates (e.g., Boschi, 2012; Bussière, Chudik, & Sestieri, 2009; Chudik & Fratzscher, 2011; Chudik & Straub, 2010; Dees, Mauro, Pesaran, & Smith, 2007; Galesi & Sgherri, 2009;N'Diaye & Ahuja, 2012; Pesaran, Schuermann, & Weiner, 2004), and the applications in narrower scope are not uncommon as well (for example, the housing market, Vansteenkiste & Hiebert, 2011; the labour market, Hiebert & Vansteenkiste, 2010).

In the context of tourism, studies concerning the business cycle of tourism demand have been very limited, even though the earliest one dates back to the late 1970s, by Schulmeister (1979). The general considerations of the existing studies have been that a specific country's tourism demand follows the economic fluctuations (e.g., Frechtling, 1982; Guizzardi & Mazzocchi, 2010) or that the variation of tourism demand elasticities across different phases of the business cycle (Smeral, 2012). However, few studies have considered the interrelationship between tourism countries. Following the discussions since the beginning of the chapter, the interdependencies between tourism countries mean that *a country's international tourism demand (inbound and outbound) is highly sensitive to idiosyncratic shocks in other countries and/or global common shocks*. Examples of shocks that disrupt the world tourism sector can be found in WTTC (2011), which summarises some unprecedented global events throughout 2011. These include the *economic instability* in the wake of the financial crisis and recession since 2008, the *natural disasters* such as the nuclear accident in Japan after a devastating tsunami and the earthquake in Christchurch in New Zealand, and the *socio-political upheaval* seen in North Africa and Middle East (known as 'Arab Spring'). It was expected that both tourism consumption and tourism production were severely deterred by such events, and the disruption could be seen not only in the particular region where the event took place, but also across borders. As commented by Held, McGrew, Goldblatt, and Perraton (2000), '…*And the growing extensity, intensity and velocity of global interactions may also be associated with a deepening enmeshment of the local and global such that the impact of distant events is magnified while even the most local developments may come to have enormous global consequences. In this sense, the boundaries between domestic matters and global affairs may be blurred.*' The impact propensity, one of the spatio-temporal dimensions of globalisation, has particular policy relevance to the any studies in a global setting.

Impacts of the Recent Global Recession

The recent global recession, ignited by the subprime mortgage crisis in the USA in 2008, has prominent implications on the international tourism sector. As a non-necessary consumer good and an industry that penetrates (or relies on) almost every other sector in the economy, the international tourism was expected to be hit by the economic slump in an all-encompassing manner.

The United Nationals World Tourism Organisation (UNWTO) data show that international tourism started to decline during the second semester of 2008, and even plummeted by 8% in terms of arrivals between January and April 2009 (Papatheodorou, Rosselló, & Xiao, 2010; Smeral, 2010). The International Air Transport Association (IATA) confirmed the slump in international tourism demand by finding an 8% decline in worldwide passenger traffic between January and May 2009; hotel performance between January and April 2009 registered a similar drop, with revenue per available room falling by double-digit rates (Smeral, 2010). The contraction of tourism activities was alleviated from 2010, but still subject to adverse economic climate. In reviewing the performance of world tourism in 2011, which was believed to be the toughest year since the outbreak of the crisis, WTTC (2011) summarised a combination of factors that contributed to the challenging global *macroeconomic* environment: uncertainty over the future of eurozone, weakening global business and investor confidence, sluggish performance of the United States' economy, slowdown in the main emerging economies, and high level of public debt, borrowing and increasing government austerity. On the finance front, the pain of credit crunch in one region could partly (if not fully) be felt by another region. As a result, the financial activity and credit growth are likely to remain subdued in many economies, restricting the expansion capacity of tourist enterprises (Papatheodorou, Rosselló, & Xiao, 2010). In addition, as noticed by Papatheodorou, Rosselló, and Xiao (2010), the recession has also led to a downturn in the world labour market. The International Labour Organisation (ILO) highlighted that worldwide unemployment rate, one of government's management targets, could reach between 6.5% and 7.4% in 2009 (Papatheodorou, Rosselló, & Xiao, 2010), reflecting the far-reaching impacts of the recession.

The Roles of Emerging Economies

One trend emerging from the recession is that *developing economies are playing a more and more important role in the world economy*. It is now formally recognised by the G7 *ancien régime* that major developing countries are important pillars of the world's financial system (Papatheodorou, Rosselló, & Xiao, 2010).

Outbound tourism from developing countries can help to restore reciprocity and stability of international trade. This is evidenced by the statistics. Over the last decade China has shown the fastest growth with respect to expenditure on international tourism, thanks to rising disposable incomes, a relaxation of restrictions on foreign travel and an appreciating currency (UNWTO, 2013). In 2009, when the world economy was severely hit by the financial crisis, China's tourism expenditure registered a whopping 21% increase, whereas other top spenders saw near zero or even negative growth (UNWTO, 2010). Indeed, in 2005 China ranked seventh in international tourism expenditure, and has since overtaken Italy, Japan, France, the UK, the USA and Germany, to become the world's first place top spender in 2012 (UNWTO, 2013). Another emerging economy showing an impressive advance is Russia. It moved up two places in 2012 to the fifth on the back of a 37% growth (UNWTO, 2013).

Such up-rise of developing countries is bound to affect not only the pattern of international trade, but furthermore the exchange rate regime. Although it is premature to argue that the Chinese yuan will eventually mount to a global dominance, it is clear that the US dollar is less exclusively relied on for international business transactions, including tourism (Papatheodorou, Rosselló, & Xiao, 2010). A strong contender, the euro, which was expected to challenge the US dollar, is however mired in the debt crisis of its member states. Nevertheless, the relative variation of values of currencies would certainly change the landscape of global tourism markets. Depreciations of US dollar and euro may bring some edge to the inbound tourism of USA, and help Mediterranean countries (e.g. Spain, Italy, and Greece) maintain cost advantage.

Table 4.2 - Top source countries for China's inbound tourism

Ranking	2013	2012	2011	2010	2009
1	Korea	Korea	Korea	Korea	Japan
2	Japan	Japan	Japan	Japan	Korea
3	Russia	Russia	Russia	Russia	Russia
4	USA	USA	USA	USA	USA
5	Vietnam	Malaysia	Malaysia	Malaysia	Malaysia
6	Malaysia	Vietnam	Singapore	Singapore	Singapore
7	Mongolia	Singapore	Vietnam	Vietnam	Philippines
8	Philippines	Mongolia	Mongolia	Philippines	Mongolia
9	Singapore	Philippines	Philippines	Mongolia	Australia
10	Australia	Australia	Canada	Canada	Canada
11	Canada	Canada	Australia	Australia	Thailand
12	India	Germany	Germany	Thailand	UK
13	Thailand	Thailand	Indonesia	Germany	Germany
14	Germany	Indonesia	Thailand	UK	Indonesia
15	UK	UK	India	Indonesia	India

Note: 1) Countries in shade are among those modelled in the current research;

2) Hong Kong, Macao and Taiwan are excluded from the above list

Table 4.3 - Top destination countries for China's outbound tourism

Ranking	2013	2012	2011	2010	2009
1	Korea	Korea	Korea	Japan	Japan
2	Thailand	Thailand	Malaysia	Korea	Korea
3	USA	Japan	Japan	Vietnam	Vietnam
4	Japan	Cambodia	Thailand	USA	USA
5	Vietnam	USA	USA	Malaysia	Russia
6	Cambodia	Malaysia	Cambodia	Thailand	Singapore
7	Malaysia	Vietnam	Vietnam	Singapore	Thailand
8	Singapore	Singapore	Singapore	Russia	Malaysia
9	Guinea-Bissau	Russia	Russia	Australia	Australia
10	Russia	Australia	Australia	Indonesia	Myanmar
11	Indonesia	Indonesia	Indonesia	Cambodia	Indonesia
12	Australia	Myanmar	Italy	UK	UK
13	Myanmar	Italy	UK	Canada	Germany
14	Canada	Canada	Canada	Germany	France
15	UK	UK	Germany	France	Cambodia

Note: 1) Countries in shade are among those modelled in the current research;

2) Hong Kong, Macao and Taiwan are excluded from the above list

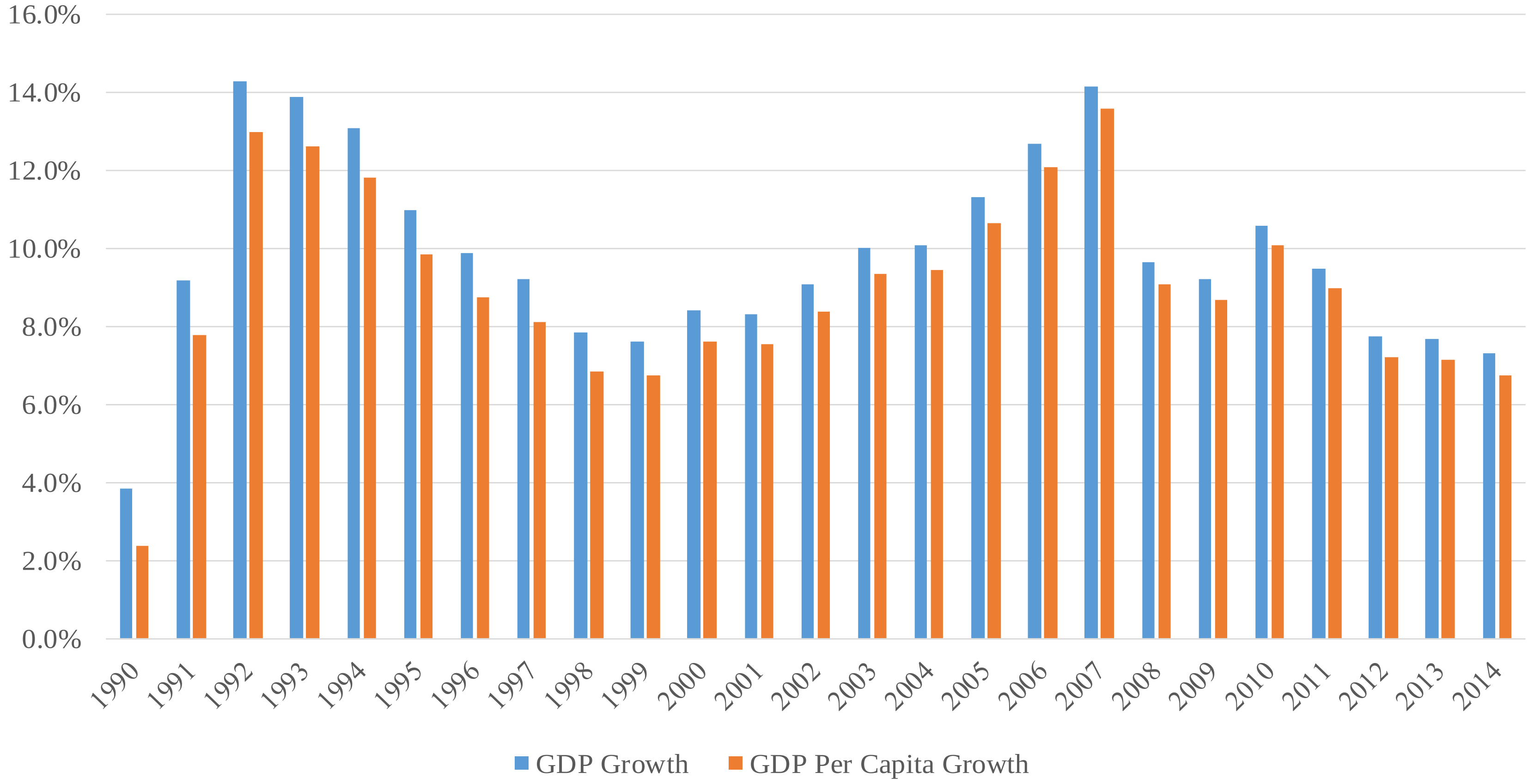

Figure 4.5 - China's GDP growth rates

Data source: World Economic Outlook, IMF (2015); Series are NGDP_R (gross domestic product) and NGDPRPC (gross domestic product per capita); both at constant prices, in national currency

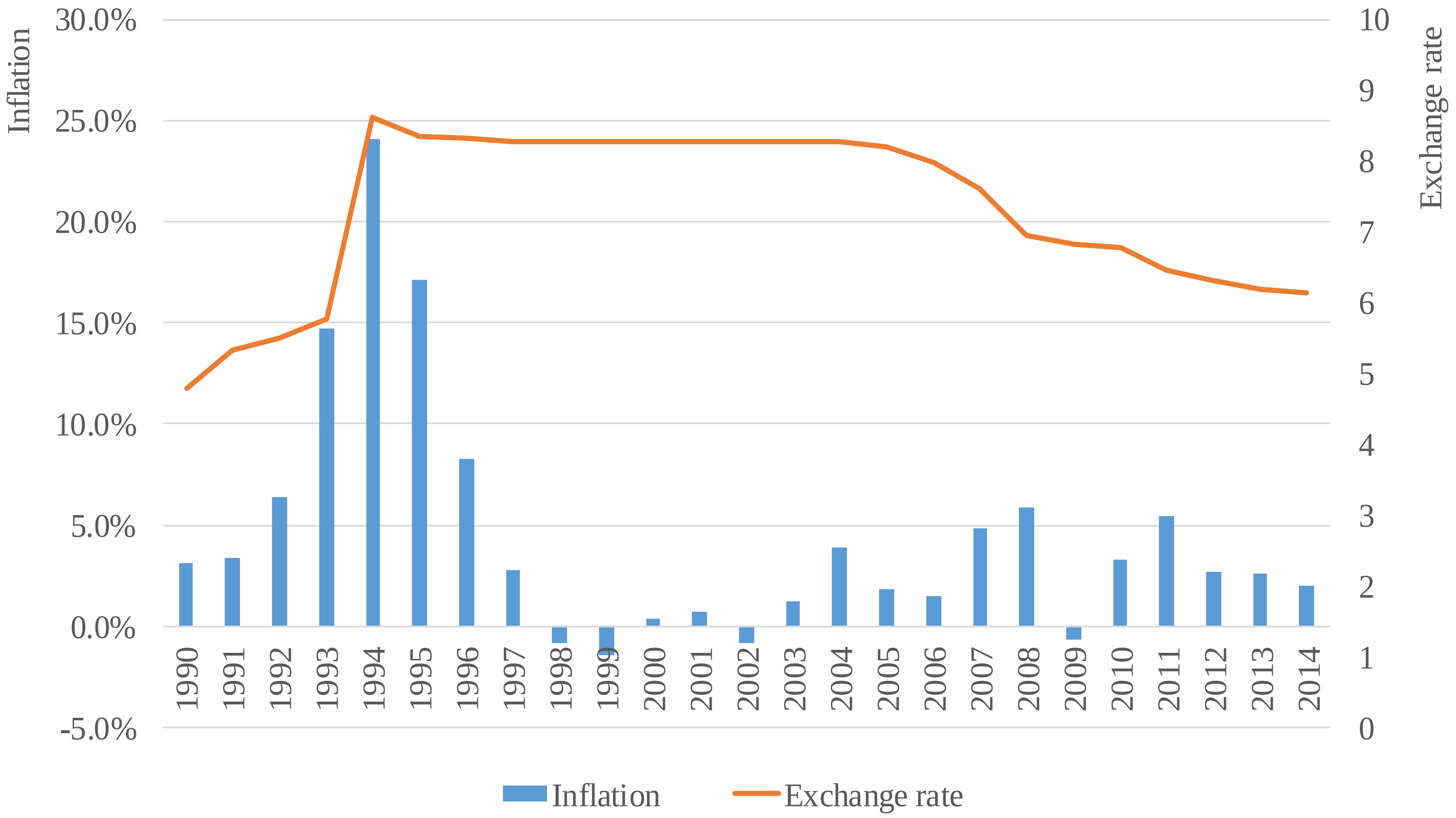

Figure 4.6 - Trends of China's inflation and exchange rate

Data source: World Economic Outlook, IMF (2015); series are PCPIPCH and RF-ZF for inflation and exchange rate; inflation is the percentage change of consumer price level; the exchange rate used in the chart is the annual average of national currency against US dollar

4.6.2 China as an Emerging Economy

China is one of the biggest economies in the world, in terms of gross domestic product (GDP). Thanks to the unprecedented growth over the past few decades, China has overtaken Japan to be the second largest economy ever since 2010[1]. Figure 4.5 shows the growth rates of China's GDP during 1990-2014, with early-1990s and mid-2000s being the most impressive, easily beyond 10%. However, since 2008, China's economic growth has seemed to lose some momemtum. The growth rate was staggering at around 8%, which is still a striking number. But it is apparent that the Chinese economy will not grow as fast as before.

Alongside the extraordinary economic growth is the expansion of China's international tourism sector. According to the National Bureau of Statistics of China (2015), the number of international tourist arrivals to China has grown from 43.685 million in 1994 to 128.49 million in 2014, whereas the resident departure from China has seen an even steep growth, from 3.73 million in 1994 to 116.59 million in 2014 (all the numbers include tourists to and from Hong Kong, Macao and Taiwan). One of the trends most discussed in the recent years is the increasing importance of Chinese outbound tourists to the local economy in other major tourism countries (see also the previous section). The Chinese market has become particularly relevant for businesses to maintain competitive edge. Table 4.2 and Table 4.3 present the major source countries and the major destination countries for China over the recent years, in terms of the number of tourist arrivals. One observation from both tables is that many of the countries are both top source markets and top destinations at the same time, reflecting the close ties between China and those countries. Another observation is that China's international tourism sector (irrespective of inbound or outbound tourism) mainly concentrates in short-haul markets, with many countries situating in Asia. It is logical to expect that any economic changes in China could have notable impacts on those short-haul markets.

As to inflation and exchange rate against the US dollar (see Figure 4.6), they had a relative unsteady period in the early to mid-1990s. Inflation was unusually high between 1992 and 1996, but has experienced less ups and downs since 2000s. For the

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[1] http://www.bbc.co.uk/news/business-12427321; http://www.wsj.com/articles/SB10001424052748703361904576142832741439402

exchange rate, it is clear that since 2008 there has been a steady appreciation of the Chinese currency. However, speculations came in the early autumn 2015 that the Chinese renminbi (RMB) now faced devaluation[1]. Depreciating the currency is of course helpful to boost China's competitiveness in its exports. To this end, China's central bank allowed for a greater role of the market in determining the value of RMB, which used to be heavily pegged against the US dollar. Such a move also fits well into China's long-term goal of establishing RMB as a major internationally traded currency[2]. Now that the Chinese currency is expected to be included into the basket of IMF's special drawing right (SDR)[3], which is a step forward for China to achieve its goal, fears of devaluation are increasingly mounting[4]. All in all, the exchange rate of the Chinese currency is likely to become more volatile. So is China's own price level (i.e., consumer price index adjusted by exchange rate against the US dollar).

4.6.3 Endogeneity Issue in Tourism Demand Modelling

From a theoretical point of view, economic interdependencies and the implied co-movements of tourism demand across countries have direct implications on how tourism demand should be modelled. Specifically, economic variables and international tourism demand variables across countries are in a state of mutual influence. It is necessary to take all the variables as endogenous to a big, global system when modelling tourism demand. All the situations described in Section 4.5 contribute to the endogeneity issue.

As have been discussed extendedly in Chapter 3, particularly Section 3.2, the existing collection of tourism demand models tend to be restricted by the assumption of *exogeneity* of explanatory variables. An appropriate setting for the exogeneity assumption could be small economies, as introduced in Section 4.5.1. The external environment in which a small economy is operating is assumed to be exogenous. In this setting, instead of dealing with a particular pair of origin and destination, the

[1] http://www.wsj.com/articles/chinas-yuan-move-highlights-importance-of-exchange-rates-for-policy-makers-1439299109
[2] http://www.businessspectator.com.au/article/2015/8/11/china/why-china-changed-its-exchange-rate-policy
[3] http://www.imf.org/external/np/exr/facts/sdr.htm
[4] http://blogs.ft.com/gavyndavies/2015/12/13/china-edges-towards-a-new-exchange-rate-policy/

model basically concerns the influence of the *rest of the world*[1] on a particular country. This is similar to the visualisation in Figure 4.2 and Figure 4.3. Notable examples are Artus (1972), Smeral (2012), Smeral and Witt (1996), and Smeral and Weber (2000), who studied the tourism imports and/or exports within a large-scale system using the single-equation approach. Generally, to denote the rest of the world, economic variables are weighted averages of a number of selected countries. For example, an index of weighted import prices is denoted as $\sum_{i=1}^{n} g_{i,xx} \cdot \frac{CPI_i}{CPI_{xx}}$, where $g_{i,xx} = \frac{n_{i,xx}}{n_{T,xx}}$ is the share of destination *i* among all the destinations visited by origin country *xx*'s tourists (see Smeral & Weber, 2000).

However, it remains that the interdependent relationship between *one country and another* cannot be accommodated under the assumption of exogeneity. As illustrated in Section 3.2.1.3, this assumption is easily subject to breach, the sources of which include omitted variables, measurement errors in the regressors and simultaneous causality. In the context of interdependencies, while it is theoretically and empirically plausible to find that the inbound tourism demand (i.e., tourism exports) is determined by the level of *income* and *prices* in the origin country and the level of *prices* in the destination as well as substitute destinations, it is equally reasonable to find that the inbound tourism will have feedback on the local *prices* in the destination (e.g., causing inflation), and the level of *income* and *prices* in the origin country and substitute destinations via outbound tourism (i.e., tourism imports). Hence, simultaneous causality (or bidirectional causality) introduces *endogeneity* into the existing tourism demand models, which renders the assumption of exogeneity problematic.

Moreover, from a holistic point of view that the world is taken as an integrated system, the simultaneous causality takes place across countries, since the fluctuations of the tourism demand variables (i.e., tourism exports and tourism imports) and the economic variables of different countries are correlated. As has been discussed in the previous section, the co-movements between tourism markets have been best manifested during the recent global recession, where a shock (i.e., defaults on

[1] The term 'rest of the world' should mean the rest of the system, which is defined on a case-by-case basis. Nevertheless, the use of this term denotes an aggregation of a wide range of countries.

subprime mortgages) to a major economy (i.e., USA) resulted in detrimental effects on almost all economies.

Therefore, it is implied, in the context of globalisation, that the tourism demand (i.e., tourism exports and tourism imports) and the economic factors for particular countries should be treated as *endogenous* variables in a tourism demand model. It by no means indicates that the tourism demand studies that are based on the existing modelling frameworks are invalid, as long as the assumption of exogeneity is appropriately justified in the setting. After all, the existing methods still show outstanding capability of generating accurate forecasts. However, taking into account the endogeneity between variables does add valuable information to help improve the accuracy of estimated effects, since it is an aspect that has been left out in many models.

A promising starting point to tackle the endogeneity issue is to adopt the VAR models, as have been introduced in Section 3.2.2.1. Studies are found to approach the interdependencies between destinations by using the VAR models, for example, Seo, Park, and Boo (2010), Seo, Park, and Yu (2009), and Torraleja, Vázquez, and Franco (2009). The major limitation with many of the existing versions of the VAR models is the '*curse of dimensionality*', which means that only a small number of variables can be included in the model. If the interdependencies between countries are to be investigated on the global scale, the limitation has to be solved in order to accommodate a good many variables in the VAR system. Based on the review in Section 4.6.1 and by Song, Dwyer, Li, and Cao (2012), an appropriate solution would be adopting the innovative approach called global VAR (GVAR), as it avoids the '*curse of dimensionality*' by estimating small VAR systems before aggregating them to form a large global VAR system.

In sum, the interdependent nature of cross-country relationship has rendered an important aspect that should be taken into account in the tourism demand modelling practice. To this end, more advanced tourism demand models are needed. So that it becomes feasible to quantify the magnitude of interconnectedness between tourism countries and to gauge the impacts of a country-specific shock on the world tourism sector.

4.7 Conclusion

Economic interdependencies have been an important feature that characterised the international tourism sector across countries in the world. Tourism demand is no longer subject to only the economic factors between an origin country and a destination country, but also correlates with the economic fluctuations in other parts of the world. As such, in the era of globalisation, events in a country can have far-reaching impacts across borders in a swift manner.

To address this reality and to take it into account in empirical tourism demand models, it is required that the model be able to accommodate a large number of endogenous variables that represent the tourism demand and the economic factors for a wide range of countries. Such a requirement prompts the need of advancement in tourism demand modelling techniques. With the advancement, the scope of tourism demand analysis will be greatly extended.

Studying the interdependencies can be beneficial to both tourism businesses and policy makers. It provides vital information regarding the intensity dimension of contemporary globalisation. Furthermore, it quantifies the extent to which a tourism market is influenced by another, so that informed decisions could be made in response to the changes in economic situations at home and abroad. The impact dimension of globalisation can thus be drawn accordingly.

All in all, this chapter provides an indispensable practical context for the current research. It justifies the need for theoretical improvements in tourism demand modelling, and points out the issues that an ideal research method should be able to tackle.

Chapter 5. Research Method

5.1 Introduction

Based on the previous chapters that discuss the economic reality of globalisation facing the world tourism sector and the imperative needs for advancing existing tourism demand models, this chapter aims to outline the research method of the current research. As reasoned in Section 4.6, an innovative modelling approach called global VAR (GVAR) is proposed to be adopted. As will be introduced in the following sections, GVAR is essentially a two-stage modelling strategy based on existing VAR models (see Section 3.2.2.1). Hence, *when GVAR is referred to as an 'approach', it means the whole modelling process*. In the meantime, since the second stage consists of forming a cross-sectional global VAR model, *when GVAR is referred to as a 'model', it means the global model in the second stage*.

Section 5.2 includes the inference of GVAR model, and discusses its modelling procedure in practice. Based on the estimated GVAR model, impulse response functions are then provided. Section 5.3 is mainly descriptions on the secondary data, including the data sources and the methods used to process the data. Last but not the least, the parameters for the setup of GVAR model are presented.

5.2 The Global Vector Autoregressive (GVAR) Approach

In light of the *curse of dimensionality* that plagues the traditional VAR models, Pesaran, Schuermann and Weiner (2004) propose the global VAR (GVAR) approach. It was further developed by Dees, Mauro, Pesaran and Smith (2007) within a global common factor model framework.

The basic idea of GVAR approach is to divide a large, global system into a number of sub-systems (or cross sections), then individually estimate the sub-systems before stacking them back to form the global system. So there is no need to estimate the large set of coefficients associated with the global system all at once. Essentially, the sub-systems are still traditional VAR models, and have the same features and modelling procedures as before. The global system is an extended VAR system.

The special feature of the GVAR approach is that, the VAR model for each sub-system normally contains two main sets of variables, namely *domestic variables* and *foreign variables*. An additional set of variables, called *global common variables*, are at times included in the GVAR studies to denote the observable common factors (for example, oil prices, technological diffusions). Domestic variables are those specific to the sub-system only (e.g., its GDP level, CPI, and exchange rates), and they are treated as endogenous variables. Foreign variables are cross sectional weighted averages of domestic variables of all other sub-systems (e.g., weighted averaged GDP of all foreign countries), and they are exogenous variables to the sub-system. So the fluctuations of the foreign variables denote any changes that are shared across countries. It is theoretically shown by Dees, Mauro, Pesaran, and Smith (2007) that, the foreign variables act as proxies for the underlying unobserved global factors. The merit of constructing foreign variables is it substantially reduces the parameters to be estimated in each sub-system, and thus avoids the curse of dimensionality.

5.2.1 Model Inference

Thanks to the division of a global system into sub-systems, the GVAR approach takes a two-stage modelling procedure.

In the context of global tourism demand, the first stage is to construct country-specific VAR models, which include *domestic variables* (e.g., tourism exports, tourism imports, income level, price level and exchange rates for a particular country) and *foreign variables* (i.e., the cross sectional weighted averages of domestic variables of all other countries). Following Bussière, Chudik, and Sestieri (2009) and Dees, Mauro, Pesaran, and Smith (2007), a third set of variables, called *global common variables* (such as oil prices), are also included in the country-specific VAR models.

Within any country-specific VAR models, all the *domestic variables* are deemed *endogenous*, while the *foreign variables* are assumed to be *weakly exogenous*. In plain words, weak exogeneity requires that the foreign variables have long-run effects on the endogenous variables, while it does not allow the other way round. This weak exogeneity is later tested against after the model estimation. The *global common variables* are also treated as *weakly exogenous*. The country-specific VAR models are then estimated individually.

In the second stage, the country-specific VAR models are stacked to form an extended VAR system (i.e., the global system). Since the foreign variables in each country-specific VAR are essentially made up from the domestic variables of other country-specific VARs, it is possible to combine *like terms*[1] so that the extended VAR (GVAR) system comprises of only the endogenous domestic variables. All that needs doing in the second stage is to recalculate the estimates of coefficients by combining like terms.

The 1st Stage – Country-Specific VAR Model

Suppose the global system consists of *N* countries. In the first stage, each country-specific model is specified as a VARX*(p_i, q_i) model,

$$\boldsymbol{\Phi}_i(L,p_i)\boldsymbol{x}_{it} = \boldsymbol{a}_{i0} + \boldsymbol{a}_{i1}t + \boldsymbol{\Lambda}_i(L,q_i)\boldsymbol{x}^*_{it} + \boldsymbol{\Upsilon}_i(L,q_i)\boldsymbol{d}_t + \boldsymbol{u}_{it} \quad (5.1)$$

Let $\boldsymbol{x}_{it}$ denote a $k_i \times 1$ vector of variables belonging to country $i \in \{1, \dots, N\}$. $\boldsymbol{x}_{it}$ are also called ***domestic variables*** in relation to country *i*. $\boldsymbol{x}^*_{it}$ are a $k^*_i \times 1$ vector of ***foreign variables*** specific to country *i*, which are supposed to capture the influence of country *i*'s trading partners. $\boldsymbol{x}^*_{it}$ are calculated as cross sectional averages of the foreign counterparts of country *i*'s domestic variables:

$$\boldsymbol{x}^*_{it} = \sum_{j=1}^{N} w_{ij}\boldsymbol{x}_{jt} \quad (5.2)$$

where $\boldsymbol{x}_{jt}$ are the domestic variables for country $j \in \{1, \dots, N\}$ and the weight for country *j*, w_{ij}, can be the share of country *j*'s trading with country *i* among country *i*'s total trading with the world. The weights can also be the share of tourist arrivals or the share of tourism revenue, as long as they are non-random (i.e., pre-determined) and granular (i.e., compared to the globe, each country's weight is small enough) (Bussière, Chudik, & Sestieri, 2009). w_{ij} satisfies that $w_{ii} = 0, \forall i = 1, \dots, N$, and $\sum_{j=1}^{N} w_{ij} = 1, \forall i, j = 1, \dots, N$. Eq. (5.2) is a data shrinkage method to solve the dimensionality problem. $\boldsymbol{d}_t$ is a $k_d \times 1$ vector of *global common factors*, which apply to all the country-specific VARX* models.

[1] In algebra, *like terms* are terms that have the same variables and powers. For example, $2x^2$ and $-7x^2$ are like terms. But $2x^2$ and $-7y^2$ are not like terms. $2x^2$ and $-7x$ are not like terms either. In this current research, any country-specific variable (say China's real income, lny_{china}) will appear in its own country's first-stage VAR model in the form of domestic variable, but also in other country's first-stage VAR models as a component to the foreign variables. Hence, in the second stage, when all country-specific VAR models are stacked and re-arranged, like terms (i.e., a particular country-specific variable, say China's real income, lny_{china}) that appear across different countries' VAR models will need to be collected and combined. This is illustrated in Eq. (5.3) – Eq. (5.5). Notice the construction of $\boldsymbol{x}_t = (\boldsymbol{x}'_{1t}, \boldsymbol{x}'_{2t}, \dots, \boldsymbol{x}'_{Nt})'$, and the use of weight matrix in $\boldsymbol{x}^*_{it} = \boldsymbol{W}'_i\boldsymbol{x}_t$.

The distinction between *domestic variables, foreign variables* and *observable global common variables* denotes the various channels through which the international transmission of business cycles takes place. Briefly, the transmission can be due to common observed global shocks (e.g., changes in oil prices); it can arise as a result of global unobserved factors (e.g., diffusion of technological progress); it could be due to specific national or sectoral shocks (Dees, Mauro, Pesaran, & Smith, 2007). It is shown by Dees, Mauro, Pesaran, and Smith (2007) that, in a factor model framework, the *foreign variables* can be proxies for unobserved global common factors, such as technological and political developments (Di Mauro & Pesaran, 2013, p.1).

$\boldsymbol{\Phi}_i(L, p_i) = \boldsymbol{I}_{k_i} - \sum_{l=1}^{p_i} \boldsymbol{\Phi}_l L^l$ is a $k_i \times k_i$ matrix of unknown factor loadings on *domestic variables*; $\boldsymbol{\Lambda}_i(L, q_i) = \sum_{l=0}^{q_i} \boldsymbol{\Lambda}_l L^l$ is a $k_i \times k_i^*$ matrix of unknown coefficients on *foreign variables*; $\boldsymbol{\Upsilon}_i(L, q_i) = \sum_{l=0}^{q_i} \boldsymbol{\Upsilon}_l L^l$ is a $k_i \times k_d$ matrix of unknown coefficients on *global common variables*. L is the lag operator, and p_i and q_i respectively denote the lag orders of *domestic variables* and *foreign* and *global common variables*. It is indicated that p_i and q_i can be different. $\boldsymbol{\Phi}_i(L, p_i)$, $\boldsymbol{\Lambda}_i(L, q_i)$, and $\boldsymbol{\Upsilon}_i(L, q_i)$, together with $\boldsymbol{a}_{i0}$ and $\boldsymbol{a}_{i1}$, are the unknown coefficients to be estimated in the first stage. Last but not least, $\boldsymbol{u}_{it}$ are a $k_i \times 1$ vector of idiosyncratic country-specific shocks, and are assumed to be serially uncorrelated with a zero mean and a non-singular covariance matrix $\sum_{ii} = (\sigma_{ii,ls})$, where $\sigma_{ii,ls} = cov(u_{ilt}, u_{ist})$ with *l* and *s* denoting the *l*th and *s*th variable respectively. More compactly, $\boldsymbol{u}_{it} \sim i.i.d.(0, \sum_{ii})$.

As noted by Dees, Mauro, Pesaran and Smith (2007), in the first stage's country-specific VARX*(p_i, q_i) models, the *domestic variables* $\boldsymbol{x}_{it}$ are treated as *endogenously* determined, whereas the *foreign variables* $\boldsymbol{x}_{it}^*$ are assumed to be *weakly exogenous*, which means that $\boldsymbol{x}_{it}^*$ are 'long-run forcing' for $\boldsymbol{x}_{it}$ but there is no long-run feedback from $\boldsymbol{x}_{it}$ to $\boldsymbol{x}_{it}^*$. Lagged short-run feedback between the two sets of variables is, however, allowed under the assumption of weak exogeneity. This is generally in line with the assumption of small economies, as have been introduced in Section 4.5.1, in the sense that they tend to be operating under the influence of external economic climate exogenously, while they are not able to determine the development of the worldwide economic climate. *Global common variables* $\boldsymbol{d}_t$ are also assumed to be *weakly exogenous*, and treated in a similar manner to the *foreign variables*. As the weak exogeneity of $\boldsymbol{x}_{it}^*$ is a main assumption underlying the first stage estimation, a formal test helps to justify its appropriateness, which will be discussed in Section 5.2.2.

The 2nd Stage – Global VAR (GVAR) model

Once $\mathbf{\Phi}_i(L, p_i)$, $\mathbf{\Lambda}_i(L, q_i)$, $\mathbf{\Upsilon}_i(L, q_i)$, $\boldsymbol{a}_{i0}$ and $\boldsymbol{a}_{i1}$ are estimated for all the country-specific VARX* models, the second stage can be proceeded. In this stage, no estimation is needed.

A key definition in the second stage is $\boldsymbol{x}_t = (\boldsymbol{x}'_{1t}, \boldsymbol{x}'_{2t}, \dots, \boldsymbol{x}'_{Nt})'$, which is a $k \times 1$ vector that collects all the domestic variables across the N countries, with $k = \sum_{i=1}^{N} k_i$ denoting the total number of variables. Given the fact that $\boldsymbol{x}^*_{it} = \sum_{j=1}^{N} w_{ij}\boldsymbol{x}_{jt}$, apparently $\boldsymbol{x}_t$ contains all the elements that have been used to construct both *domestic variables* and *foreign variables* for each country-specific VARX* model. It should be noted that in the second stage, all the elements in $\boldsymbol{x}_t$ are treated as *endogenously* determined. This is because that from the standpoint of the global system, all the variables of individual countries are endogenously determined.

The second stage involves re-arranging Eq. (5.1) as

$$\mathbf{B}_i(L, p_i, q_i)\boldsymbol{x}_t = \boldsymbol{a}_{i0} + \boldsymbol{a}_{i1}t + \mathbf{\Upsilon}_i(L, q_i)\boldsymbol{d}_t + \boldsymbol{u}_{it} \quad (5.3)$$

where $\mathbf{B}_i(L, p_i, q_i) = [\mathbf{\Phi}_i(L, p_i)\boldsymbol{E}'_i, -\mathbf{\Lambda}_i(L, q_i)\boldsymbol{W}'_i]$. $\boldsymbol{E}_i$ is a $k \times k_i$ selection matrix that selects vector $\boldsymbol{x}_{it}$, namely $\boldsymbol{x}_{it} = \boldsymbol{E}'_i\boldsymbol{x}_t$. $\boldsymbol{W}_i$ is merely a $k \times k^*_i$ matrix that collects the weights w_{ij} used in calculating the *foreign variables*, so that $\boldsymbol{x}^*_{it} = \boldsymbol{W}'_i\boldsymbol{x}_t$.

Let $p = max\{max\ p_i, max\ q_i\}$, and construct $\mathbf{B}_i(L, p)$ from $\mathbf{B}_i(L, p_i, q_i)$ by augmenting $p - p_i$ or $p - q_i$ additional terms in powers of L by zeros; similarly, construct $\mathbf{\Upsilon}_i(L, p)$. Then Eq. (5.3) becomes,

$$\mathbf{B}_i(L, p)\boldsymbol{x}_t = \boldsymbol{a}_{i0} + \boldsymbol{a}_{i1}t + \mathbf{\Upsilon}_i(L, p)\boldsymbol{d}_t + \boldsymbol{u}_{it} \quad (5.4)$$

The next step is to form a GVAR system by stacking Eq. (5.4) for all $i = 1, \dots, N$, such that

$$\boldsymbol{G}(L, p)\boldsymbol{x}_t = \boldsymbol{a}_0 + \boldsymbol{a}_1 t + \mathbf{\Upsilon}(L, p)\boldsymbol{d}_t + \boldsymbol{u}_t \quad (5.5)$$

where $\boldsymbol{u}_t = (\boldsymbol{u}'_{1t}, \dots, \boldsymbol{u}'_{Nt})'$, $\boldsymbol{a}_0 = (\boldsymbol{a}'_{10}, \dots, \boldsymbol{a}'_{N0})'$, $\boldsymbol{a}_1 = (\boldsymbol{a}'_{11}, \dots, \boldsymbol{a}'_{N1})'$,

$$\boldsymbol{\Upsilon}(L,p)=\begin{pmatrix}\boldsymbol{\Upsilon}_1(L,p)\\ \vdots \\ \boldsymbol{\Upsilon}_N(L,p)\end{pmatrix} \text{ and } \boldsymbol{G}(L,p)=\begin{pmatrix}\mathbf{B}_1(L,p)\\ \vdots \\ \mathbf{B}_N(L,p)\end{pmatrix}.$$

Eq. (5.5) is the global VAR (GVAR) model that explains the causal relationships among all the $k=\sum_{i=1}^{N} k_i$ variables in the global system.

To obtain the reduced form of GVAR model Eq. (5.5), further transformation can be:

$$\boldsymbol{G}(L,p)\boldsymbol{x}_t=\boldsymbol{G}_0\boldsymbol{x}_t-\sum_{j=1}^{p}\boldsymbol{G}_j\boldsymbol{x}_{t-j}=\boldsymbol{a}_0+\boldsymbol{a}_1 t+\sum_{j=0}^{p}\boldsymbol{\Upsilon}_j\boldsymbol{d}_{t-j}+\boldsymbol{u}_t \qquad (5.6)$$

Pre-multiplying both sides the above equation by $\boldsymbol{G}_0^{-1}$, which is a non-singular matrix:

$$\boldsymbol{x}_t=\boldsymbol{G}_0^{-1}\boldsymbol{a}_0+\boldsymbol{G}_0^{-1}\boldsymbol{a}_1 t+\sum_{j=1}^{p}\boldsymbol{G}_0^{-1}\boldsymbol{G}_j\boldsymbol{x}_{t-j}+\sum_{j=0}^{p}\boldsymbol{G}_0^{-1}\boldsymbol{\Upsilon}_j\boldsymbol{d}_{t-j}+\boldsymbol{G}_0^{-1}\boldsymbol{u}_t$$

$$=\boldsymbol{b}_0+\boldsymbol{b}_1 t+\sum_{j=1}^{p}\boldsymbol{F}_j\boldsymbol{x}_{t-j}+\sum_{j=0}^{p}\boldsymbol{\Psi}_j\boldsymbol{d}_{t-j}+\boldsymbol{\varepsilon}_t \qquad (5.7)$$

where $\boldsymbol{b}_0=\boldsymbol{G}_0^{-1}\boldsymbol{a}_0$, $\boldsymbol{b}_1=\boldsymbol{G}_0^{-1}\boldsymbol{a}_1$, $\boldsymbol{F}_j=\boldsymbol{G}_0^{-1}\boldsymbol{G}_j$, $\boldsymbol{\Psi}_j=\boldsymbol{G}_0^{-1}\boldsymbol{\Upsilon}_j$ for j=1, 2…p, and $\boldsymbol{\varepsilon}_t=\boldsymbol{G}_0^{-1}\boldsymbol{u}_t$.

5.2.2 Model Specification

Variables

To specify the country-specific VARX* model, variables concerning tourism exports, tourism imports as well as macroeconomic factors are chosen. Based on the influencing factors identified in Section 2.4 and the international trade literature (e.g., Bussière, Chudik, & Sestieri, 2009; Smeral & Weber, 2000), the endogenous variables used in the current empirical models are (1) *tourism trade variables*: real tourism imports (*rtim*), real tourism exports (*rtex*); (2) *macroeconomic variables*: real GDP index (*y*), CPI (adjusted by exchange rate) (*p*); (3) *global common variable*: crude oil prices (p_{oil}).

All variables are in logarithm form, so that the impact elasticities can be readily extracted based on the estimated coefficients. Specifically, the variables will be arranged as *domestic variables*, i.e., $\mathbf{x}_{it}$, *foreign variables*, i.e., $\mathbf{x}^*_{it}$, and *global common factor*, $\boldsymbol{d}$, in the following manner:

$$\boldsymbol{x}_{it}=(rtim_{it}, rtex_{it}, y_{it}, p_{it}),\ \boldsymbol{x}_{it}^*=(rtim_{it}^*, rtex_{it}^*, y_{it}^*, p_{it}^*), \text{ and } \boldsymbol{d}_t=(p_{oil_t})$$

where $rtim_{it}^{*} = \sum_{j=1}^{N} w_{ij} rtim_{jt}$, $rtex_{it}^{*} = \sum_{j=1}^{N} w_{ij} rtex$, $y_{it}^{*} = \sum_{j=1}^{N} w_{ij} y_{jt}$, $p_{it}^{*} = \sum_{j=1}^{N} w_{ij} p_{jt}$; w_{ij} is the bilateral tourism trade weight that country *j* accounts for among all of country *i*'s trading partners, and $w_{ij} = 0$ where *i*=*j*. Table 5.1 is a brief summary to help understand the role of each variable.

Table 5.1 - Summary of variables

	Domestic variables	Foreign variables	Global common variable
Tourism trade variables	*lnrtim*, *lnrtex*	$lnrtim^{*}$, $lnrtex^{*}$	
Macroeconomic variables	*lny*, *lnp*	lny^{*}, lnp^{*}	lnp_{oil}
Endogeneity in VECMX models	Endogenous	Weakly exogenous	Weakly exogenous

Note: The above setting applies to all countries except the USA; for the USA, lnpoil is treated as an endogenous domestic variable; the prefix 'ln' of variable name means the variables are in logarithm

As indicated earlier in Section 5.2.1, *foreign variables* (i.e., cross-sectional weighted averages of domestic variables) are deemed proxies for unobserved global common factors. Recalling the discussions in Section 4.3, the driving forces for globalisation are not only *economic*, but also *technologlical, political* and *cultural*. It is appropriate to further argue that, foreign variables as *unobserved global common factors* embody all of these worldwide forces, even though the variables are measured in only economic values. This view is in line with Dees, Mauro, Pesaran, and Smith (2007) and Garratt, Lee, and Shields (2013), and the mathematical proof can be found in Dees, Mauro, Pesaran, and Smith (2007). Hence, although the GVAR approach does not explicitly include non-economic factors, the influences of non-economic driving forces have been incorporated and proxied in the models.

That said, the foreign variables only embody the *unobserved global common factors*. Any *country-specific* non-economic factors are still left out under the GVAR framework. It should be noted that non-economic factors are difficult to properly quantify. Simply adding unjustified and unappropriately measured non-economic factors does not help to improve the econometric model's explanatory power.

For all the countries that are covered in the current research, the same sets of domestic, foreign and global variables are constructed. The only exception is the USA's VARX* model, which is regarded as a *reference country* in the global economy (see Dees, Mauro, Pesaran, & Smith, 2007; Greenwood-Nimmo, Nguyen, & Shin, 2012). Its domestic variables and the foreign variables are:

$\boldsymbol{x}_{USA,t} = (rtim_{USA,t}, rtex_{USA,t}, y_{USA,t}, p_{USA,t}, p_{oil_t})$ and

$\boldsymbol{x}_{it}^{*} = (rtim_{USA,t}^{*}, rtex_{USA,t}^{*}, y_{USA,t}^{*}, p_{USA,t}^{*})$.

The difference is that, the oil price p_{oil_t} is deemed as an endogenous variable for the USA. As hinted in Section 4.5.1, where the assumption of small economies is discussed, the USA exerts more power in dominating the global economic and political landscape than other countries. Since oil price is very sensitive, treating it as an endogenous variable in the USA's model allows the evolution of the global macro-economic variables (in the form of USA's *foreign variables*) to influence oil prices (Dees, Mauro, Pesaran, & Smith, 2007) and captures the power of the USA on global affairs. The appropriateness of treating the USA as a reference country is discussed in great details in Chudik and Smith (2013).

For any other countries that will be sampled in the current research, none of them is as powerful as the USA from the economic perspective. A brief evidence is the prevalence of the US dollar in international markets. The dollar is the standard unit of currency in goods, services and commodities trading. It is also the preferred reserve currency for central banks as well as private holdings. The monetary policy by the Federal Reserve Bank is closely eyed upon by other central banks (especially those that operate a pegged exchange rate system against the dollar), due to the policy's implications on not only the interest rates and inflation rate in the USA, but also potential impacts on other countries. As a result, in the current research, only the USA is chosen as the reference country.

Country-Specific Model: VECMX

Following Bussière, Chudik, and Sestieri (2009) and Dees, Mauro, Pesaran, and Smith (2007), the first stage country-specific VARX* models take the error correction form augmented with exogenous variables, i.e., *VECMX*, which is written in reduced form[1] as:

$$\Delta \boldsymbol{x}_{it} = \boldsymbol{a}_{i0} - \boldsymbol{\alpha}_i \boldsymbol{\beta}_i' [\boldsymbol{z}_{i,t-1} - \boldsymbol{\gamma}_i (t-1)]$$

$$+\boldsymbol{\Lambda}_{i0} \Delta \boldsymbol{x}_{it}^* + \boldsymbol{\Upsilon}_{i0} \Delta \boldsymbol{d}_t + \boldsymbol{\Phi}_i (L, p_i, q_i) \Delta \boldsymbol{z}_{i,t-1} + \boldsymbol{u}_{it} \quad (5.8)$$

where $\boldsymbol{z}_{it} = (\boldsymbol{x}_{it}', \boldsymbol{x}_{it}^{*\prime}, \boldsymbol{d}_t')'$; $\boldsymbol{\beta}_i$ is the $(k_i + k_i^* + k_d) \times r_i$ matrix denoting the long-run cointegrating relationship between variables; $\boldsymbol{\alpha}_i$ is the $k_i \times r_i$ matrix of adjustment coefficients measuring the speed of adjustment to long-run cointegration; p_i and q_i are the lag orders of the domestic variables $\boldsymbol{x}_{it}$ and the other variables $\boldsymbol{x}_{it}^*$ and $\boldsymbol{d}_t$; $\boldsymbol{a}_{i0}$, $\boldsymbol{\gamma}_i$, $\boldsymbol{\Lambda}_{i0}$, $\boldsymbol{\Upsilon}_{i0}$ and $\boldsymbol{\Phi}_i(L, p_i, q_i)$ are the parameters to be estimated. Determination of $\boldsymbol{\alpha}_i$ and $\boldsymbol{\beta}_i$ can be based on the identity matrix normalisation scheme as described in Section 3.2.2.1.

The key parameters that capture the magnitude of interdependencies are matrix $\boldsymbol{\Lambda}_{i0}$, which constitute the factor loadings on $\Delta \boldsymbol{x}_{it}^*$. $\boldsymbol{\Lambda}_{i0}$ denote the contemporaneous effects of foreign variables on their domestic counterparts, for example, the percentage change of a particular country's tourism exports (*rtex*) in response to 1 percent change of other countries' tourism exports (*rtex**).

The global VAR (GVAR) model is derived after estimating Eq. (5.8), following the transformation procedure from Eq. (5.3) to Eq. (5.5).

Unit Root Tests

For the error correction form of VAR model (i.e., VECM), it is generally required that the cointegration exists only between *I*(1) series. However, in practice this assumption is not always strictly followed. The GVAR modelling, especially in its first stage (i.e., country-specific VECMX), can well accommodate both *I*(0) and *I*(1) series in the

[1] Generally, VAR model written as $B_0 y_t = c_0 + B_1 y_{t-1} + B_2 y_{t-2} + \cdots + B_p y_{t-p} + \epsilon_t$ is denoted a structural VAR (SVAR) with p lags. After pre-multiplying the SVAR with the inverse of B_0, the SVAR can be written in the reduced form as $y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t$, where $c = B_0^{-1} c_0$, $A_i = B_0^{-1} B_i \; for \; i = 1, 2 \ldots, p$, and $e_t = B_0^{-1} \epsilon_0$.

system (e.g., Assenmacher, 2013; Dees, Mauro, Pesaran, & Smith, 2007). As long as a reduced rank of the coefficient matrix $\mathbf{\Pi} = \boldsymbol{\alpha\beta}'$, i.e., rank($\mathbf{\Pi}$) = r ($0<r<k$) in Eq. (3.14), is detected, r cointegrating relations can be established.

The most commonly used unit root test is the augmented Dickey-Fuller (ADF) test, which is based on

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \sum_{j=1}^{p} \beta_j \Delta y_{t-j} + \nu_t \qquad (5.9)$$

where y_t is the series in concern, x_t is a vector of optional exogenous regressors, p is the lag length of the differenced terms and can be decided using the information criteria such as AIC and SBC, α, δ and β_j ($j = 1,2,\ldots,p$) are the coefficients to be estimated. The unit root test is to test the null hypothesis $H_0: \alpha = 0$ against the one-sided alternative $H_1: \alpha < 0$. If the null hypothesis is accepted, then it is found that the series y_t has a unit root. Otherwise, y_t is said to be stationary.

While testing unit roots with the above ADF test is very much a standard practice in empirical time series analysis, modifications of ADF test as well as alternative tests are also often considered by researchers. Among others, the weighted symmetric versions of ADF (WS-ADF) have been recognised as more powerful than the standard ADF test (Dees, Mauro, Pesaran, & Smith, 2007; Patterson & Heravi, 2003) and been applied in macroeconometric studies such as Galesi and Lombardi (2009).

Lag Orders (p_i, q_i) Selection

In Eq. (5.8), the lag order of the domestic variables, i.e., p_i, and that of the foreign and global common variables, i.e., q_i, can be selected based on the Akaike information criterion (AIC) or the Schwarz Bayesian criterion (SBC). These are computed as follows:

Akaike information criterion (AIC):

$$AIC_{i,pq} = -\frac{Tk_i}{2}(1 + log2\pi) - \frac{T}{2}\log\left|\hat{\Sigma}_i\right| - k_i s_i \qquad (5.10)$$

Schwarz Bayesian criterion (SBC):

$$SBC_{i,pq} = -\frac{Tk_i}{2}(1 + log2\pi) - \frac{T}{2}\log\left|\hat{\Sigma}_i\right| - \frac{k_i s_i}{2} lnT \qquad (5.11)$$

where $\hat{\Sigma}_i = \sum_{t=1}^{T} \hat{\boldsymbol{u}}_{it} \hat{\boldsymbol{u}}'_{it'} / T$ and $\hat{\boldsymbol{u}}_{it}$ are the estimated residuals obtained from Eq. (5.8), T is the sample size, $|\hat{\Sigma}_i|$ is the determinant of $\hat{\Sigma}_i$, k_i is the number of domestic variables (k_i becomes k_i^* in the case of foreign variables), and $s_i = k_i p_i + k_i^* q_i + 2$. The model with the highest AIC or SBC value is chosen.

It should, however, be noted that p_i and q_i need not be the same across different country-specific models, i.e., Eq. (5.8). Following Dees, Mauro, Pesaran, and Smith (2007), the lag orders is allowed to be set arbitrarily in case of data limitations (e.g., low order for relatively small sample size).

Deterministics of the VECMX Model

As reviewed in Section 3.2.2.1, the estimation of a VEC model involves whether or not to restrict the deterministic components, i.e., the intercepts and the trend terms, in the cointegrating vectors. Five cases have been discussed in Section 3.2.2.1.

Generally, *Case III* and *Case IV* are considered particularly relevant to macroeconomic analysis (Garratt, Lee, Pesaran, & Shin, 2012, p.122; Song, Witt, & Li, 2009, p.130), even though the preference between *Case III* and *Case IV* differs from one research area to another.

Case III: unrestricted intercepts and no trend coefficients

Case IV: unrestricted intercepts and restricted trend coefficients

Since the intercepts in both the above cases are unrestricted and the trend term (only exists in *Case IV*) is restricted to the cointegration space, it means that the level of the endogenous variables contains a linear, but not quadratic, trend[1]. For modelling purposes, the current research sets the deterministics of the VECMX model to *Case IV*, so as to allow for trends in the long-run equilibrium of an economy.

Rank Orders (r_i): Number of Cointegrating relations

[1] Since the dependent variables in the VEC model are differenced terms and are in logarithm, an intercept is equivalent to a constant growth for the level of the variables. Hence, the level of the variables has a linear trend.

As set out in Section 2.2.2.1, the number of cointegrating relations in a VECMX model can be determined following the Johansen maximum likelihood (JML) approach.

Two types of log-likelihood ratio statistics can be derived using Eq. (3.15), i.e., $\lambda_{trace} = -T\sum_{i=r+1}^{m}\ln(1-\hat{\lambda}_i)$, and Eq. (3.16), i.e., $\lambda_{max} = -T\ln(1-\hat{\lambda}_{r+1})$. The null hypothesis for both tests is H_0: rank(**Π**) = *r*, meaning there are *r* cointegrating relations. The trace statistics is intended for testing the null hypothesis against the full rank hypothesis, H_1: rank(**Π**) = *m*. The maximum eigenvalue statistics is intended for testing the null hypothesis against the null against H_1: rank(**Π**) = *r* + 1 (Garratt, Lee, Pesaran, & Shin, 2012, p.123). The critical values for VEC models containing exogenous *I*(1) variables have been reported by Pesaran, Shin, and Smith (2000) across *Case I* to *Case V*. In the case of a small sample size, it is suggested that the trace statistics can yield better power than the maximal eigenvalue statistics (Dees, Mauro, Pesaran, & Smith, 2007), and hence the determination of *r* in the current research primarily relies on the trace statistics. It is, however, allowed that *r* can be adjusted after preliminary estimation of the VECMX model, in order to yield better estimation results. For example, reducing *r* (that is less cointegrating relations) to obtain more stable persistence profiles. It is also suggested by Juselius (2006, pp.140-142) that the choice of rank orders is not only a statistical process, but is also based on the economic interpretability of the results.

Weak Exogeneity Test

One of the major assumptions underlying the country-specific VECMX model is the weak exogeneity of the foreign variables $\boldsymbol{x}^*_{it}$ and the global variables $\boldsymbol{d}_t$. A formal test for weak exogeneity can be performed via auxiliary equations for the foreign variables, as outlined by Dees, Mauro, Pesaran, and Smith (2007).

Specifically, for each *l*th element of $\boldsymbol{x}^*_{it}$, the following regression is carried out:

$$\Delta \boldsymbol{x}^*_{it,l} = \boldsymbol{\mu}_{il} + \sum_{j=1}^{r_i} \boldsymbol{\gamma}_{ij,l}\boldsymbol{ECM}^j_{i,t-1} + \sum_{k=1}^{s_i} \boldsymbol{\varphi}_{ik,l}\Delta \boldsymbol{x}_{i,t-k} + \sum_{m=1}^{n_i} \boldsymbol{\vartheta}_{im,l}\Delta\widetilde{\boldsymbol{x}}^*_{i,t-m} + \boldsymbol{\varepsilon}_{it,l} \qquad (5.12)$$

where $ECM^{j}_{i,t-1}$, $j = 1, 2, \ldots, r_i$ are the estimated error correction terms corresponding to the r_i cointegrating relations found for the ith country model and $\Delta\tilde{\boldsymbol{x}}^{*}_{i,t} = (\Delta\boldsymbol{x}'^{*}_{it}, \Delta p_{oil_t})'$. The lag orders s_i and n_i in Eq. (5.12) need not be the same as the orders p_i and q_i of the underlying country-specific VECMX models. Hence, Eq. (5.12) is seen independent of Eq. (5.8). The test for weak exogeneity is an F-test of the joint hypothesis that $\gamma_{ij,l} = 0, j = 1, 2, \ldots, r_i$ in Eq. (5.12). Passing the weak exogeneity test means the error correction mechanism does not exist for $\boldsymbol{x}^{*}_{it}$ to restore the long-run equilibrium. Hence, there is no 'long-run forcing' from $\boldsymbol{x}_{it}$ to $\boldsymbol{x}^{*}_{it}$, but only short-run feedbacks for $\boldsymbol{x}^{*}_{it}$.

Persistence Profiles

Persistence profiles (PPs) refer to the time profile of the effects of system-wide or variable-specific shocks on cointegrating relations in the context of VAR models (Pesaran & Shin, 1996). They measure the speed with which an economy returns its long-run equilibrium, once shocked. In the case of relations between $I(1)$ variables that are not cointegrated, the effect of a shock persists forever, while in the case of cointegrated relations the impact of a shock will be transitory and eventually disappear as the economy restores equilibrium (Pesaran & Shin, 1996). PPs are scaled to a value of unity on the initial impact, while they should tend to zero as the horizon $n \to \infty$, if the cointegration vector is valid.

Consider Eq. (5.7), and for simplicity treat the global common variable $\boldsymbol{d}_t$ as an element in $\boldsymbol{x}_t$, such that the reduced form GVAR becomes $\boldsymbol{x}_t = \boldsymbol{b}_0 + \boldsymbol{b}_1 t + \sum_{j=1}^{p} \boldsymbol{F}_j \boldsymbol{x}_{t-j} + \boldsymbol{\varepsilon}_t$. Its moving average representation is given by

$$\boldsymbol{x}_t = \boldsymbol{b}_0 + \boldsymbol{b}_1 t + \sum_{s=1}^{\infty} \boldsymbol{A}_s \boldsymbol{\varepsilon}_{t-s} \qquad (5.13)$$

where each $\boldsymbol{A}_s$ itself can be derived recursively as

$$\boldsymbol{A}_s = \boldsymbol{F}_1 \boldsymbol{A}_{s-1} + \boldsymbol{F}_2 \boldsymbol{A}_{s-2} + \cdots + \boldsymbol{F}_p \boldsymbol{A}_{s-p}, \text{ for } s=1, 2, \ldots \qquad (5.14)$$

wtih $\boldsymbol{A}_0 = \boldsymbol{I}_k$, $\boldsymbol{A}_s = \boldsymbol{0}$ for any s<0.

Let $\boldsymbol{z}_{it} = (\boldsymbol{x}'_{it}, \boldsymbol{x}^{*\prime}_{it})'$ (same as in Eq. (5.8), but treat $\boldsymbol{d}_t$ as part of $\boldsymbol{x}^*_{it}$ only for simplicity). Let $\boldsymbol{V}_i = (\boldsymbol{E}_i, \boldsymbol{W}_i)'$. $\boldsymbol{E}_i$ and $\boldsymbol{W}_i$ are defined in Eq. (5.3). Since $\boldsymbol{x}_{it} = \boldsymbol{E}'_i\boldsymbol{x}_t$ and $\boldsymbol{x}^*_{it} = \boldsymbol{W}'_i\boldsymbol{x}_t$, thus

$$\boldsymbol{z}_{it} = (\boldsymbol{x}'_{it}, \boldsymbol{x}^{*\prime}_{it})' = \boldsymbol{V}_i\boldsymbol{x}_t \tag{5.15}$$

Eq. (5.15) provides the mapping between $\boldsymbol{z}_{it}$ and $\boldsymbol{x}_t$.

Since the cointegrating relations for any specific country (as in Eq. (5.8)) are given in terms of the country-specific domestic and foreign variables, in the form of $\boldsymbol{\beta}'_i\boldsymbol{z}_{it}$ (as in Eq. (5.8)). From Eq. (5.13), it can be derived that

$$\boldsymbol{z}_{it} = \boldsymbol{V}_i(\boldsymbol{b}_0 + \boldsymbol{b}_1 t) + \boldsymbol{V}_i \sum_{s=1}^{\infty} \boldsymbol{A}_s\boldsymbol{\varepsilon}_{t-s} \tag{5.16}$$

The PPs of $\boldsymbol{\beta}'_{ji}\boldsymbol{z}_{it}$, with respect to a system-wide shock to $\boldsymbol{\varepsilon}_t$, are

$$\text{PP}(\boldsymbol{\beta}'_{ji}\boldsymbol{z}_{it}; \boldsymbol{\varepsilon}_t, n) = \frac{\boldsymbol{\beta}'_{ji}\boldsymbol{V}_i\boldsymbol{A}_n\boldsymbol{\Sigma}_\varepsilon\boldsymbol{A}'_n\boldsymbol{V}'_i\boldsymbol{\beta}_{ji}}{\boldsymbol{\beta}'_{ji}\boldsymbol{V}_i\boldsymbol{A}_0\boldsymbol{\Sigma}_\varepsilon\boldsymbol{A}'_0\boldsymbol{V}'_i\boldsymbol{\beta}_{ji}},\ n = 0, 1, 2, \ldots \tag{5.17}$$

where $\boldsymbol{\beta}'_{ji}$ is the j^{th} cointegrating relation in the i^{th} country (j=1, 2, …, r_i), n is the horizon and $\boldsymbol{\Sigma}_\varepsilon$ is the covariance matrix of $\boldsymbol{\varepsilon}_t$.

5.2.3 Impulse Response Analysis

One important use of macroeconometric models is to conduct *counterfactual experiments* in order to interpret previous historical episodes and to help with policy analysis. For example, an analysis of the dynamic impact of shocks is typically carried out using impulse response functions that focus on the evolution of the conditional means of the target variables in response to different types of shocks. (Garratt, Lee, Pesaran, & Shin, 2012, p.225). Here, *counterfactual experiments* are posed by 'what if' questions, and are considered in decision making under uncertainty in relation to hypothetical states of the world (Pesaran & Smith, 2012). It is worth reiterating that, in economics a shock refers to an unexpected or unpredictable event that affects an economy either positively or negatively. Technically in econometrics, the unpredictable change takes place in exogenous factors, which are not explained by the endogenous variables in the model.

Impulse response analysis is intended to characterise the evolution of a system at different future periods in response to the effect of shocking one of the variables within the system (Pesaran, Schuermann, & Weiner, 2004). With the moving average representation of a VAR model, e.g., Eq. (5.13), one can derive the impulse responses of the endogenous variables to a 'unit' displacement in the particular elements of either the exogenous variables (if any) or the errors. The former represent the time profile of the response of the system to changes in the observed forcing variables of the system, while the latter examine the responses of the system to changes in the unobserved forcing variables (Garratt, Lee, Pesaran, & Shin, 2012, pp.111-112).

In the current research, the counterfactual experiments are scenarios related to unexpected changes of the Chinese economy. Specifically, it is presumed that the Chinese economy experienced a sudden slowdown in its real GDP; another presumption is that the Chinese currency experienced a depreciation, and as a result a slump in its own price. Accordingly in the GVAR model, two individual shocks are to be imposed: a negative shock to China's real GDP variable (*lny*) and a negative shock to China's own price variable (*lnp*).

These two counterfactual scenarios have their practical grounding, as discussed in Section 4.6.2. China's GDP growth has been relaxed in the very recent years. A negative shock to China's GDP, equivalent to a sudden recession, is indeed a strong presumption given that in reality China is still expecting economic growth. Defining this counterfactual scenario is to test how 'devastating' (if any) the world tourism market could become in a dire situation. The other shock, to China's own price, is more in accordance with the recent speculation that China would devaluate its currency. The event itself (if realised) is not necessarily an adverse situation for other countries.

It is proposed by Pesaran, Schuermann, and Weiner (2004) to make use of the generalised impulse response (GIR) functions, instead of the traditionally used orthogonalised impulse response (OIR) functions. In the context of the global VAR (GVAR) approach, OIR depends on the order of factors in each country and on the order in which the countries are stacked in $\boldsymbol{x}_t$, whereas the GIR function is invariant to the ordering (Dees, Mauro, Pesaran, & Smith, 2007; Pesaran, Schuermann, & Weiner, 2004). Hence, the current research adopts the generalised impulse response analysis.

The derivation of GIR functions follows a similar process to the persistence profiles. Consider the GVAR model Eq. (5.5), and for simplicity the lag orders are set to be 1. Then Eq. (5.5) can be re-written as follows:

$$\boldsymbol{G}_0\boldsymbol{x}_t = \boldsymbol{a}_0 + \boldsymbol{a}_1 t + \boldsymbol{G}_1\boldsymbol{x}_{t-1} + \boldsymbol{\Upsilon}_0\boldsymbol{d}_t + \boldsymbol{\Upsilon}_1\boldsymbol{d}_{t-1} + \boldsymbol{u}_t \qquad (5.18)$$

Assuming $\boldsymbol{G}_0$ is nonsingular, the reduced-form global model can be obtained as

$$\boldsymbol{x}_t = \boldsymbol{b}_0 + \boldsymbol{b}_1 t + \boldsymbol{F}\boldsymbol{x}_{t-1} + \boldsymbol{\Gamma}_0\boldsymbol{d}_t + \boldsymbol{\Gamma}_1\boldsymbol{d}_{t-1} + \boldsymbol{\varepsilon}_t \qquad (5.19)$$

where $\boldsymbol{b}_0 = \boldsymbol{G}_0^{-1}\boldsymbol{a}_0$, $\boldsymbol{b}_1 = \boldsymbol{G}_0^{-1}\boldsymbol{a}_1$, $\boldsymbol{F} = \boldsymbol{G}_0^{-1}\boldsymbol{G}_1$, $\boldsymbol{\Gamma}_0 = \boldsymbol{G}_0^{-1}\boldsymbol{\Upsilon}_0$, $\boldsymbol{\Gamma}_1 = \boldsymbol{G}_0^{-1}\boldsymbol{\Upsilon}_1$, and $\boldsymbol{\varepsilon}_t = \boldsymbol{G}_0^{-1}\boldsymbol{u}_t$.

For predetermined values of $\boldsymbol{d}_t$ ($t = T$+1, T+2 …), it can be solved based on Eq. (5.19) that

$$\boldsymbol{x}_{T+n} = \boldsymbol{F}^n\boldsymbol{x}_T + \sum_{\tau=0}^{n-1}\boldsymbol{F}^\tau[\boldsymbol{b}_0 + \boldsymbol{b}_1(T+n-\tau)]$$
$$+ \sum_{\tau=0}^{n-1}\boldsymbol{F}^\tau[\boldsymbol{\Gamma}_0\boldsymbol{d}_{T+n-\tau} + \boldsymbol{\Gamma}_1\boldsymbol{d}_{T+n-\tau-1}]$$
$$+ \sum_{\tau=0}^{n-1}\boldsymbol{F}^\tau\boldsymbol{\varepsilon}_{T+n-\tau} \qquad (5.20)$$

The point forecasts of $\boldsymbol{x}_{T+n}$ conditional on the initial state of the system and the exogenous global variables are given by

$$\boldsymbol{x}_{T+n}^f = E(\boldsymbol{x}_{T+n}|\boldsymbol{x}_T, \cup_{\tau=1}^n \boldsymbol{d}_{T+\tau})$$
$$= \boldsymbol{F}^n\boldsymbol{x}_T + \sum_{\tau=0}^{n-1}\boldsymbol{F}^\tau[\boldsymbol{b}_0 + \boldsymbol{b}_1(T+n-\tau)]$$
$$+ \sum_{\tau=0}^{n-1}\boldsymbol{F}^\tau[\boldsymbol{\Gamma}_0\boldsymbol{d}_{T+n-\tau} + \boldsymbol{\Gamma}_1\boldsymbol{d}_{T+n-\tau-1}] \qquad (5.21)$$

Under the assumption that $\boldsymbol{u}_t$ (as in Eq. (5.18)) is normally distributed, it follows that

$$\boldsymbol{x}_{T+n}|\boldsymbol{x}_T, \cup_{\tau=1}^n \boldsymbol{d}_{T+\tau} \backsim N(\boldsymbol{x}_{T+n}^f, \boldsymbol{\Omega}_n) \qquad (5.22)$$

where $\boldsymbol{\Omega}_n = \sum_{\tau=0}^{n-1}\boldsymbol{F}^\tau\boldsymbol{G}_0^{-1}\boldsymbol{\Sigma}\boldsymbol{G}_0'^{-1}\boldsymbol{F}'^\tau$, $\boldsymbol{\Sigma}$ is the $k \times k$ variance-covariance matrix of the shocks $\boldsymbol{u}_t$, which is the same as in Eq. (5.1). $\boldsymbol{\Sigma}_{ij}$, which measures the dependence of shocks in country *i* on the shocks in country *j*, is defined as $\boldsymbol{\Sigma}_{ij} = cov(\boldsymbol{u}_{it}, \boldsymbol{u}_{jt})$. A typical element of $\boldsymbol{\Sigma}_{ij}$ is denoted by $\sigma_{ij,ls} = cov(u_{ilt}, u_{jst})$, which is the covariance of the l^{th} variable in country *i* with the s^{th} variable in country *j*.

With the above in mind, it follows Pesaran, Schuermann, and Weiner (2004) that the GIR function which denotes the j^{th} shock in $\boldsymbol{u}_t$ (corresponding to the l^{th} variable in the i^{th} country), is given by:

$$\boldsymbol{GI}_{x:u_{il}}\left(n, \sqrt{\sigma_{ii,ll}}, \mathcal{I}_{t-1}\right) = E\left(\boldsymbol{x}_{t+n} | u_{ilt} = \sqrt{\sigma_{ii,ll}}, \mathcal{I}_{t-1}\right) - E(\boldsymbol{x}_{t+n} | \mathcal{I}_{t-1}) \quad (5.23)$$

where $\boldsymbol{\mathcal{I}}_t = (\boldsymbol{x}_t, \boldsymbol{x}_{t-1}, \dots)$ is the information set at time t - 1 and $\boldsymbol{d}_t$ is assumed to be given exogenously. On the assumption that $\boldsymbol{u}_t$ has a multivariate normal distribution, and using Eq. (5.20), it is derived that

$$\boldsymbol{\psi}_j^g(n) = \frac{1}{\sqrt{\sigma_{ii,ll}}} \boldsymbol{F}^n \boldsymbol{G}_0^{-1} \boldsymbol{\Sigma} \boldsymbol{\zeta}_j \quad (5.24)$$

where $\boldsymbol{\zeta}_j$ is a $k \times 1$ selection vector with unity as its j^{th} element (corresponding to a particular shock in a particular country) and zeros elsewhere. Eq. (5.24) measures the effect of one standard error shock to the j^{th} equation (corresponding to the l^{th} variable in the i^{th} country) at time t on the expected values of $\mathbf{x}$ at time $t + n$.

5.3 Data Descriptions

The data that are required to model the interdependencies of tourism demand are described in Section 5.2.2. They mostly can be obtained from major macroeconomic databases, even though it is unavoidable that the availability of data varies from one database to another. If the data of all domestic variables across countries are arranged as panel data, it is rare that the data set will be a balanced one, due to the missing observations of certain variables for certain countries and at certain quarters/years.

Building a data set for the GVAR analysis hence involves a careful trade-off between the number of countries under consideration and the length of sample period. Wherever necessary, interpolation of missing data have to be applied.

5.3.1 Data Sources

The current research takes into consideration 24 major countries across the globe. They are shown in Table 5.2. While the more countries included in the global VAR (GVAR) model, the more complete the study can be, the final choice of the countries to be analysed is down to several concerns.

The first is data availability. Measures of tourism demand in the current research are tourism imports and tourism exports. But tourism trade figures are not as widely reported as other tourism demand measures (e.g., tourism arrivals). Besides, the desirable frequency of data is quarterly/monthly, so as to generate more observations over a defined sample period. But quarterly data are less commonly seen than annual data. Eventually, the raw data have been gathered from several sources, as listed in Table 5.3. It should be reiterated that for tourism imports and tourism exports, the data contain travel items and passenger transport items from the Balance of Payments data published by IMF. The use of BOP data is in line with the World Travel & Tourism Council's practice and the BOP data are acknowledged to be consistent with UNWTO's data on tourism expenditure and receipts (see Section 3.2, and see WTTC, 2015, p.11). The availability of as many data and as many quarters covered as possible primarily dictates which countries to include. The second is a country's importance in the world tourism market. Top tourism destinations/origins are hence preferred. To this end, the statistics on international tourist arrivals and international tourism receipts from *Tourism Highlights* (UNWTO, 2013, 2014a, 2015) have been used for reference. According to Table 5.4 and Table 5.5, the 24 countries under consideration constantly accounted for over half of the world's tourism market (about 55% of the international arrivals, 61% of the tourism receipts), and they are all among the top destinations within their home continent. In addition, Australia, Brazil, Canada, China, France, Germany, Italy, Japan, UK and USA have constantly or recently made the list of top ten spenders in international tourism (see Table 1.4). So it is expected that the 24 countries listed in Table 5.2 can well represent the world tourism market to a large extent. The third is global coverage. As the GVAR model concerns the linkages between countries on a global scale, it is desirable to include countries from as many continents as possible, rather than only from one continent or two.

Ideally, all the rest of the countries in the world can be aggregated to form an imagined country called 'Rest of the World (ROW)' and be included in the GVAR analysis. The construction of this ROW country is however hindered by the limited availability of data, with rampant missing values across countries over the sample period. Nevertheless, the GVAR model can still work fairly well without aggregating the rest in the system (see for example, Chudik & Fratzscher, 2011; Dees, Mauro, Pesaran, & Smith, 2007; Koukouritakis, Papadopoulos, & Yannopoulos, 2015; Pesaran, Schuermann, & Weiner, 2004).

All the variables span from 1994Q1 to 2011Q4, resulting in 72 observations for each series. The sample period covers tourism trade figures from the BPM5 version of Balance of Payments Statistics Yearbook. A more recent version, BPM6, however, covers basically only the most recent years, hence much less observations. Therefore, the current research opts to use data from an earlier version of statistics.

Table 5.2 - Geographic coverage

Continent	Country		
Africa	South Africa		
North America	Canada	Mexico	USA
South America	Argentina	Brazil	
Asia	China	India	Japan
	Korea	Malaysia	Thailand
Europe	Austria	France	Germany
	Italy	Netherlands	Norway
	Portugal	Spain	Sweden
	United Kingdom		
Oceania	Australia	New Zealand	

Table 5.3 - Summary of data sources

Variable	Measure	Frequency	Source
Nominal tourism imports	Travel debits (million US$); passenger transport debits (million US$)	Quarterly	Balance of Payments Statistics Yearbook (BPM5), IMF
Nominal tourism exports	Travel credits (million US$); passenger transport credits (million US$)	Quarterly	Balance of Payments Statistics Yearbook (BPM5), IMF
Income level	Real GDP index (year 2005 = 100)	Quarterly	International Financial Statistics, IMF; national statistical office
Consumer prices	CPI (year 2005 = 100)	Quarterly	International Financial Statistics, IMF; main economic indicators, OECD
Exchange rates	National currency against US dollar	Quarterly	International Financial Statistics, IMF
Oil prices	Petroleum: average crude price (US$ per barrel)	Quarterly	International Financial Statistics, IMF
Bilateral trade volume	Average of exports and imports (in US$)	Annual	Direction of Trade Statistics, IMF

Table 5.4 - International tourist arrivals of selected countries

	International Tourist Arrivals							
	('000 persons)				World Market Share (%)			
	2011	2012	2013	2014	2011	2012	2013	2014
Europe								
Austria	23,012	24,151	24,813	25,291	2.3	2.3	2.3	2.2
France	81,550	81,980	83,633	83,700	8.2	7.9	7.7	7.4
Germany	28,352	30,407	31,545	33,005	2.9	2.9	2.9	2.9
Italy	46,119	46,360	47,704	48,576	4.6	4.5	4.4	4.3
Netherlands	11,300	12,205	12,782	13,926	1.1	1.2	1.2	1.2
Norway	4,963	4,375	4,734	4,811	0.5	0.4	0.4	0.4
Portugal	7,412	7,685	8,301	9,323	0.7	0.7	0.8	0.8
Spain	56,177	57,464	60,675	64,995	5.6	5.5	5.6	5.7
Sweden	9,959	12,372	11,139	10,750	1.0	1.2	1.0	0.9
United Kingdom	29,306	29,282	31,064	32,613	2.9	2.8	2.9	2.9
Asia								
China	57,581	57,725	55,686	55,622	5.8	5.6	5.1	4.9
India	6,309	6,578	6,968	7,703	0.6	0.6	0.6	0.7
Japan	6,219	8,358	10,364	13,413	0.6	0.8	1.0	1.2
Korea	9,795	11,140	12,176	14,202	1.0	1.1	1.1	1.3
Malaysia	24,714	25,033	25,715	27,437	2.5	2.4	2.4	2.4
Thailand	19,230	22,354	26,547	24,780	1.9	2.2	2.4	2.2
Oceania								
Australia	5,771	6,032	6,382	6,868	0.6	0.6	0.6	0.6
New Zealand	2,511	2,473	2,629	-	0.3	0.2	0.2	-
North America								
Canada	16,016	16,344	16,059	16,528	1.6	1.6	1.5	1.5
Mexico	23,403	23,403	24,151	29,091	2.4	2.3	2.2	2.6
USA	62,711	66,657	69,995	74,757	6.3	6.4	6.4	6.6
South America								
Argentina	5,705	5,587	5,246	5,935	0.6	0.5	0.5	0.5
Brazil	5,433	5,677	5,813	-	0.5	0.5	0.5	-
Africa								
South Africa	8,339	9,188	9,537	9,549	0.8	0.9	0.9	0.8
Total (24 countries)	551,887	572,830	593,658	612,875	55.5	55.2	54.6	54.1

Data source: UNWTO Tourism Highlights (UNWTO, 2013, 2014a, 2015)

Table 5.5 - International tourism receipts of selected countries

	International Tourism Receipts							
	(US$ million)				World Market Share (%)			
	2011	2012	2013	2014	2011	2012	2013	2014
Europe								
Austria	19,860	18,894	20,236	20,559	1.9	1.7	1.7	1.7
France	54,753	53,702	56,683	55,402	5.3	4.8	4.7	4.4
Germany	38,879	38,136	41,279	43,326	3.7	3.4	3.4	3.5
Italy	43,000	41,185	43,912	45,545	4.1	3.7	3.7	3.7
Netherlands	14,348	12,314	13,779	14,716	1.4	1.1	1.2	1.2
Norway	5,308	5,442	5,675	5,643	0.5	0.5	0.5	0.5
Portugal	11,339	11,056	12,284	13,808	1.1	1.0	1.0	1.1
Spain	60,031	58,162	62,565	65,187	5.8	5.2	5.2	5.2
Sweden	10,404	10,613	11,544	12,695	1.0	1.0	1.0	1.0
United Kingdom	35,069	36,613	41,028	45,262	3.4	3.3	3.4	3.6
Asia								
China	48,464	50,028	51,664	56,913	4.7	4.5	4.3	4.6
India	17,707	17,971	18,397	19,700	1.7	1.6	1.5	1.6
Japan	10,966	14,576	15,131	18,853	1.1	1.3	1.3	1.5
Korea	12,476	13,429	14,629	18,147	1.2	1.2	1.2	1.5
Malaysia	19,656	20,250	21,496	21,820	1.9	1.8	1.8	1.8
Thailand	27,184	33,855	41,780	38,437	2.6	3.0	3.5	3.1
Oceania								
Australia	31,335	31,898	31,254	32,022	3.0	2.9	2.6	2.6
New Zealand	7,341	7,128	7,472	8,464	0.7	0.6	0.6	0.7
North America								
Canada	16,834	17,407	17,656	17,445	1.6	1.6	1.5	1.4
Mexico	11,869	12,739	13,949	16,258	1.1	1.1	1.2	1.3
USA	115,552	161,631	172,901	177,240	11.1	14.5	14.4	14.2
South America								
Argentina	5,354	4,887	4,313	4,627	0.5	0.4	0.4	0.4
Brazil	6,555	6,645	6,704	6,843	0.6	0.6	0.6	0.5
Africa								
South Africa	9,547	9,994	9,238	9,348	0.9	0.9	0.8	0.8
Total (24 countries)	633,831	688,555	735,569	768,260	60.8	61.7	61.4	61.7

Data source: UNWTO Tourism Highlights (UNWTO, 2013, 2014a, 2015)

5.3.2 Data Processing

As outlined in Section 5.2.2, the actual variables that enter the empirical model are real tourism imports, real tourism exports, real income, own price (CPI adjusted by exchange rate) and crude oil prices.

The variables of real tourism imports (*rtim*) and real tourism exports (*rtex*), as advised by previous literature (e.g., Smeral, 2012; Smeral & Weber, 2000), are the tourism imports and tourism exports in million US dollars at the prices and exchange rates of the base year. These are each country's *total* tourism imports from and *total* tourism exports to all countries in the world, rather than the trades with other 23 countries sampled in the current research. 2005 is chosen as the base year to yield real term figures. The real income (y) variable is real GDP index adjusted to US dollar terms at constant prices and exchange rates. The own price variable (p) is CPI data adjusted by current exchange rate level (not constant exchange rates)[1]. Oil prices (p_{oil}) are transformed to index. All the five variables are then taken logarithm.

However, there are several additional treatments to the data before fitting them into the empirical models. These include seasonal adjustment, in order to remove the seasonality in the data; interpolation of missing observations for certain variables. To construct the *foreign variables* in the first stage VECMX models, bilateral trade shares are used as weights.

Seasonal Adjustment

For quarterly or monthly economic data, such as retail sales, seasonal patterns can generally be observed. For example, the volume of retail sales tends to rise during December due to Christmas. This type of short-term phenomena, associated with the time of the year, is seasonality, which may obscure or confound other underlying movements of the data. The purpose of seasonal adjustment is to remove such systematic effects and facilitates comparisons between consecutive time periods.

Time series are generally thought of as combinations of three basic components plus irregular fluctuations (as introduced in Section 3.3.3). The three basic components are

[1] Here, the own price variable is defined slightly different from that introducted in Section 2.4.4. It involves only the exchange-rate-adjusted CPI of a specific countries, rather than a comparison of exchange-rate-adjusted CPI between destination and origin.

seasonality, cycle and trend. Seasonality, as explained, is calendar related. Cycle is regular or periodic fluctuations around the trend. Trend represents the medium- to long-term direction of the series. Irregular fluctuations are usually due to certain unpredictable factors, which affect the evolution of the time series on a random basis. The rationale behind seasonal adjustment is thus to remove the seasonal component from the time series.

For the current research, seasonal adjustment has been carried out on the raw data of nominal tourism exports, nominal tourism imports, and real GDP index, as they exhibit apparent seasonal patterns. This is done by using the X-13 ARIMA-SEATS package available in EViews 8. The package is the latest version of the seasonal adjustment tool developed by the U.S. Census Bureau.

Interpolation of Missing Data

The raw data of nominal tourism exports, nominal tourism imports and real GDP index contain missing observations for some countries. To make the most of these series, interpolation has been performed using the STAMP 7.10 package of OxMetrics 4.1 software.

The model used by STAMP essentially follows the structural time series model (STSM) and the basic structural model (BSM), as explained in Section 3.3.3 and Section 3.3.4. So the model decomposes a time series into the seasonal, cycle, trend and irregular components. The raw data are first fed into the model in order to obtain satisfactory coefficients. The missing observations are then backcast based on the estimated model.

Constructing Weight Matrices

As shown in Eq. (5.2), the *foreign variables* for the country-specific models are cross-sectional weighted averages of domestic variables. A common weighting scheme is to use the bilateral trade figures between countries. Table 5.6 and Table 5.7 illustrate the calculation based on a small number of countries. Both are used as examples only.

Eight countries are chosen in the above example, namely Australia, Canada, China, France, Germany, Japan, UK and USA. Each number represents the trading between the column country and the row country, calculated as $(exports + imports)/2$. The table is read from column to column. For example, column one (i.e., AUS) denotes the trading relationship between Australia and the rest seven countries.

Table 5.6 - Country level bilateral trade

Unit: US$ billion

	AUS	CAN	CHN	FRA	DEU	JPN	GBR	USA
AUS	0.00	1.94	57.42	3.17	5.69	37.31	6.55	19.04
CAN	1.76	0.00	23.41	3.39	6.05	10.93	12.61	300.73
CHN	60.99	35.23	0.00	26.42	79.87	172.86	30.95	260.62
FRA	2.75	4.64	26.16	0.00	118.09	10.01	35.23	34.81
DEU	7.23	9.11	84.60	116.71	0.00	23.40	65.39	74.77
JPN	36.25	12.63	170.85	7.77	19.03	0.00	9.39	99.31
GBR	7.74	15.25	29.33	37.65	75.42	11.84	0.00	54.06
USA	19.82	289.66	222.01	26.97	60.85	101.97	45.32	0.00
Total	136.54	368.46	613.77	222.07	365.00	368.32	205.42	843.33

Source: Direction of Trade Statistics, IMF, 2011

Based on Table 5.6, the share of each country in another country's total trading is calculated in Table 5.7. It should be noted that each column sums to one.

Table 5.7 - Country level trade shares

	AUS	CAN	CHN	FRA	DEU	JPN	GBR	USA
AUS	0.00	0.01	0.09	0.01	0.02	0.10	0.03	0.02
CAN	0.01	0.00	0.04	0.02	0.02	0.03	0.06	0.36
CHN	0.45	0.10	0.00	0.12	0.22	0.47	0.15	0.31
FRA	0.02	0.01	0.04	0.00	0.32	0.03	0.17	0.04
DEU	0.05	0.02	0.14	0.53	0.00	0.06	0.32	0.09
JPN	0.27	0.03	0.28	0.03	0.05	0.00	0.05	0.12
GBR	0.06	0.04	0.05	0.17	0.21	0.03	0.00	0.06
USA	0.15	0.79	0.36	0.12	0.17	0.28	0.22	0.00
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Hence, from the first column, among the total trading between Australia and the rest seven countries, Canada accounts for roughly 1% (or 0.01), China 45% (or 0.45), France 2% (or 0.02) and so on. These weights are then used to calculate the foreign variables in Australia's VECMX model.

It should be reiterated that the actual weight matrix used in the current research consists of 24 countries, resulting in a 24×24 matrix. In addition, time-varying weight matrices are calculated over the sample period 1994-2011, given that bilateral trade figures are available on an annual basis.

5.3.3 Setup of GVAR

The estimation is conducted using the GVAR toolbox 2.0 (Smith & Galesi, 2014) available at https://sites.google.com/site/gvarmodelling/gvar-toolbox/, which is essentially a set of Matlab codes. The toolbox greatly follows Dees, Mauro, Pesaran, and Smith (2007), which also forms the basis of Section 5.2.

To run the toolbox, processed data are fed into an Excel spreadsheet template, and a range of parameters are set up in relation to the choice of model specification. Table 5.8 lists the main parameters and their values used by the current research.

The lag orders (p_i, q_i) of the first stage country-specific VECMX models are determined subject to the preset maximum lag orders. The maximum lag order is set to be 2 at the beginning, and accordingly individual VECMX models are generated before forming the second stage GVAR model. Then, the maximum lag order is set to be 3, and generates another set of models. The process is re-run until the maximum lag order is set to be 5. The estimation results under different maximum lag order settings are then compared in order to find the most reasonable results. For the variables and the data used in the current research, the estimation results tend to be much better if lower lag orders are chosen.

Another parameter that affects the VECMX model specification is the rank order of $\boldsymbol{\beta}_i$ in Eq. (5.8), which denotes the number of cointegrating relations of each individual VECMX model. In line with the descriptions in Section 5.2.2, the rank order is chosen by the toolbox based on the JML approach automatically. However, preliminary analysis of the data suggested that the GVAR model tended not to be stable (persistence profiles were not approximating zero, when the horizon was approaching infinity, see Section 5.2.2). Hence, it is decided that the rank order of $\boldsymbol{\beta}_i$ is manually reduced to be either 1 or 2 if the toolbox suggested a higher rank order initially.

Manually adjusting the rank order is in line with the practice by Pesaran, Schuermann, and Smith (2009).

Among a range of possible estimation results based on different settings, the final results are chosen based on plausible cointegration vectors, residual diagnostic test results, weak exogeneity test results, persistence profiles and impulse responses.

Table 5.8 - Setting of model in GVAR Toolbox 2.0

Parameter	**Value**	**Remark**
Estimation sample	1994Q1-2011Q4	
Weight matrix		
Type of weights	time-varying	The weight matrix changes from year to year
Window size in year	1	The weight matrix is calculated based on the bilateral trades in one particular year
Select a year for solution	2011	The year of weight matrix that is used to solve for the GVAR model, as in Eq. (5.5)
Unit root tests		
Lag order selection	AIC	AIC generally selects lower lag orders
Maximum lag order	6	
Model selection		
Lag order selection	AIC	AIC generally selects lower lag orders
Maximum lag orders	2, 3, 4, 5	The max lag order is set separately from 2 to 5; each generates different model specifications
Lag order for serial correlation test	2, 3, 4, 5	This is set to be identical to the max lag order
Weak exogeneity test		
Lag order selection	AIC	AIC generally selects lower lag orders
Maximum lag order	4	
Treatment of deterministics in VECMX*	4	This is *Case IV: unrestricted intercepts and restricted trend coefficients*, as explained in Section 5.2.2

5.4 Conclusion

The global VAR (GVAR) approach is heavily based on traditional vector autoregressive (VAR) models. The GVAR approach is able to overcome major limitations in the existing tourism demand models, mainly the assumption of exogeneity of explanatory variables and the curse of dimensionality. An important use of the GVAR model is to simulate impulse responses, which tracks the evolution of tourism trade variables after a shock. The impulse responses provide critical information on the impact of interdependencies between different countries.

All the raw data collected from online databases have been processed before being fed into the statistical software. The final specifications of models are obtained after a few rounds of comparisons between outputs.

Chapter 6. Empirical Results and Analysis

6.1 Introduction

This chapter presents the estimation results from the global VAR (GVAR) model, and provides an in-depth analysis. There are several layers of the results, with the most important ones being reported in Section 6.3.2 and Section 6.4. Briefly speaking, Section 6.2 shows some basic descriptive statistics, especially in relation to tourism imports and tourism exports of the 24 major countries. The idea is to give a general impression about the possible interdependent relations between countries. Section 6.3 presents, firstly, the parameters of model specification, which are decided according to relevant tests. Then, contemporaneous impact elasticities are reported in Section 6.3.2, which are from the country-specific VECMX models in the first stage of GVAR approach. Persistence profiles and diagnostic tests in Section 6.3.3 and Section 6.3.4 are used to decide whether the estimated VECMX models are satisfactory or not. Section 6.4 simulates impulse responses in relation to two counterfactural scenarios. They are derived from the GVAR model. While a brief analysis is presented right alongside the result tables/figures, a further summary of the findings and that of the implications are followed in Section 6.5.

6.2 Descriptive Statistics

As introduced in Section 5.2, the current research uses macroeconomic variables and tourism trade variables for 24 major countries around the globe. The following section presents some basic statistics of all the variables, with greater emphasis placing on the tourism trade variables.

In addition, unit root tests have been carried out to conclude the order of integration for each variable. But as pointed out in Section 5.2.2, the GVAR modelling approach works well even with a mixture of $I(0)$ and $I(1)$ series.

6.2.1 Basic Statistics

Tourism trade, in terms of tourism imports and tourism exports, is at the centre of the current research. Nominal tourism trade figures of the 24 major countries are used to outline the historical trends. But it is the variables in real terms that have been fed into the GVAR model. As such, basic descriptive statistics of the real term variables are also presented.

Tourism Trade in Nominal Terms

Over the almost two decades between 1994 and 2011, tourism trade of the 24 major countries has by and large been ascending all the time.

Figure 6.1 – Figure 6.8 show the recent trends of tourism imports and tourism exports (in nominal terms) of the 24 major countries around the globe. The data are each country's *total* tourism imports and *total* tourism exports after seasonal adjustments.

Countries in each figure are grouped primarily based on their geography. They are generally neighbouring countries. Even though the intention is by no means to experiment the viewpoints of the sceptics (as discussed in Section 4.2), who hold that the world is experiencing regionalisation, patterns of convergence indeed tend to be observed between neighbouring countries. In other words, the lines in the same chart more or less co-move along with each other.

For many of the countries, their tourism imports and tourism exports from 1994 to 2011 have been growing mildly and steadily, despite some backlashes notably in late 2001 (September 11 terrorist attacks), early 2003 (SARS epidemic) and late 2008 (financial crisis). Countries that have seen a relatively dramatic growth in tourism imports and tourism exports are Australia and China. However, the tourism imports (outbound tourism) of Japan have appeared to be sluggish (see Figure 6.3).

In addition to observing the charts, another perspective is to estimate pair-wise correlations. Table 6.1 and Table 6.2 show the correlation coefficients between all the 24 countries. Similar to the patterns in Figure 6.1 – Figure 6.8, most of the countries show significantly strong correlations with other countries in terms of tourism trade. Such correlations can be as high as above .900, as widely observed in both Table 6.1 and Table 6.2. Although correlations tend to be high between countries within close proximity, it is not uncommon to find strong correlations between countries that are not geographically close, for example, between Sweden and other countries.

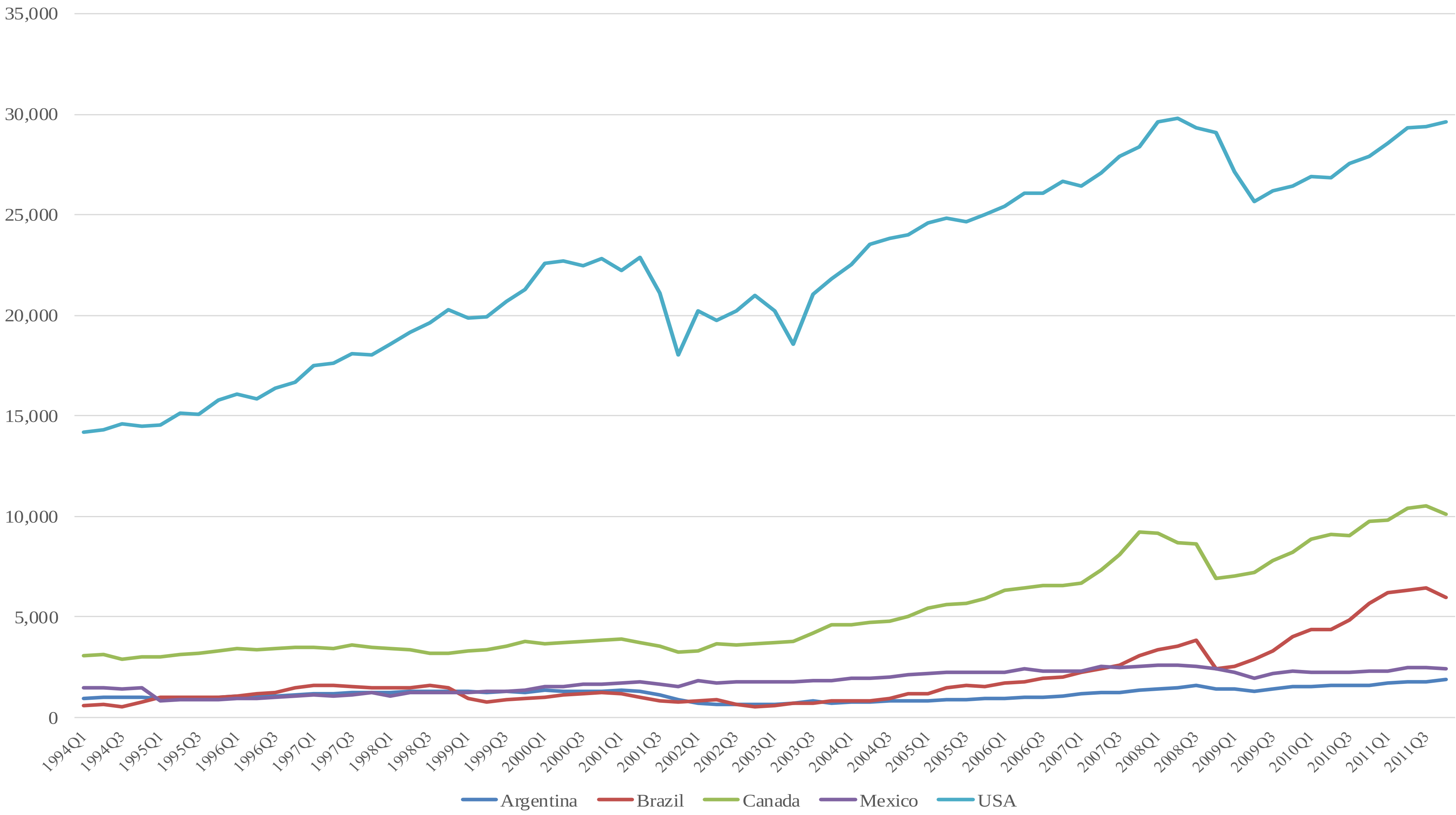

Figure 6.1 - Nominal tourism imports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

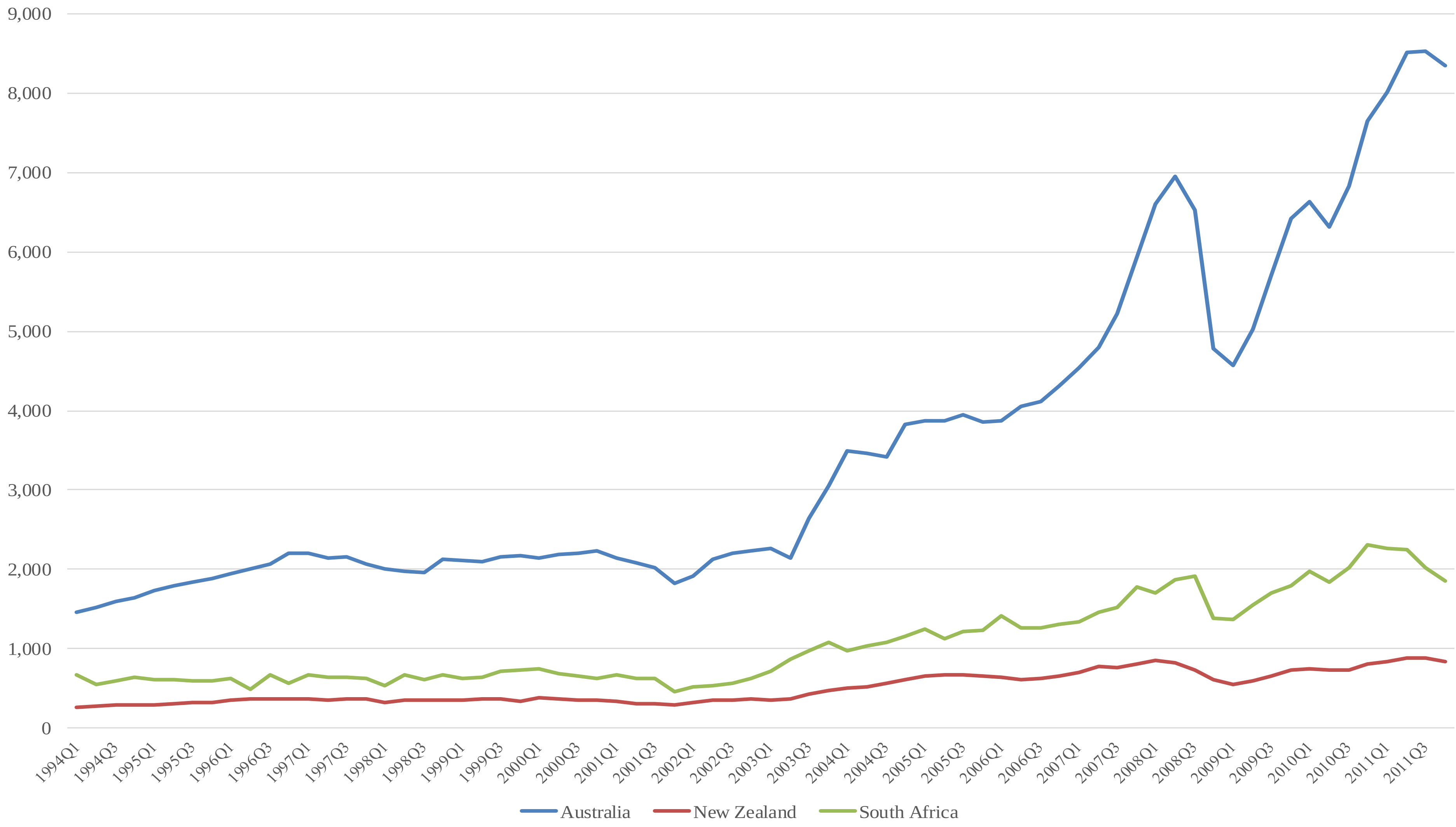

Figure 6.2 - Nominal tourism imports of selected Countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

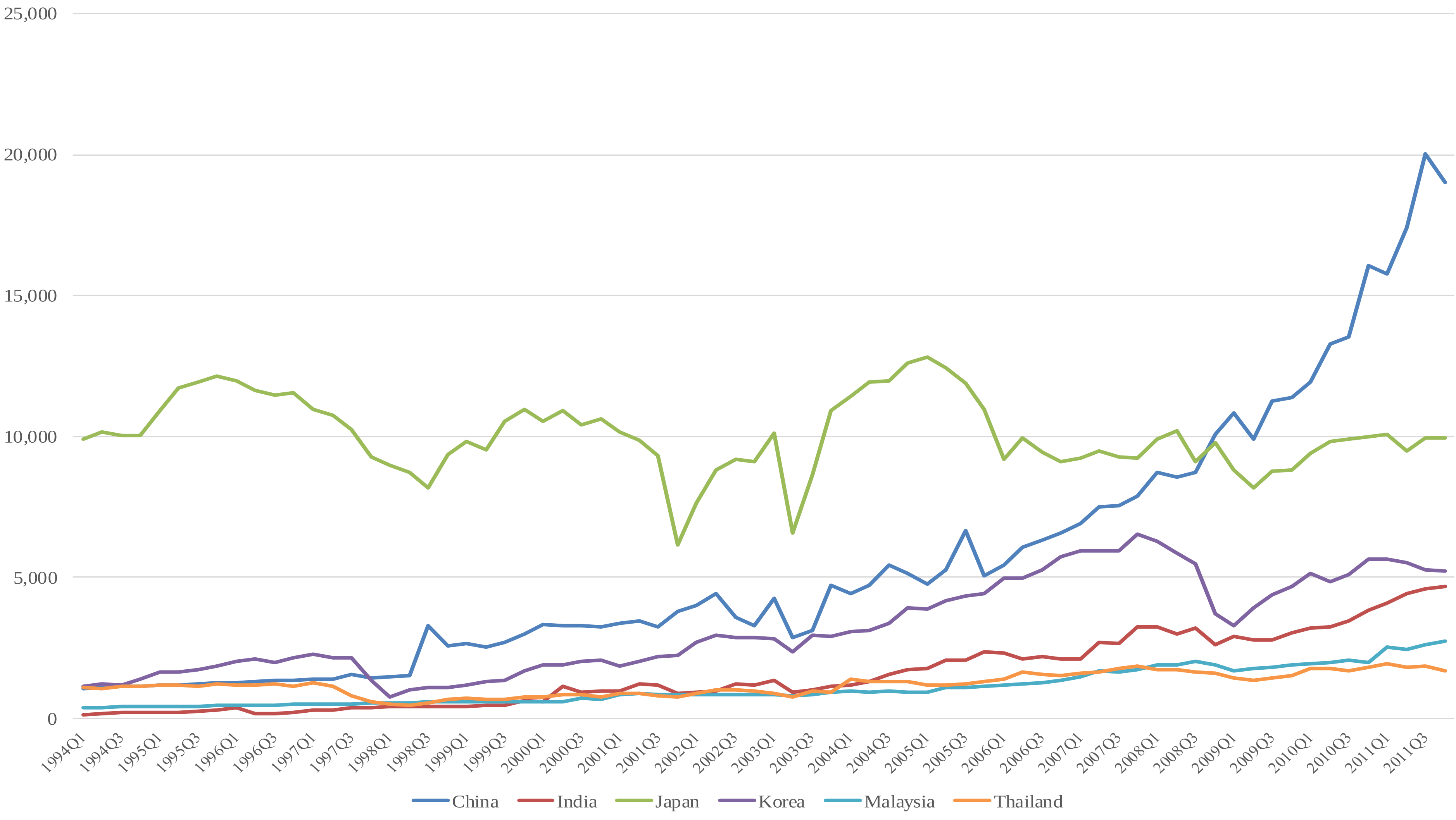

Figure 6.3 - Nominal tourism imports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

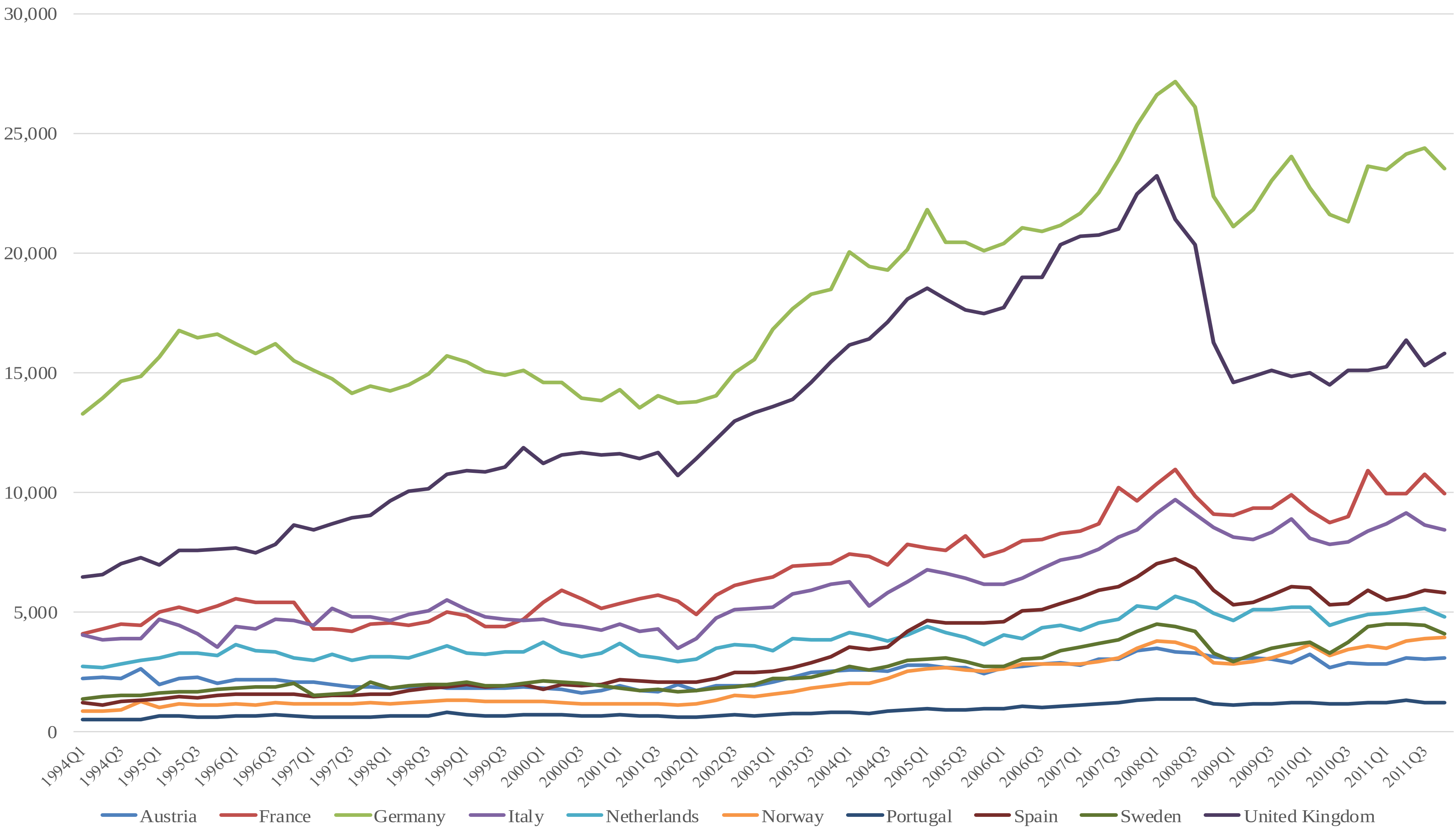

Figure 6.4 - Nominal tourism imports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

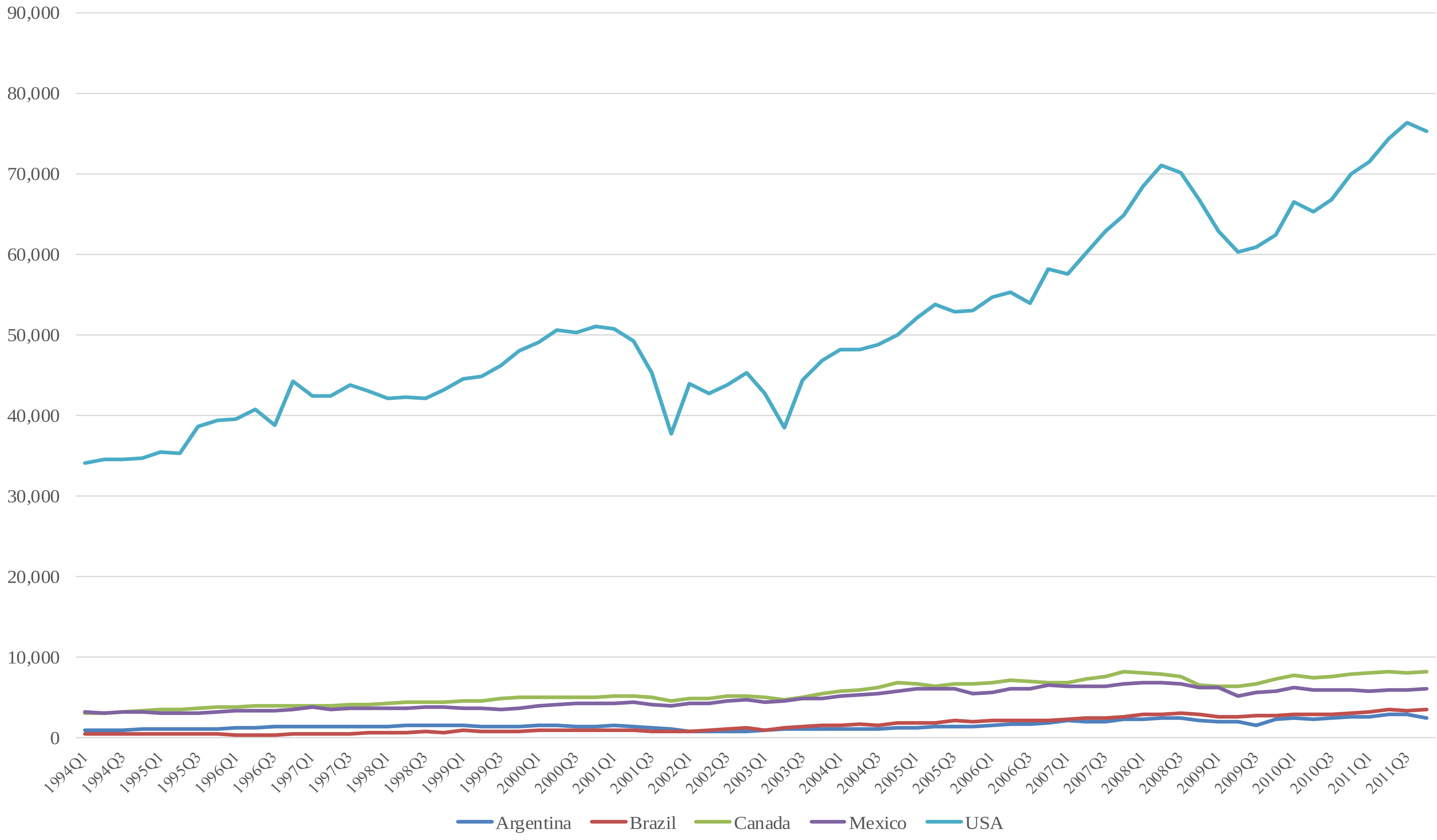

Figure 6.5 - Nominal tourism exports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

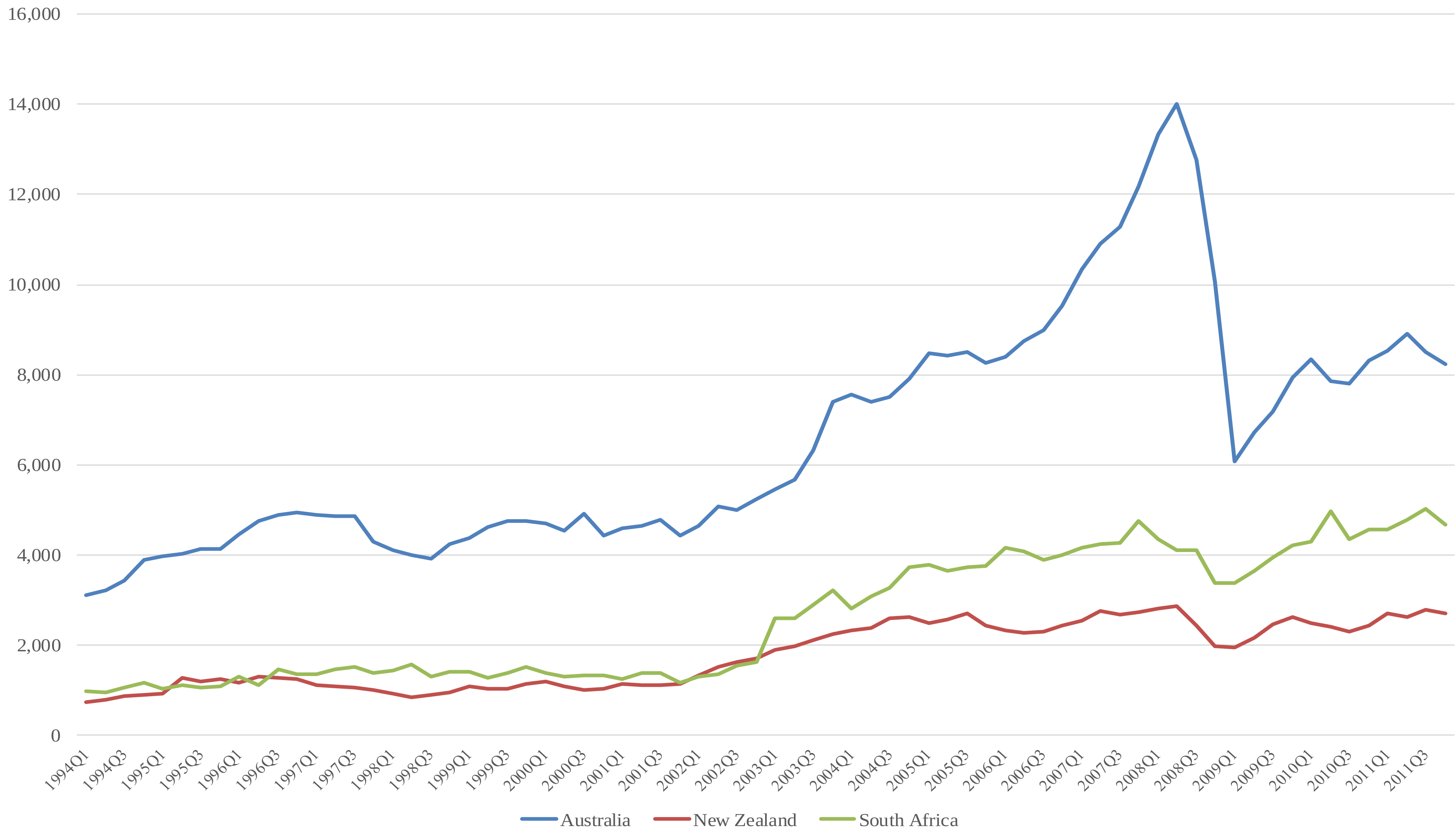

Figure 6.6 - Nominal tourism exports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

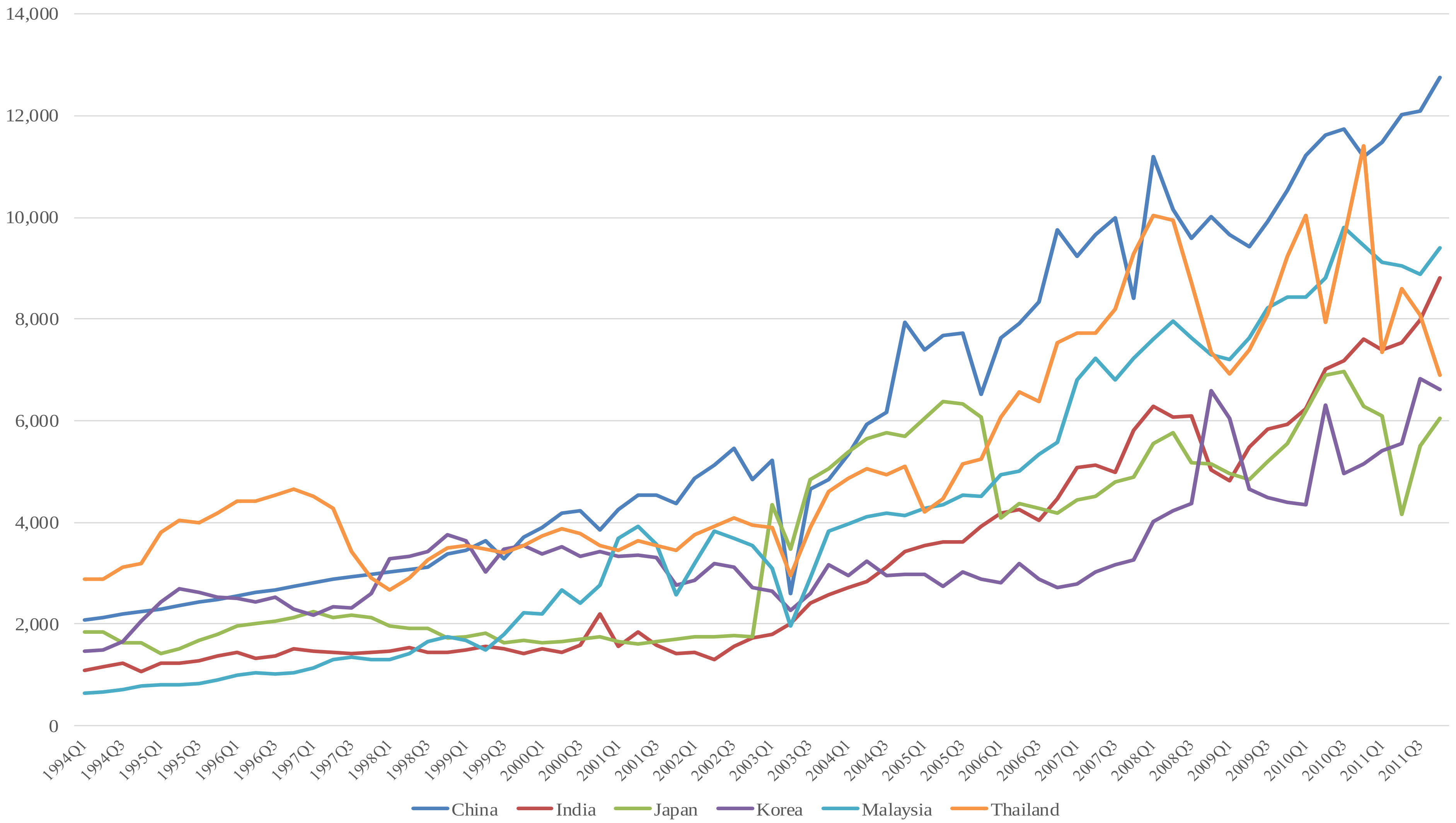

Figure 6.7 - Nominal tourism exports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

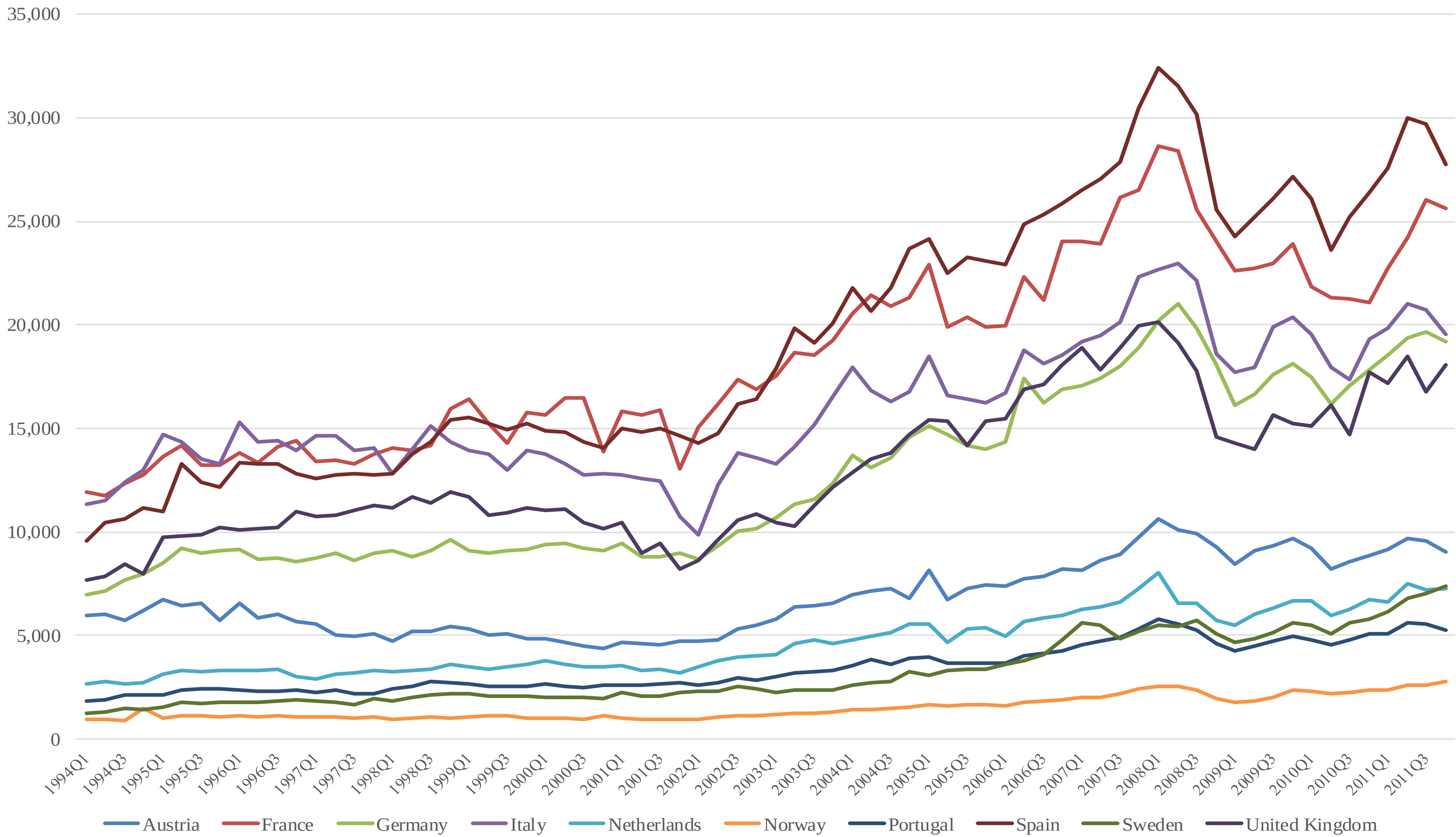

Figure 6.8 - Nominal tourism exports of selected countries (Million US$)

Data source: Balance of payments statistics yearbook (BPM5), IMF; data are seasonally adjusted.

Table 6.1 - Correlations of nominal tourism imports between major countries

Pearson Correlations												
N=72	ARG	AUS	AUT	BRA	CAN	CHN	FRA	DEU	IND	ITA	JPN	KOR
Argentina	1	.668**	.368**	.808**	.654**	.671**	.463**	.446**	.593**	.570**	-.164	.353**
Australia	.668**	1	.835**	.940**	.988**	.953**	.932**	.910**	.969**	.936**	-.106	.871**
Austria	.368**	.835**	1	.670**	.858**	.719**	.892**	.946**	.812**	.890**	-.035	.859**
Brazil	.808**	.940**	.670**	1	.916**	.933**	.784**	.748**	.883**	.817**	-.157	.711**
Canada	.654**	.988**	.858**	.916**	1	.935**	.944**	.922**	.975**	.944**	-.147	.905**
China	.671**	.953**	.719**	.933**	.935**	1	.869**	.789**	.957**	.854**	-.192	.771**
France	.463**	.932**	.892**	.784**	.944**	.869**	1	.958**	.943**	.949**	-.120	.925**
Germany	.446**	.910**	.946**	.748**	.922**	.789**	.958**	1	.884**	.955**	-.022	.914**
India	.593**	.969**	.812**	.883**	.975**	.957**	.943**	.884**	1	.916**	-.181	.892**
Italy	.570**	.936**	.890**	.817**	.944**	.854**	.949**	.955**	.916**	1	-.164	.877**
Japan	-.164	-.106	-.035	-.157	-.147	-.192	-.120	-.022	-.181	-.164	1	-.099
Korea	.353**	.871**	.859**	.711**	.905**	.771**	.925**	.914**	.892**	.877**	-.099	1
Malaysia	.649**	.973**	.810**	.907**	.973**	.965**	.930**	.875**	.983**	.926**	-.240*	.863**
Mexico	.310**	.806**	.805**	.605**	.840**	.762**	.888**	.837**	.881**	.840**	-.213	.895**
Netherlands	.530**	.912**	.889**	.776**	.921**	.831**	.956**	.949**	.897**	.966**	-.137	.868**
New Zealand	.521**	.951**	.884**	.823**	.961**	.859**	.943**	.955**	.937**	.939**	-.018	.944**
Norway	.528**	.963**	.911**	.833**	.974**	.890**	.967**	.965**	.960**	.965**	-.108	.935**
Portugal	.577**	.935**	.890**	.807**	.958**	.843**	.959**	.964**	.929**	.975**	-.144	.921**
South Africa	.618**	.978**	.865**	.897**	.980**	.916**	.936**	.925**	.952**	.943**	-.111	.884**
Spain	.467**	.911**	.911**	.744**	.938**	.823**	.968**	.964**	.927**	.960**	-.153	.946**
Sweden	.573**	.964**	.877**	.847**	.968**	.878**	.963**	.959**	.943**	.960**	-.095	.921**
Thailand	.420**	.847**	.874**	.750**	.865**	.757**	.850**	.868**	.813**	.803**	.088	.874**
United Kingdom	.161	.688**	.754**	.437**	.730**	.574**	.823**	.828**	.747**	.790**	-.100	.879**
USA	.540**	.870**	.740**	.723**	.891**	.832**	.898**	.847**	.917**	.891**	-.156	.869**
Average	.472	.821	.751	.717	.829	.758	.818	.808	.814	.813	-.116	.782

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

'*Average*' is the average of correlation coefficients excluding the particular country itself. Significance level is not shown

Table 6.1 - Correlations of nominal tourism imports between major countries (cont.)

Pearson Correlations												
N=72	MYS	MEX	NLD	NZL	NOR	PRT	ZAF	ESP	SWE	THA	GBR	USA
Argentina	.649**	.310**	.530**	.521**	.528**	.577**	.618**	.467**	.573**	.420**	.161	.540**
Australia	.973**	.806**	.912**	.951**	.963**	.935**	.978**	.911**	.964**	.847**	.688**	.870**
Austria	.810**	.805**	.889**	.884**	.911**	.890**	.865**	.911**	.877**	.874**	.754**	.740**
Brazil	.907**	.605**	.776**	.823**	.833**	.807**	.897**	.744**	.847**	.750**	.437**	.723**
Canada	.973**	.840**	.921**	.961**	.974**	.958**	.980**	.938**	.968**	.865**	.730**	.891**
China	.965**	.762**	.831**	.859**	.890**	.843**	.916**	.823**	.878**	.757**	.574**	.832**
France	.930**	.888**	.956**	.943**	.967**	.959**	.936**	.968**	.963**	.850**	.823**	.898**
Germany	.875**	.837**	.949**	.955**	.965**	.964**	.925**	.964**	.959**	.868**	.828**	.847**
India	.983**	.881**	.897**	.937**	.960**	.929**	.952**	.927**	.943**	.813**	.747**	.917**
Italy	.926**	.840**	.966**	.939**	.965**	.975**	.943**	.960**	.960**	.803**	.790**	.891**
Japan	-.240*	-.213	-.137	-.018	-.108	-.144	-.111	-.153	-.095	.088	-.100	-.156
Korea	.863**	.895**	.868**	.944**	.935**	.921**	.884**	.946**	.921**	.874**	.879**	.869**
Malaysia	1	.846**	.905**	.916**	.946**	.927**	.945**	.915**	.936**	.812**	.702**	.896**
Mexico	.846**	1	.830**	.869**	.889**	.862**	.828**	.924**	.862**	.718**	.906**	.917**
Netherlands	.905**	.830**	1	.913**	.947**	.962**	.921**	.951**	.945**	.795**	.790**	.887**
New Zealand	.916**	.869**	.913**	1	.982**	.958**	.952**	.958**	.977**	.855**	.832**	.900**
Norway	.946**	.889**	.947**	.982**	1	.975**	.967**	.979**	.978**	.855**	.824**	.912**
Portugal	.927**	.862**	.962**	.958**	.975**	1	.942**	.981**	.974**	.833**	.835**	.923**
South Africa	.945**	.828**	.921**	.952**	.967**	.942**	1	.927**	.961**	.853**	.716**	.867**
Spain	.915**	.924**	.951**	.958**	.979**	.981**	.927**	1	.960**	.832**	.885**	.930**
Sweden	.936**	.862**	.945**	.977**	.978**	.974**	.961**	.960**	1	.833**	.820**	.910**
Thailand	.812**	.718**	.795**	.855**	.855**	.833**	.853**	.832**	.833**	1	.622**	.685**
United Kingdom	.702**	.906**	.790**	.832**	.824**	.835**	.716**	.885**	.820**	.622**	1	.878**
USA	.896**	.917**	.887**	.900**	.912**	.923**	.867**	.930**	.910**	.685**	.878**	1
Average	.807	.738	.800	.825	.835	.824	.819	.819	.830	.729	.672	.774

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

'*Average*' is the average of correlation coefficients excluding the particular country itself. Significance level is not shown

Table 6.2 - Correlations of nominal tourism exports between major countries

Pearson Correlations												
N=72	ARG	AUS	AUT	BRA	CAN	CHN	FRA	DEU	IND	ITA	JPN	KOR
Argentina	1	.674**	.760**	.831**	.788**	.820**	.718**	.808**	.884**	.800**	.587**	.776**
Australia	.674**	1	.847**	.840**	.882**	.819**	.932**	.918**	.793**	.905**	.787**	.431**
Austria	.760**	.847**	1	.897**	.820**	.861**	.883**	.936**	.897**	.935**	.812**	.576**
Brazil	.831**	.840**	.897**	1	.959**	.979**	.927**	.970**	.976**	.883**	.855**	.756**
Canada	.788**	.882**	.820**	.959**	1	.958**	.940**	.953**	.925**	.871**	.845**	.683**
China	.820**	.819**	.861**	.979**	.958**	1	.910**	.952**	.965**	.849**	.838**	.758**
France	.718**	.932**	.883**	.927**	.940**	.910**	1	.967**	.875**	.921**	.834**	.616**
Germany	.808**	.918**	.936**	.970**	.953**	.952**	.967**	1	.945**	.950**	.862**	.665**
India	.884**	.793**	.897**	.976**	.925**	.965**	.875**	.945**	1	.876**	.831**	.771**
Italy	.800**	.905**	.935**	.883**	.871**	.849**	.921**	.950**	.876**	1	.797**	.577**
Japan	.587**	.787**	.812**	.855**	.845**	.838**	.834**	.862**	.831**	.797**	1	.536**
Korea	.776**	.431**	.576**	.756**	.683**	.758**	.616**	.665**	.771**	.577**	.536**	1
Malaysia	.824**	.788**	.842**	.973**	.944**	.981**	.889**	.931**	.962**	.829**	.811**	.783**
Mexico	.673**	.924**	.819**	.917**	.950**	.915**	.953**	.943**	.851**	.860**	.864**	.558**
Netherlands	.796**	.891**	.917**	.967**	.962**	.950**	.962**	.980**	.945**	.927**	.854**	.659**
New Zealand	.586**	.888**	.847**	.886**	.910**	.870**	.926**	.920**	.840**	.862**	.919**	.479**
Norway	.862**	.857**	.941**	.955**	.915**	.939**	.905**	.962**	.971**	.926**	.817**	.694**
Portugal	.827**	.898**	.920**	.975**	.960**	.959**	.962**	.987**	.956**	.933**	.843**	.703**
South Africa	.747**	.875**	.888**	.952**	.949**	.934**	.927**	.959**	.931**	.897**	.923**	.606**
Spain	.768**	.932**	.902**	.958**	.967**	.936**	.981**	.987**	.916**	.932**	.863**	.630**
Sweden	.888**	.811**	.889**	.972**	.927**	.969**	.897**	.952**	.980**	.878**	.773**	.767**
Thailand	.842**	.830**	.903**	.894**	.864**	.897**	.844**	.912**	.911**	.890**	.748**	.627**
United Kingdom	.796**	.924**	.858**	.890**	.923**	.878**	.926**	.945**	.876**	.940**	.790**	.551**
USA	.903**	.807**	.813**	.951**	.942**	.948**	.884**	.923**	.949**	.854**	.754**	.820**
Average	.748	.802	.823	.882	.868	.870	.858	.889	.868	.837	.773	.626

**. Correlation is significant at the 0.01 level (2-tailed).

'*Average*' is the average of correlation coefficients excluding the particular country itself. Significance level is not shown.

Table 6.2 - Correlations of nominal tourism exports between major countries (cont.)

Pearson Correlations												
N=72	MYS	MEX	NLD	NZL	NOR	PRT	ZAF	ESP	SWE	THA	GBR	USA
Argentina	.824**	.673**	.796**	.586**	.862**	.827**	.747**	.768**	.888**	.842**	.796**	.903**
Australia	.788**	.924**	.891**	.888**	.857**	.898**	.875**	.932**	.811**	.830**	.924**	.807**
Austria	.842**	.819**	.917**	.847**	.941**	.920**	.888**	.902**	.889**	.903**	.858**	.813**
Brazil	.973**	.917**	.967**	.886**	.955**	.975**	.952**	.958**	.972**	.894**	.890**	.951**
Canada	.944**	.950**	.962**	.910**	.915**	.960**	.949**	.967**	.927**	.864**	.923**	.942**
China	.981**	.915**	.950**	.870**	.939**	.959**	.934**	.936**	.969**	.897**	.878**	.948**
France	.889**	.953**	.962**	.926**	.905**	.962**	.927**	.981**	.897**	.844**	.926**	.884**
Germany	.931**	.943**	.980**	.920**	.962**	.987**	.959**	.987**	.952**	.912**	.945**	.923**
India	.962**	.851**	.945**	.840**	.971**	.956**	.931**	.916**	.980**	.911**	.876**	.949**
Italy	.829**	.860**	.927**	.862**	.926**	.933**	.897**	.932**	.878**	.890**	.940**	.854**
Japan	.811**	.864**	.854**	.919**	.817**	.843**	.923**	.863**	.773**	.748**	.790**	.754**
Korea	.783**	.558**	.659**	.479**	.694**	.703**	.606**	.630**	.767**	.627**	.551**	.820**
Malaysia	1	.886**	.935**	.839**	.923**	.951**	.906**	.917**	.962**	.904**	.836**	.950**
Mexico	.886**	1	.928**	.926**	.864**	.927**	.935**	.960**	.865**	.818**	.909**	.865**
Netherlands	.935**	.928**	1	.928**	.956**	.987**	.961**	.983**	.951**	.903**	.934**	.915**
New Zealand	.839**	.926**	.928**	1	.860**	.907**	.951**	.941**	.832**	.791**	.875**	.786**
Norway	.923**	.864**	.956**	.860**	1	.966**	.925**	.936**	.966**	.922**	.903**	.921**
Portugal	.951**	.927**	.987**	.907**	.966**	1	.948**	.984**	.965**	.918**	.927**	.936**
South Africa	.906**	.935**	.961**	.951**	.925**	.948**	1	.961**	.911**	.857**	.923**	.873**
Spain	.917**	.960**	.983**	.941**	.936**	.984**	.961**	1	.928**	.880**	.943**	.907**
Sweden	.962**	.865**	.951**	.832**	.966**	.965**	.911**	.928**	1	.909**	.887**	.951**
Thailand	.904**	.818**	.903**	.791**	.922**	.918**	.857**	.880**	.909**	1	.858**	.880**
United Kingdom	.836**	.909**	.934**	.875**	.903**	.927**	.923**	.943**	.887**	.858**	1	.874**
USA	.950**	.865**	.915**	.786**	.921**	.936**	.873**	.907**	.951**	.880**	.874**	1
Average	.857	.838	.883	.815	.870	.889	.864	.880	.868	.825	.840	.850

**. Correlation is significant at the 0.01 level (2-tailed).

'*Average*' is the average of correlation coefficients excluding the particular country itself. Significance level is not shown.

Table 6.3 - Descriptive statistics of country-specific domestic variables

Real Tourism Imports (*lnrtim*)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	6.676	6.660	7.786	5.831	0.541
Australia	8.153	8.119	8.603	7.651	0.274
Austria	7.870	7.875	8.141	7.699	0.079
Brazil	7.029	6.912	8.246	4.360	0.700
Canada	8.608	8.561	8.904	8.360	0.150
China	8.316	8.373	9.513	7.324	0.635
France	8.894	8.939	9.102	8.625	0.129
Germany	9.903	9.898	10.009	9.803	0.049
India	6.958	7.190	8.449	4.854	0.993
Italy	8.760	8.794	8.904	8.354	0.102
Japan	9.248	9.358	9.600	8.708	0.255
Korea	8.034	8.193	8.630	7.084	0.466
Malaysia	6.762	6.818	7.587	5.880	0.508
Mexico	7.362	7.502	7.904	6.352	0.452
Netherlands	8.349	8.334	8.617	8.228	0.093
New Zealand	6.349	6.376	6.552	6.022	0.158
Norway	7.630	7.554	8.025	7.166	0.262
Portugal	6.818	6.834	6.987	6.528	0.109
South Africa	6.908	6.943	7.716	6.008	0.525
Spain	8.084	8.105	8.588	7.374	0.380
Sweden	6.956	6.964	7.304	6.346	0.213
Thailand	6.956	6.964	7.304	6.346	0.213
United Kingdom	9.618	9.670	9.887	9.247	0.178
USA	10.055	10.090	10.214	9.844	0.103

Note: the variable has undergone logarithmic transformation

Table 6.3 - Descriptive statistics of country-specific domestic variables (cont.)

Real Tourism Exports (*lnrtex*)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	6.927	6.931	8.152	6.033	0.680
Australia	8.835	8.787	9.256	8.402	0.214
Austria	8.899	8.894	9.083	8.787	0.059
Brazil	6.795	7.357	7.794	4.252	0.931
Canada	8.718	8.726	8.886	8.392	0.113
China	8.584	8.581	9.112	7.935	0.377
France	9.902	9.911	10.148	9.674	0.120
Germany	9.495	9.532	9.721	9.221	0.128
India	7.874	7.705	9.081	6.902	0.610
Italy	9.763	9.758	9.931	9.614	0.081
Japan	8.070	7.996	8.762	7.302	0.418
Korea	8.179	8.208	8.995	7.341	0.369
Malaysia	7.973	8.303	8.898	6.403	0.790
Mexico	8.360	8.451	8.930	7.115	0.417
Netherlands	8.497	8.538	8.718	8.164	0.137
New Zealand	7.598	7.662	7.966	7.105	0.243
Norway	7.367	7.359	7.677	7.123	0.132
Portugal	8.194	8.236	8.393	7.886	0.139
South Africa	7.773	7.982	8.571	6.549	0.639
Spain	9.925	10.001	10.117	9.537	0.162
Sweden	8.046	8.004	8.661	7.500	0.317
Thailand	8.420	8.406	8.934	7.775	0.286
United Kingdom	9.602	9.615	9.807	9.340	0.100
USA	10.879	10.874	11.095	10.619	0.108

Note: the variable has undergone logarithmic transformation

Table 6.3 - Descriptive statistics of country-specific domestic variables (cont.)

Real Income (*lny*)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	0.060	0.065	0.280	-0.186	0.114
Australia	-0.034	-0.018	0.030	-0.134	0.050
Austria	0.006	0.013	0.051	-0.060	0.028
Brazil	-0.401	-0.413	-0.294	-0.463	0.044
Canada	-0.035	-0.026	0.007	-0.098	0.034
China	-0.145	-0.184	0.505	-0.676	0.364
France	0.000	0.015	0.051	-0.099	0.045
Germany	0.045	0.056	0.130	-0.070	0.062
India	-0.069	-0.126	0.343	-0.350	0.218
Italy	0.013	0.044	0.108	-0.160	0.079
Japan	0.027	0.032	0.163	-0.146	0.090
Korea	-0.062	-0.029	0.088	-0.283	0.106
Malaysia	-0.061	-0.077	0.137	-0.320	0.116
Mexico	-0.019	-0.011	0.050	-0.168	0.044
Netherlands	0.005	0.004	0.063	-0.071	0.034
New Zealand	-0.057	-0.063	0.007	-0.114	0.033
Norway	-0.018	-0.008	0.040	-0.098	0.035
Portugal	-0.003	-0.007	0.094	-0.151	0.061
South Africa	-0.022	-0.038	0.059	-0.088	0.050
Spain	-0.051	-0.036	0.022	-0.137	0.049
Sweden	-0.030	-0.021	0.029	-0.092	0.030
Thailand	-0.032	-0.015	0.084	-0.179	0.070
United Kingdom	-0.039	-0.032	0.018	-0.110	0.036
USA	-0.036	-0.018	0.013	-0.095	0.036

Note: the variable has undergone logarithmic transformation

Table 6.3 - Descriptive statistics of country-specific domestic variables (cont.)

Own Price (*lnp*)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	0.275	0.178	0.611	-0.396	0.306
Australia	-0.116	-0.189	0.509	-0.506	0.287
Austria	-0.088	-0.119	0.298	-0.449	0.213
Brazil	0.095	0.176	0.711	-0.628	0.325
Canada	-0.116	-0.274	0.339	-0.397	0.243
China	0.021	-0.057	0.466	-0.447	0.198
France	-0.085	-0.103	0.291	-0.447	0.205
Germany	-0.074	-0.088	0.292	-0.429	0.199
India	-0.047	-0.177	0.482	-0.364	0.235
Italy	-0.106	-0.169	0.299	-0.468	0.228
Japan	0.031	0.017	0.345	-0.211	0.127
Korea	-0.128	-0.127	0.164	-0.647	0.183
Malaysia	0.060	0.072	0.264	-0.197	0.134
Mexico	-0.112	-0.058	0.184	-0.696	0.200
Netherlands	-0.107	-0.164	0.282	-0.470	0.218
New Zealand	-0.184	-0.184	0.352	-0.647	0.266
Norway	-0.103	-0.159	0.299	-0.439	0.217
Portugal	-0.125	-0.212	0.315	-0.498	0.245
South Africa	-0.112	-0.074	0.309	-0.745	0.219
Spain	-0.122	-0.221	0.336	-0.502	0.256
Sweden	-0.048	-0.046	0.292	-0.392	0.173
Thailand	0.080	0.074	0.479	-0.309	0.201
United Kingdom	-0.123	-0.167	0.173	-0.389	0.154
USA	-0.064	-0.070	0.148	-0.286	0.131

Note: the variable has undergone logarithmic transformation

Table 6.4 - Descriptive statistics of country-specific foreign variables

Real Tourism Imports (*lnrtim**)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	8.323	8.286	8.793	7.678	0.222
Australia	8.737	8.759	8.852	8.571	0.067
Austria	9.381	9.409	9.476	9.232	0.073
Brazil	8.787	8.838	9.001	8.561	0.133
Canada	9.739	9.764	9.870	9.531	0.093
China	9.018	9.037	9.103	8.851	0.059
France	9.004	9.046	9.139	8.818	0.097
Germany	8.665	8.729	8.800	8.413	0.127
India	8.989	8.987	9.063	8.842	0.039
Italy	8.992	9.039	9.096	8.830	0.091
Japan	8.847	8.909	9.094	8.558	0.156
Korea	9.007	9.011	9.131	8.801	0.059
Malaysia	9.010	9.026	9.122	8.841	0.065
Mexico	9.764	9.773	9.938	9.559	0.089
Netherlands	9.170	9.200	9.270	9.056	0.066
New Zealand	8.795	8.822	8.946	8.587	0.104
Norway	8.885	8.914	9.090	8.659	0.136
Portugal	8.808	8.846	8.946	8.576	0.109
South Africa	8.941	9.060	9.141	8.399	0.240
Spain	8.857	8.883	8.963	8.718	0.072
Sweden	8.972	9.006	9.083	8.802	0.085
Thailand	8.965	8.984	9.095	8.778	0.072
United Kingdom	8.893	8.939	9.000	8.686	0.096
USA	8.467	8.460	8.756	8.200	0.152

Note: the variable has undergone logarithmic transformation

Table 6.4 - Descriptive statistics of country-specific foreign variables (cont.)

Real Tourism Exports (*lnrtex**)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	8.622	8.781	8.955	7.999	0.276
Australia	8.915	8.908	9.136	8.534	0.170
Austria	9.451	9.502	9.637	9.147	0.133
Brazil	9.186	9.239	9.426	8.907	0.175
Canada	10.401	10.428	10.531	10.169	0.092
China	9.073	9.025	9.375	8.649	0.199
France	9.395	9.431	9.553	9.147	0.110
Germany	9.275	9.314	9.434	9.007	0.121
India	9.328	9.348	9.483	9.085	0.104
Italy	9.389	9.443	9.558	9.128	0.127
Japan	9.402	9.423	9.558	9.160	0.100
Korea	9.140	9.117	9.388	8.812	0.145
Malaysia	9.142	9.100	9.372	8.776	0.167
Mexico	10.436	10.440	10.626	10.266	0.087
Netherlands	9.422	9.450	9.566	9.216	0.096
New Zealand	9.086	9.097	9.355	8.729	0.171
Norway	9.225	9.236	9.441	8.921	0.148
Portugal	9.536	9.588	9.737	9.197	0.152
South Africa	9.186	9.270	9.397	8.676	0.223
Spain	9.334	9.362	9.456	9.131	0.088
Sweden	9.167	9.186	9.320	8.960	0.094
Thailand	8.983	8.982	9.231	8.539	0.183
United Kingdom	9.333	9.364	9.485	9.034	0.129
USA	8.619	8.640	8.884	8.116	0.230

Note: the variable has undergone logarithmic transformation

Table 6.4 - Descriptive statistics of country-specific foreign variables (cont.)

Real Income (*lny**)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	-0.133	-0.146	-0.056	-0.168	0.030
Australia	-0.006	-0.024	0.101	-0.055	0.043
Austria	0.019	0.033	0.063	-0.064	0.040
Brazil	0.010	0.006	0.095	-0.030	0.030
Canada	-0.027	-0.017	0.006	-0.077	0.026
China	-0.008	-0.002	0.015	-0.061	0.020
France	-0.005	0.000	0.024	-0.056	0.021
Germany	-0.014	-0.009	0.014	-0.042	0.016
India	-0.003	-0.010	0.067	-0.034	0.028
Italy	-0.003	-0.001	0.022	-0.043	0.015
Japan	-0.027	-0.047	0.135	-0.139	0.080
Korea	-0.003	-0.033	0.128	-0.055	0.054
Malaysia	0.000	-0.009	0.069	-0.030	0.027
Mexico	-0.027	-0.017	0.009	-0.074	0.025
Netherlands	0.005	0.011	0.032	-0.043	0.019
New Zealand	-0.012	-0.017	0.060	-0.064	0.034
Norway	-0.011	-0.006	0.018	-0.061	0.021
Portugal	-0.013	-0.007	0.019	-0.076	0.026
South Africa	-0.022	-0.008	0.053	-0.124	0.048
Spain	0.000	0.007	0.036	-0.059	0.026
Sweden	-0.005	0.000	0.025	-0.050	0.019
Thailand	0.001	-0.004	0.064	-0.025	0.023
United Kingdom	-0.001	-0.001	0.026	-0.037	0.014
USA	-0.016	-0.019	0.062	-0.065	0.034

Note: the variable has undergone logarithmic transformation

Table 6.4 - Descriptive statistics of country-specific foreign variables (cont.)

Own Price (*lnp**)					
	Mean	Median	Max.	Min.	Std. dev.
Argentina	-0.011	-0.062	0.435	-0.326	0.210
Australia	-0.037	-0.095	0.317	-0.241	0.158
Austria	-0.076	-0.116	0.272	-0.390	0.192
Brazil	-0.009	-0.057	0.259	-0.233	0.124
Canada	-0.056	-0.087	0.190	-0.269	0.134
China	-0.039	-0.074	0.264	-0.236	0.139
France	-0.080	-0.148	0.260	-0.354	0.189
Germany	-0.075	-0.137	0.257	-0.335	0.183
India	-0.050	-0.120	0.290	-0.259	0.165
Italy	-0.072	-0.126	0.261	-0.353	0.186
Japan	-0.045	-0.127	0.310	-0.272	0.170
Korea	-0.017	-0.090	0.342	-0.196	0.156
Malaysia	-0.026	-0.091	0.320	-0.216	0.151
Mexico	-0.055	-0.093	0.205	-0.273	0.139
Netherlands	-0.071	-0.126	0.254	-0.344	0.181
New Zealand	-0.055	-0.128	0.346	-0.280	0.183
Norway	-0.081	-0.137	0.239	-0.338	0.173
Portugal	-0.085	-0.144	0.291	-0.402	0.206
South Africa	-0.053	-0.116	0.291	-0.283	0.172
Spain	-0.077	-0.132	0.263	-0.367	0.188
Sweden	-0.078	-0.144	0.253	-0.345	0.183
Thailand	-0.021	-0.068	0.314	-0.213	0.143
United Kingdom	-0.068	-0.121	0.274	-0.330	0.184
USA	-0.057	-0.140	0.305	-0.266	0.174

Note: the variable has undergone logarithmic transformation

Table 6.5 - Descriptive statistics of global common variable

Oil Price (*lnp*$_{oil}$)					
	Mean	Median	Max.	Min.	Std. dev.
	-0.435	-0.614	0.820	-1.522	0.673

Note: the variable has undergone a logarithmic transformation

To summarise the pair-wise correlations, a simple statistic is the arithmetic average. The bottom rows of both Table 6.1 and Table 6.2 calculate the averages of correlations for each country (excluding the particular country itself, i.e., the entries that are 1). In terms of tourism imports, the average pair-wise correlation of many countries stands at between .472 and .835, except for Japan which is -.116. Almost all the pair-wise correlations of Japan are statistically insignificant. This is in line with Figure 6.3, which shows stagnant changes of Japan's tourism imports over the years. In terms of tourism exports, the magnitude of the correlations is generally higher, ranging between .626 and .889.

While the pair-wise correlation indicates how interconnected tourism trade (or international tourism demand) is, it does not offer much explanatory power with regard to the underlying causal relationship. A detailed assessment of interdependencies of international tourism demand has to rely on econometric models.

Variables in Real Terms

As proposed in Chapter 5, real macroeconomic variables and real tourism trade variables will be used in the GVAR modelling approach. Table 6.3 – Table 6.5 show the basic descriptive statistics of all the variables. The real term variables are the actual variables used in the current research's modelling exercise and they have all undergone logarithm transformation. This is in line with other existing studies on tourism trade.

To interpret these descriptive statistics, one can take exponential of the mean and median statistics to obtain the original levels of respective variables. The mean and median numbers are for the sample period, i.e., 1994Q1 to 2011Q4. A straightforward way of making sense of these statistics is to simply compare the mean and median across different countries. The higher the statistics, the larger volume a country has.

From Table 6.3, it is shown that the USA has the largest volume of real tourism imports and real tourism exports, as its mean (10.055) is higher than any other country's. The other countries that have relatively large volumes of real tourism trade are Germany, Japan, and the UK, according to their mean figures. The std.dev. (standard deviation) column shows how volatile during the sample period the real tourism trade figures are. On the one hand, among all the 24 countries, Austria has seen a relatively stable real tourism trade, as its std.dev. maintains at 0.079 and 0.059. On the other hand, emerging countries and developing countries such as Argentina, Brazil, India, Malaysia, and South Africa are among the countries which have seen substantial fluctuations of real tourism trade over the years.

With regard to the real income variable and the own price variable in Table 6.3, the std.dev. column shows a clear pattern that over the sample period, emerging countries such as Argentina, China and India have witnessed remarkable developments in terms of real income. For other countries (mostly developed countries), their real income levels remain relatively stable. Meanwhile, all the 24 countries have seen their own price level varying greatly over the sample period. Hence, compared with the real income variable, the own price variable may play a more important role in explaining the fluctuations of real tourism trade.

Table 6.4 reports the descriptive statistics of each country's foreign variables, which are the weighted averages of each country's foreign counterparts. The foreign variables are supposed to be proxies for a country's external economic performance. The mean values of these foreign variables are relatively similar for different countries.

Table 6.6 - Order of integration of each variable

	Real Tourism Imports (*lnrtim*)	Real Tourism Exports (*lnrtex*)	Real Income (*lny*)	Own price (*lnp*)	Foreign Tourism Imports ($lnrtim^*$)	Foreign Tourism Exports ($lnrtex^*$)	Foreign Real Income (lny^*)	Foreign Prices (lnp^*)
Argentina	1	1	1	1	1	1	1	1
Australia	0	1	1	1	1	1	1	1
Austria	1	0	1	1	1	1	1	1
Brazil	1	1	1	1	0	1	1	1
Canada	1	1	1	1	1	1	1	1
China	0	0	1	1	0	1	0	1
France	1	1	1	1	1	1	1	1
Germany	1	1	1	1	1	1	1	1
India	1	1	1	1	1	1	1	1
Italy	0	1	1	1	1	1	1	1
Japan	1	1	1	1	1	1	1	1
Korea	1	1	0	1	1	1	1	1

Table 6.6 - Order of integration of each variable (cont.)

	Real Tourism Imports ($lnrtim$)	Real Tourism Exports ($lnrtex$)	Real Income (lny)	Own price (lnp)	Foreign Tourism Imports ($lnrtim^*$)	Foreign Tourism Exports ($lnrtex^*$)	Foreign Real Income (lny^*)	Foreign Prices (lnp^*)	Oil Price (lnp_{oil})
Malaysia	1	1	0	1	1	1	1	1	-
Mexico	0	1	0	1	1	1	1	1	-
Netherlands	1	1	2#	1	1	1	1	1	-
New Zealand	1	1	1	1	0	1	0	1	-
Norway	1	1	1	1	1	1	1	1	-
Portugal	1	1	1	1	1	1	1	1	-
South Africa	1	1	1	1	1	1	1	1	-
Spain	1	2#	2#	1	1	1	1	1	-
Sweden	1	0	1	1	1	1	1	1	-
Thailand	1	1	1	1	1	0	1	1	-
United Kingdom	1	1	1	1	1	1	1	1	-
USA	1	1	1	1	0	1	0	1	0

#: the series is at the border between I(1) and I(2); null hypothesis of stationarity is marginally accepted at the 5% level for the first difference of the series

6.2.2 Unit Root Tests

Table 6.6 reports the results of unit root tests. A unit root test aims to find out whether a variable, for instance real tourism imports, evolves over time in a random manner or a stationary manner. The unit root test results will decide the appropriateness of the model specification proposed in Section 5.2.2. As described in Section 5.2.2, the augmented Dickey-Fuller (ADF) test and the weighted symmetric versions of ADF (WS-ADF) test are used. As long as one of ADF and WS-ADF indicates stationarity of a variable, whether at its level, first difference or second difference, the variable (or its differenced term) will be deemed stationary. The test results are according to critical values at the 5% significance level.

It is obvious that across all the countries sampled in the current research, the variables are $I(1)$ series in most cases, with occasional $I(0)$ series. The real tourism exports (*lnrtex*) of Spain and the real income (*lny*) for both Netherlands and Spain are found to be $I(2)$, at the 5% significance level. They are marginal cases. For both domestic own price (*lnp*) and foreign prices (lnp^*), they are $I(1)$ series across all the countries. The oil price variable, which is global common variable, is marginally accepted as $I(0)$ series.

Given that the GVAR approach is able to work with both $I(0)$ and $I(1)$ series, the unit root test results above confirm that the data set meet the requirements.

6.3 Model Estimation Results

The global VAR (GVAR) modelling approach is able to generate a large set of estimation results, due to the potential number of endogenous variables included in the model.

As discussed in Section 5.2.2, one of the focuses is the matrix $\boldsymbol{\Lambda}_{i0}$ in Eq. (5.8), which captures the contemporaneous effects of foreign variables on their domestic counterparts, for example, the percentage change of a particular country's tourism exports (*rtex*) in response to 1 percent change of other countries' tourism exports ($rtex^*$). Another focus is the impulse responses to shocks. The impacts of shocks to China's macroeconomic variables on all other countries' tourism trade will be simulated. All of these provide a quantitative picture of the degree of interdependencies between major countries around the world.

Table 6.7 - Lag orders of country-specific VECMX models

	Lag order of domestic variables (p_i)	*Lag order of foreign variables* (q_i)
Argentina	2	2
Australia	2	1
Austria	2	2
Brazil	1	2
Canada	2	1
China	3	2
France	1	1
Germany	2	2
India	1	1
Italy	2	1
Japan	2	1
Korea	2	1
Malaysia	2	3
Mexico	2	1
Netherlands	1	1
New Zealand	1	1
Norway	1	1
Portugal	3	2
South Africa	1	1
Spain	2	2
Sweden	1	1
Thailand	3	2
United Kingdom	3	3
USA	2	1

Table 6.8 - Number of cointegrations of country-specific VECMX models

	Rank
Argentina	1
Australia	1
Austria	1
Brazil	1
Canada	1
China	2
France	0
Germany	1
India	0
Italy	1
Japan	1
Korea	1
Malaysia	2
Mexico	1
Netherlands	1
New Zealand	0
Norway	1
Portugal	2
South Africa	1
Spain	1
Sweden	0
Thailand	2
United Kingdom	1
USA	1

6.3.1 Model Specification Parameters

The most important parameters concerning the first stage country-specific VECMX models are the lag orders of domestic variables and foreign variables, which are described in Section 5.2.2, i.e., p_i and q_i in Eq. (5.8), and the number of cointegrating relations among endogenous domestic variables, weakly exogenous foreign variables and weakly exogenous global common variable, i.e., r_i in Eq. (5.8). Table 6.7 and Table 6.8 shows the final choices of these parameters.

As described in Section 5.3.3, the determination of lag orders is through comparing the preliminary GVAR estimation results under different maximum lag order settings. In the same vein, the final choice of the rank order of each VECMX model depends on whether a lower rank will generate better estimation results. This is done by manually setting the rank order to 2 or 1, if the rank is initially found to be above 2 according to trace statistics. Pesaran, Schuermann, and Smith (2009) describe a similar strategy to achieve better model specifications. All in all, it is found that lower lag orders as well as lower rank orders tend to produce better results, in terms of acceptable diagnostic test results and reasonable persistence profiles.

In the cases where the rank order is zero, the country-specific VECMX model as Eq. (5.8) will be replaced by differenced VAR model augmented with exogenous variables (VARX). That is equivalent to Eq. (5.8) without the $\boldsymbol{\alpha}_i\boldsymbol{\beta}_i'\left[\mathbf{z}_{i,t-1} - \boldsymbol{\gamma}_i(t-1)\right]$ part.

In total, there are 24 cointegrating relations identified among the countries sampled in the current research. Each of them denotes an equilibrium state where the domestic variables, foreign variables and global common variables have a stable and consistent relationship.

6.3.2 Contemporaneous Impact Elasticities

One set of the main results from the GVAR approach are the contemporaneous impact elasticities between domestic variables and their corresponding foreign variables in the first stage VECMX models. *They show how much a country's economy will change (or be affected) if its external environment changes.* They are particularly useful in the GVAR approach in order to identify general co-movements among variables across different countries (Galesi & Lombardi, 2009). The concept of elasticity, which measures the change of a target variable in response to a one-percent change of its explanatory variable, is widely applied in tourism demand analysis. It is a simple indicator of the relationship between a target variable and its explanatory variable. For tourism practitioners, it would be of their interests to know about the changes of their native market's tourism demand (inbound and outbound) in response to changes of explanatory factors, especially if they are operating at different destination countries. So they can react differently in different destinations. Tourism demand for a destination country directly affects the performance of tourism businesses, in terms of their revenues and profits.

Specifically, the contemporaneous impact elasticities, which come from $\boldsymbol{\Lambda}_{i0}$ in Eq. (5.8), are reported in Table 6.9. They are the coefficients on the weakly exogenous foreign variables $\boldsymbol{x}_{it}^{*}$, when the endogenous domestic variables $\boldsymbol{x}_{it}$ are the 'dependent' variables[1]. Similar to demand elasticities, *a contemporaneous impact elasticities denotes the percentage change of* $\boldsymbol{x}_{it}$ *in response to 1% change in* $\boldsymbol{x}_{it}^{*}$*, at time t.* For example, an impact elasticity of 0.5 for real tourism exports (*lnrtex*) in the first stage VECMX model implies that, if on average the other countries' tourism exports (i.e., foreign tourism exports, *lnrtex**) increases by 1%, then the tourism exports (*lnrtex*) of the country concerned would accordingly increase by 0.5%.

'Contemporaneous' means $\boldsymbol{x}_{it}$ and $\boldsymbol{x}_{it}^{*}$ are at time *t*, and no lagged effects from time *t*-1, *t*-2, …, are involved. For one thing, this is in line with the practice of reporting in existing economic studies using the GVAR approach, for example, Vansteenkiste and Hiebert (2011), Dees, Mauro, Pesaran, and Smith (2007), Galesi and Lombardi (2009). Contemporaneous effects are also a good indicator of synchronisation of business cycles, since contemporaneity means the effects are immediate. For another, it is difficult to track the dynamic effects (lagged effects) between variables within a VAR model setting, given that there are too many variables involved simultaneously.

General Observations

[1] Strictly speaking, there are no 'dependent' and 'independent' variables in a vector autoregressive (VAR) model, since all variables are supposed to be 'dependent' and 'independent' variables in the same model. So instead, the distinction could be made between 'endogenous' and 'exogenous' variables in a conditional VAR model, see Garratt, Lee, Pesaran, and Shin (2012, pp.57-59).

Statistically significant impact elasticities are widely observed in Table 6.9. All the 24 countries in the current research have at least one statistically significant impact elasticity. This confirms the existence of dependencies on external world for the major countries around the world. While this finding is not entirely new nor surprising, the results in the table measure how intense such dependencies are. The value of the impact elasticities ranges between 0.348 and 1.958 for real tourism imports, 0.373 and 0.841 for real tourism exports, 0.408 and 2.360 for real income, 0.109 and 1.715 for own price (excluding all insignificant numbers).

There is, however, no definitive pattern among the 24 countries. Countries with three significant impact elasticities are notably Brazil, France, India, Italy, the Netherlands, Norway and Spain. They are predominantly European countries, and can be seen as more interconnected with other countries' international tourism sector. In other words, the international tourism trade of these countries is easily affected by the general economic performance around the world. Monitoring the macroeconomic trends is of particular importance to these countries, especially in times of global economic turbulence.

Real Tourism Imports and Real Tourism Exports

Above half of the 24 countries in the current research see either their tourism imports (i.e., outbound demand) or their tourism exports (i.e., inbound demand) depend on their foreign counterparts. In many cases, the contemporaneous impact elasticities are between 0.5 and 1 (see column Real Tourism Imports and Real Tourism Exports in Table 6.9), meaning a country's response to external world changes is rather moderate and not very sensitive. For example, the contemporaneous impact elasticity for Australia's real tourism imports is 0.590. It means that, if the value of outbound tourism of other countries increases by 1%, then the value of Australia's outbound tourism will correspondingly increase by 0.590%. Hence, Australia's outbound tourism follows the general trend of other countries to a moderate extent. On the contrary, the impact elasticities for real income and own price are almost unanimously significant and sensitive across all the 24 countries.

The less sensitive elasticities of tourism trade variables may well be linked to the fact that tourism interdependency is not only an economic phenomenon, but is also influenced by non-economic factors. Admittedly, the contemporaneous impact elasticities obtained from the GVAR approach only consider the impacts of economic changes, since the variables in the current research are measured in economic terms. However, at the macro level and international level, tourism embodies the process of globalisation, which as discussed in Section 4.3 is driven by not only economic forces, but also technological, political and cultural forces. Even though the foreign variables (those with a star *) are understood to be proxies for unobserved global common factors (including global common non-economic factors), the country-specific non-economic factors are still omitted by the model. Hence, persistence resulting from non-economic factors may exist for a country's tourism demand, and it reduces the sensitivity of the country's dependency on external economic changes alone. For example, tourist flows in and out of a country can be manipulated through border controls and visa regulations (a country-specific non-economic factor), which in turn certainly alternate the contemporaneous impact elasticities had there been only economic forces in place.

It can be seen as a shortcoming of the GVAR approach, which indeed is also a general shortcoming of econometric models, in the sense that only measurable factors are considered in a model (and it happens that measurable factors tend to be economic ones, see Section 2.4.1 for extensive discussions). But within the topic of interdependencies, it remains that compared to non-economic factors, economic factors tend to be more volatile and are much more mutually influencing across countries. Endogeneity, which the GVAR approach is set out to tackle, is more 'rampant' among economic factors, rather than among country-specific non-economic factors.

Nevertheless, the results in Table 6.9 show that there is a certain level of interdependency of tourism trade for many countries. Hence, the economic performance of international tourism sector across many countries is found to be somewhat synchronised.

Real Income and Own price

Contemporaneous impact elasticities for real income and own price are mostly significant. Almost every one of the 24 countries sees its real income as well as its own price (i.e., consumer price index adjusted by exchange rates against US dollar) co-move with the other countries.

Table 6.9 - Contemporaneous effects of foreign variables on domestic variables

	Real Tourism Imports *($lnrtim^*$, lnrtim)*	Real Tourism Exports *($lnrtex^*$, lnrtex)*	Real Income *(lny^*, lny)*	Own price *(lnp^*, lnp)*
Argentina	-	0.136	0.624*	-0.149
Australia	0.590***	0.006	-	-
Austria	-0.641	-0.017	0.639***	1.163***
Brazil	0.776*	0.882	0.847***	1.088*
Canada	0.348***	-	-	-
China	0.010	0.368	0.599**	0.109*
France	0.406	0.752**	0.809***	1.300***
Germany	-0.071	0.187	0.920***	1.436***
India	1.958*	0.153	0.739***	0.774***
Italy	0.373	0.841***	0.852***	1.336***
Japan	-	-	0.776***	0.614
Korea	-0.009	-0.479	0.886***	0.438
Malaysia	-	-	1.082***	0.848***
Mexico	0.824**	0.261	2.360***	0.203
Netherlands	0.553	0.506*	0.827***	1.349***
New Zealand	0.394	-0.324	0.796***	1.715***
Norway	0.732***	0.008	0.903**	1.077***
Portugal	0.352	0.548**	0.964***	-
South Africa	0.154	0.864	0.408***	1.262***
Spain	0.351	0.373*	0.982***	1.298***
Sweden	0.857	0.121	1.358***	1.280***
Thailand	1.212***	-0.070	0.551	1.461***
United Kingdom	0.146	0.042	0.637***	0.553***
USA	0.551***	0.077	-	0.140***

****, **, *: statistically significant at the 1%, 5% and 10% level, respectively*

The numbers denote the percentage change of domestic variable in response to 1% change in foreign variable

Domestic variables are lnrtim, lnrtex, lny and lnp; foreign variables are $lnrtim^*$, $lnrtex^*$, lny^* and lnp^*

-: The foreign variable is not used, since it is not weakly exogenous in the VECMX model; no impact elasticity is derived

For real income, the elasticities are usually between 0.7 and 1, more sensitive than those of tourism trade variables. These results are generally consistent with those reported in other economic studies, such as Dees, Holly, Pesaran, and Smith (2007), Dees, Mauro, Pesaran, and Smith (2007), and Galesi and Lombardi (2009). For own price, the elasticities are even more sensitive, generally standing between 1 and 1.5. But there are some countries which have insignificant elasticities of own price. They tend to be Asian countries or emerging economies.

Overall, real income and own price are more prominent channels through which an economy is influenced by its external environment. As opposed to tourism trade variables, real income and own price are both principally economic-related. As long as a country is actively engaging in cross-country economic activities, co-movements of real income as well as own price are likely to be observed and not hindered by non-economic factors. The interconnection between countries via real income and own price is thus greater than via tourism trade only.

6.3.3 Persistence Profiles

Persistence profiles (PPs) are the time profiles of the effects of system or variable-specific shocks on the cointegrating relations in the GVAR model (Dees, Holly, Pesaran, & Smith, 2007). The idea of PPs is to illustrate how the impacts of a shock onto the relationship among variables will evolve over time. It is desirable to see that a shock will only have impacts in the short run, rather than in the long run. As introduced in Section 5.2.2, PPs have a value of unity of impact at the exact time of shock. That is, the initial magnitude of impact is set to be 1. As the horizon $n \to \infty$, PPs tend to zero, meaning the impact of a shock will vanish as time goes by and the cointegrating relations will return to their equilibrium states (Bussière , Chudik, & Sestieri, 2009; Koukouritakis, Papadopoulos, & Yannopoulos, 2015).

Figure 6.9 shows the PPs of all the cointegrating relations found in the country-specific VECMX models. The 24 lines in Figure 6.9 correspond to the progress of the 24 cointegrating relations (as identified in Table 6.8) restoring long-run equilibrium. At the beginning, i.e., Quarter 0, the impact of a shock is 1. After *nine* quarters, almost all the PPs are already below 0.2. From Quarter 20 onwards, the PPs are very close to zero. All of them are practically equal to zero at Quarter 40. It is clear that, for most of the major countries sampled in the current research, the impact of a shock lasts around two to five years. Disruptions to the economy's equilibrium take place mainly in the first *two years* after a shock. In the long run, i.e., beyond five years, the impact of a shock tends to disspear.

Since all the PPs approach zero after a number of quarters, the cointegrating relations identified are confirmed to be valid.

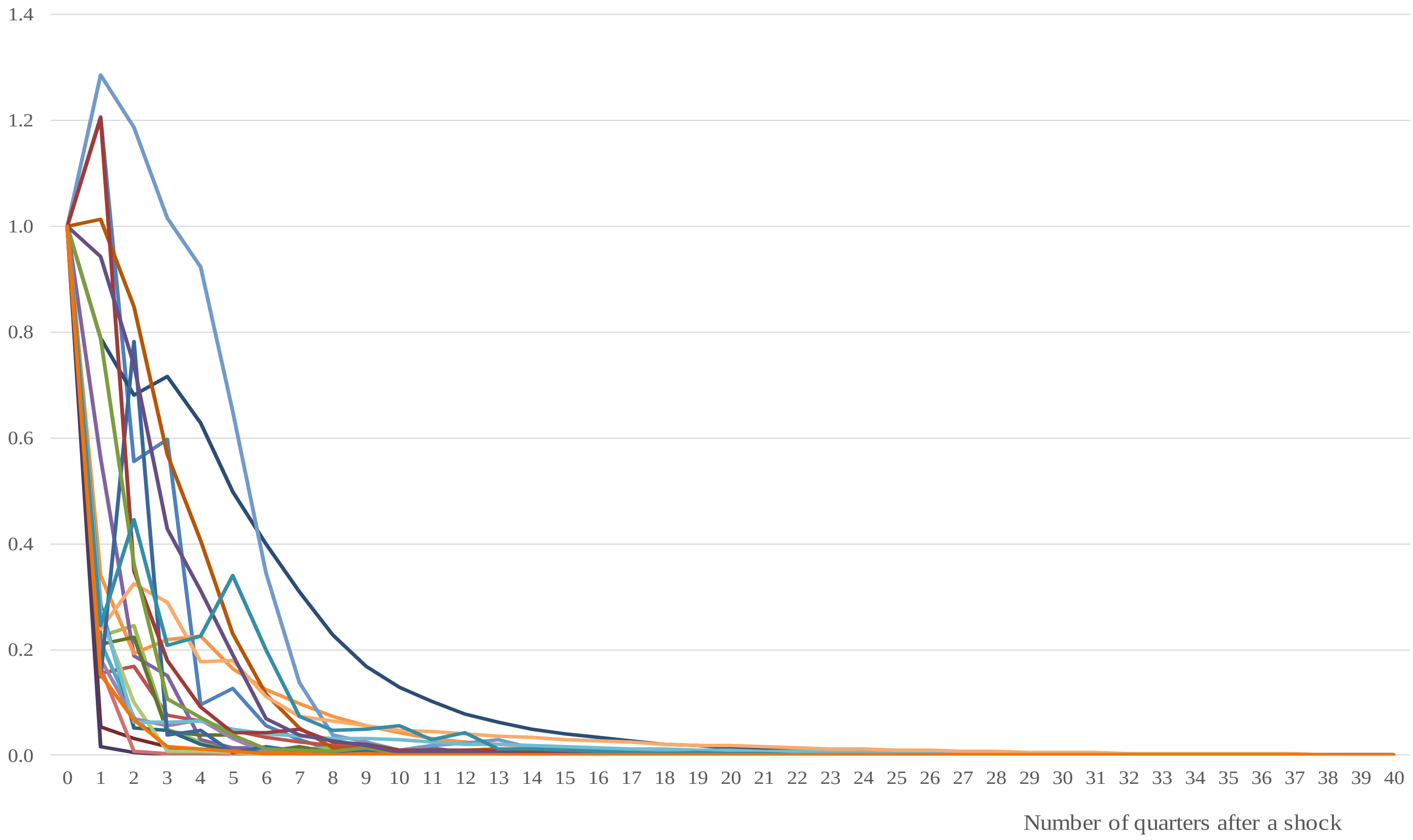

Figure 6.9 - Persistence profile of the effect of system-wide shocks to the cointegrating relations

Table 6.10 - F-statistics for the serial correlation test of the VECMX residuals

Country	Real Tourism Imports (*lnrtim*)	Real Tourism Exports (*lnrtex*)	Real Income (*lny*)	Own price (*lnp*)	Oil Price (lnp_{oil})
Argentina	0.699	0.179	0.311	0.464	
Australia	0.698	1.139	0.675	1.964	
Austria	0.749	2.214	1.325	3.532	
Brazil	0.619	1.312	1.876	0.315	
Canada	1.006	0.114	3.169**	1.357	
China	1.560	0.316	2.251	1.653	
France	1.849	5.817***	0.804	0.261	
Germany	0.173	1.584	1.076	0.491	
India	4.801***	1.637	0.372	0.372	
Italy	0.908	0.162	1.036	1.140	
Japan	2.509	0.808	0.139	2.975**	
Korea	0.534	1.287	0.668	2.734	
Malaysia	0.884	1.003	0.323	0.212	
Mexico	2.580	1.653	1.025	1.429	
Netherlands	4.371***	2.007	5.681***	0.423	
New Zealand	1.348	0.407	0.213	0.855	
Norway	2.031	2.167	9.474***	0.244	
Portugal	1.323	1.009	2.441	0.532	
South Africa	0.961	3.814**	2.986**	1.179	
Spain	0.610	1.830	0.740	2.542	
Sweden	1.119	1.193	0.250	0.771	
Thailand	2.750	1.917	1.498	1.698	
United Kingdom	1.428	0.425	0.193	0.127	
USA	2.966**	1.048	3.361**	2.290	2.448

*Note: *** and ** denote rejecting the null hypothesis of no serial correlation at the 1% and 5% significance level, respectively.*

Table 6.11 - Test for weak exogeneity at the 5% significance level

Country	Real Tourism Imports *(lnrtim*)*	Real Tourism Exports *(lnrtex*)*	Real Income *(lny*)*	Own price *(lnp*)*	Oil Price *(lnp_{oil})*
Argentina	-	1.437	0.012	2.420	0.164
Australia	0.120	0.000	-	-	0.969
Austria	0.967	0.109	0.779	1.391	0.207
Brazil	0.208	0.026	0.563	0.116	0.155
Canada	0.124	-	-	-	1.196
China	3.072	2.593	0.887	0.335	0.780
France	-	-	-	-	-
Germany	0.022	0.205	0.782	1.314	1.781
India	-	-	-	-	-
Italy	0.153	0.025	0.013	0.502	0.683
Japan	-	-	0.045	0.000	0.447
Korea	0.095	2.644	0.527	3.114	1.341
Malaysia	-	-	2.490	0.442	0.843
Mexico	0.485	1.277	0.345	1.965	0.351
Netherlands	0.000	1.012	0.386	0.131	0.248
New Zealand	-	-	-	-	-
Norway	0.052	0.249	0.120	0.192	0.001
Portugal	1.019	0.298	0.214	-	-
South Africa	1.536	0.938	0.151	0.636	0.005
Spain	0.748	2.594	1.770	1.737	2.566
Sweden	-	-	-	-	-
Thailand	0.311	1.269	2.218	2.357	0.303
United Kingdom	0.060	1.711	0.007	0.488	0.064
USA	0.004	0.048	-	0.294	-

Note: All variables pass the weak exogeneity test at the 5% significance level

Table 6.12 - Average pairwise cross-section correlations: variables and residuals

	Real Tourism Imports (*lnrtim*)			Real Tourism Exports (*lnrtex*)		
	Levels	First Differences	VECMX Residuals	Levels	First Differences	VECMX Residuals
Argentina	0.5302	0.1967	0.0403	0.5595	0.0539	-0.0064
Australia	0.6142	0.2988	0.0729	0.4261	0.1434	0.0216
Austria	-0.1624	0.0267	0.0248	0.0693	0.0804	0.0385
Brazil	0.5720	0.1115	0.0280	0.6508	0.0935	0.0282
Canada	0.5508	0.2313	0.0442	0.2451	0.2197	0.0279
China	0.6160	0.0687	0.0103	0.6394	0.1542	-0.0166
France	0.5109	0.0509	-0.0567	0.3231	0.1714	-0.0249
Germany	-0.0880	0.1407	0.0178	0.6584	0.1399	-0.0079
India	0.6449	0.1475	0.0110	0.6038	0.0726	0.0255
Italy	0.4284	0.1577	0.0402	-0.2965	0.1436	-0.0254
Japan	-0.5215	0.2265	0.0527	0.4394	-0.0170	-0.0557
Korea	0.6101	0.1432	0.0367	0.2474	0.1133	-0.0054
Malaysia	0.6306	-0.0012	-0.0115	0.6685	0.1748	-0.0272
Mexico	0.6474	0.1488	-0.0083	0.6461	0.1494	0.0139
Netherlands	-0.0499	0.0976	0.0586	0.5983	0.1584	0.0250
New Zealand	0.6279	0.1653	0.0074	0.5248	0.0390	0.0297
Norway	0.6126	0.1639	0.0364	0.4910	0.0373	0.0301
Portugal	0.5180	0.1428	-0.0103	0.6198	0.1419	0.0050
South Africa	0.6226	0.1251	0.0866	0.6465	0.0683	-0.0092
Spain	0.6533	0.2113	0.0405	0.6151	0.0902	0.0116
Sweden	0.4932	0.1891	0.0067	0.6038	0.0611	0.0540
Thailand	0.4932	0.1891	0.0434	0.6104	0.1158	0.0098
United Kingdom	0.6074	0.2085	0.0354	0.2647	0.1189	0.0061
USA	0.5623	0.3097	0.0292	0.4009	0.1511	-0.0382

Table 6.12 - Average pairwise cross-section correlations: variables and residuals (cont.)

	Real Income (*lny*)			Own price (*lnp*)		
	Levels	First Differences	VECMX Residuals	Levels	First Differences	VECMX Residuals
Argentina	-0.1957	0.0676	-0.0032	-0.3605	0.0752	0.0059
Australia	0.1864	0.3773	0.0842	0.8164	0.5700	0.0774
Austria	0.0916	0.3760	0.0493	0.8090	0.5983	0.0507
Brazil	-0.1166	0.1540	-0.0386	0.6345	0.3407	0.0016
Canada	0.3227	0.4681	0.1095	0.7933	0.4845	0.0471
China	0.0574	0.3010	-0.0308	0.7241	0.1784	-0.0284
France	0.0503	0.4943	0.0475	0.8037	0.6012	0.0347
Germany	-0.0916	0.4123	-0.1023	0.8039	0.5979	-0.0086
India	0.0341	0.1934	-0.0005	0.7749	0.4071	-0.0116
Italy	-0.0326	0.4235	0.0125	0.8074	0.5937	0.0168
Japan	-0.1157	0.3812	0.0261	0.5235	0.1199	-0.1138
Korea	0.1254	0.1972	0.0378	0.6864	0.3684	-0.0213
Malaysia	0.0747	0.2613	0.0483	0.6138	0.3163	-0.0066
Mexico	0.2594	0.1709	0.0216	0.4051	0.1223	-0.0252
Netherlands	0.1686	0.4576	0.0046	0.8030	0.5928	0.0358
New Zealand	0.2798	0.3527	0.0675	0.7987	0.5398	0.0565
Norway	0.1526	0.1890	0.0037	0.8061	0.5747	0.0544
Portugal	0.1195	0.3174	0.0156	0.8012	0.5938	0.0545
South Africa	0.0559	0.4314	0.0947	0.6939	0.4270	0.0084
Spain	0.3092	0.4103	0.0535	0.8071	0.5942	0.0413
Sweden	0.3200	0.3955	-0.0034	0.7735	0.5816	-0.0228
Thailand	-0.0621	0.1632	0.0268	0.7285	0.3427	0.0187
United Kingdom	0.2996	0.4642	-0.0098	0.6908	0.5308	-0.0698
USA	0.2923	0.4317	0.0536	0.6696	0.3289	0.0007

6.3.4 Diagnostic Tests

Diagnostic tests have been carried out onto the VECMX models' residuals. Table 6.10 presents the test results for serial correlation of the residuals. Each column is for the residuals from an endogenous variable's equation in the VECMX model. In most cases, the test is passed, meaning there is no serial correlation in most of the residuals.

Table 6.11 shows the test results for weak exogeneity, as has been described in Section 5.2.2. Passing the weak exogeneity test means that the foreign variables $\boldsymbol{x}_{it}^{*}$ in the country-specific VECMX models do not restore the long-run cointegrating relations that exist among domestic variables, foreign variables and global common variables. Hence there is no 'long-run forcing' from $\boldsymbol{x}_{it}$ to $\boldsymbol{x}_{it}^{*}$. The test is passed for all the cases reported in Table 6.11. It can be spotted that some of the cases are omitted, denoted as '-'. For Argentina, Australia, Canada, Japan, Portugal, and USA, the omitted values mean that the corresponding foreign variable has been deleted from the country-specific VECMX models, since a preliminary estimation suggested a violation of the weak exogeneity assumption. After taking out some foreign variables, both the first stage VECMX models and the second stage GVAR model improved on their performance. For France, India, New Zealand and Sweden, there are omitted values because no cointegrating relations are found in their VECMX model (see Table 6.8) and there is no need for weak exogeneity test to address the long-run forcing from $\boldsymbol{x}_{it}$ to $\boldsymbol{x}_{it}^{*}$.

Following Dees, Mauro, Pesaran, and Smith (2007), in addition to the serial correlation test and the weak exogeneity test discussed above, the average pairwise cross-section correlations are used to see if the VECMX models are satisfactory. Table 6.12 shows these correlations. They are essentially averaging the Pearson correlations between a particular country and any of the other 23 countries (similar to the 'average' row in Table 6.1). The idea behind Table 6.12 is to illustrate the effectiveness of foreign variables in accounting for cross-country correlations. Note that the column 'levels' indicates that, the endogenous variables for each country almost unanimously correlate with their counterparts of other countries. The values are generally above 0.50 for real tourism imports and real tourism exports, and even higher (more than 0.70) for own price. But for the VECMX residuals, such correlations are greatly reduced, thanks to the domestic variables, foreign variables and global common variables in the VECMX models to account for cross-country correlations. For all the four variables (*lnrtim*, *lnrtex*, *lny*, *lnp*), correlations of their VECMX residuals are in many cases below 0.05 (in absolute values).

All in all, the above tests and statistics confirm that the country-specific VECMX models are satisfactory.

6.4 Impulse Responses

Impulse response functions are well suited to track the evolution of economic fluctuations, and are highly relevant to business cycle studies. As discussed in Section 4.6.1, in the context of globalisation, business cycles are believed to exhibit convergence/synchronisation across countries. In the wake of a shock to China, a major emerging economy in the world, it is expected that other major countries experience certain degrees of fluctuations in their tourism trade. An advantage of impulse response analysis for tourim research is that it maps out the evolution of tourism variables after the shock. *If the pattern of impulse responses of different countries is similar, it implies that the business cycles across those countries are synchronised.* In addition, impulse response analysis is useful in illustrating how stable a country's economy is. If a country reacts strongly towards a shock, it means that local businesses in that country will face great uncertainty.

In the current research, the impulse response analysis is based on hypothetical scenarios related to changes of the Chinese economy. Specifically, it is presumed that the Chinese economy experienced a sudden slowdown in its real GDP; another presumption is that the Chinese currency experienced an unexpected depreciation, and as a result a slump in its own price. Accordingly in the GVAR model, two individual shocks are to be imposed: a negative exogenous shock to China's real GDP variable (*lny*) and a negative exogenous shock to China's own price variable (*lnp*). The impulse responses are calculated as described in Section 5.2.3. The results are reported in the Appendices, Figure A1 to Figure A8. Among them, Figure A3, Figure A4, Figure A7 and Figures A8 are the impulse responses of real tourism trade variables. These figures are relevant to tourism business practitioners to gauge how stable or how uncertain their native market will be in the face of shocks.

It should be reiterated that the shocks herein are hypothetical *unexpected* events. If the events were expected, economic variables might well be adjusted beforehand since economic agents (firms, consumers, and governments) could change their behaviour if given enough time[1]. Therefore, *impulse responses should not be seen as forecasts of an economy*. Forecasts are the expected future values of a variable based on current realistic information, which will be factored into the economic agents' decision in the current period. Impulse responses are based on counterfactual scenarios and focus on the reactions of an economy to unrealised exogenous changes.

In reporting the results from the GVAR model, an aggregation is applied to some countries, to form a bigger region. As such, *a 'region' in this chapter means a large area consisting of two or more countries, rather than a small part of a country.* The aim of the aggregation is to provide a succinct presentation of the impulse responses. The aggregation follows Table 5.2, creating such regions as South America, Asia, Europe and Oceania. But it should be noted that the results for China, Canada, Mexico, South Africa and the USA are individually reported. This is to highlight the importance of China and the USA. For Canada and Mexico, it is not coherent to combine them to form a single region of North America, in the absence of the USA. Hence, results for Canada and Mexico are not aggregated.

6.4.1 One Negative Shock to China's Real Income

The first counterfactual scenario is an exogenous negative shock to China's real income. Precisely, it is a negative shock equivalent to one standard deviation of the error term of China's real income equation in the GVAR model Eq. (5.18). This means a hypothetical situation where China was experiencing a sudden decline in real income due to exogenous reasons.

Macroeconomic variables (lny, lnp)

Figure A1 depicts the evolution of real income across countries/regions up to 40 quarters after the negative shock. For China, it results in an instant 2.7% decrease (i.e., -0.027) in the country's real income at the time of shock. But the decline starts to die out quickly, amounting to roughly 0.5% in the first two years (i.e., 8 quarters) and less than 0.4% thereafter in the long run.

[1] Of course, if the expectation is formed long before the event, the economic agents are able to adjust their optimal decisions. If the expectation is formed only well before the event, leaving the economic agents unable to make adjustments, then the event is indeed seen as unexpected.

For other countries/regions, the negative shock to China generates certain impacts on their real income. For the USA, the impact is about a 0.1% increase at the time of shock and tends to be much lower than 0.1% thereafter. For the rest of the countries/regions, the impacts can be a bit negative, especially in the first two years (i.e., 8 quarters). But in the long run, the impact is only a below 0.1% increase. An exception is Mexico, whose impulse response is more in sync with that of China, a less than 0.2% decline in the long run.

In terms of the own price (i.e., consumer price index adjusted by a country's exchange rates against US dollars), the impacts of the shock are evident, mainly a drop in price levels for all countries/regions in the short run as well as the long run. For China, its own price level will go down by roughly 1.9%. For Asia, Europe, South Africa and South America, the long-run impact is a decline by 1.1%, 1.9%, 2.7% and 2.3%, respectively. For Canada, Mexico, Oceania, and USA, the long-run price drop is less than 1%. These impulse responses are displayed in Figure A2. Synchronisation of the impulse responses across countries/regions is observable.

Real tourism imports (lnrtim)

The evolution of real tourism imports and that of real tourism exports after the shock to China's real income are shown in Figure A3 and Figure A4, respectively. Overall, the impacts mainly concentrate in the short run. Tourism trade is volatile across different countries/regions, especially in the first three years (i.e., 12 quarters) after the shock. However, the impacts may not necessarily last into the long run.

In the wake of a negative shock to real income, it is theoretically predicted that outbound tourism will retract. For China, its real tourism imports will experience a downward trend in the first two years (i.e., 8 quarters). This is in line with the finding above that China will see a sudden drop in its real income in the very short run. After 3 years (i.e., 12 quarters), China's real tourism imports will rebound, resulting in roughly a 1% increase in the long run (see Figure A3). This may be due to the finding that the own price of other countries/regions will witness varying degrees of declines in the long run (see Figure A2), whereas China's real income will not be much affected in the long run (see Figure A1). The lowering of own price in other countries/regions makes it conducive for Chinese going on outbound trips.

For other countries/regions, the impact of the shock tends to be discernible particularly in the short run (see Figure A3). For the USA, it will see a slight decrease in real tourism imports in the first year (i.e., 4 quarters) after the shock. The decrease becomes minor thereafter. From Figure A1 and Figure A2, both the real income and the own price of the USA are found not to be much affected by the shock to China. The real tourism imports of Canada, Europe, Mexico, Oceania and South Africa generally experience turbulences in the first four to eight quarters. The pattern basically follows that of China's impulse responses. In the long run, the real tourism imports of these countries can return to their equilibrium level, with roughly a less than 1% increase. For Asia, its impulse response follows that of China even more closely, seeing a short-run decline in real tourism imports, but over the long run a 1% increase. The much more affected area is South America, up to a 2% decline in real tourism imports in the long run after some ups and downs in the first six quarters. The reason could be that its own price has a 2.3% drop in the long run, and outbound tourism is substituted away for domestic tourism.

All in all, despite the different magnitudes of long-run impacts, the short-run fluctuations (especially in the first eight quarters) in tourism imports are generally in sync across countries/regions.

Real tourism exports (lnrtex)

Right after the shock to China's real income, the real tourism exports of many countries/regions suffer from a setback in the short run. For China, its real tourism exports will be much volatile in the first two years (i.e., 8 quarters), but the long-run trend is towards a 2.5% increase (see Figure A4). This could be explained by the finding that China's own price level will drop by 1.9% in the long run after the shock, facilitating China's inbound tourism to attract overseas visitors.

Other countries/regions that also see certain long-run increase in real tourism exports are South Africa (1.0%) and South America (1.7%), both of which also experience evident own price drops (see Figure A2). For the rest of the countries/regions, i.e., Asia, Europe, Mexico, Oceania and the USA, their real tourism exports have notable fluctuations in the first two years (i.e., 8 quarters), but tend to restore equilibrium in the long run. Both Oceania and the USA will see a 0.3% drop in real tourism exports, as their own price drops are among the least across countries/regions (see Figure A2).

Asia, Europe and Mexico will see an increase by 0.2% - 0.8% in the long run. For Canada, the changes of its real tourism exports are quite stable no matter whether in the short run or the long run, around a 0.5% increase.

Summary of findings

A negative shock to China's real income (*lny*) (2.7% at the exact quarter of shock) has relatively limited impact on the real income (*lny*) across all the countries/regions. But in the long run, the impact is evident on the own price level (*lnp*) of almost all countries/regions (particularly China, Asia, Europe, South Africa and South America). In the meantime, China's real tourism imports (*lnrtim*) and real tourism exports (*lnrtex*) suffer from a temporary decline in the first two years (i.e., 8 quarters), but rebound and even increase in the long run. For tourism businesses in China, it is important to take short-run measures, such as cutting labour costs and increasing marketing activities, in order to counter the decline in tourism demand. The tourism trade (*lnrtim, lnrtex*) of other countries/regions tends to be affected basically in the first one to two years (i.e., 4 – 8 quarters). In the long run, a notable example is South America, whose real tourism imports (*lnrtim*) will go down and whose real tourism exports (*lnrtex*) will rise. This should encourage local businesses in South America to engage in catering to domestic tourists as well as overseas tourists. Synchronisation of fluctuations across countries can be observed for the own price (*lnp*) constantly, and for the real tourism imports (*lnrtim*) in the short run. Table 6.13 provides a brief summary.

Table 6.13 - Brief summary of the findings

A negative shock to China's real income		
	Short run (<5 years)	Long run (5-10years)
Real income		China: -0.4%; Mexico: -0.2%
Own price	synchronised fluctuations	China: -1.9%; Asia: -1.1%; Europe: -1.9%; South Africa: -2.7%; South America: -2.3%
Real tourism imports	synchronised fluctuations	China: 1%; Asia: 1%; South America: -2%
Real tourism exports	Asia, Europe, Mexico, Oceania, USA: fluctuations in the first two years	China: 2.5%; South Africa: 1%; South America: 1.7%

6.4.2 One Negative Shock to China's Own Price

The other counterfactual scenario is an exogenous negative shock to China's own price. It is hypothesised to be resulting from a sudden depreciation of the Chinese currency. Since exchange rate is a component in calculating the own price, the negative shock is implemented on the error term of China's own price equation in the GVAR model Eq. (5.18). Its magnitude is one standard deviation of the error term.

In reality, the recent development of China's currency and its consumer prices (both elements to calculate own price) is uncertain, thus either a negative shock or a positive shock to China's own price could be speculated. Although the following discussions are solely related to the consequences of a negative shock, the impulse responses under a positive shock setting practically remain identical, with only an opposite sign imposed on the numbers (i.e., '+' becomes '-', and *vice versa*).

Macroeconomic variables (lny, lnp)

Figure A6 shows the development of own price level across countries/regions after the negative shock to China. Specifically, the shock will immediately result in a decline in China's own price by about 2.0% at the exact quarter of shock. This is similar to a 2.0% deflation in US dollar terms for China. Such deflation is rather persistent in the long run, slightly above 1.0% even after 40 quarters.

Own price level in other countries/regions tends to decrease as well, and falls down after the shock in the short run and the long run. The impact on USA's own price level is relatively small, a decline by below 0.5% in the first year (i.e., 4 quarters) and by slightly above 0.1% in the long run. For Asia, Canada, Europe, Mexico, Oceania and South America, their own price level will experience disturbances mainly in the first quarter, by about -2%. Then the impact on own price quickly diminishes within the first two years (i.e., 8 quarters) after the shock, resulting in a drop by 0.2%-0.8% for these countries/regions in the long run. An exception is Oceania, which will see a price increase by roughly 0.5%. The only country that will witness a deeper long-run impact on its own price is South Africa. It will have a decline in own price by approximately 1.5%. In general, co-movements of the impulse responses are present across countries/regions.

In terms of real income (see Figure A5), the shock tends not to create much impact, no matter whether in the short run or the long run. For China, Asia, Mexico and South America, the long-run impact on their real income is negative, at -0.1% for China and far smaller than -0.1% for the others. For Canada, Oceania, South Africa and the USA, the long-run impact is positive, at 0.2% for Oceania and again far smaller than 0.1% for the rest. For Europe, the shock is hardly felt in terms of real income and the impact is almost zero. It is, however, difficult to provide definitive explanations as to how real income should react in the long run alongside a relatively mild drop in the price level. After all, changes in the price level have implications on the wages of labour (hence their disposable income), the private and government consumptions, the cost of capital investments, the expenses of technological developments, and net exports, all of which may contribute to a new market clearing level of real income in the long run. Hence, the real income level across countries/regions may well react to the shock differently in the long run.

Real tourism imports (lnrtim)

The shock to China's own price generally has mild impacts on real tourism imports across countries/regions. Figure A7 illustrates the impulse responses. For China, its real tourism imports will experience some downward pressure, declining by 2.1% at the time of shock. Thereafter, the decline becomes stable, at around 1% in the long run. This could be associated with a similar pattern of impulse responses in China's own price (see Figure A6). As discussed above, China's own price level will have a roughly 1.0% drop in the long run, while the own price of other countries/regions (i.e., the potential outbound destinations) is only slightly changed. Hence, there could be a small decline in China's outbound tourism, in favour of domestic tourism instead.

For the other countries/regions, their real tourism imports are mildly affected. In the long run. Asia, Oceania and USA will see slight decline in terms of their outbound tourism, at 0.97%, 0.59% and 0.59% respectively after 40 quarters. For Canada, Europe, Mexico and South Africa, the changes in real tourism imports mainly take place in the first year (i.e., 4 quarters) after the shock. Thereafter, the impact is a relatively small increase in real tourism imports, at roughly 0.2% or even much lower. The only region that may see a large long-lasting impact is South America. Its real tourism imports are expected to go down by 1.6% in the long run, a likely reaction to the decline in both its real income (less budget to spend) and its own price level (cheaper for domestic trips).

Real tourism exports (lnrtex)

Similar to real tourism imports, by and large the real tourism exports do not suffer extensively from the shock to China's own price. Figure A8 outlines the impulse responses across countries/regions. For China, its real tourism exports will experience some ups and downs in the first year (i.e., 4 quarters), roughly 2%-3% in absolute values. Thereafter, China's real tourism exports will decline by about 0.2% in the long run. The reason behind such decline is not obvious. As discussed above, China's own price will have a long-term drop at around 1%-2%. In the meantime, the own price level of most other countries/regions will see a smaller decline (by about 1%) in the short run. Hence, the pattern of China's real tourism exports suggests that, China is not particularly effective in taking advantage of the own price drop in order to entice inbound tourists. As will be discussed immediately, some other countries/regions will see a long-run increase in their real tourism exports. These are the countries/regions that are more successful than China in attracting international tourists.

A long-run drop in real tourism exports is seen in Asia, Oceania and USA, at about 0.5%, 0.9% and 0.7% respectively. For Canada and Europe, their real tourism exports are generally calm and stable in both the short run and the long run, with an increase by 0.03% and 0.08% after 40 quarters. In comparison, the real tourism exports of Mexico, South Africa and South America are more volatile in the first year (i.e., 4 quarters) after the shock. Fluctuations can be up to ±3% during this period. In the long run, the impact on real tourism exports is roughly a 0.3%-0.6% increase. In the short run, certain level of synchronisation can be widely spotted between Canada, China, Europe, Mexico and South America.

Summary of findings

Overall, the impacts of a shock to China's own price level (*lnp*) are smaller than those of a shock to China's real income (*lny*). The real income (*lny*) across countries/regions is only slightly changed, irrespective of the horizon. The changes in own price level (*lnp*) are particularly evident in the first two years for most of the countries/regions. In the long run, only China and South Africa will see noticeable decline in their own prices (*lnp*). In terms of tourism trade (*lnrtim*, *lnrtex*), China will see long-lasting contraction in both tourism imports (-1%) and tourism exports (-0.2%). So travel agents arranging overseas trips for Chinese tourists have to make effort to counter the decline of outgoing tourism demand in the long run. The other countries/regions will however experience fluctuations in the very short run. An exception is South America, whose real tourism imports (*lnrtim*) will decrease even in the long run. Synchronisation of fluctuations are widely observed across most countries/regions for own price level (*lnp*) and real tourism exports (*lnrtex*). Table 6.14 presents a brief summary.

Table 6.14 - Brief summary of the findings

A negative shock to China's own price		
	Short run (<5 years)	Long run (5-10 years)
Real income		China: -0.1%; Oceania: 0.2%
Own price	synchronised fluctuations	China: -1%; South Africa: -1.5%
Real tourism imports	Canada, Europe, Mexico, South Africa: slight fluctuations in the first year	China: -1%; Asia: -0.97%; Oceania: 0.59%; South America: -1.6%; USA: 0.59%
Real tourism exports	synchronised fluctuations	China: -0.2%; Asia: -0.5%; Mexico: 0.3%; Oceania: -0.9%; South Africa: 0.7%; South America: 0.5%; USA: -0.7%

6.5 Further Discussions

One evidence the current research intends to seek is whether and by how much an economy is influenced by its external world. The contemporaneous impact elasticities reported in Table 6.9 quantify such influence in the form of percentage changes in economic performance. At the macro level, this information is vital to understand the *intensity* of global interconnectedness, one of the four 'spatio-temporal dimensions of globalisation' introduced in Section 4.2.

The patterns shown in Table 6.9 in Section 6.3.2 confirm that all the 24 major countries are to a certain extent dependent on each other, since each of them has at least one variable (either macroeconomic or tourism trade) significantly co-moving with their foreign counterparts. Macroeconomic variables, namely real income and own price, are the main channels for interdependencies, because their contemporaneous impact elasticities[1] tend to be higher than those of tourism trade

[1] Remember that, the contemporaneous impact elasticity denotes the percentage change of a country-specific variable in response to 1% change of its foreign counterpart variable (the one with *). For

variables. The magnitude of elasticities for macroeconomic variables generally stands at between 0.9-1.5, quite elastic. The interdependencies between tourism trade variables are admittedly less impressive. Still, over half of the 24 countries see their inbound or outbound tourism demand co-move with their foreign counterparts, though the magnitude of elasticities usually falls in between 0.5-0.8, only moderate and not so elastic. As suggested in Section 6.3.2, this is possibly because tourism demand is also affected by country-specific non-economic factors, which render a country's tourism demand less susceptible to external economic changes alone.

Another pattern from Table 6.9 that might be of interest is whether there is a divide between countries in terms of their magnitude of contemporaneous impact elasticities. One divide could be *emerging economies* versus *developed economies*. However, the pattern is not very outstanding. The magnitude of contemporaneous impact elasticities, if statistically significant, is not higher for developed economies than for emerging economies, nor the other way round. The only pattern, as hinted in Section 6.3.2, is that European countries tend to have more variables associated with statistically significant contemporaneous impact elasticities. This may be explained by the fact that, of the 24 countries in the current research, ten are European countries, which are well connected to each other economically.

If the contemporaneous impact elasticities in Table 6.9 take care of the *intensity* dimension of globalisation, then the impulse response analysis in Section 6.4 is an attempt to assess the *impact* propensity of global interconnectedness, another 'spatio-temporal dimension of globalisation' (see Section 4.2). The impulse responses illustrate the developments of different variables across a number of major countries in the wake of shocks. China, as an important emerging economy, is chosen to be where the shocks originate. The shocks are expected to have global impacts.

Table 6.13 and Table 6.14 summarise the findings from the impulse response analysis. Between the two negative shocks, a shock to China's real income tends to have deeper impacts on other countries/regions. The long-run changes of a country's/region's variables (real income, own price, real tourism imports, and real tourism exports) are rougly 2%-3% (in absolute values). But a shock to China's own

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example, how many percentage China's *real income* will change, if the weighted average of other countries' *real income* rises up by 1%.

price tends to create wider impacts in terms of geography. More countries/regions are affected even in the long run.

Between the variables, the real income level across countries/regions is the least to be affected by either shock. The own price level across countries/regions will, however, experience changes in both the short run and the long run. For the real tourism imports and real tourism exports, short-run flucutations are widely observed after either shock, and in the long run many countries/regions still see a slight decline.

Between the countries/regions, the developed countries/regions, such as Europe, Canada and the USA, are generally affected only in the short run. Synchronised fluctuations in terms of own price level and real tourism demand are found after both shocks. However, in the long run basically it is the developing countries/regions (such as South Africa and South America) that suffer from continuous impacts. This finding to some extent resonates with that of Kose, Otrok, and Prasad (2012), who find a substantial convergence of business cycles among emerging market economies alongside a convergence among industrial economies. Asia, the region where China situates and can be seen as a short-haul market to China, is also among the regions that see long-run impacts by the shocks. As shown in Table 4.2 and Table 4.3, China interacts intensively with the other Asian countries in terms of tourism trade.

Overall, Table 6.13 and Table 6.14 (together with the impulse responses charts Figure A1 to Figure A8) provide another evidence of interdependencies between tourism countries. That is, in the short run, the fluctuations of own price variable and tourism trade variables across major countries in the world are somewhat in sync; but of course, in the long run, China's unexpected economic changes tend to have persistent influence over other developing countries and those that are geographically close to China, rather than developed countries in the West.

Admittedly, the estimation results from the GVAR approach outline only part of the temporal-spatial dimensions of globalisation. Nevertheless, from an economic perspective, the above evidence is able to demonstrate that, rather than a perfectly interconnected world where all economies co-move strongly, the economy and the international tourism sector of major countries experience synchronised movements mainly in the short run. But in the long run, the tendency becomes evident that the countries in similar stage of development (developing countries) and in proximate region are more in sync.

6.6 Practical Implications

Modelling the interdependencies between tourism demand provides information about the reaction of a country's international tourism sector towards changes in other countries. From a practical point of view, the *economic performance* of a country's international tourism sector, *in terms of tourism imports and tourism exports*, is inevitabley influenced by the country's external economic climate. In the same vein, at the micro level, the financial performance of tourism businesses is reliant on the macroeconomic climate both at home and abroad.

The GVAR model quantifies the impacts of external influence, in the form of *contemporaneous impact elasticities* and *impulse responses* towards exogenous shocks. This quantitative information is particularly relevant to macroeconomic analysis for tourism authorities as well as multi-national corporations in tourism and hospitality, especially when they are developing business strategy and making decisions about procurement and employment.

6.6.1 Use of the Results

With regard to the contemporaneous impact elasticities reported in Table 6.9, the higher the values are, the deeper a country's intenraiotnal tourism sector is integrated with the world and hence the more vulnerable to external changes. For a country where international tourism is a major industry, higher elasticity values mean that the country will face higher uncertainty (due to fluctuations) of its economic performance in times of turbulence. Such uncertainty is a double-edged sword. On the one hand, it means a higher growth opportunity for the countries with higher elasticities than for those with lower elasticities, if the world is experiencing advances (for example, technological progress). On the other hand, it means deeper recession for the particular country, if adverse events (for example, economic crisis, political unrests) take place around the world. For a country with lower elasticities, it can expect a relatively stable economic performance in its international tourism sector.

Hence, to some extent the contemporaneous impact elasticities reflect the competitiveness of a country's international tourism sector. An ideally-managed destination should aim to adjust its tourism sector between low elasticities and high elasticities across different stages of business cycle, such that in times of adversity it is less vulnerable (low elasticities), but in times of booming it can capture high economic yield (high elasticities).

At the corporate level, tourism businesses can use the contemporaneous impact elasticities as general indicators of variability of their local economies, when they are planning their future activities such as procurement and employment. For example, in Table 6.9, column Real Tourism Exports, the impact elasticities for France and Italy are 0.752 and 0.841 respectively, while for Portugal and Spain 0.548 and 0.373. These stastistics mean that if the overall inbound tourism around the world increases by 1%, then the inbound tourism of France and Italy will increase by a larger degree than Portugal and Spain will. As a result, tourism-related companies in France and Italy generally face a more variable inbound tourism demand time and time again, which in turn requires the companies to make better coordination with their suppliers and make better employment plan.

The impulse responses reported in Figure A1 to Figure A8 of the Appendices show how the performance of a country's international tourism sector will evolve, in the wake of exogenous and unexpected events in other parts of the world. Specifically, after the shocks to China, short-run synchronised fluctuations are observed across both developing countries and developed countries, whereas long-run impacts are evident for developing countries and for China's short-haul markets. Hence, for other developing countries and the Asian countries, the development of the Chinese economy is particularly relevant to maintaining stability in their international tourism sector as well as their local economies. For developed countries, although no long-run impacts are expected, the short-run fluctuations resulting from a shock to China may not be desirable to tourism businesses.

Indeed, businesses in both developing countries and developed countries can make use of the information on the *timefrome* after which their local economies restore equilibrium. For example, if a country's real tourism exports are expected to face fluctuations in the first two years (i.e.,8 quarters) after a shock to China, it is necessary for the local businesses (tourism-related companies) to allow for sufficient flexibility in their production (e.g., flexibility in employment arrangement) to cope with the fluctuations of inbound tourism demand for a two-year period. Such flexibility should be factored into the companies' business strategies.

It should be noted that, impulse responses are essentially different from the forecasts in many tourism demand studies. On the one hand, tourism demand forecasts assume that the historical trends of variables can be maintained, and future values of tourism demand are only continuations of existing trends. On the other hand, impulse responses assume a sudden change to historical trends, and such 'new information' will be embedded in 'future' values. Given that the timing of shocks cannot be known beforehand, the impulse response analysis only provides counterfactual scenarios, rather than realistic forecasts. Nevertheless, based on the impulse responses, tourism businesses can establish contingency plans under the counterfactual scenarios.

In short, it is not appropriate to compare the impulse responses with any tourism demand forecasts published in other studies. *The impulse responses are useful to gauge how well or how badly a country copes with uncertainty.* Apparently, with the GVAR model, any other shocks (i.e., other counterfactual scenarios) can also be considered for impulse response analysis.

6.6.2 Implications for the Major Countries

Based on the above discussions, country/region-specific implications are drawn as follows. It should be reiterated that China and the USA are reported as individual countries for the impulse response analysis in Section 6.4. Hence, both countries continue to be discussed individually in this current section.

China

China's real income and own price are mildly affected by its foreign counterparts, but its tourism trade is not significantly affected. These results suggest that the Chinese economy (including its internatioan tourism sector) should be rather stable, in the wake of external turbulences. But facing the negative shocks to its own economy (real income and own price level), China is expected to suffer from some short-run fluctuations as well as long-run impacts. Tourism businesses should be prepared for considerable ups and downs during the first two years after a shock. Thereafter, tourism businesses continue to face a change in the level of tourism imports and tourism exports, which should be factored into their long-term business strategies.

Asia

The other countries in Asia (especially India and Thailand) tend to have higher contemporaneous impact elasticities than China does, indicating their higher levels of dependency on external environment. Seen as a neighbouring area to China, Asia is expected to witness notable changes after the shocks to the Chinese economy. The first two years are important to tourism businesses in the Asian countries because of the fluctuations in international tourism demand, especially after a shock to China's real income. As with their Chinese counterparts, tourism businesses in other Asian countries should expect long-lasting changes in the level of tourism imports and tourism exports.

Europe

European countries generally have more contemporaneous impact elasticities that are significant and elastic than other countries, meaning that their economies could face high volatility if the external environment changes. As analysed in the previous sections, this pattern might be due to the fact that many European countries are chosen in the GVAR model and they are well interconnected to each other. Seen as a long-haul market to China, Europe appears to cope with the shocks in China fairly well. For tourism businesses, the window of uncertainty is the first one to two years after the shocks, during which small fluctuations can be observed. In the long-run, the impacts are not so noticeable.

Oceania

Both Australia and New Zealand's tourism trades are not very sensitive to external changes, according to their contemporaneous impact elasticities. But New Zealand's macroeconomic variables are quite elastic. Though still within the Asia-Pacific area, both Australia and New Zealand are a bit farther away from China than most of the Asian countries are. The impacts of shocks in China tend not to be long-lived, with the first two years (especially after the one to China's real income) being a bit volatile for tourism businesses in Oceania.

South Africa

Real income and especially own price are two main channels through which South Africa is affected by its external environment, whereas its tourism trade is inelastic. The negative shocks in China result in moderate fluctuations for South Africa's tourism trade in the first one to two years. In the long run, since the own price level in South Africa is going to drop remarkably, the level of tourim exports is expected to rise quite noticeably.

South America

Compared with other countries, Argentina and Brazil are evidently dependent on the external world. But the magnitude of the contemporaneous impact elasticities is average compared to other countries/regions. In response to the shocks in China, tourism businesses in South America should be warned against strong fluctuations in international tourism demand especially in the first year. Thereafter, tourism businesses should be aware of some long-run changes in tourism trade. Under the two shocks discussed in Section 6.4, South America generally sees an increase in tourism exports along with a decrease in tourism imports. As explained, this pattern could be due to the fact that the own price level falls down in the long run, making the region price-wise particularly attractive to incoming tourists.

North America: Canada

Only the contemporaneous impact elasticity of real tourism imports is measured for Canada. It is statistically significant, but not elastic. Compared with all other countries studied, Canada is the least affected by the shocks in China. Short-run fluctuations of Canada's tourism trade is observed mainly in the first two years after the shocks.

North America: Mexico

The real income of Mexico is greatly influenced by external changes. Hence, a shock to China's real income causes quite noticeable short-run fluctuations in Mexico's real income. Overall, in the wake of shocks in China, tourism businesses in Mexico should pay more attention to short-run changes in international tourism demand during the first two years. In the long-run, the international tourism demand is not going to change dramatically.

North America: USA

The contemporaneous impact elasticites of the USA are not very high, even though they are found statistically significant. Economically, the USA is more likely to exert influence over other countries, while it is not necessarily affected by its external environment to a great extent. A shock to China's real income causes remarkable flucations in the USA's tourism trade especially in the first year. But in the long run, tourism trade does not change that much. In comparison, a shock to China's own price has quite consistent impacts on the USA's tourism trade. Tourism businesses should expect small changes in the level of tourism demand right after this shock.

6.7 Conclusion

Overall, the GVAR model is satisfactory in terms of passing the diagnostic tests and generating credible empirical results. Particularly, the core assumption of weak exogeneity is met in the country-specific VECMX models.

Correlations of tourism imports and those of tourism exports are found across countries, implying the presence of interdependencies. The GVAR model provides a rigorous framework to quantify such relations.

Contemporaneous impact elasticities are thus derived to measure how much a country will change in reaction to changes in foreign countries. It is confirmed that all of the 24 major countries sampled in the current research, to various extents, see their international tourism demand as well as their local economies integrated with their foreign counterparts.

In addition, impulse responses are simulated to see how negative shocks to China's economy will result in changes in other countries' international tourism demand as well as their local economies. Generally speaking, the shocks will cause short-run fluctuations in own price level and real tourism trade (imports and exports) across both developing countries and developed countries. But in the long run, the impacts are more likely to remain for developing countries plus China's neighbouring countries, rather than for developed countries in the West.

The above results justify the importance for tourism businesses and policy makers to be vigilant to events in other parts of the world, since businesses are now operating in an interdependent environment.

Chapter 7. Conclusions

7.1 Introduction

This current research identifies some research gaps and proposes adopting a new modelling approach to study international tourism demand. In brief, the new approach has generated satisfactory estimation results and is able to answer the research questions set out at the beginning of the research. Practical implications are drawn in relation to how tourism policy makers and business practitioners can make use of the empirical results.

The following sections summarise the main findings from previous chapters, with a view to articulating the theoretical and practical contributions of the current research. Furthermore, the limitations of the GVAR approach are discussed. To conclude the current research, future research directions are identified.

7.2 Summary of the Findings

The current research is set out to study economic interdependencies of international tourism demand across major countries in the world. Globalisation provides the backdrop to understand the research questions.

Through literature review, it is found that there is a gap between the capabilities of existing tourism demand models and the current economic reality. Economic activities of different countries are increasingly interconnected. In the international tourism sector, tourism destinations are not only affected by the economic fluctuations in their inbound tourists' home countries, but also play a role in transmitting the business cycles to other countries. As a result, co-movements of business cycles of international tourism demand are expected to be observed, an example being the recent global recession in 2008-2009. In such a globalising setting, gauging the impacts of shocks in a major country, such as China, is of particular relevance to tourism businesses in any other countries. However, the independent nature of cross-country relations has not been properly accounted for in most of existing tourism demand models.

In order to fill this research gap, the current research develops a tourism demand model using an innovative approach, called the global vector autoregressive (GVAR) approach. The current research considers tourism trade, i.e., tourism imports and tourism exports, as the measure of tourism demand. Two economic factors, namely a country's real income and a country's own price (i.e., exchange-rate-adjused consumer price index), are identified as the determinants of international tourism demand, and these two factors also exhibit cross-country linkages. The oil price is regarded as an observable global common factor that influences the internatioan tourism demand across countries.

Overall, the GVAR approach has generated satisfactory estimation results, from the standpoint of statistical significance and diagnostic test results. Results show that all the 24 major countries, to different extents, see their tourism trade as well as their local economies move alongside their foreign counterparts. Besides, impulse responses are simulated to see how negative shocks to the Chinese economy will affect other countries. It is found that synchronised short-run fluctuations of the own price and of the real tourism trade across almost all the 24 countries are observed. But in the long run, the impacts tend to be deeper for developing countries as well as China's neighbouring countries, than for developed countries in the West.

In meeting the research objectives, the current research attempts to contribute to the knowledge on tourism demand on both the theoretical front and the practical front:

1. It studies the endogeneity issue in tourism demand models and interprets the issue in a practical context;
2. It reviews the economic interdependencies of tourism demand across different countries, and it provides an outline for studying economic globalisation in the context of tourism;
3. It developes a tourism demand model based on an innovative approach, which is able to overcome the endogeneity issue;
4. The empirical results are helpful to measure the intensity and the impact propensity of economic interdependencies;
5. The empirical results are useful for tourism policy makers and business practitioners in different countries when they conduct macroeconomic analysis.

7.3 Limitations of the Current Research

As with any other studies, the current research is not exempt from limitations. They are down to the data quality and are also inherent to the model, which albeit is a new approach but still requires further developments:

1. There could be more countries in the data set. The more countries included, the more representive the data set becomes. One solution is to aggregate all the countries that are not listed in the data set as an imaginary country called 'Rest of the World (ROW)'. However, this solution is vulnerable. For example, calculating the total exports of ROW means all the intra-regional exports and imports have to be cancelled out, leaving in only the trade with the countries outside ROW. This is a cumbersome process, and it faces a great unavailability of bilateral trade data. Hence, a fundamental issue remains that the availability of data varies greatly across countries and over time. A tradeoff has to be made between the number of countries and the amount of available data.
2. The econometric model used in the current research only explicitly considers economic factors. The model basically is only capable of accounting for the economic aspects of interdependencies, since it is understandably very difficult and not practical to quantify non-economic factors. Essentially, other studies using econometric methods encounter similar limitations. The current research manages to study the economic aspects of interdepencies in a coherent manner, as the theories underlying the research topic are systematically reviewed, and the econometric model is constructed in line with economic theories as well as previous empirical evidence. In addition, with regard to the model, while it is sensible to argue that economic factors are interdependent across countries, it might not be reasonable to justify that non-economic factors will also co-move in a short- to medium-term period. Hence, it is not appropriate to include both economic factors and non-economic factors within the same econometric model, even if there were some ways to measure the non-economic factors in numerical terms. The non-economic aspects of interdependencies may be better studied on a relatively qualitative basis, which deserve to be a separate research.
3. The empirical results concern about each country's overall tourism trade, without further splits into their trading partners. For example, after a shock, China's total outbound tourism is expected to increase by 1% in the long run. There is no information about how this increase will be distributed across the destinations. This limitation is down to the use of a country's overall tourism trade figures, rather than bilateral tourism figures. The model itself does not

necessarily measure the co-movements between specific origin-destination pairs. For n countries, there will be $n \cdot (n\text{-}1)$ pairs; for 24 countries, there will be 552 pairs. It is not viable to model them altogether. Nevertheless, the model works well with the overall trade figures, and the endogeneity between these figures are well accounted for.

All in all, the current research faces issues that could also arise in other econometric models, basically due to the unavailability of data and the choice of specific variables. While the latter might be (partly) accommodated through using other types of models, the former is somewhat at the mercy of data producers.

7.4 Recommendations for Future Research

The current research is an initial attempt to approach a topic using a rigorous, quantitative method. Future research on interdependencies can aim to explore further developments of the GVAR approach, and/or in new contexts:

1. The GVAR approach can be applied to different sample periods. The results such as contemporaneous impact elasticities can then be compared across different periods. Implications can be drawn with regard to the evolution of interdependencies over time. This reflects the idea that the degree of globalisation is changing, as presented in Section 4.2. Although such an idea may not prove to be correct, attempts to map out the different levels of interdependencies over time will be helpful for theoretical discussions. A major consideration is the length of sample period, which has to be sufficiently long. Gathering sufficient data may be a pressure.
2. The GVAR approach may be used in conjunction with other econometric techniques, such as time-varying-parameters (TVP) and Bayesian statistics. The idea of TVP is similar to the first recommendation, which is to capture the variations of elasticities over time. Bayesian VAR is an increasingly popular model that provides an alternative way to deal with the overfitting issue. The GVAR approach can be further developed with the 'new' techniques. New dimensions will be brought into the estimation process. Hence, additional information can be drawn accordingly.
3. The GVAR approach is also fit for other contexts. Even though it was initially intended for modelling global interdependencies, the approach may be applied

to a regional context that consists of active intra-regional tourism, such as the European Union, China and the USA; it may also be applied to explore the interdependencies between tourism and other sectors in an economy.

The value of GVAR approach is that it clears one important issue in existing tourism demand models, and hence allows for many new opportunities for tourism economics research.

Appendices

Table A1 - Cointegrating vectors of the country-specific VECMX models

		Argentina	Australia	Austria	Brazil	Canada
		CV1	CV1	CV1	CV1	CV1
ALPHA						
Real Tourism Imports	*(lnrtim)*	-0.174	0.023	-0.185	-0.413	-0.171
Real Tourism Exports	*(lnrtex)*	-0.352	0.183	-0.031	0.416	-0.153
Real Income	*(lny)*	0.022	-0.018	0.043	0.014	0.005
Own price	*(lnp)*	0.295	-0.128	-0.008	-0.193	-0.048
Oil Price	(lnp_{oil})					
BETA						
Trend	*(Trend)*	-0.039	-0.061	0.001	-0.012	-0.013
Real Tourism Imports	*(lnrtim)*	1.000	1.000	1.000	1.000	1.000
Real Tourism Exports	*(lnrtex)*	1.154	-0.408	-0.155	-0.036	2.691
Real Income	*(lny)*	-0.617	10.409	-14.500	-2.660	-1.383
Own price	*(lnp)*	0.977	0.097	-0.553	0.142	0.972
Foreign Tourism Imports	$(lnrtim^{*})$		0.406	-1.221	1.759	-1.815
Foreign Tourism Exports	$(lnrtex^{*})$	0.253	-0.054	1.677	-0.390	
Foreign Real Income	(lny^{*})	-3.078		11.939	-3.613	
Foreign Prices	(lnp^{*})	-1.895		1.265	0.185	
Oil Price	(lnp_{oil})	0.140	0.721	-0.163	-0.471	-0.062

Table A1 - Cointegrating vectors of the country-specific VECMX models (cont.)

		China	China	Germany	Italy	Japan
		CV1	CV2	CV1	CV1	CV1
ALPHA						
Real Tourism Imports	*(lnrtim)*	-0.394	0.367	-0.371	0.094	-0.715
Real Tourism Exports	*(lnrtex)*	0.038	-0.089	-0.491	0.198	-0.587
Real Income	*(lny)*	-0.030	0.031	-0.034	0.016	0.021
Own price	*(lnp)*	-0.011	0.032	0.151	0.013	0.084
Oil Price	(lnp_{oil})					
BETA						
Trend	*(Trend)*	-0.482	-0.395	0.001	-0.043	-0.054
Real Tourism Imports	*(lnrtim)*	1.000	0.000	1.000	1.000	1.000
Real Tourism Exports	*(lnrtex)*	0.000	1.000	0.770	-4.433	0.078
Real Income	*(lny)*	28.688	24.691	1.304	-0.989	-8.016
Own price	*(lnp)*	-7.228	-6.293	0.189	-6.514	-0.564
Foreign Tourism Imports	$(lnrtim^*)$	1.090	-1.448	-0.080	0.052	
Foreign Tourism Exports	$(lnrtex^*)$	-1.538	-1.645	0.042	4.755	
Foreign Real Income	(lny^*)	12.802	18.429	-5.205	-5.531	7.769
Foreign Prices	(lnp^*)	0.544	0.869	0.028	8.153	-0.293
Oil Price	(lnp_{oil})	0.989	0.747	-0.046	-0.115	0.099

Table A1 - Cointegrating vectors of the country-specific VECMX models (cont.)

		Korea	Malaysia	Malaysia	Mexico	Netherlands
		CV1	CV1	CV2	CV1	CV1
ALPHA						
Real Tourism Imports	*(lnrtim)*	-0.079	-0.142	-0.001	0.089	-0.188
Real Tourism Exports	*(lnrtex)*	-0.121	0.797	-0.613	0.225	0.303
Real Income	*(lny)*	-0.008	-0.026	0.031	0.173	-0.001
Own price	*(lnp)*	-0.020	0.094	-0.042	-0.101	-0.036
Oil Price	(lnp_{oil})					
BETA						
Trend	*(Trend)*	-0.073	0.009	0.020	-0.039	0.015
Real Tourism Imports	*(lnrtim)*	1.000	1.000	0.000	1.000	1.000
Real Tourism Exports	*(lnrtex)*	3.205	0.000	1.000	-0.913	-1.593
Real Income	*(lny)*	5.766	-6.787	-11.407	-7.756	-3.516
Own price	*(lnp)*	5.699	1.521	3.158	0.824	2.292
Foreign Tourism Imports	$(lnrtim^*)$	-4.192			-0.158	-2.321
Foreign Tourism Exports	$(lnrtex^*)$	2.248			0.747	1.382
Foreign Real Income	(lny^*)	2.011	-12.818	-16.622	8.763	10.066
Foreign Prices	(lnp^*)	-2.655	1.675	2.801	4.567	-3.465
Oil Price	(lnp_{oil})	-0.711	-0.017	-0.251	-0.022	0.193

Table A1 - Cointegrating vectors of the country-specific VECMX models (cont.)

		Norway	Portugal	Portugal	South Africa	Spain
		CV1	CV1	CV2	CV1	CV1
ALPHA						
Real Tourism Imports	*(lnrtim)*	0.026	-0.133	0.200	-0.676	-0.160
Real Tourism Exports	*(lnrtex)*	0.060	0.201	-0.365	-0.479	0.087
Real Income	*(lny)*	0.007	0.059	0.012	-0.011	0.057
Own price	*(lnp)*	0.001	0.074	-0.309	0.095	0.046
Oil Price	(lnp_{oil})					
BETA						
Trend	*(Trend)*	-0.001	-0.009	-0.020	-0.023	-0.003
Real Tourism Imports	*(lnrtim)*	1.000	1.000	0.000	1.000	1.000
Real Tourism Exports	*(lnrtex)*	-14.836	0.000	1.000	0.218	-0.547
Real Income	*(lny)*	-54.113	-2.148	-0.033	1.118	-4.067
Own price	*(lnp)*	-15.690	-0.127	0.523	0.602	2.104
Foreign Tourism Imports	$(lnrtim^*)$	-6.099	-2.344	-0.004	1.608	0.777
Foreign Tourism Exports	$(lnrtex^*)$	10.733	1.806	0.814	-1.772	-0.660
Foreign Real Income	(lny^*)	39.837	2.208	-4.403	-1.938	6.896
Foreign Prices	(lnp^*)	16.996			-0.581	-2.554
Oil Price	(lnp_{oil})	0.772			-0.145	-0.140

Table A1 - Cointegrating vectors of the country-specific VECMX models (cont.)

		Thailand	Thailand	United Kingdom	USA
		CV1	CV2	CV1	CV1
ALPHA					
Real Tourism Imports	*(lnrtim)*	-0.359	-0.350	-0.899	-0.346
Real Tourism Exports	*(lnrtex)*	0.055	-0.169	-1.141	0.072
Real Income	*(lny)*	0.070	-0.014	0.043	0.025
Own price	*(lnp)*	-0.083	0.153	-0.186	-0.106
Oil Price	(lnp_{oil})				-1.429
BETA					
Trend	*(Trend)*	-0.010	-0.014	-0.005	-0.012
Real Tourism Imports	*(lnrtim)*	1.000	0.000	1.000	1.000
Real Tourism Exports	*(lnrtex)*	0.000	1.000	-0.064	-0.955
Real Income	*(lny)*	-3.547	2.560	-2.623	-1.377
Own price	*(lnp)*	1.464	-2.438	0.061	2.182
Foreign Tourism Imports	$(lnrtim^{*})$	-1.223	0.245	0.020	0.410
Foreign Tourism Exports	$(lnrtex^{*})$	0.988	-1.217	-0.300	-0.332
Foreign Real Income	(lny^{*})	1.218	1.764	1.022	
Foreign Prices	(lnp^{*})	-0.803	3.518	0.182	-0.169
Oil Price	(lnp_{oil})	-0.176	-0.097	-0.035	-0.003

Table A2 - Estimates of individual VECMX models

	Argentina				Australia			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp
Intercept	2.812	5.645	-0.350	-4.740	-0.102	-0.868	0.085	0.602
Trend	0.007	0.014	-0.001	-0.011	-0.001	-0.011	0.001	0.008
$lnrtim_{t-1}$	-0.174	-0.352	0.022	0.295	0.023	0.183	-0.018	-0.128
$lnrtex_{t-1}$	-0.201	-0.406	0.025	0.340	-0.010	-0.075	0.007	0.052
lny_{t-1}	0.108	0.217	-0.013	-0.182	0.243	1.906	-0.182	-1.332
lnp_{t-1}	-0.170	-0.344	0.021	0.288	0.002	0.018	-0.002	-0.012
$lnpoil_{t-1}$								
$lnrtim^{*}_{t-1}$					0.009	0.074	-0.007	-0.052
$lnrtex^{*}_{t-1}$	-0.044	-0.089	0.006	0.075	-0.001	-0.010	0.001	0.007
lny^{*}_{t-1}	0.537	1.082	-0.067	-0.908				
lnp^{*}_{t-1}	0.330	0.666	-0.041	-0.559				
$lnpoil_{t-1}$	-0.024	-0.049	0.003	0.041	0.017	0.132	-0.013	-0.092
$\Delta lnrtim^{*}_{t}$					0.590	0.592	0.017	-0.343
$\Delta lnrtex^{*}_{t}$	0.245	0.136	-0.097	-0.216	0.068	0.006	0.013	-0.057
Δlny^{*}_{t}	0.522	0.839	0.624	-0.332				
Δlnp^{*}_{t}	0.302	0.913	-0.050	-0.149				
$\Delta lnpoil_{t}$	0.050	-0.031	-0.019	-0.018	0.006	-0.085	-0.034	0.237
$\Delta lnrtim^{*}_{t-1}$								
$\Delta lnrtex^{*}_{t-1}$	-0.006	0.207	0.062	0.082				
Δlny^{*}_{t-1}	1.092	0.531	0.277	0.137				
Δlnp^{*}_{t-1}	0.572	0.328	0.128	0.149				
$\Delta lnpoil_{t-1}$	-0.136	-0.119	0.032	0.147				
$\Delta lnrtim^{*}_{t-2}$								
$\Delta lnrtex^{*}_{t-2}$								
Δlny^{*}_{t-2}								
Δlnp^{*}_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$	-0.277	0.843	0.050	0.186	-0.002	0.096	0.023	0.243
$\Delta lnrtex_{t-1}$	0.035	-0.162	-0.024	-0.103	0.048	-0.231	0.010	0.016
Δlny_{t-1}	0.547	0.013	0.392	0.466	0.615	-0.095	-0.057	0.904
Δlnp_{t-1}	-0.532	0.253	-0.023	0.224	0.137	0.687	-0.012	0.151
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Austria				Brazil			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp
Intercept	2.051	0.336	-0.472	0.093	8.088	-8.081	-0.279	3.766
Trend	0.000	0.000	0.000	0.000	0.005	-0.005	0.000	0.002
$lnrtim_{t-1}$	-0.185	-0.031	0.043	-0.008	-0.413	0.416	0.014	-0.193
$lnrtex_{t-1}$	0.029	0.005	-0.007	0.001	0.015	-0.015	-0.001	0.007
lny_{t-1}	2.679	0.443	-0.619	0.122	1.099	-1.107	-0.038	0.514
lnp_{t-1}	0.102	0.017	-0.024	0.005	-0.059	0.059	0.002	-0.027
$lnpoil_{t-1}$								
$lnrtim^*_{t-1}$	0.225	0.037	-0.052	0.010	-0.727	0.732	0.025	-0.340
$lnrtex^*_{t-1}$	-0.310	-0.051	0.072	-0.014	0.161	-0.162	-0.006	0.075
lny^*_{t-1}	-2.206	-0.365	0.510	-0.101	1.493	-1.503	-0.052	0.698
lnp^*_{t-1}	-0.234	-0.039	0.054	-0.011	-0.076	0.077	0.003	-0.036
$lnpoil_{t-1}$	0.030	0.005	-0.007	0.001	0.194	-0.196	-0.007	0.091
$\Delta lnrtim^*_{t}$	-0.641	0.460	0.052	0.021	0.776	-0.354	-0.031	0.125
$\Delta lnrtex^*_{t}$	0.239	-0.017	-0.058	-0.020	-0.839	0.882	0.131	-0.321
Δlny^*_{t}	2.230	-0.429	0.639	-0.229	2.929	-4.232	0.847	1.693
Δlnp^*_{t}	-0.442	-0.164	0.036	1.163	0.503	-0.702	0.149	1.088
$\Delta lnpoil_{t}$	-0.045	-0.059	-0.011	-0.021	0.117	-0.401	0.011	0.213
$\Delta lnrtim^*_{t-1}$	-0.243	0.348	-0.022	0.019	0.894	-0.035	-0.350	-0.742
$\Delta lnrtex^*_{t-1}$	0.348	-0.244	-0.065	-0.007	-0.473	0.722	0.281	0.087
Δlny^*_{t-1}	-0.296	-0.439	0.265	0.017	-0.272	2.484	-0.358	0.978
Δlnp^*_{t-1}	-2.462	3.852	-0.248	0.618	-0.078	0.968	-0.098	-0.511
$\Delta lnpoil_{t-1}$	-0.039	-0.061	0.030	-0.002	-0.083	0.267	-0.002	-0.029
$\Delta lnrtim^*_{t-2}$								
$\Delta lnrtex^*_{t-2}$								
Δlny^*_{t-2}								
Δlnp^*_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$	-0.411	0.091	-0.023	0.012				
$\Delta lnrtex_{t-1}$	-0.285	-0.605	0.015	0.004				
Δlny_{t-1}	0.228	0.070	0.130	-0.033				
Δlnp_{t-1}	2.083	-3.163	0.132	-0.539				
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Canada				China			
	Δlnrtim	*Δlnrtex*	*Δlny*	*Δlnp*	*Δlnrtim*	*Δlnrtex*	*Δlny*	*Δlnp*
Intercept	2.381	2.126	-0.073	0.665	6.848	-2.706	0.664	1.067
Trend	0.002	0.002	0.000	0.001	0.045	0.017	0.002	-0.008
$lnrtim_{t-1}$	-0.171	-0.153	0.005	-0.048	-0.394	0.038	-0.030	-0.011
$lnrtex_{t-1}$	-0.461	-0.412	0.014	-0.128	0.367	-0.089	0.031	0.032
lny_{t-1}	0.237	0.212	-0.007	0.066	-2.241	-1.103	-0.082	0.490
lnp_{t-1}	-0.166	-0.149	0.005	-0.046	0.538	0.284	0.019	-0.126
$lnpoil_{t-1}$								
$lnrtim^*_{t-1}$	0.311	0.278	-0.010	0.086	-0.960	0.171	-0.077	-0.059
$lnrtex^*_{t-1}$					0.002	0.088	-0.006	-0.037
lny^*_{t-1}					1.716	-1.153	0.193	0.458
lnp^*_{t-1}					0.104	-0.057	0.011	0.022
$lnpoil_{t-1}$	0.011	0.009	0.000	0.003	-0.116	-0.029	-0.006	0.014
$\Delta lnrtim^*_t$	0.348	0.601	0.058	-0.211	0.010	1.147	0.003	-0.033
$\Delta lnrtex^*_t$					0.076	0.368	-0.020	0.020
Δlny^*_t					-0.911	-0.652	0.599	-0.205
Δlnp^*_t					-0.851	0.601	0.039	0.109
$\Delta lnpoil_t$	0.039	-0.035	-0.029	0.167	0.037	-0.164	-0.021	0.002
$\Delta lnrtim^*_{t-1}$					2.655	1.282	0.079	0.120
$\Delta lnrtex^*_{t-1}$					-1.491	-1.297	-0.053	-0.006
Δlny^*_{t-1}					0.067	5.553	0.291	-0.296
Δlnp^*_{t-1}					0.528	-0.551	-0.036	0.135
$\Delta lnpoil_{t-1}$					-0.262	-0.092	-0.010	-0.033
$\Delta lnrtim^*_{t-2}$								
$\Delta lnrtex^*_{t-2}$								
Δlny^*_{t-2}								
Δlnp^*_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$	-0.168	-0.014	-0.003	0.037	-0.105	-0.052	0.022	0.023
$\Delta lnrtex_{t-1}$	0.243	0.247	0.033	-0.052	-0.222	-0.352	-0.033	-0.048
Δlny_{t-1}	0.843	0.357	0.245	0.123	-0.399	0.360	-0.251	-0.543
Δlnp_{t-1}	0.159	0.040	0.069	0.157	0.018	-0.221	-0.009	0.240
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$					-0.217	-0.057	0.005	0.004
$\Delta lnrtex_{t-2}$					-0.148	-0.037	-0.015	-0.028
Δlny_{t-2}					-2.094	1.625	-0.065	-0.465
Δlnp_{t-2}					0.502	1.701	-0.072	-0.482

Table A2 - Estimates of individual VECMX models (cont.)

	France				Germany			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp
Intercept	0.003	-0.002	-0.002	-0.002	6.335	8.404	0.576	-2.578
Trend					0.000	-0.001	0.000	0.000
$lnrtim_{t-1}$					-0.371	-0.491	-0.034	0.151
$lnrtex_{t-1}$					-0.285	-0.378	-0.026	0.116
lny_{t-1}					-0.484	-0.641	-0.044	0.196
lnp_{t-1}					-0.070	-0.093	-0.006	0.028
$lnpoil_{t-1}$								
$lnrtim^{*}_{t-1}$					0.030	0.039	0.003	-0.012
$lnrtex^{*}_{t-1}$					-0.016	-0.021	-0.001	0.006
lny^{*}_{t-1}					1.930	2.558	0.176	-0.784
lnp^{*}_{t-1}					-0.010	-0.014	-0.001	0.004
$lnpoil_{t-1}$					0.017	0.022	0.002	-0.007
$\Delta lnrtim^{*}_{t}$	0.406	0.619	0.016	0.042	-0.071	0.154	-0.008	0.009
$\Delta lnrtex^{*}_{t}$	0.098	0.752	0.044	-0.023	0.141	0.187	0.015	0.070
Δlny^{*}_{t}	1.177	-0.143	0.809	-0.217	1.167	-0.073	0.920	-0.446
Δlnp^{*}_{t}	-0.130	-0.075	-0.013	1.300	-0.287	-0.123	0.005	1.436
$\Delta lnpoil_{t}$	0.005	-0.041	-0.004	-0.031	0.026	-0.074	-0.007	-0.042
$\Delta lnrtim^{*}_{t-1}$					0.067	-0.123	0.011	-0.065
$\Delta lnrtex^{*}_{t-1}$					-0.054	0.086	-0.025	0.054
Δlny^{*}_{t-1}					-0.714	0.224	0.019	0.578
Δlnp^{*}_{t-1}					0.180	-0.113	0.102	0.533
$\Delta lnpoil_{t-1}$					-0.050	0.065	0.012	-0.001
$\Delta lnrtim^{*}_{t-2}$								
$\Delta lnrtex^{*}_{t-2}$								
Δlny^{*}_{t-2}								
Δlnp^{*}_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$					-0.204	0.347	0.022	-0.081
$\Delta lnrtex_{t-1}$					0.150	-0.172	0.015	-0.070
Δlny_{t-1}					-0.148	-0.049	-0.122	-0.133
Δlnp_{t-1}					-0.015	0.017	-0.067	-0.434
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	India				Italy			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp
Intercept	0.054	0.027	0.010	0.004	-0.866	-1.822	-0.148	-0.118
Trend					-0.004	-0.008	-0.001	-0.001
$lnrtim_{t-1}$					0.094	0.198	0.016	0.013
$lnrtex_{t-1}$					-0.416	-0.876	-0.070	-0.057
lny_{t-1}					-0.093	-0.195	-0.016	-0.013
lnp_{t-1}					-0.612	-1.287	-0.102	-0.084
$lnpoil_{t-1}$								
$lnrtim^*_{t-1}$					0.005	0.010	0.001	0.001
$lnrtex^*_{t-1}$					0.446	0.939	0.075	0.061
lny^*_{t-1}					-0.519	-1.093	-0.087	-0.071
lnp^*_{t-1}					0.765	1.610	0.128	0.105
$lnpoil_{t-1}$					-0.011	-0.023	-0.002	-0.001
$\Delta lnrtim^*_{t}$	1.958	0.002	-0.040	0.202	0.373	0.240	-0.025	0.043
$\Delta lnrtex^*_{t}$	0.012	0.153	-0.026	-0.144	0.980	0.841	0.080	0.018
Δlny^*_{t}	-4.924	1.948	0.739	0.968	-1.287	-0.820	0.852	-0.231
Δlnp^*_{t}	-0.867	-0.802	-0.031	0.774	0.268	-0.054	0.007	1.336
$\Delta lnpoil_{t}$	0.060	0.174	-0.024	0.005	-0.034	0.067	-0.004	-0.039
$\Delta lnrtim^*_{t-1}$								
$\Delta lnrtex^*_{t-1}$								
Δlny^*_{t-1}								
Δlnp^*_{t-1}								
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim^*_{t-2}$								
$\Delta lnrtex^*_{t-2}$								
Δlny^*_{t-2}								
Δlnp^*_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$					-0.230	-0.012	-0.039	-0.028
$\Delta lnrtex_{t-1}$					0.297	0.242	0.041	0.034
Δlny_{t-1}					-1.372	-0.855	-0.017	-0.060
Δlnp_{t-1}					-0.349	0.068	-0.004	-0.018
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Japan				Korea			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	$\Delta lnycons$	Δlnp
Intercept	5.313	4.395	-0.165	-0.630	1.085	1.686	0.109	0.260
Trend	0.039	0.032	-0.001	-0.005	0.006	0.009	0.001	0.001
$lnrtim_{t-1}$	-0.715	-0.587	0.021	0.084	-0.079	-0.121	-0.008	-0.020
$lnrtex_{t-1}$	-0.056	-0.046	0.002	0.007	-0.252	-0.387	-0.025	-0.063
lny_{t-1}	5.732	4.707	-0.170	-0.673	-0.453	-0.696	-0.046	-0.114
lnp_{t-1}	0.404	0.331	-0.012	-0.047	-0.448	-0.688	-0.045	-0.112
$lnpoil_{t-1}$								
$lnrtim^{*}_{t-1}$					0.329	0.506	0.033	0.083
$lnrtex^{*}_{t-1}$					-0.177	-0.271	-0.018	-0.044
lny^{*}_{t-1}	-5.555	-4.562	0.165	0.653	-0.158	-0.243	-0.016	-0.040
lnp^{*}_{t-1}	0.209	0.172	-0.006	-0.025	0.209	0.320	0.021	0.052
$lnpoil_{t-1}$	-0.071	-0.058	0.002	0.008	0.056	0.086	0.006	0.014
$\Delta lnrtim^{*}_{t}$					-0.009	1.840	-0.031	-0.284
$\Delta lnrtex^{*}_{t}$					0.391	-0.479	0.042	0.136
Δlny^{*}_{t}	-0.224	-3.159	0.776	2.001	2.760	-4.733	0.886	1.521
Δlnp^{*}_{t}	-1.304	-1.046	0.010	0.614	-1.260	0.733	-0.112	0.438
$\Delta lnpoil_{t}$	0.277	0.173	0.006	-0.062	0.344	-0.637	0.044	0.262
$\Delta lnrtim^{*}_{t-1}$								
$\Delta lnrtex^{*}_{t-1}$								
Δlny^{*}_{t-1}								
Δlnp^{*}_{t-1}								
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim^{*}_{t-2}$								
$\Delta lnrtex^{*}_{t-2}$								
Δlny^{*}_{t-2}								
Δlnp^{*}_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$	0.203	0.069	-0.006	0.098	0.186	-0.050	0.083	0.163
$\Delta lnrtex_{t-1}$	-0.224	-0.142	0.008	-0.075	0.094	-0.105	0.027	0.064
Δlny_{t-1}	0.739	1.490	0.083	0.063	-0.182	2.548	-0.203	-1.034
Δlnp_{t-1}	-0.531	-0.326	0.000	0.045	-0.173	-0.493	0.066	0.147
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Malaysia				Mexico			
	Δlnrtim	*Δlnrtex*	*Δlny*	*Δlnp*	*Δlnrtim*	*Δlnrtex*	*Δlny*	*Δlnp*
Intercept	1.112	-0.073	-0.103	-0.304	-0.340	-0.908	-0.722	0.412
Trend	-0.001	-0.005	0.000	0.000	-0.003	-0.009	-0.007	0.004
$lnrtim_{t-1}$	-0.142	0.797	-0.026	0.094	0.089	0.225	0.173	-0.101
$lnrtex_{t-1}$	-0.001	-0.613	0.031	-0.042	-0.082	-0.206	-0.158	0.092
lny_{t-1}	0.977	1.587	-0.181	-0.161	-0.694	-1.747	-1.345	0.780
lnp_{t-1}	-0.220	-0.725	0.060	0.011	0.074	0.186	0.143	-0.083
$lnpoil_{t-1}$								
$lnrtim^{*}_{t-1}$					-0.014	-0.036	-0.027	0.016
$lnrtex^{*}_{t-1}$					0.067	0.168	0.129	-0.075
lny^{*}_{t-1}	1.840	-0.020	-0.187	-0.508	0.784	1.973	1.520	-0.881
lnp^{*}_{t-1}	-0.241	-0.383	0.044	0.040	0.408	1.029	0.792	-0.459
$lnpoil_{t-1}$	0.003	0.141	-0.007	0.009	-0.002	-0.005	-0.004	0.002
$\Delta lnrtim^{*}_{t}$					0.824	0.675	0.116	-0.105
$\Delta lnrtex^{*}_{t}$					-0.073	0.261	-0.044	-0.226
Δlny^{*}_{t}	0.258	2.688	1.082	-0.833	0.099	0.113	2.360	1.443
Δlnp^{*}_{t}	-1.122	-1.623	-0.055	0.848	-0.453	1.125	0.818	0.203
$\Delta lnpoil_{t}$	-0.001	0.229	0.032	0.017	-0.101	-0.235	-0.032	0.172
$\Delta lnrtim^{*}_{t-1}$								
$\Delta lnrtex^{*}_{t-1}$								
Δlny^{*}_{t-1}	-1.681	1.618	0.264	0.878				
Δlnp^{*}_{t-1}	0.657	-1.138	0.020	-0.331				
$\Delta lnpoil_{t-1}$	-0.018	-0.094	0.012	0.006				
$\Delta lnrtim^{*}_{t-2}$								
$\Delta lnrtex^{*}_{t-2}$								
Δlny^{*}_{t-2}	-3.389	-1.725	0.308	1.696				
Δlnp^{*}_{t-2}	0.947	0.049	-0.015	-0.216				
$\Delta lnpoil_{t-2}$	-0.184	-0.099	0.014	0.096				
$\Delta lnrtim_{t-1}$	-0.306	-0.310	0.001	-0.106	-0.367	0.155	-0.062	-0.240
$\Delta lnrtex_{t-1}$	0.195	0.370	-0.009	-0.040	0.146	-0.173	0.042	0.252
Δlny_{t-1}	0.186	1.453	0.015	-0.478	0.343	1.191	-0.001	-0.458
Δlnp_{t-1}	-0.110	0.855	0.034	0.175	-0.107	-0.600	-0.056	0.282
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Netherlands				New Zealand			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp
Intercept	-2.428	3.935	-0.014	-0.461	0.005	0.006	-0.001	-0.005
Trend	-0.003	0.004	0.000	-0.001				
$lnrtim_{t-1}$	-0.188	0.303	-0.001	-0.036				
$lnrtex_{t-1}$	0.299	-0.483	0.002	0.057				
lny_{t-1}	0.659	-1.066	0.004	0.125				
lnp_{t-1}	-0.430	0.695	-0.002	-0.081				
$lnpoil_{t-1}$								
$lnrtim^*_{t-1}$	0.435	-0.704	0.002	0.082				
$lnrtex^*_{t-1}$	-0.259	0.419	-0.001	-0.049				
lny^*_{t-1}	-1.887	3.052	-0.011	-0.357				
lnp^*_{t-1}	0.650	-1.051	0.004	0.123				
$lnpoil_{t-1}$	-0.036	0.059	0.000	-0.007				
$\Delta lnrtim^*_t$	0.553	0.038	0.002	0.107	0.394	0.483	0.021	-0.271
$\Delta lnrtex^*_t$	-0.252	0.506	0.017	-0.044	-0.152	-0.324	-0.001	0.379
Δlny^*_t	0.185	1.468	0.827	-0.595	1.518	0.394	0.796	0.637
Δlnp^*_t	-0.056	-0.237	-0.020	1.349	-0.741	-0.083	-0.007	1.715
$\Delta lnpoil_t$	-0.045	0.039	-0.007	-0.047	0.094	0.014	-0.012	0.007
$\Delta lnrtim^*_{t-1}$								
$\Delta lnrtex^*_{t-1}$								
Δlny^*_{t-1}								
Δlnp^*_{t-1}								
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim^*_{t-2}$								
$\Delta lnrtex^*_{t-2}$								
Δlny^*_{t-2}								
Δlnp^*_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$								
$\Delta lnrtex_{t-1}$								
Δlny_{t-1}								
Δlnp_{t-1}								
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Norway				Portugal			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	$\Delta lnycons$	Δlnp
Intercept	1.476	3.408	0.398	0.029	-2.623	4.927	-0.366	4.464
Trend	0.000	0.000	0.000	0.000	-0.003	0.006	-0.001	0.006
$lnrtim_{t-1}$	0.026	0.060	0.007	0.001	-0.133	0.201	0.059	0.074
$lnrtex_{t-1}$	-0.385	-0.893	-0.104	-0.008	0.200	-0.365	0.012	-0.309
lny_{t-1}	-1.404	-3.257	-0.381	-0.029	0.279	-0.420	-0.126	-0.149
lnp_{t-1}	-0.407	-0.944	-0.110	-0.008	0.121	-0.217	-0.001	-0.171
$lnpoil_{t-1}$								
$lnrtim^{*}_{t-1}$	-0.158	-0.367	-0.043	-0.003	0.311	-0.471	-0.137	-0.173
$lnrtex^{*}_{t-1}$	0.278	0.646	0.076	0.006	-0.077	0.066	0.116	-0.117
lny^{*}_{t-1}	1.033	2.398	0.280	0.022	-1.173	2.053	0.075	1.525
lnp^{*}_{t-1}	0.441	1.023	0.120	0.009				
$lnpoil_{t-1}$	0.020	0.046	0.005	0.000				
$\Delta lnrtim^{*}_{t}$	0.732	0.038	0.065	-0.280	0.352	-0.009	0.007	-0.285
$\Delta lnrtex^{*}_{t}$	-0.169	0.008	-0.078	0.210	0.662	0.548	-0.047	-0.227
Δlny^{*}_{t}	1.028	2.576	0.903	-0.369	-0.270	0.585	0.964	-0.416
Δlnp^{*}_{t}	0.084	-0.398	-0.020	1.077				
$\Delta lnpoil_{t}$	-0.058	0.063	-0.004	0.070				
$\Delta lnrtim^{*}_{t-1}$					0.085	0.016	0.034	0.021
$\Delta lnrtex^{*}_{t-1}$					0.171	0.362	-0.035	0.072
Δlny^{*}_{t-1}					0.660	-2.015	0.338	-0.473
Δlnp^{*}_{t-1}								
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim^{*}_{t-2}$								
$\Delta lnrtex^{*}_{t-2}$								
Δlny^{*}_{t-2}								
Δlnp^{*}_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$					-0.170	-0.108	-0.028	0.048
$\Delta lnrtex_{t-1}$					-0.031	-0.220	-0.113	0.305
Δlny_{t-1}					-0.109	1.032	-0.016	0.121
Δlnp_{t-1}					-0.149	0.190	0.000	0.366
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$					-0.154	0.110	-0.041	-0.072
$\Delta lnrtex_{t-2}$					0.147	-0.027	-0.057	0.276
Δlny_{t-2}					-0.094	0.104	-0.113	0.164
Δlnp_{t-2}					-0.082	-0.042	-0.013	0.038

Table A2 - Estimates of individual VECMX models (cont.)

	South Africa				Spain			
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp
Intercept	4.017	2.860	0.067	-0.574	0.565	-0.295	-0.198	-0.157
Trend	0.015	0.011	0.000	-0.002	0.000	0.000	0.000	0.000
$lnrtim_{t-1}$	-0.676	-0.479	-0.011	0.095	-0.160	0.087	0.057	0.046
$lnrtex_{t-1}$	-0.148	-0.105	-0.002	0.021	0.088	-0.047	-0.031	-0.025
lny_{t-1}	-0.756	-0.536	-0.012	0.107	0.650	-0.352	-0.234	-0.185
lnp_{t-1}	-0.407	-0.288	-0.007	0.057	-0.336	0.182	0.121	0.096
$lnpoil_{t-1}$								
$lnrtim^*_{t-1}$	-1.087	-0.770	-0.018	0.153	-0.124	0.067	0.045	0.035
$lnrtex^*_{t-1}$	1.198	0.849	0.020	-0.169	0.106	-0.057	-0.038	-0.030
lny^*_{t-1}	1.310	0.929	0.021	-0.185	-1.103	0.597	0.396	0.314
lnp^*_{t-1}	0.392	0.278	0.006	-0.055	0.408	-0.221	-0.147	-0.116
$lnpoil_{t-1}$	0.098	0.069	0.002	-0.014	0.022	-0.012	-0.008	-0.006
$\Delta lnrtim^*_t$	0.154	-0.310	-0.083	0.436	0.351	-0.016	-0.032	0.098
$\Delta lnrtex^*_t$	-0.325	0.864	0.037	-0.306	0.239	0.373	0.049	0.016
Δlny^*_t	-0.498	-1.992	0.408	0.421	1.325	0.662	0.982	-0.394
Δlnp^*_t	0.503	0.174	-0.024	1.262	0.012	-0.022	-0.018	1.298
$\Delta lnpoil_t$	-0.013	-0.082	-0.004	0.132	0.017	-0.011	-0.004	-0.034
$\Delta lnrtim^*_{t-1}$					0.110	0.027	-0.036	-0.001
$\Delta lnrtex^*_{t-1}$					-0.049	0.276	0.054	0.019
Δlny^*_{t-1}					0.184	-0.859	-0.201	-0.649
Δlnp^*_{t-1}					-0.785	-0.647	0.066	0.862
$\Delta lnpoil_{t-1}$					-0.011	0.034	-0.001	-0.003
$\Delta lnrtim^*_{t-2}$								
$\Delta lnrtex^*_{t-2}$								
Δlny^*_{t-2}								
Δlnp^*_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$					0.032	-0.176	-0.029	0.018
$\Delta lnrtex_{t-1}$					0.029	-0.213	0.046	-0.007
Δlny_{t-1}					0.514	1.144	0.052	0.312
Δlnp_{t-1}					0.812	0.565	-0.058	-0.736
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$								
$\Delta lnrtex_{t-2}$								
Δlny_{t-2}								
Δlnp_{t-2}								

Table A2 - Estimates of individual VECMX models (cont.)

	Sweden				Thailand			
	Δlnrtim	*Δlnrtex*	*Δlny*	*Δlnp*	*Δlnrtim*	*Δlnrtex*	*Δlny*	*Δlnp*
Intercept	-0.003	0.021	0.001	-0.004	1.341	-0.451	-0.356	0.567
Trend					0.008	0.002	0.000	-0.001
$lnrtim_{t-1}$					-0.359	0.055	0.070	-0.083
$lnrtex_{t-1}$					-0.350	-0.169	-0.014	0.153
lny_{t-1}					0.375	-0.630	-0.284	0.684
lnp_{t-1}					0.329	0.493	0.136	-0.493
$lnpoil_{t-1}$								
$lnrtim^*_{t-1}$					0.353	-0.109	-0.089	0.138
$lnrtex^*_{t-1}$					0.072	0.261	0.086	-0.267
lny^*_{t-1}					-1.055	-0.231	0.061	0.169
lnp^*_{t-1}					-0.945	-0.640	-0.105	0.603
$lnpoil_{t-1}$					0.097	0.007	-0.011	0.000
$\Delta lnrtim^*_t$	0.857	-0.304	0.097	-0.243	1.212	0.953	-0.005	-0.010
$\Delta lnrtex^*_t$	0.352	0.121	-0.101	0.213	-0.387	-0.070	0.002	0.001
Δlny^*_t	0.708	0.143	1.358	1.199	-2.485	1.663	0.551	1.266
Δlnp^*_t	-0.106	-0.146	0.012	1.280	-0.312	0.482	0.259	1.461
$\Delta lnpoil_t$	0.094	-0.137	0.013	0.058	-0.101	0.064	-0.018	0.031
$\Delta lnrtim^*_{t-1}$					0.440	0.058	-0.048	-0.418
$\Delta lnrtex^*_{t-1}$					-0.657	-0.184	-0.064	0.242
Δlny^*_{t-1}					0.112	0.999	-0.189	-0.762
Δlnp^*_{t-1}					-0.881	-0.153	-0.195	-0.450
$\Delta lnpoil_{t-1}$					-0.052	0.013	0.030	-0.075
$\Delta lnrtim^*_{t-2}$								
$\Delta lnrtex^*_{t-2}$								
Δlny^*_{t-2}								
Δlnp^*_{t-2}								
$\Delta lnpoil_{t-2}$								
$\Delta lnrtim_{t-1}$					-0.317	-0.003	-0.016	0.150
$\Delta lnrtex_{t-1}$					0.497	-0.184	0.042	-0.001
Δlny_{t-1}					1.198	0.210	0.320	-0.599
Δlnp_{t-1}					0.561	-0.259	0.081	0.459
$\Delta lnpoil_{t-1}$								
$\Delta lnrtim_{t-2}$					-0.007	0.044	-0.002	0.039
$\Delta lnrtex_{t-2}$					0.366	-0.080	-0.019	0.029
Δlny_{t-2}					0.818	0.788	0.191	-0.202
Δlnp_{t-2}					0.373	-0.430	-0.064	0.037

Table A2 - Estimates of individual VECMX models (cont.)

	United Kingdom				USA				
	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	$\Delta lnrtim$	$\Delta lnrtex$	Δlny	Δlnp	Δlnp_{oil}
Intercept	5.662	7.177	-0.270	1.172	-0.084	0.009	0.004	-0.018	-0.310
Trend	0.004	0.006	0.000	0.001	0.004	-0.001	0.000	0.001	0.017
$lnrtim_{t-1}$	-0.899	-1.141	0.043	-0.186	-0.346	0.072	0.025	-0.106	-1.429
$lnrtex_{t-1}$	0.058	0.073	-0.003	0.012	0.331	-0.069	-0.024	0.101	1.364
lny_{t-1}	2.359	2.992	-0.113	0.488	0.477	-0.099	-0.035	0.145	1.968
lnp_{t-1}	-0.055	-0.070	0.003	-0.011	-0.756	0.158	0.055	-0.230	-3.118
$lnpoil_{t-1}$					0.001	0.000	0.000	0.000	0.004
$lnrtim^{*}_{t-1}$	-0.018	-0.023	0.001	-0.004	-0.142	0.030	0.010	-0.043	-0.586
$lnrtex^{*}_{t-1}$	0.270	0.343	-0.013	0.056	0.115	-0.024	-0.008	0.035	0.474
lny^{*}_{t-1}	-0.919	-1.166	0.044	-0.190					
lnp^{*}_{t-1}	-0.164	-0.208	0.008	-0.034	0.059	-0.012	-0.004	0.018	0.242
$lnpoil_{t-1}$	0.032	0.040	-0.002	0.007					
$\Delta lnrtim^{*}_{t}$	0.146	0.491	0.027	-0.476	0.551	0.869	0.025	-0.014	0.966
$\Delta lnrtex^{*}_{t}$	0.496	0.042	0.028	0.224	0.251	0.077	0.013	0.009	-0.110
Δlny^{*}_{t}	-0.050	1.025	0.637	0.987					
Δlnp^{*}_{t}	-0.001	0.346	0.020	0.553	0.216	0.319	-0.046	0.140	3.676
$\Delta lnpoil_{t}$	-0.030	0.009	-0.024	0.074					
$\Delta lnrtim^{*}_{t-1}$	-0.025	0.890	-0.072	-0.137					
$\Delta lnrtex^{*}_{t-1}$	0.059	0.013	0.053	0.161					
Δlny^{*}_{t-1}	1.476	4.215	-0.295	-0.528					
Δlnp^{*}_{t-1}	0.450	0.365	-0.036	-0.016					
$\Delta lnpoil_{t-1}$	0.075	-0.098	0.025	0.000					
$\Delta lnrtim^{*}_{t-2}$	0.063	0.152	-0.047	-0.379					
$\Delta lnrtex^{*}_{t-2}$	0.251	-0.092	0.083	0.117					
Δlny^{*}_{t-2}	1.276	1.628	-0.085	0.948					
Δlnp^{*}_{t-2}	0.376	1.150	-0.012	-0.020					
$\Delta lnpoil_{t-2}$	-0.042	0.033	-0.016	-0.024					
$\Delta lnrtim_{t-1}$	0.080	0.417	-0.008	0.036	-0.182	0.126	0.054	0.006	-0.563
$\Delta lnrtex_{t-1}$	-0.128	-0.736	0.008	0.093	-0.118	-0.387	-0.086	0.000	0.259
Δlny_{t-1}	-0.484	-3.822	0.654	0.610	0.242	1.375	0.490	-0.244	-1.904
Δlnp_{t-1}	-0.642	-0.174	-0.003	0.298	1.012	0.454	0.272	0.076	-0.760
$\Delta lnpoil_{t-1}$					0.006	0.058	0.004	-0.005	0.061
$\Delta lnrtim_{t-2}$	-0.111	0.000	-0.026	0.236					
$\Delta lnrtex_{t-2}$	-0.086	-0.149	-0.003	0.086					
Δlny_{t-2}	-2.281	-2.629	0.023	-0.919					
Δlnp_{t-2}	-0.156	-0.995	0.032	-0.250					

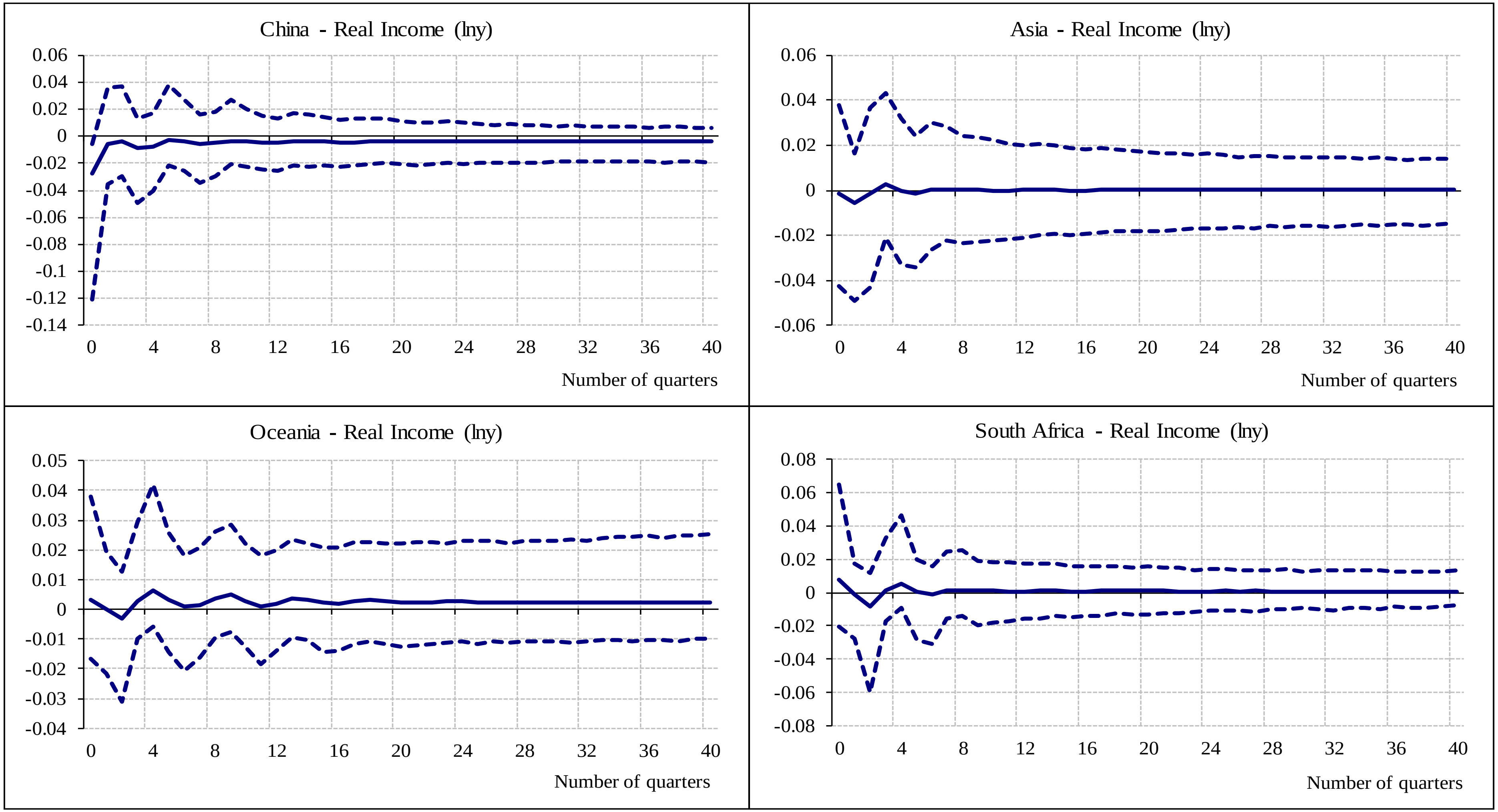

Figure A1 - Generalised impulse responses of a negative shock to China’s real income on real income across countries/regions

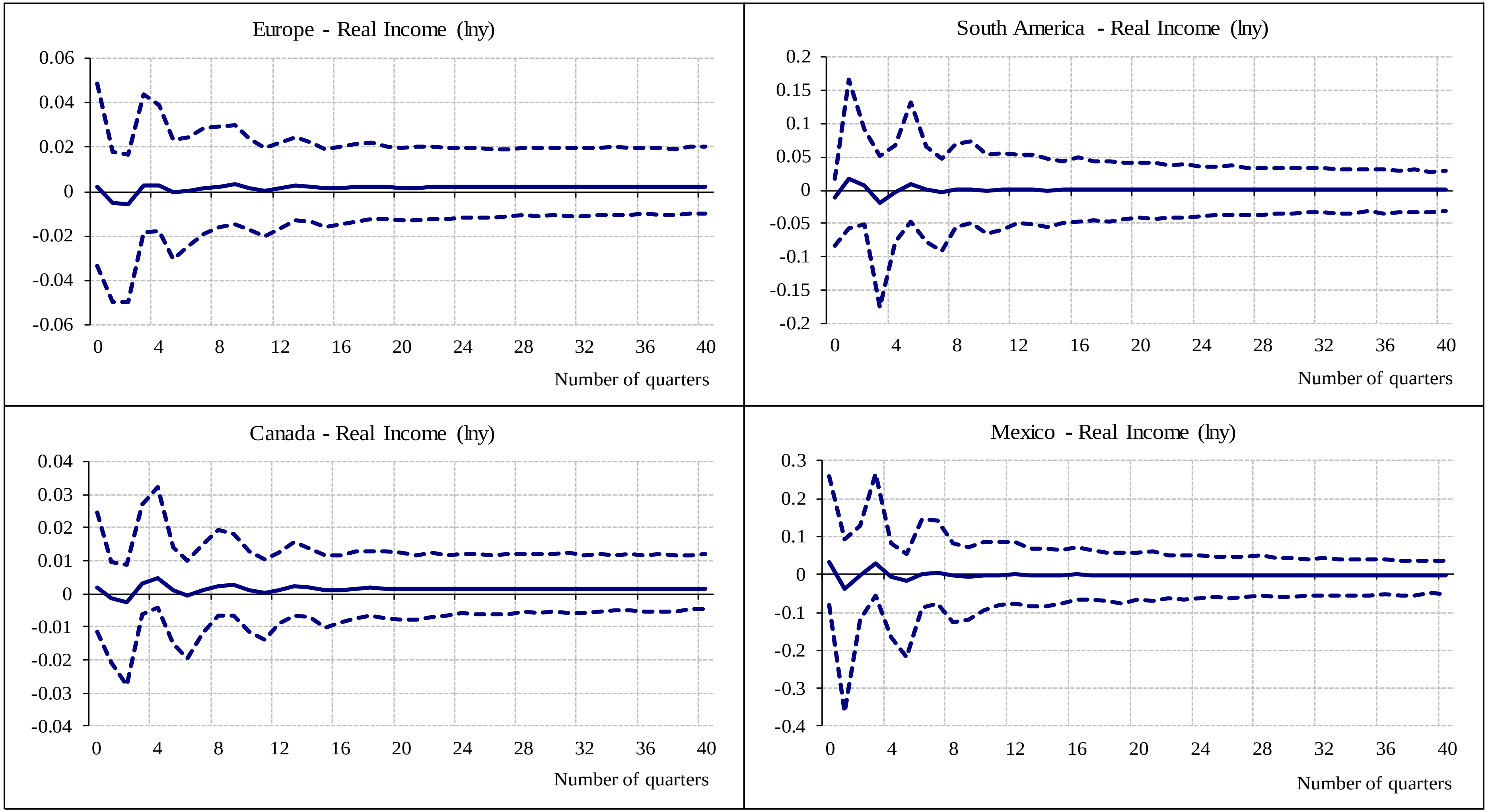

Figure A1 - Generalised impulse responses of a negative shock to China's real income on real income across countries/regions (cont.)

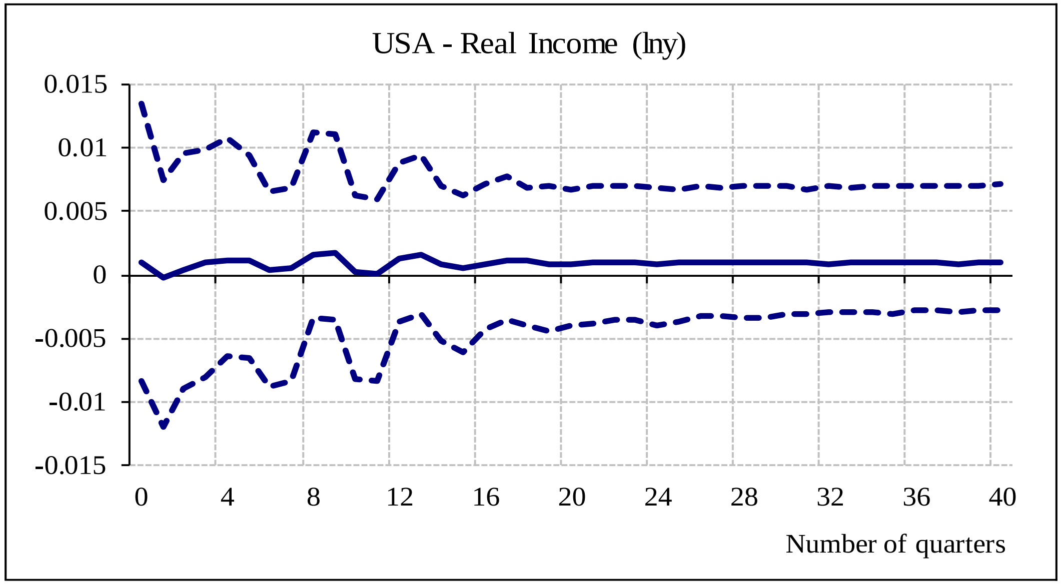

Figure A1 - Generalised impulse responses of a negative shock to China's real income on real income across countries/regions (cont.)

Notes: 'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;

'Europe' include Austria, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and UK;

'Oceania' include Australia and New Zealand;

'South America' include Argentina and Brazil;

To highlight the importance of USA's economy, countries of the North America are not aggregated;

The lines are bootstrap mean estimates with 90% bootstrap error bounds.

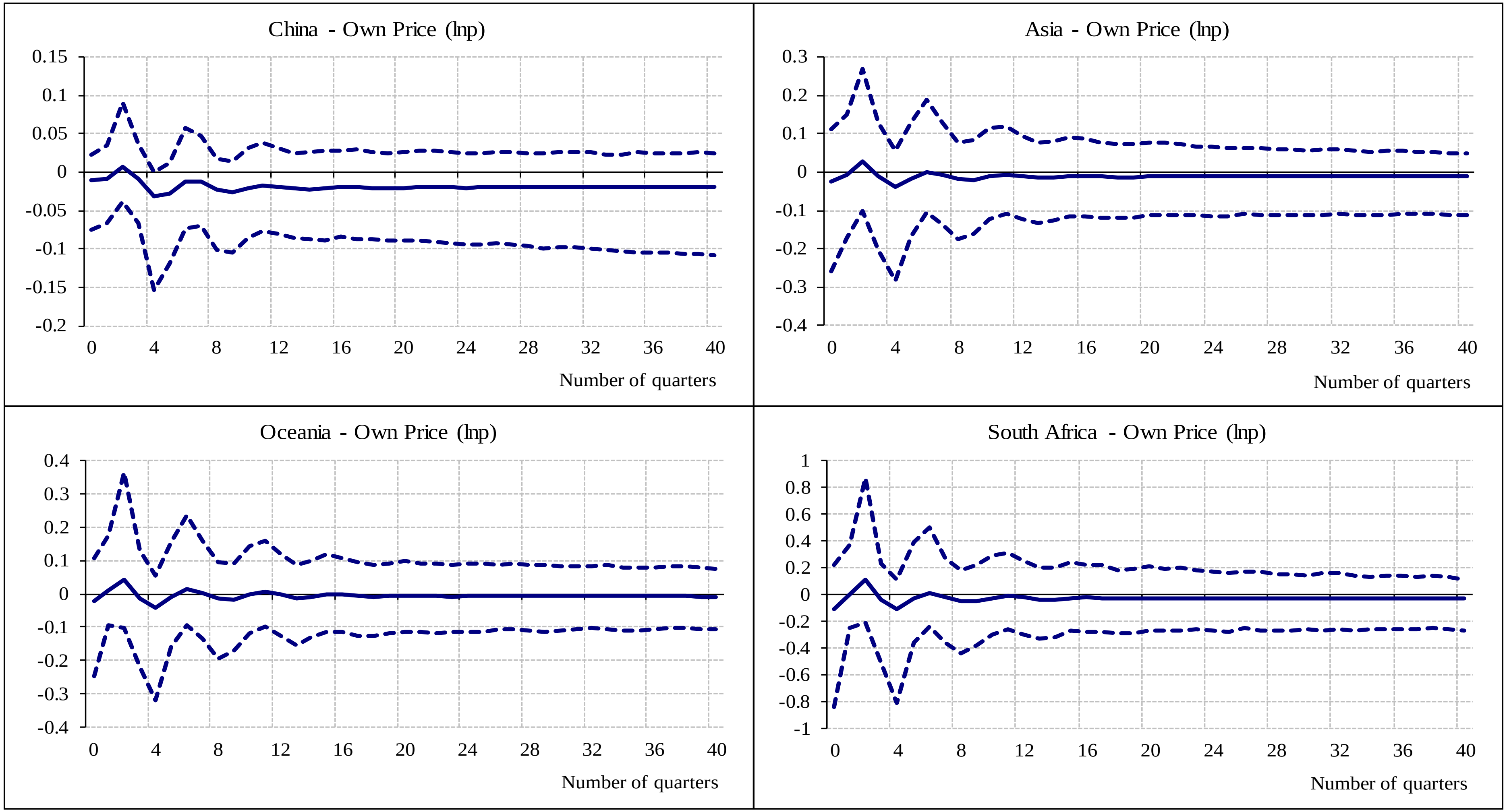

Figure A2 - Generalised impulse responses of a negative shock to China’s real income on own price across countries/regions

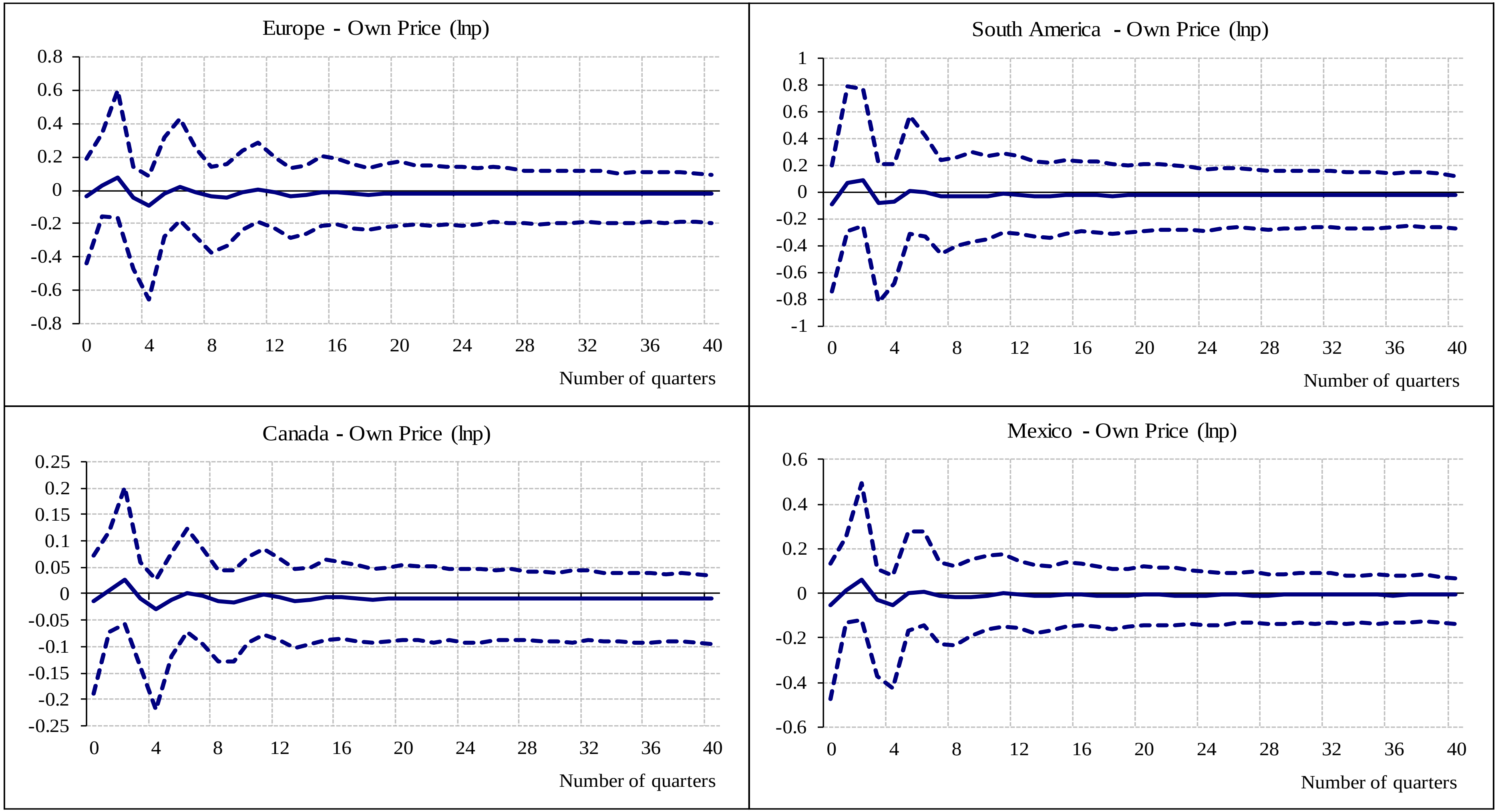

Figure A2 - Generalised impulse responses of a negative shock to China's real income on own price across countries/regions (cont.)

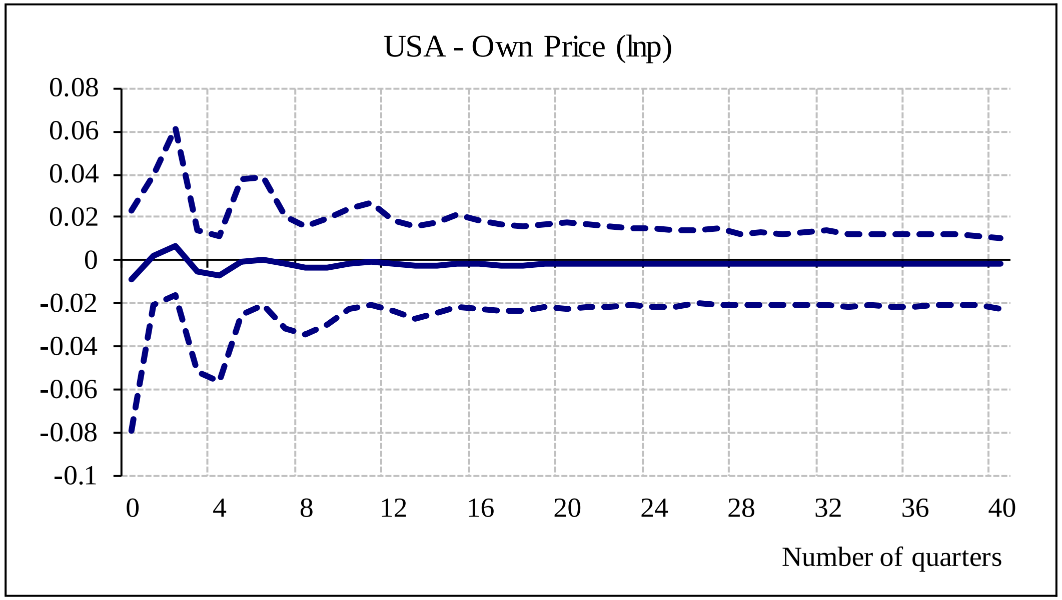

Figure A2 - Generalised impulse responses of a negative shock to China's real income on own price across countries/regions (cont.)

Notes: 'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;

'Europe' include Austria, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and UK;

'Oceania' include Australia and New Zealand;

'South America' include Argentina and Brazil;

To highlight the importance of USA's economy, countries of the North America are not aggregated;

The lines are bootstrap mean estimates with 90% bootstrap error bounds.

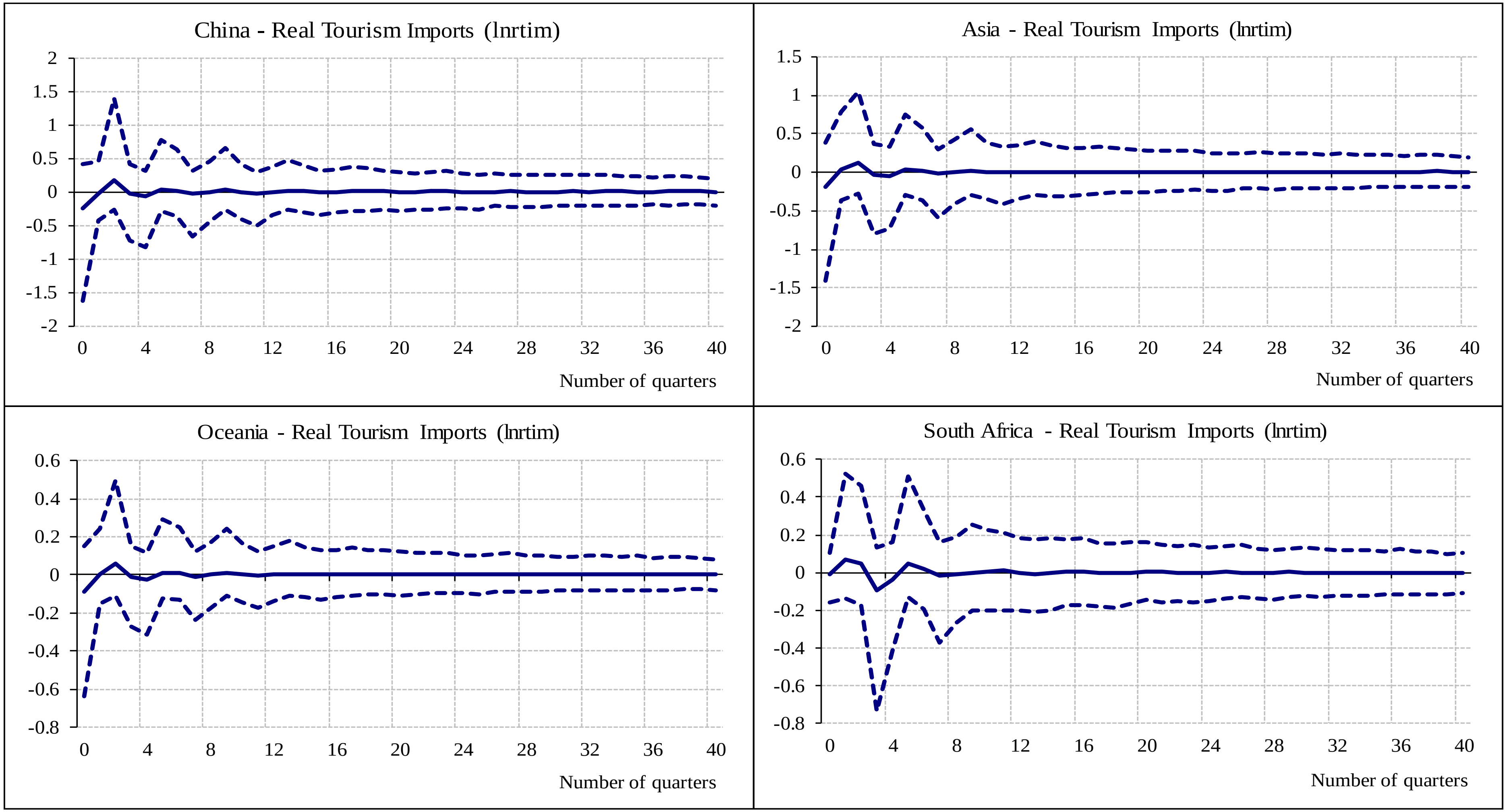

Figure A3 - Generalised impulse responses of a negative shock to China’s real income on real tourism imports across countries/regions

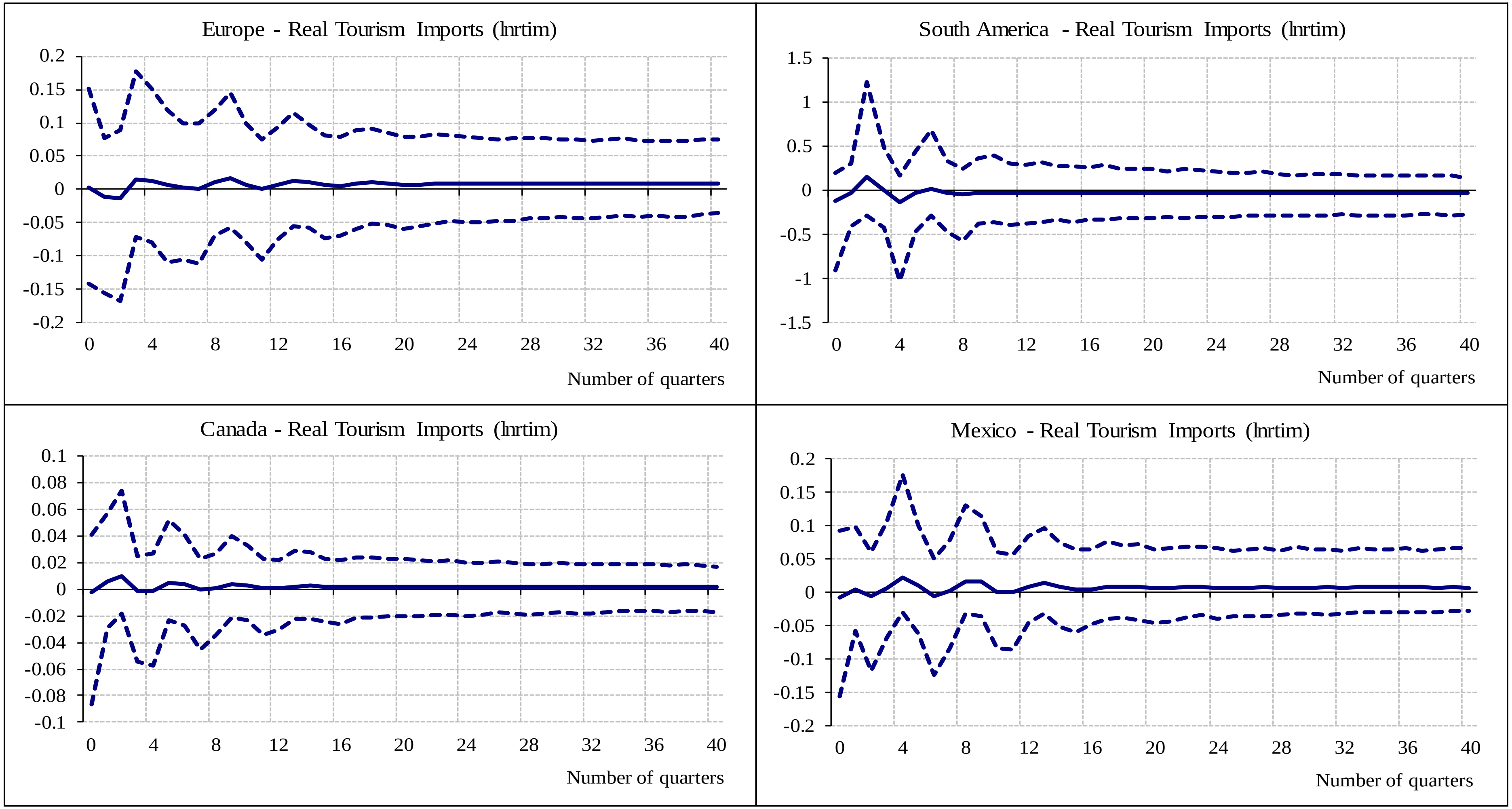

Figure A3 - Generalised impulse responses of a negative shock to China's real income on real tourism imports across countries/regions (cont.)

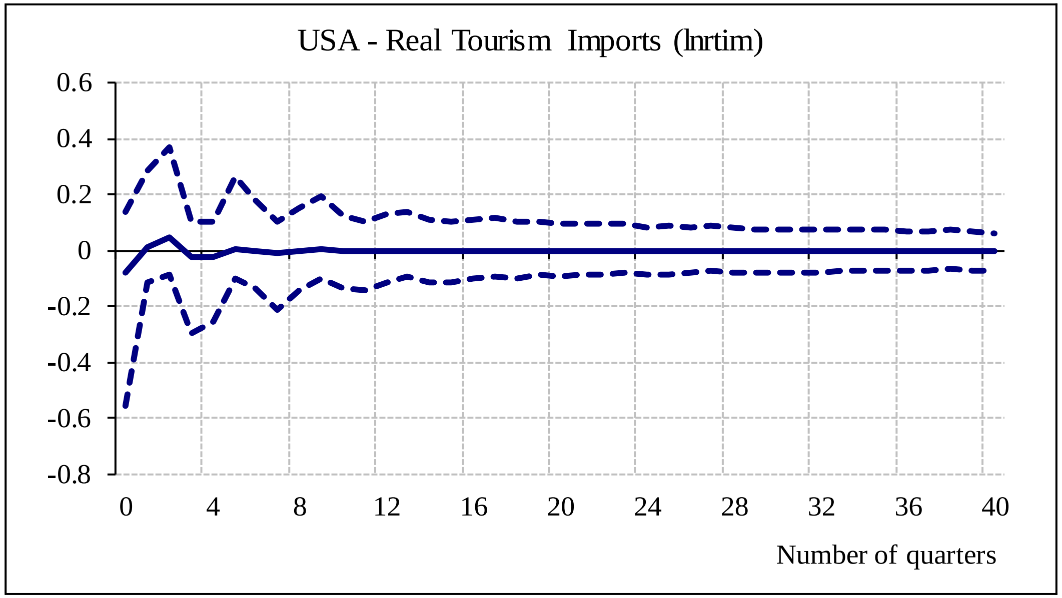

Figure A3 - Generalised impulse responses of a negative shock to China's real income on real tourism imports across countries/regions (cont.)

Notes: 'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;

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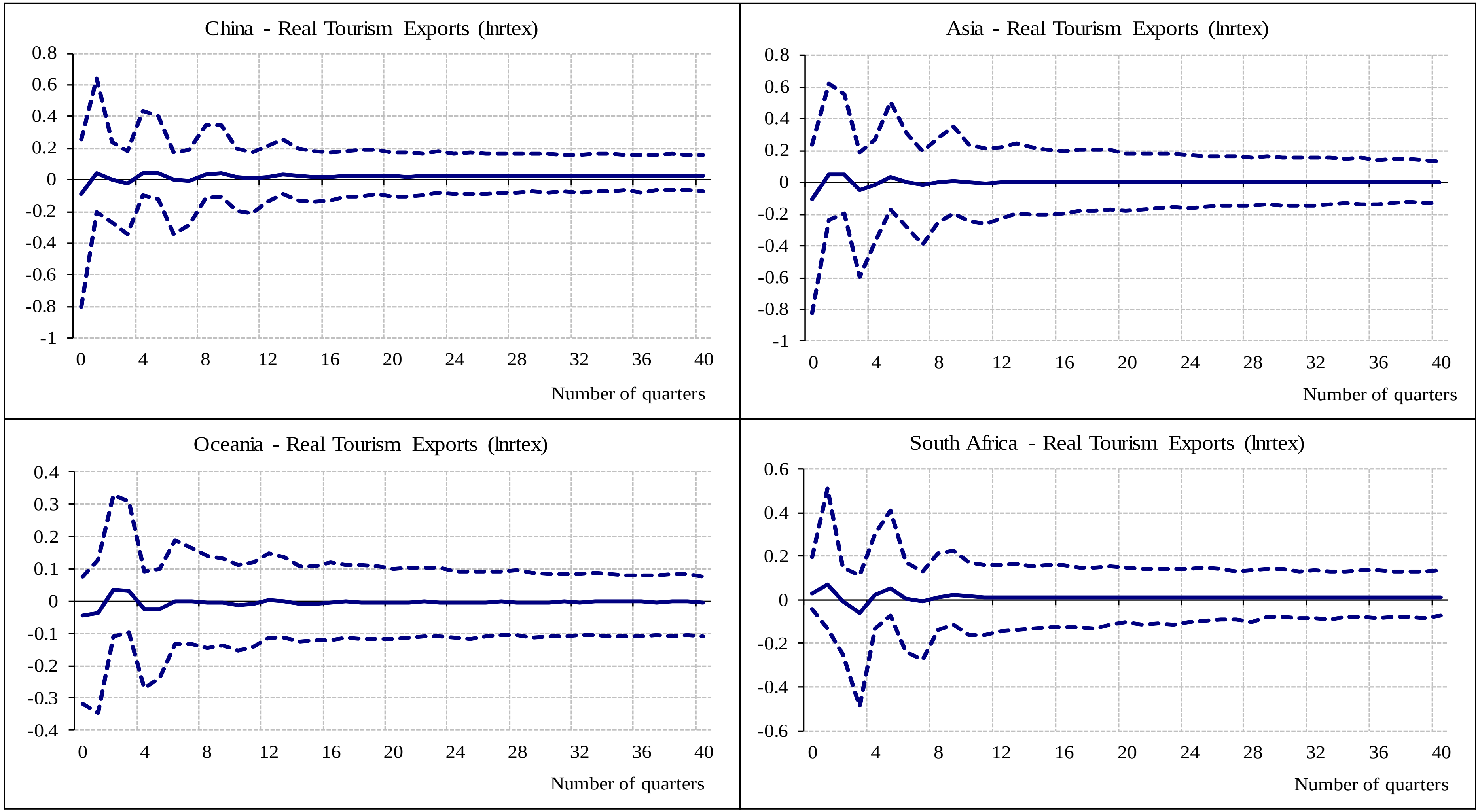

Figure A4 - Generalised impulse responses of a negative shock to China’s real income on real tourism exports across countries/regions

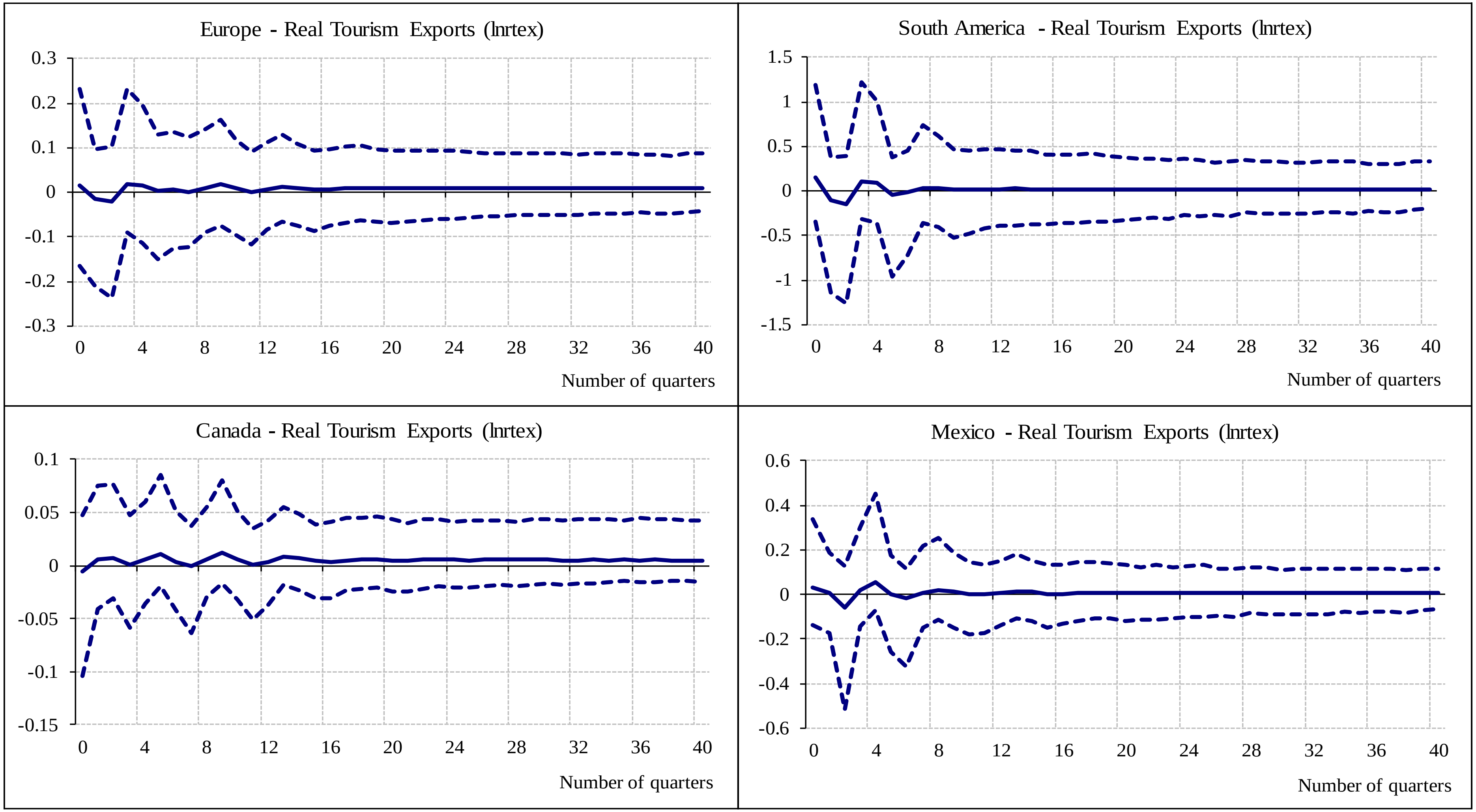

Figure A4 - Generalised impulse responses of a negative shock to China's real income on real tourism exports across countries/regions (cont.)

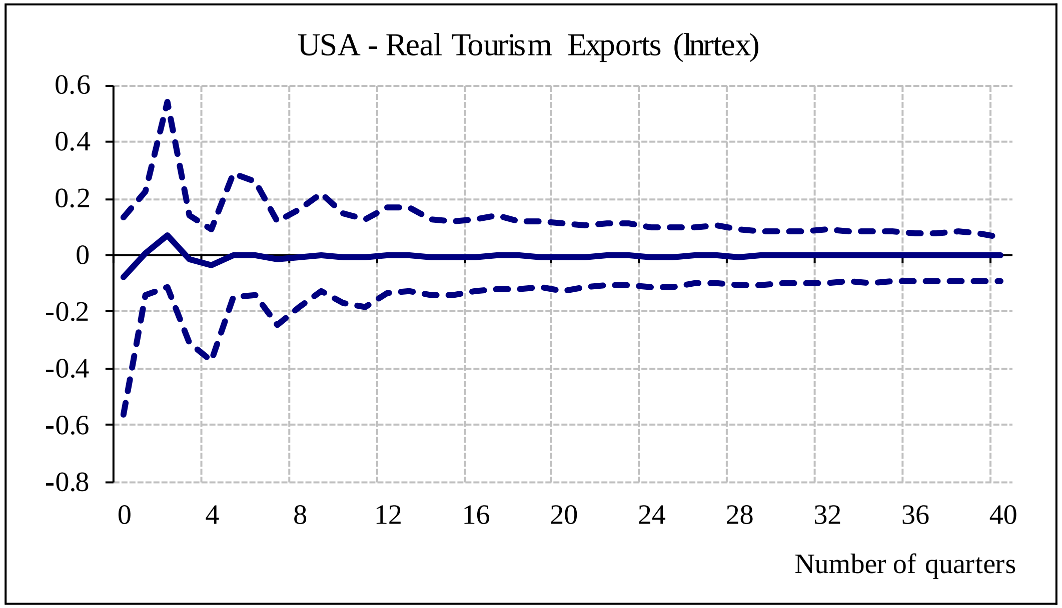

Figure A4 - Generalised impulse responses of a negative shock to China's real income on real tourism exports across countries/regions (cont.)

Notes: 'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;

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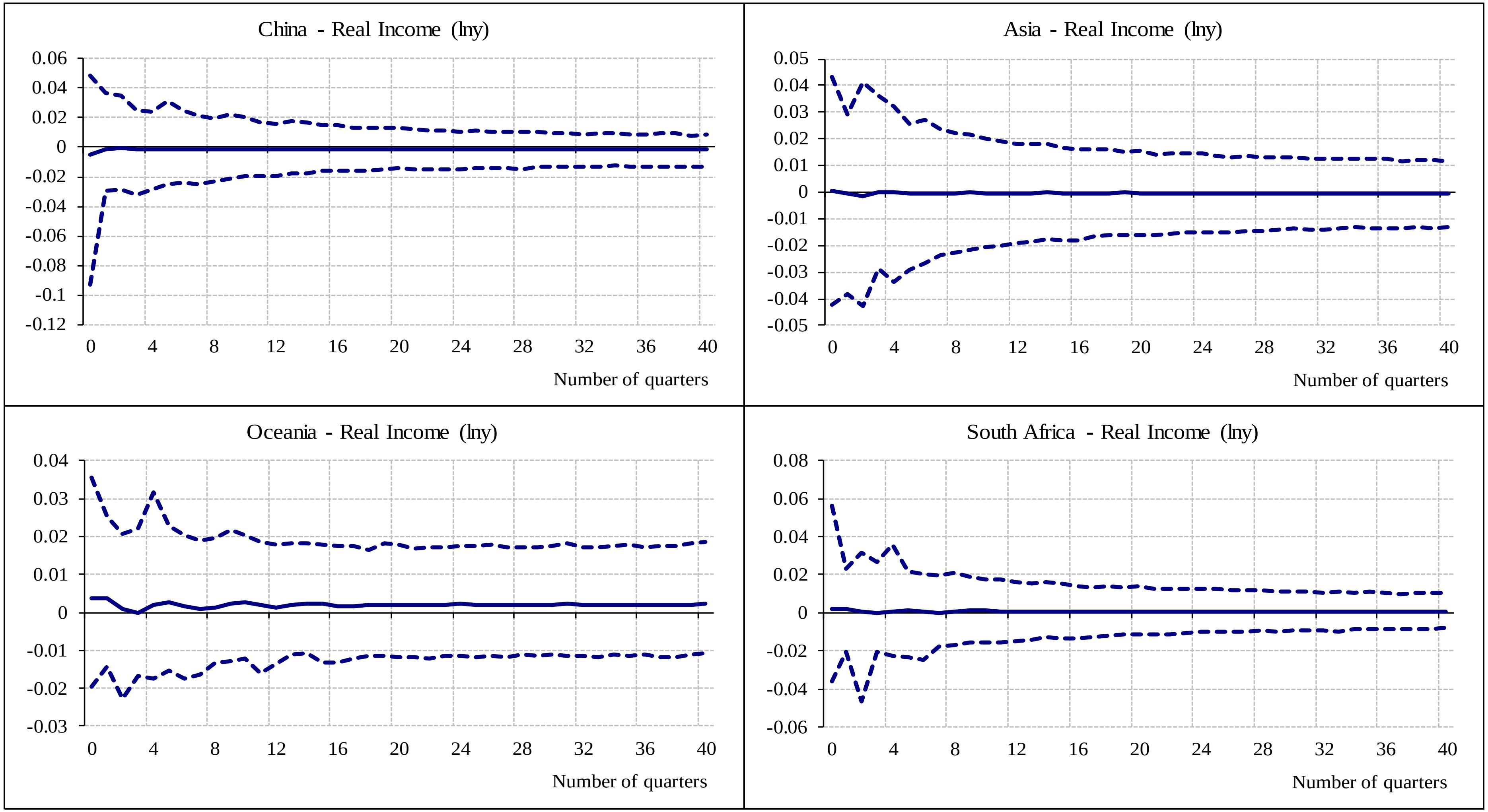

Figure A5 - Generalised impulse responses of a negative shock to China's own price on real income across countries/regions

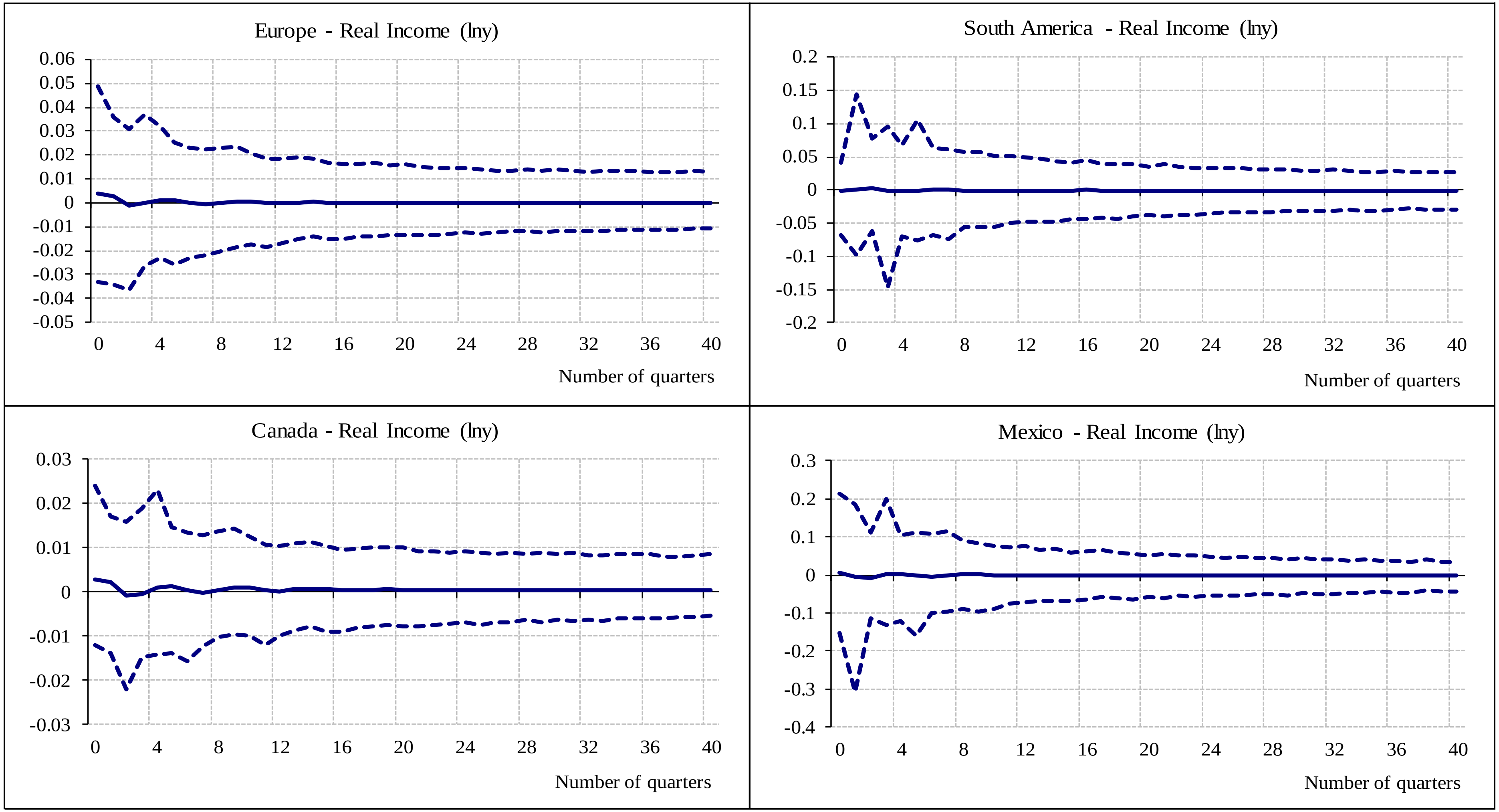

Figure A5 - Generalised impulse responses of a negative shock to China’s own price on real income across countries/regions (cont.)

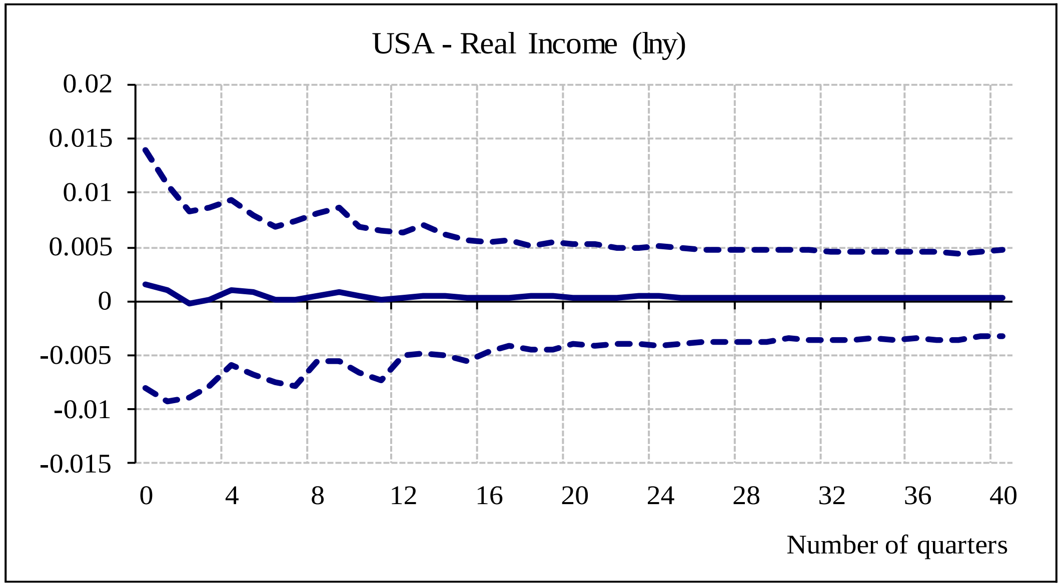

Figure A5 - Generalised impulse responses of a negative shock to China's own price on real income across countries/regions (cont.)

Notes: 'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;

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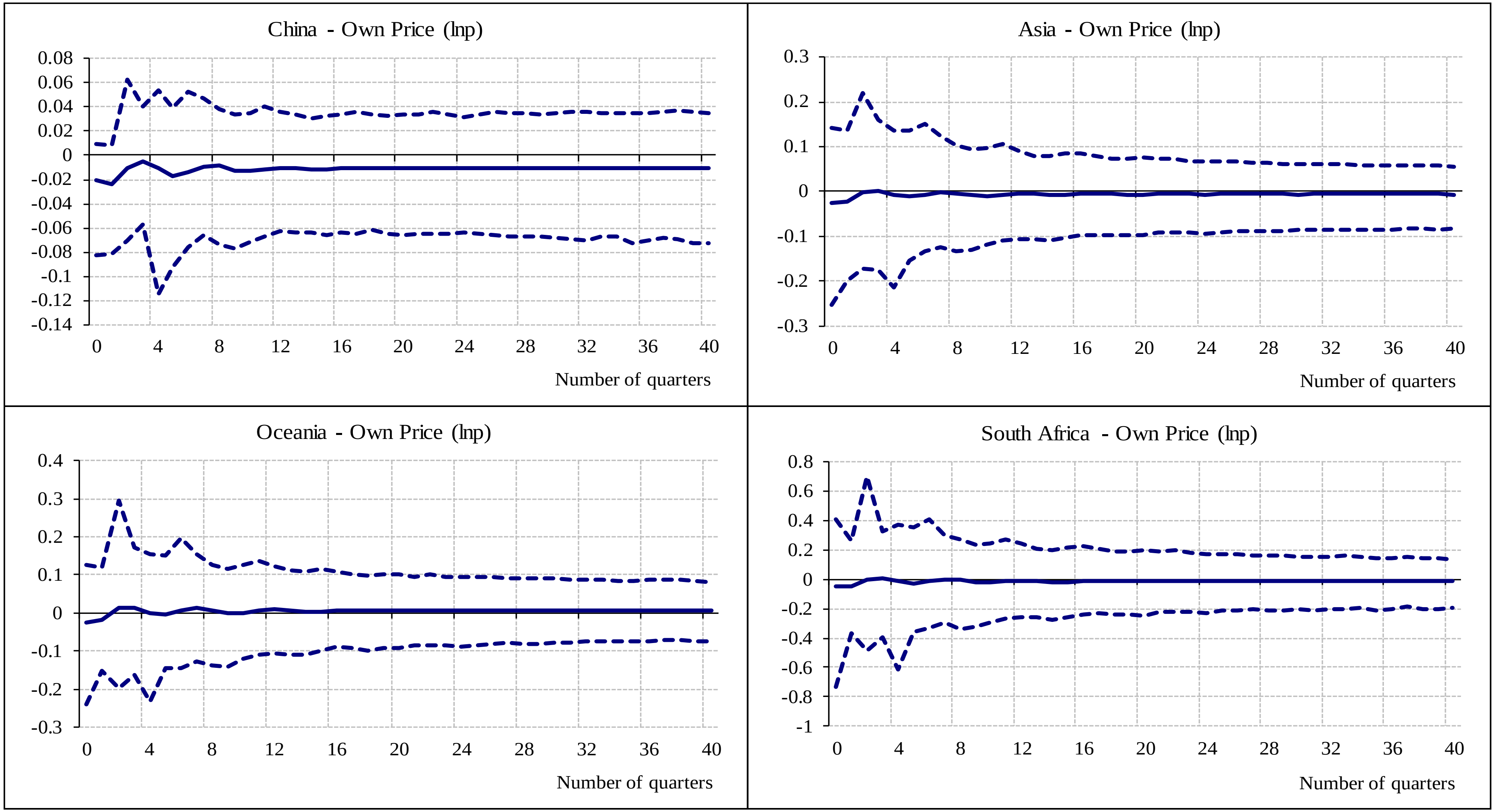

Figure A6 - Generalised impulse responses of a negative shock to China’s own price on own price across countries/regions

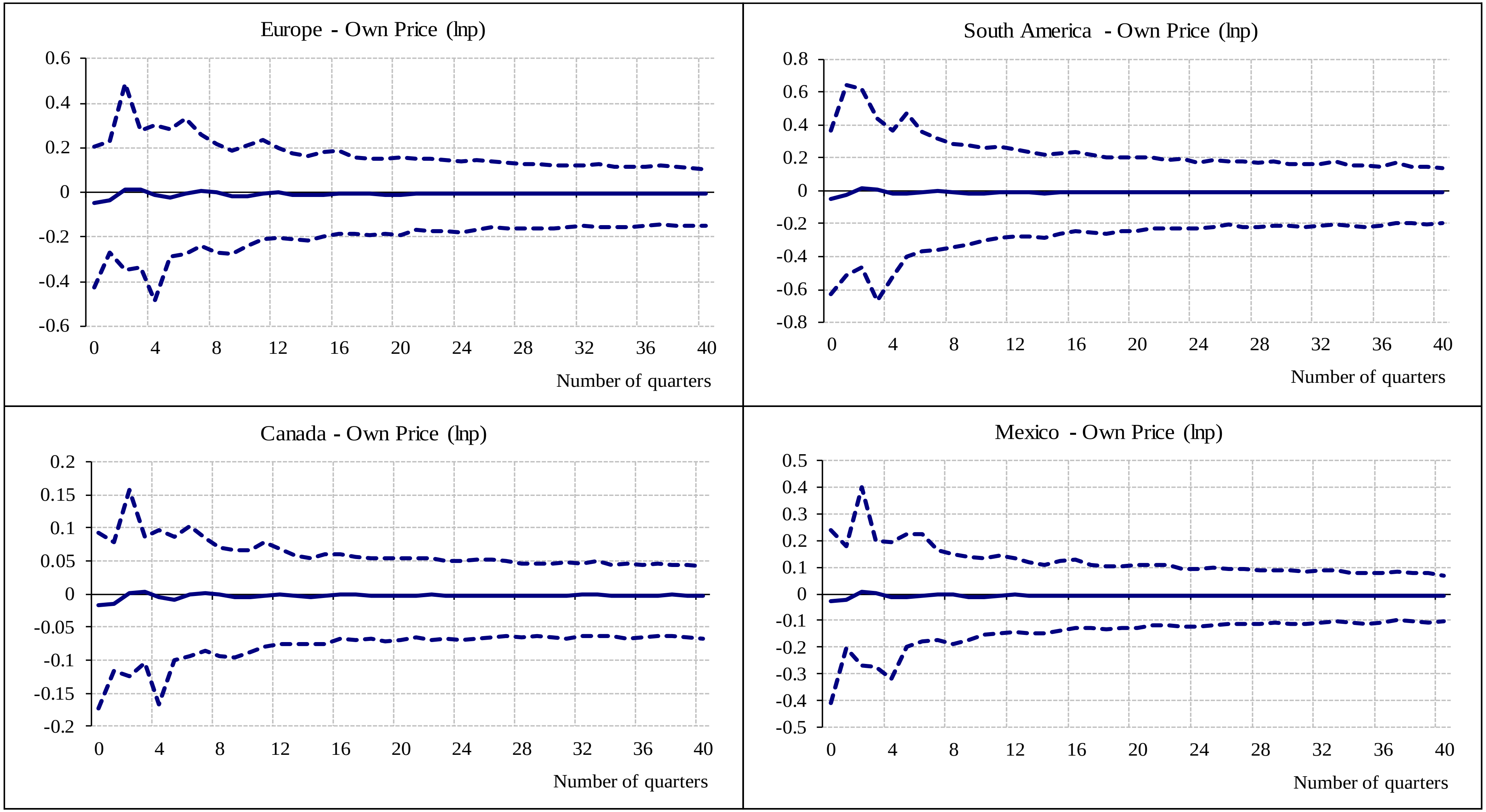

Figure A6 - Generalised impulse responses of a negative shock to China's own price on own price across countries/regions (cont.)

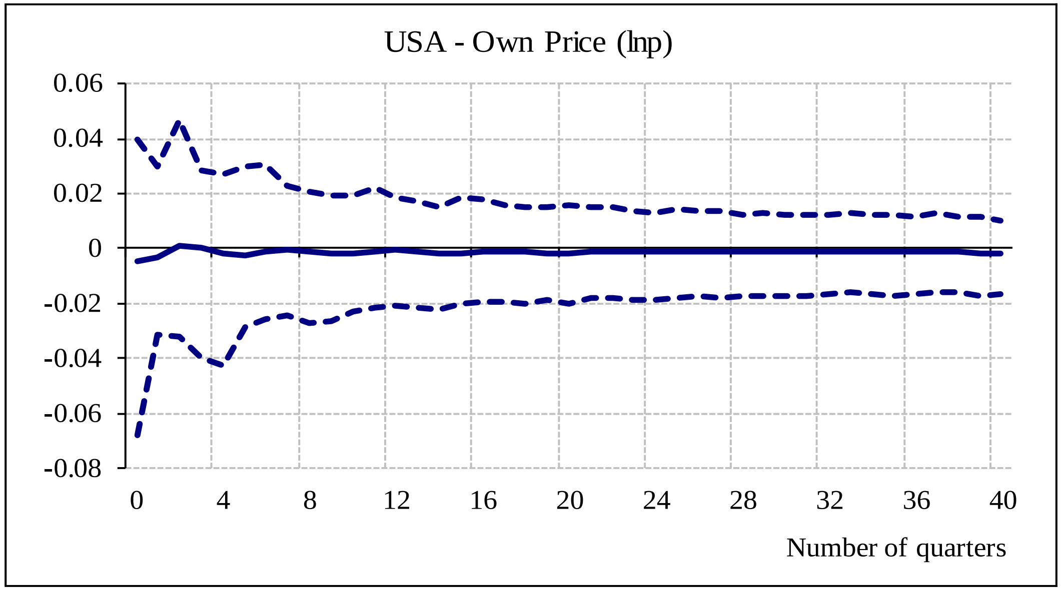

Figure A6 - Generalised impulse responses of a negative shock to China's own price on own price across countries/regions (cont.)

Notes: *'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;*

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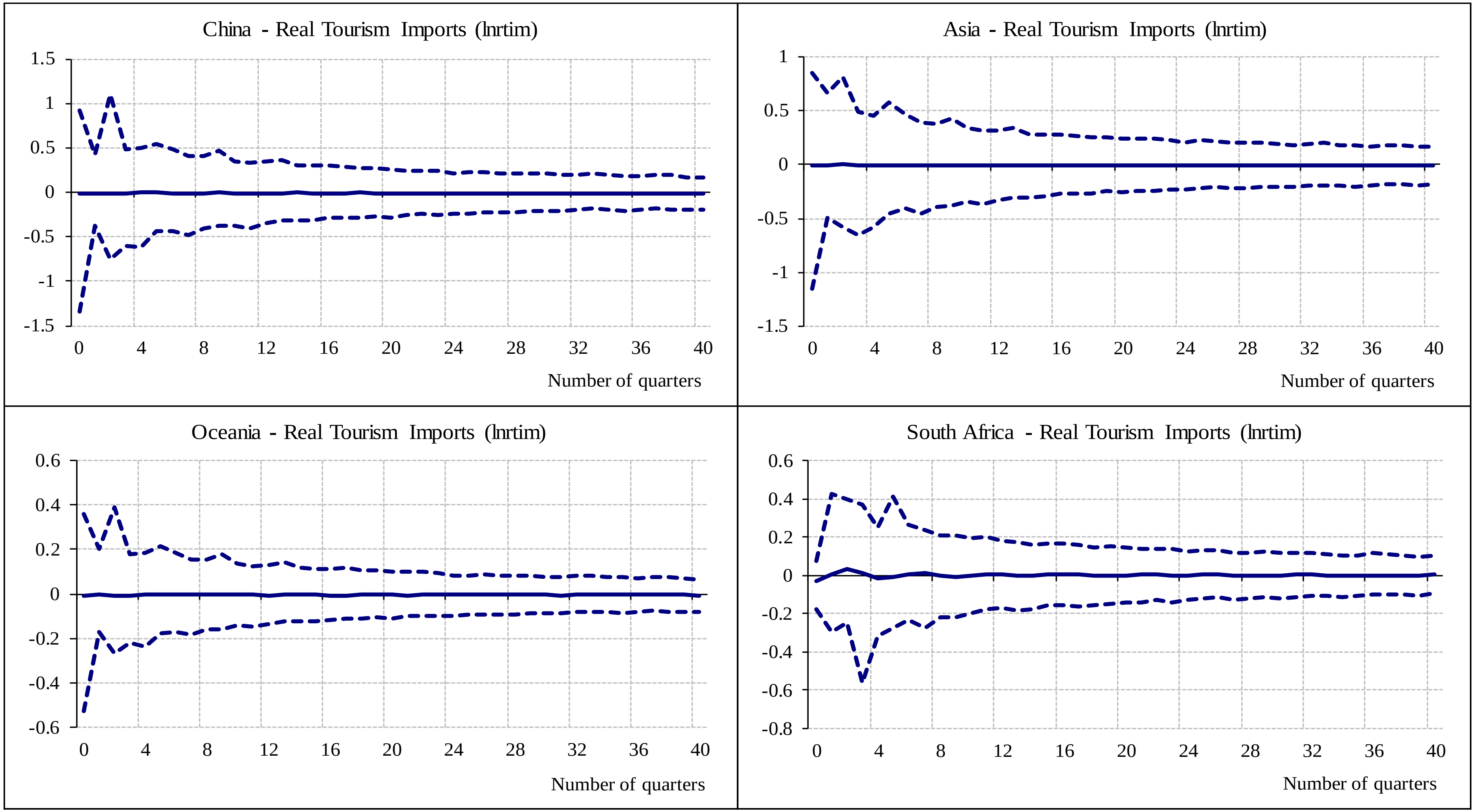

Figure A7 - Generalised impulse responses of a negative shock to China's own price on real tourism imports across countries/regions

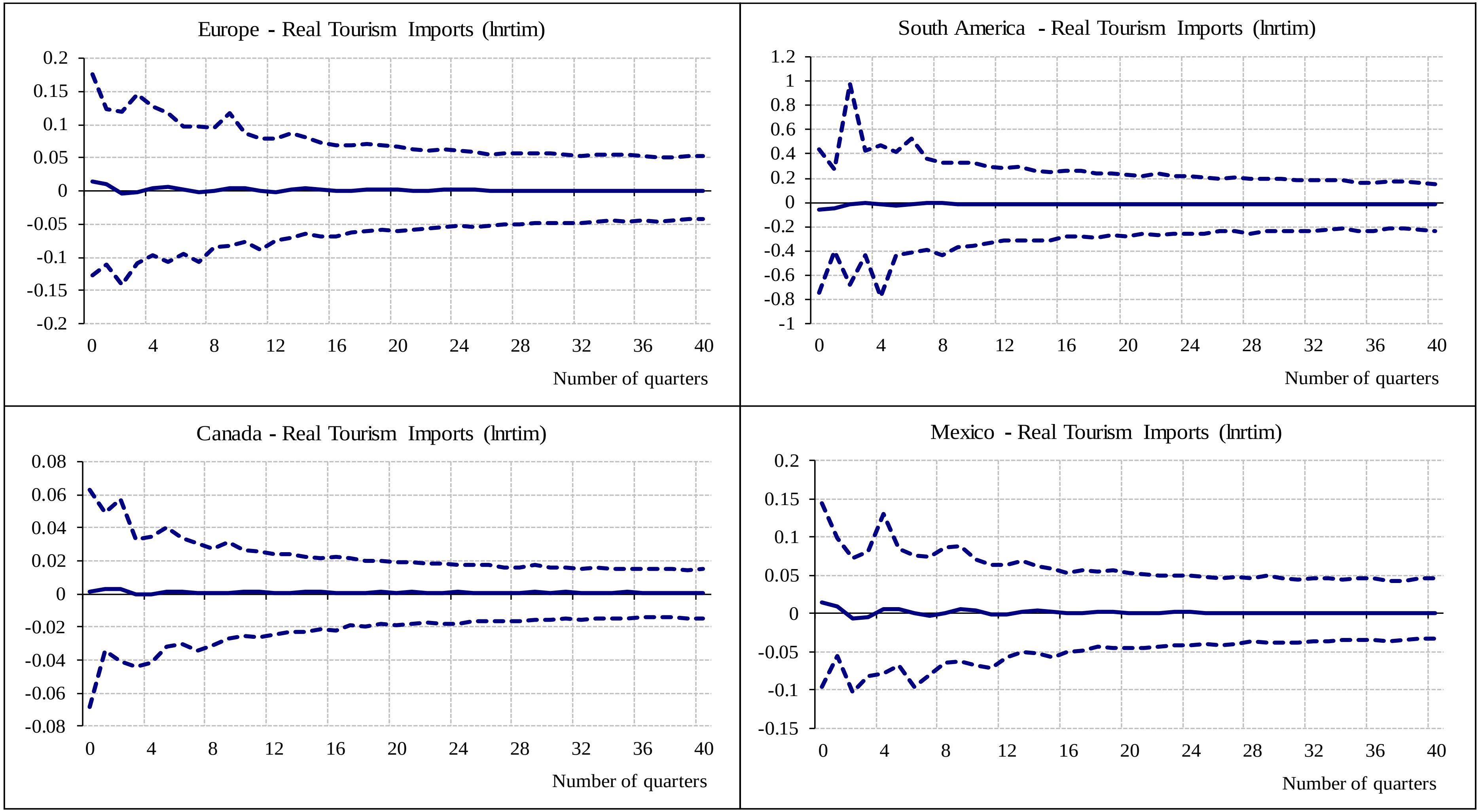

Figure A7 - Generalised impulse responses of a negative shock to China's own price on real tourism imports across countries/regions (cont.)

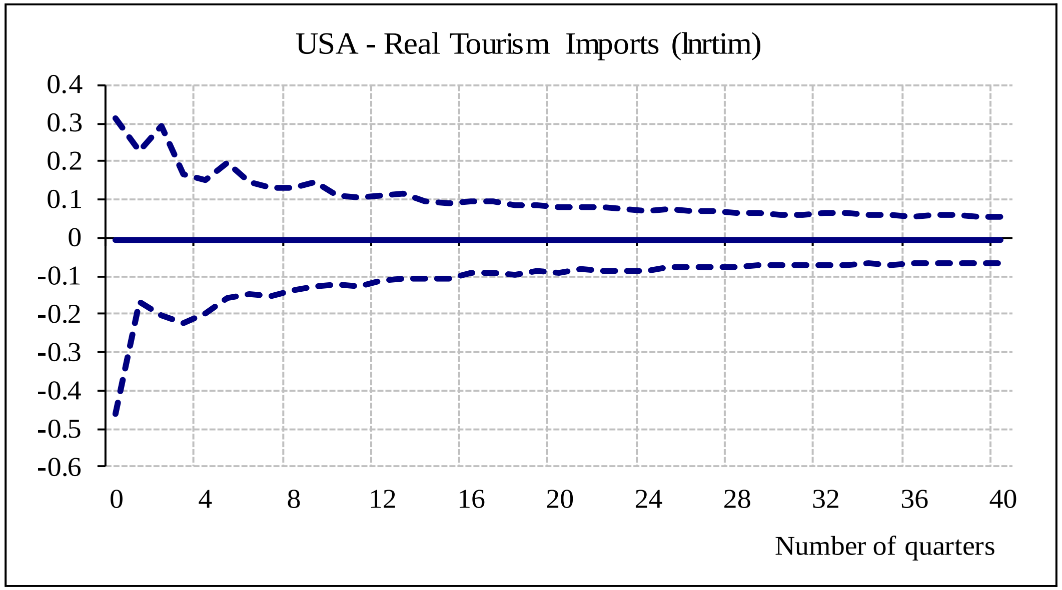

Figure A7 - Generalised impulse responses of a negative shock to China's own price on real tourism imports across countries/regions (cont.)

Notes: *'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;*

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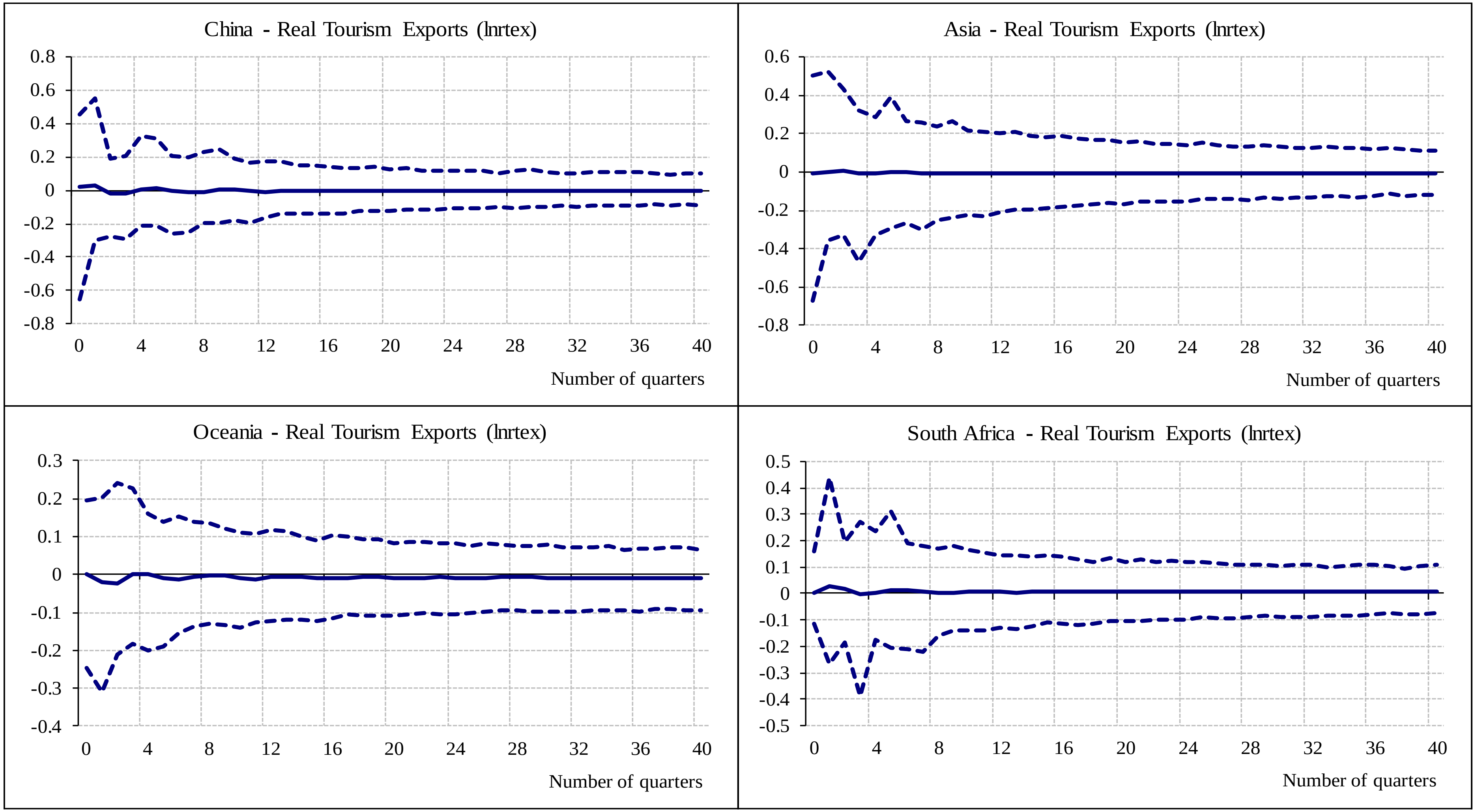

Figure A8 - Generalised impulse responses of a negative shock to China’s own price on real tourism exports across countries/regions

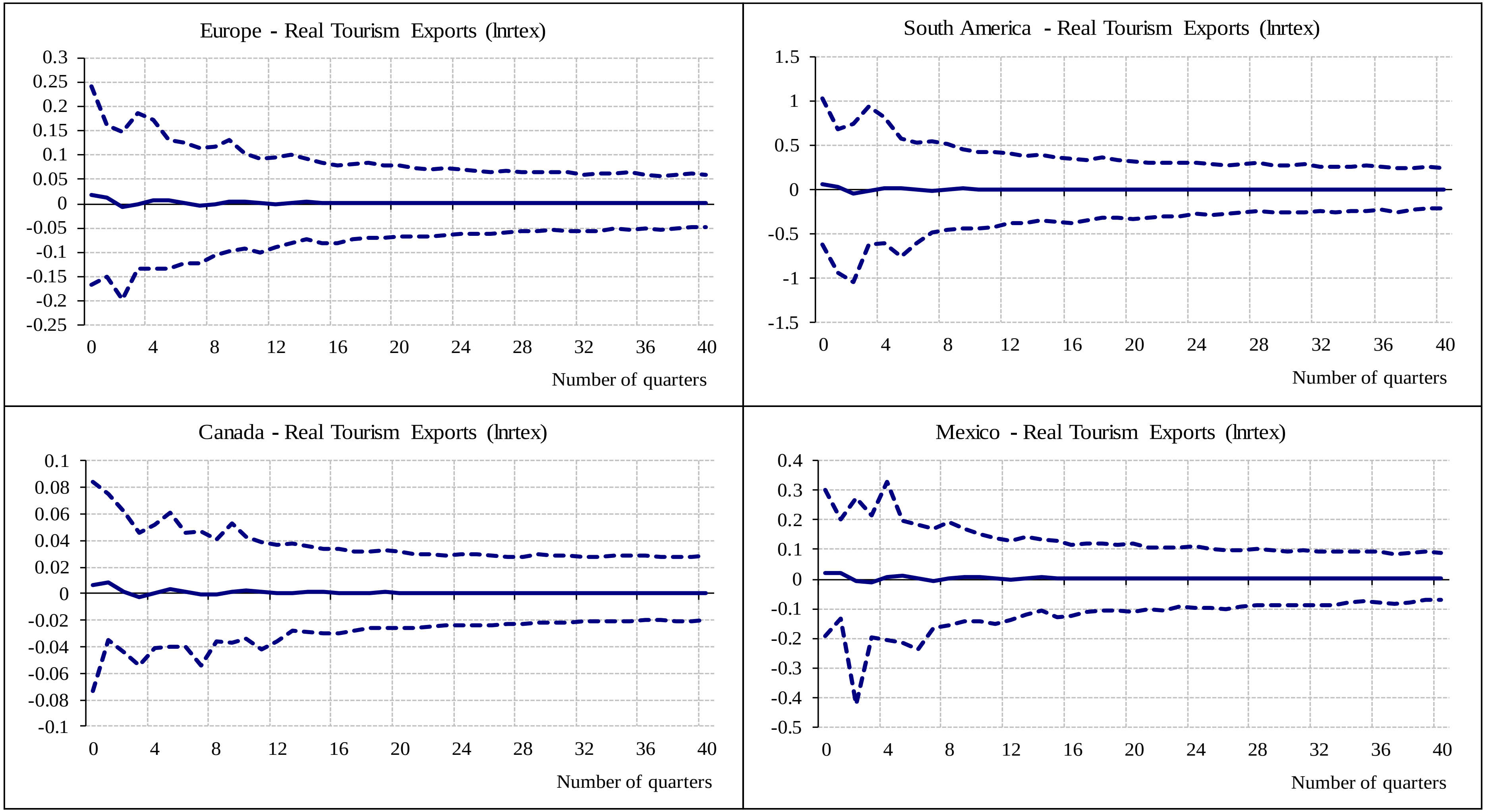

Figure A8 - Generalised impulse responses of a negative shock to China's own price on real tourism exports across countries/regions (cont.)

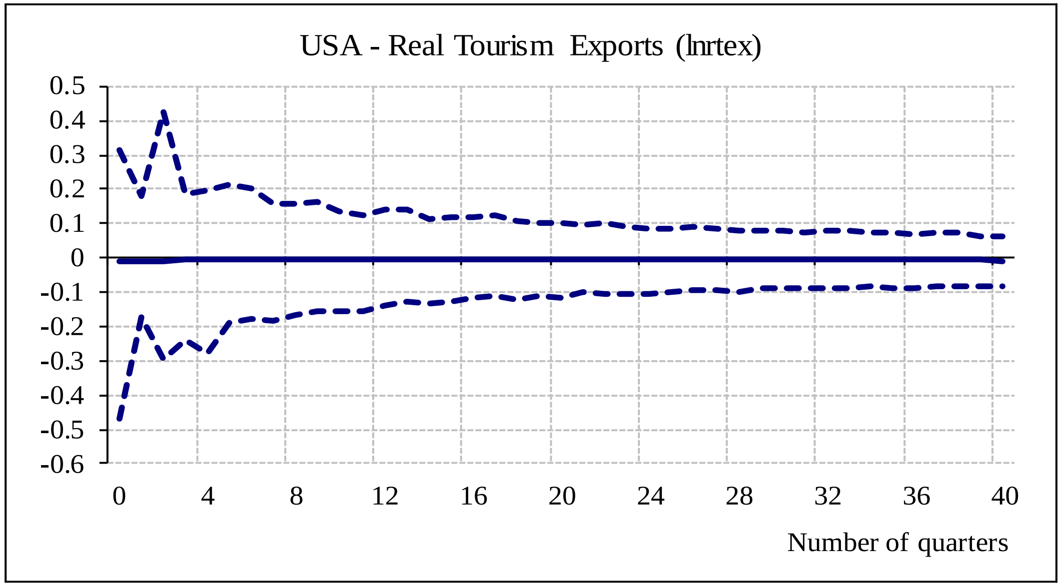

Figure A8 - Generalised impulse responses of a negative shock to China's own price on real tourism exports across countries/regions (cont.)

Notes: 'Asia' include India, Japan, Korea, Malaysia, and Thailand, but China is displayed individually;

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To highlight the importance of USA's economy, countries of the North America are not aggregated;

The lines are bootstrap mean estimates with 90% bootstrap error bounds.

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