ISSN 1837-7750

Griffith Business School

Discussion Papers Economics

SLCGE - Tourism: A Computable General Equilibrium Model of the Sri Lankan Economy for Tourism Policy Analysis

Sriyantha Fernando, Jayatilleke S Bandara, Christine Smith, Tien Pham

No. 2015-06

Series Editor: Dr Nicholas Rohde and Dr Athula Naranpanawa

SLCGE - Tourism: A Computable General Equilibrium Model of the Sri Lankan Economy for Tourism Policy Analysis

Sriyantha Fernando, Jayatilleke S Bandara, Christine Smith, Tien Pham

Abstract

Following the end of nearly three decades of civil war in May 2009, Sri Lanka has witnessed an unprecedented post-war tourism boom beyond its expectation. Recognising the key role that the tourism industry can play in post-war development the Sri Lankan government launched a Tourism Development Strategy (TDS). There is a dearth of research on integrated economy-wide modelling capable of simulating the effects of tourism related policies and measuring the impact of the current tourism boom on the Sri Lankan economy quantitatively. This paper attempts to fill this gap by developing a tourism focused Computable General Equilibrium Model of the Sri Lankan Economy (SLCGE–Tourism) and creating a suitable database for its operationalisation. The usefulness of this model is demonstrated via a policy simulation aimed at examining the economy-wide effects of tourism growth on the Sri Lankan economy. The results of the simulation support the view that tourism can play a major role in post-war development in Sri Lanka in terms of enhancing economic growth and employment generation.

Key words:

JEL Codes:

1. Introduction

There was a high level of optimism about development opportunities in Sri Lanka immediately after independence from British colonial rule in 1948. Indeed up until the early 1970s, Sri Lanka was often seen as a role model for economic development in the third world. After opening up of the economy to trade and investment in 1977, Sri Lankan policy makers expected to develop the small island economy like Singapore through export-led industrialisation and tourism (Jupp, 1999). None of these predictions or expectations materialised as a result of a separatist war (also known as the *Eelam* war) which began in 1983. This war was concentrated in the North and the East and involved fighting between government security forces and the *Liberation Tigers of Tamil Eelam* (LTTE). In addition, a youth rebellion erupted in the late 1980s in the South. These 'twin wars ' inflicted a significant cost to the Sri Lankan economy (Abeyratne, 2004).

The tourism sector was the one most affected by the wars and the associated violence (Selvanathan, 2006, Fernando et al., 2013b). Sri Lanka fell far behind many of its competitors and Asian neighbours in terms of attracting international tourists (Kiriella, 2011). Although the Sri Lankan government managed to quell the second youth uprising in the south in the late 1980s, the separatist war in the North and the East escalated in the next two decades. Finally, this war ended in May 2009 with the defeat of the LTTE and the gaining of control over the entire country by the Sri Lankan security forces.

Following the end of hostilities Sri Lanka has witnessed an unprecedented post-war tourism boom. This experience is similar to the experience of other former war affected Asian countries like Vietnam, Cambodia and Laos (see for details Fernando et al., 2013b). The total number of international tourist arrivals to Sri Lanka has nearly doubled within two years and almost four times after five years (from 447,890 in 2009 to 855,975 in 2011 and 1,527,153 in 2014). The tourism sector has become a major driver of the Sri Lankan economy in terms of foreign exchange earnings, employment generation and attracting foreign direct investment (FDI). In 2013, tourism generated 112,550 direct and 157,600 indirect employment opportunities and US$ million 1,715 foreign exchange earnings for the Sri Lankan economy (SLTDA, 2012). The sector attracted 20 per cent of total national FDI in 2011. After recognising the key role that the tourism industry can play in post-war development the Sri Lankan government launched a Tourism Development Strategy (TDS) with a five year master plan for 2011-2016. In its TDS, the Sri Lankan government has set a target of receiving 2.5 million tourists by 2016. Other targets in the TDS include doubling the current hotel room capacity from 22,745 to 45,000, an increase in foreign exchange earnings from tourism of $501 million in 2010 to $2.75 billion and an increase tourism related employment from the current level of 125,000 to 500,000 by 2016 (Ministry of Economic Development, 2011, p.4).

These targets demonstrate that the Sri Lankan government is very keen to accelerate post war economic development through tourism. However, there is a dearth of research on the historical evolution of tourism policies, analysis of historical data or the contribution of tourism to the Sri Lankan economy with a small number of exceptions (for examples, Bandara, 1997, O'Hare and Barrett, 1994, United Nation, 1993, Wickremasinghe and Ihalanayake, 2006, Selvanathan, 2006, Tisdell and Bandara, 2005, Gamage, 1978, Gamage et al., 1997, Due, 1980, Fernando et al., 2013a, Fernando et al., 2013b, Buultjens et al., 2015). None of these studies attempt to examine the economy-wide effects of a tourism boom or bust in Sri Lanka.

This gap has emerged partly because it is difficult to find the data necessary to analyse the contribution of tourism to national GDP. In the national accounting sense an industry is defined as a group of businesses producing a product or service, and the value of an industry is measured by how much of that product is produced (Forst, 1999). Tourism does not generate a specific product. By contrast it represents the sum of expenditure by travelers for wide range of products, for example transportation, lodging, meals, entertainment and retail sales. “Since it is not possible to identify tourism as a single "industry" in the national accounts, its value to the economy is not readily revealed. Tourism activity is “hidden” in other industry activities.” (Pham and Dwyer, 2013). As a result, economic activities generated by tourism are not separately identifiable in the normally used national income and product accounting framework (Fletcher, 1989). As a consequence there is often an on-going battle to establish credibility for tourism as an economic activity and generator of income in the economy. Since policy analysts cannot use official national income statistics to measure the impact of tourism on an economy, a significant volume of tourism research over the past few decades has focused on the development and use of a variety of ‘indirect’ economic techniques aimed at quantifying the effects of tourism on an economy.

Although tourism is expected to play a crucial role in the post-war development strategy for Sri Lanka, there is no analytical technique currently available to investigate the economic impact of tourism. Tourism related government agencies have been just collecting and reporting basic data such as number of tourist arrivals, foreign exchange earnings from tourism, direct and indirect employment generation and hotel occupancy rate for the last three to four decades. The current practice of producing policy statements specifying targets without policy analysis prior to formulation of these targets, and without establishing mechanisms for monitoring the progress with respect to these targets requires reform. In particular, a tourism-focused Computable General Equilibrium (CGE) model is needed to simulate the economy wide feedback effects of strategic plan targets and to identify bottlenecks towards achievement of the desired economic benefits to be derived from achievement of these targets. Thus, the main objectives of this study are: (1) to develop a tourism-focused CGE model for the Sri Lankan economy; (2) to create a suitable tourism data base to implement a tourism-focused CGE model; and (3) to demonstrate a how this

CGE model can be used to analyse tourism related policy issues. The rest of the paper is structured as follows. The next section provides an overview of different techniques used in tourism impact analysis. Section 3 develops the SLCGE-Tourism model and its database. Section 4 presents an illustrative simulation with the model, while the final section makes some concluding remarks.

2. A Brief Overview on Techniques Used in Tourism Analysis

Tourism research has expanded over the past few decades and a variety of economic techniques have been employed to quantify the effects of tourism on an economy. Very often, the overall impact of tourism on an economy is estimated by looking at the multiplier effect of tourism expenditures (see Lejárraga and Walkenhorst, 2008).

In the past, the Input-Output (I-O) technique has, perhaps, been the most widely used analytical tool for evaluating the economy-wide impacts of tourism (Dwyer et al., 2004). The I-O technique is simple to use and capable of measuring either the direct and indirect, or the direct, indirect, and induced impact of tourism (Archer and Fletcher, 1996, Fletcher, 1989, Henry and Deane, 1997, Blake et al., 2008, Andrew, 1997, Wagner, 1997). This technique also provides an excellent framework for measuring the impact of a multiproduct industry such as tourism (Khan et al., 1990). I-O models have been used for estimating the impact of tourism in a large number of economies, including Kenya (Valle and Yobesia, 2009), Tanzania (Kweka et al., 2003), Singapore (Heng and Low, 1990, Khan et al., 1990), Bermuda (Archer, 1995), Ireland (Henry and Deane, 1997), Israel (Fleischer and Freeman, 1997), and the Seychelles (Archer and Fletcher, 1996).

Although the I-O technique can be used to capture the effects of tourism on an economy, it has some well-known limitations. For example it is entirely demand driven, does not recognise supply constraints and ignores price effects and substitutability between primary inputs such as land, labour and capital. To overcome the limitations of I-O techniques some researchers have attempted to use a more sophisticated analytical tool known as the CGE model (for example, Adams and Parmenter, 1995b, Dwyer et al., 2000, Dwyer et al., 2003, Sugiyarto et al., 2003, Zhou et al., 1997).

A large number of CGE models have been developed to examine the impact of tourism in many countries following the seminal theoretical work of Copeland (1991). Fernando (2015) provides an up to date survey of tourism-focused CGE modelling. It is evident from this survey that defining the tourism sector remains somewhat problematic. In most previous studies, the tourism sector is identified as a collection of tourism related sectors such as hotels, accommodation. In some studies, tourism is recognised as a separate final demand sector. This approach to modelling could, arguably, lead to an underestimation of the true size of the tourism related sectors since it fails to capture the full range of multiplier effects (Ihalanayake, 2012).

Therefore, a major drawback of prior studies is the lack of agreement on the appropriate way of incorporating the tourism sector into the model. This drawback in turn acts to limit the capacity of these types of models to address all of the policy issues related to tourism. In particular many of these models fail to utilise an explicit tourism sector or sectors that combine both the demand and supply side of tourism (Ihalanayake, 2012). Thus, the resulting policy simulations may not be able to capture the full extent of the economy-wide impacts of the tourism sector.

Against this background, Madden et al. (2000) have formally defined the tourism sector with a novel approach, labelled the "tourism dummy sector approach", and its use has further enhanced the popularity of CGE models for conducting tourism related economic analyses (Clark et al., 2004, Dwyer et al., 2004, Ihalanayake, 2007, Pham et al., 2008, Dwyer and Pham, 2013, Ihalanayake, 2012, Pham and Dwyer, 2013, Dwyer et al., 2014, Pham et al., 2015).

3. Developing the SLCGE-Tourism Model

There is a long history of CGE modelling in Sri Lanka. As reviewed by (Bandara, 1989,1991), De Melo (1978) developed the first CGE model for the Sri Lankan economy by using the Social Accounting Matrix compiled by Pyatt and Roe (1977) for the year 1970. This model was used to examine the effects of selected agricultural policies on the Sri Lankan economy (De Melo, 1979), and the effect of alternative development strategies for the overall economy (De Melo, 1982). Following the seminal CGE work on Sri Lanka by De Melo, Blitzer and Eckaus (1986) developed another CGE model and focused on the impact of energy cost and prices on key economic variables and the industrial structure.

Despite these early attempts, serious CGE modelling research activities related to the Sri Lankan economy began only after the construction of a CGE model by Bandara (1989) using the methodology associated with the Australian ORANI model (Dixon et al., 1997, 1982). The former model was developed to examine the combine effects of the “Dutch Disease” impact of foreign capital inflows and the terms of trade shock in the late 1970s and the early 1980s. Following Bandara (1989) a number of ORANI type CGE models have been developed for the Sri Lankan economy (see for example, Centre For International Economics- CIE, 1992, Somaratne, 1998, Bandara and Coxhead, 1999, Kandiah, 1999, Naranpanawa, 2005, Naranpanawa et al., 2011, Perera et al., 2014). Most of the early applications of CGE models have been in the area of the effects of protection. However, some Sri Lankan modellers have attempted to address issues such as poverty (Naranpanawa et al., 2011), income distribution (Perera et al., 2014), soil erosion (Bandara et al., 2001), trade liberalisation on labour markets (Liyanaarachchi et al., 2014) and poverty and trade policy reversal (Liyanaarachchi et al., 2015).

The aim of this paper is to develop a Computable General Equilibrium (CGE) Model of the Sri Lankan Economy (hereafter referred to as SLCGE-Tourism) for tourism

impact analysis. SLCGE-Tourism is an extension of previous CGE modelling studies. The core of the model is developed following the framework of the ORANl-G single country generic model (Dixon et al., 1997, 1982, Horridge et al., 2000). The extension of tourism to the core model closely follows the recent work of other Australian tourism modellers (Madden and Thapa, 2000, Clark et al., 2004, Ihalanayake, 2012, Pham and Dwyer, 2013).

3.1 Model Specifications

The SLCGE–Tourism is a typical comparative static CGE model and comprises the following groups of equations describing for some time period:

- Producers' demands for produced inputs and primary factors;
- Producers' supplies of commodities;
- Demands for inputs to capital formation;
- Household demands for final goods and services;
- Export demands;
- Government demands for final goods and services;
- The relationship of basic values to production costs and to purchasers' prices;
- Market-clearing conditions for commodities and primary factors;
- Some equations to describe macroeconomic variables and price indices.

The model's equations are derived from microeconomic theory based on neo-classical assumptions about the behaviour of price taking agents. Consumers maximize utility subject to budget constraints. Producers chose inputs so as to minimize production costs, with both product and factor markets assumed to be perfectly competitive. Production technologies are characterized by nested production functions with constant elasticity of substitution and Leontief nests at different levels. Finally, prices adjust in goods or services and factor markets to equate demand and supplies. In common with other ORANI type CGE models, the SLCGE-Tourism model is developed to perform comparative-static policy simulations and contains equations and variables which refer implicitly to the economy at some future time period (see Horridge, 2014 p.2.).

In order to solve these set of equations, the SLCGE-Tourism is implemented using GEMPACK software– a flexible system for solving CGE model (Harrison and Pearson, 1994, Harrison and Pearson, 1996).

3.2 Modelling the Tourism Sector

In a typical I-O table, a conventional sector purchases intermediate inputs from other sectors, primary factors such as labour, land and capital and then produces an output.

This output is sold to other sectors as their intermediate input, to the household sector for consumption, to capital creators, to the government sector for its use and to the rest of the world as exports. However, tourism acts in a different way than conventional I-O sectors. The tourism sector does not sell its output to other sectors as an intermediate input and neither does this sector purchase primary factors directly. The tourism sector purchases components of the tourism product from domestic industries and import the rest. It is only sold to the final demand sector as tourism exports.

SLCGE-Tourism has incorporated an 'intermediate tourism sector' as a dummy sector that purchases a range of commodities from other intermediate sectors, they combine them and then sell the composite commodity to a relevant final demand sector. This approach combines adequately both the demand and supply sides of tourism. In other words, the dummy sector has no explicit production of an output, thus it does not purchase primary factors. However, this sector purchases intermediate inputs, utilises margin services and pays taxes on purchases (Ihalanayake, 2012). Therefore, the dummy sector is defined based on its purchases of different components of composite tourism product from other intermediate sectors. These components include accommodation, transport, food, entertainment and other tourism products. This approach recognises the fundamental nature of tourism in an economy-wide setting where the tourism sector interacts with other intermediate and final demand sectors while responding to relative price changes.

In order to explain the way in which tourism is incorporated into the SLCGE–Tourism model, it is important to explain how the above mentioned dummy sector approach is used to modify the conventional I-O database.

To explain the procedure of modification of the I-O database, firstly, a typical aggregated three sector I-O data base is given in Figure 1. In this figure all intermediate users (aggregated as Agriculture, Manufacture and Services sectors) and final users are represented by columns.

	Agric	**Manuf**	**Servi**	**HhdCon**	**Gov Con**	**CapFom**	**Invnt**	**Export**	**Total**
Agric	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Manuf	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Servi	XX	XX	XX	XX	XX	XX	XX	XX	XXX
Tot. Cost & Sale	*XXX*	*XXX*	*XXX*	*XXX*	*XXX*	*XXX*	*XXX*	*XXX*	***XXXX***
Tax - Subs	XX	XX	XX	XX	XX	XX	XX	XX	XXX
WageSaly	XX	XX	XX						XXX
OperSupl	XX	XX	XX						XXX

Figure 1: Structure of a typical aggregated Input Output Database

GDP can be calculated using both expenditure and income approaches using entries given in Figure 1 as shown below:

GDP from the expenditure side = C+I+G+X-M (where total household consumption is C, total investment is I, total government consumption, G, total export is E and total imports is M) and

GDP from the income side = ER + OS + TX (where the total wages and salaries bill is ER, total gross operating surplus is OS, and total net product taxes (taxes minus subsidies) is TA).

In order to recognise the international tourist sector and its interaction with other intermediate sectors and final users, the 'InTour' tourism dummy sector is included by modifying the conventional I-O data framework as indicated in Figure 2.

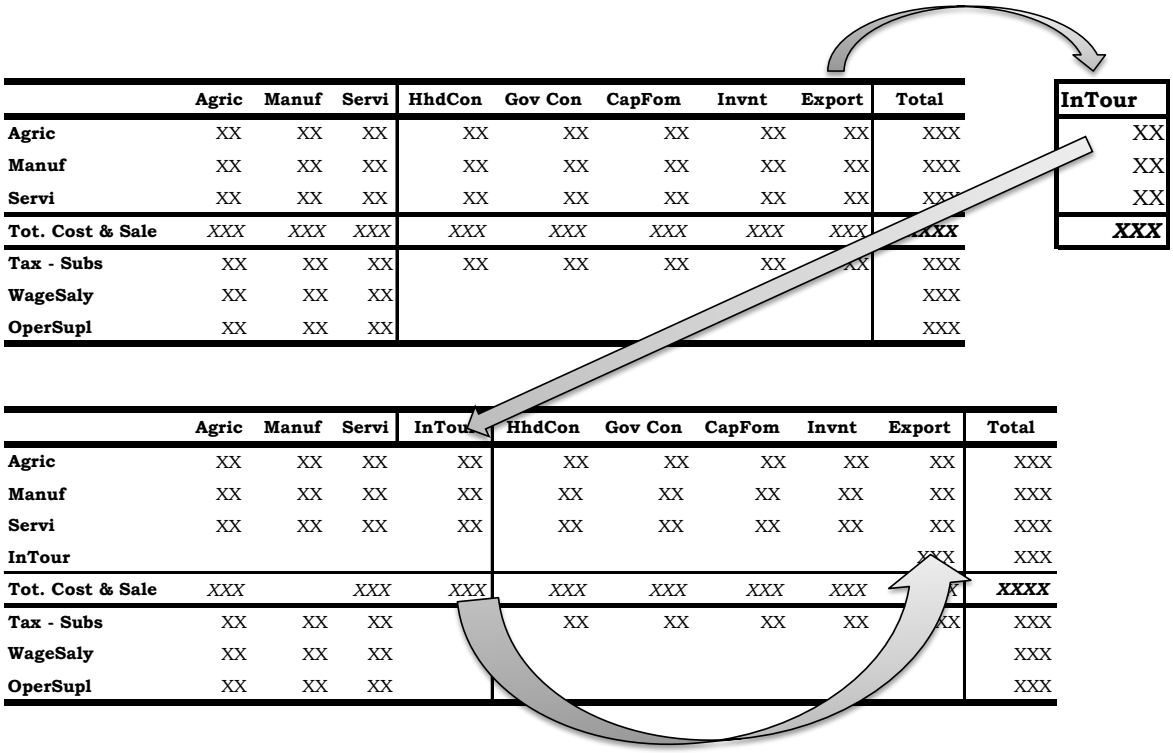

Figure 2: Structure of Input Output Database after incorporating the International Tourist (InTour) sector

InTour sector is created by disaggregating the conventional exports column into international tourism expenditure and non-tourism export earnings. InTour does not need to purchase primary inputs since the sector is acting as a "middle men" (Ihalanayake, 2012). Therefore, InTour is only purchased by the export sector.

3.3 Compiling the Main Database

In common with any other CGE modelling exercise, two types of data are necessary to implement the model and in addition, tourism consumption data are required to construct a tourism vector for the tourism extension. Firstly, an economy-wide input-output (I-O) database or a Social Accounting Matrix (SAM) is required. In this study an I-O database is used since there is no need to use a SAM as there is no focus on

distributional issues. A recently compiled and unofficially available I-O table (Bandara, 2014) is used in this study.

Secondly, values for different elasticity parameters are necessary to implement the model. Usually, CGE modellers use various methods to gather elasticity parameters. Econometric estimation of elasticity parameters using cross sectional or time series data would be the most ideal method. However, there is no attempt to estimate elasticities in this study since our focus is on demonstration of the usefulness of introducing a dummy sector for tourism. As a result the elasticity values employed in other Sri Lankan CGE studies are used to implement our model.

Finally, the primary requirement for construction of a tourism vector is to find the required tourism consumption data. Tourism consumption can be found in two ways; first, Tourism Satellite Accounts (TSA) provide a sophisticated database for estimating tourism consumption for both international and domestic tourists. Unfortunately, Sri Lanka has not developed a TSA. Therefore, to obtain data on tourism consumption, alternative sources of data are required. The Airport Survey (2005/2006) on foreign departing tourists at Bandaranaike International Airport (SLTDA, 2006) and the Tourism Annual Report 2005 published by Sri Lanka Tourist Board are used in this study as alternative sources. Components of average expenditure and average duration of stay for each market were taken from the Airport survey in order to map the tourism goods and services. Meanwhile, tourist arrivals, average expenditure per tourist per night and total earnings from tourists were found from Tourism Annual Reports.

3.3.1. Data Transformation in to CGE Framework (ORANI-G format)

The I-O table used in this study is a symmetric industry-by-industry table for Sri Lanka in the benchmark year 2006. It distinguishes 64 commodities and 64 industries and there is one-to-one relationship between industries and commodities. Transactions are valued at basic prices. This database provides an import matrix, a tax matrix and margins matrixes. Table 1 presents a 3-sector aggregate of the 64-sector conventional I-O table, wherein the columns show intermediate input demands for three commodities by industries and the components of gross value added, while rows show supplies of commodities to different users and demands for commodities by final users.

Table 1: The 3-sector aggregated 64-sector conventional IO table (LKR: Millions)

	Agric	Manuf	Servi	HhdCon	Gov Con	CapFom	Invnt	Export	Total
Agric	17,119	193,625	9,902	215,339		2,342	21,809	68,490	528,626
Manuf	35,913	221,347	229,413	540,840		464,461	10,352	408,272	1,910,598
Servi	51,216	258,491	397,373	46,276	446,784	45,364	24,966	367,961	2,338,431
	104,248	673,463	636,688	1,502,455	104,248	512,167	57,127	104,248	**4,777,655**
Tax - Subs	2,321	56,352	80,888	63,190	4,282	46,637	5,483	40,653	295,164
WaeSalay	161,219	418,159	935,357						,514,734
OperSupl	229,410	397,694	501,675						1,128,779
GDP									2,938,677
Imports	36,068	364,934	183,822	407,971	372	172,105	28,723		1,193,995

In addition to the core data sourced from the l-O table, a wide range of elasticity parameters are required in order to implement a CGE model. The behavioural parameters in the SLCGE-Tourism model mainly consist of elasticities for substitution between domestic and imported sources (Armington elasticities) of commodities, elasticities of substitution between primary factors, household expenditure parameters, and export demand elasticities. This study, therefore, adopts readily available elasticity parameters that have been used in previous Sri Lankan CGE models by using the GTAP database. After mapping the GTAP classification into 64 commodities (and sectors) in the model, we assign values for elasticities as in the GTAP version 6 database.

In order to implement the Sri Lankan CGE model, it is required to transform the data into standard ORANI-G flows. Figure 3 presents the structure of these flows. It provides the capacity to facilitate detailed structural analysis. In another words, Figure 3 depicts more disaggregated data matrices than a conventional input-output table. It disaggregates commodities by source, treatment of *sales taxes* and *mark-ups*. The entries in each column represent the structure of the purchases of commodities made by the agents identified in the relevant column heading. This disaggregated and detailed data structure has some broader analytical advantages.

Firstly, each commodity (64 commodities) is available from both from domestically produced and imported sources. Therefore, supply of commodities can now be obtained from two sources, either locally or imported from abroad. In addition the use of commodities can also be categorised by source. Figure 3 shows that commodities, produced domestically or imported, are used by industries for inputs into current production as V1BAS and capital formation as V2BAS as well as consumed by households as V3BAS and the government as V4BAS. In addition export of the commodities shown as V4BAS and change in inventories as V6BAS. All these are valued at basic prices.

		Absorption Matrix					
		1	2	3	4	5	6
		Producers	Investors	Household	Export*	Other	Stocks*
	Size	← I →	← I →	← H →	← 1 →	← 1 →	← 1 →
Basic Flows	↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Margins	↑ C×S×M ↓	V1MAR	V2MAR	V3MAR	V4MAR	V5MAR	
Taxes	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	
Labour	↑ O ↓	V1LAB					
Capital	↑ 1 ↓	V1CAP					
Land	↑ 1 ↓	V1LND					
Other Costs	↑ 1 ↓	V1OCT					
Sub-sidies	↑ 1 ↓	V1SUB					

C = Number of Commodities
I = Number of Industries

S = 2: Domestic,Imported,
O = Number of Occupation Types

M = Number of Commodities used as Margins

H = Number of Household Types

* Note: Export column is for domestic goods only.

	Make Matrix
Size	← I →
↑ C ↓	MAKE

	Import Duty
Size	← 1 →
↑ C ↓	V0TAR

Figure 3: Structure of the Standard ORANI-G Flows Database
Adapted from (Harrison and Horridge, 2001)

Secondly, four domestically produced services including wholesale and retail trade services, land transport services, water transport services and air transport services are also classified as margin commodities, which are responsible for transferring commodities from producers to various users. In Figure 3, these margins are shown in a four dimension matrix (64x64x2x4) as V1MAR for industries, V2MAR for investors, V3MAR for households, V4MAR for exports and V5MAR for the government.

Thirdly, the payment of commodity taxes associated with each agent's purchase can also be identified as payable by producers (V1TAX), investors (V2TAX), households (V3TAX), exporters (V4TAX) and the government (V5TAX).

Finally, in addition to intermediate inputs, current production utilises primary factors and these are shown in Figure 3 as labour (VILAB), fixed capital (VICAP), agricultural land (VILND) and production subsidies or taxes known as "other costs" (VIOCT) which include various miscellaneous expenses of production.

In addition, Figure 3 also presents two satellite matrices, showing the MAKE matrix and import tariff revenue matrix. The MAKE matrix provides the details amount of commodities produced by each industry.

The main part of Figure 3 (excluding primary factors) is known as the absorption matrix and each cell of this represents a matrix of data identified by the name which appears in the figure. For instance, VIBAS is a three-dimensional matrix (64x64x2) of the flows of C commodities (64) to I industries (64) by sources (2). The transformed I-O absorption matrix respects three balance conditions. First, for each industry, total cost of production equals its total value of commodity output (column sum of the MAKE matrix). Second, for each commodity, total production equals the value of total sales (row sum of the MAKE matrix). Third, since the Sri Lankan I-O table is symmetric, the pure profit condition confirms that for each sector, total sales equals total output.

It is necessary to implement a particular data transformation process to derive the database described in Figure 3 from conventional I-O data matrices. The transformed I-O database with the value flows of a 3-sector aggregate is presented in Table 2. This is the schematic representation of the SLCGE-Tourism model's I-O table database as described in Figure 3. This database contains comprehensive information according to the well-defined ORANI G format for CGE models. All the information presented in this table has been used to support the TABLO language oriented program which is used to assemble the database and convert the equation system of the model into computer readable format.

An advantage of the transformed I-O table data shown in Table 2 is that it has the capacity to facilitate structural analysis compared to the conventional I-O table shown in Table 1. Commodities can now be obtained from two sources, either locally or imported from abroad. Certain domestically produced goods are also classified as margin commodities, which are responsible for transferring commodities to various users. Finally, associated with each agent's purchase is the payment of commodity taxes. Table 2 also presents a satellite matrix, namely the MAKE matrix.

Table 2: Transformed I-O Table (LKR: Millions)

		Absorption Matrix							
		1			2	4	3	5	6
		Producers			Investors	Households	Exports	Government	Stocks
	Size	*AGR*	*MFG*	*SER*					
Basic Flows (Dom)	*AGR*	17,119	193,626	9,901	2,342	215,338	68,490	0	21,810
	MFG	35,914	221,345	229,415	464,461	540,840	408,275	0	10,348
	SER	26,801	90,912	310,816	7,707	340,905	157,088	446,785	24,965
Basic Flows (Imp)	*AGR*	2,548	114,033	2,629	161	38,771	0	0	21,160
	MFG	33,028	242,746	132,869	170,022	286,894	0	0	7,563
	SER	492	8,155	48,324	1,922	82,306	0	372	0
Margin (Dom)	*Trade*	10,352	66,285	36,334	8,847	187,427	0	0	
	Land-T	7,224	46,258	25,356	6,174	130,799	122,887	0	
	Water-T	10	62	34	8	175	85,759	0	
	Air-T	178	1,139	569	152	2,625	114	0	
Margin (Imp)	*Trade*	3,876	31,373	14,146	13,098	49,243	2,114	0	
	Land-T	2,705	21,894	9,872	9,140	34,365	0	0	
	Water-T	4	29	13	12	46	0	0	
	Air-T	67	539	232	225	690	0	0	
Taxes (Dom)	*AGR*	173	8,686	212	3	2,702	3,333	0	
	MFG	-3,212	40,539	52,487	44,981	55,365	28,840	0	
	SER	717	7,127	28,190	1,665	10,197	8,915	0	
Taxes (Imp)	*AGR*	0	0	0	0	0	0	0	
	MFG	0	0	0	0	0	0	0	
	SER	0	0	0	0	0	0	0	
Wage		161,219	418,159	935,357					
Surplus	*Land*	229,410	0	0					
	Cap	0	397,694	501,675					

	Joint Production (MAKE) Matrix			
Size	AGR	MFG	SER	Total
AGR	528,626			528,626
MFG		1,910,599		1,910,599
SER			2,338,430	2,338,430
Total	**528,626**	**1,910,599**	**2,338,430**	**4,777,655**

3.3.2. Construction of Tourism Consumption Vectors

The most important modification of the SLCGE–Tourism model is the incorporation of the tourism sector. The traditional I-O tables are not sufficient to implement tourism-focused CGE models since tourism does not represent one particular sector within an I-O table. A number of traditional I-O sectors such as food and beverages, transport and trade are associated with tourism expenditure.

Therefore, the main task of incorporating the tourism sector is the construction of tourism consumption vectors for the international tourism sector. The following steps were applied in the process of constructing international tourism consumption vectors:

1. Find international tourism arrivals, consumption and export earnings.

2. Calculate international tourism consumption according to expenditure ratios and total tourism export earnings by market.

3. Map tourism consumption with expenditure components of the core I-O database to prepare the tourism vector.

4. Disaggregate the tourism vectors into basic values, taxes and use of margins as original tourism consumption data represents purchasers' values.

5. Merge the new tourism sectors to the core database and extract consumption figures from exports in the core database. This will form the SLCGE–Tourism database with a tourism sector.

In order to calculate tourism consumption, available international tourism expenditure survey data (SLTDA, 2006) is used for basic disaggregation. The survey detailed total international tourism expenditure by five components, namely Accommodation, Food & Beverage, Shopping, Transport and Other. Further, it illustrates the percentages associated with each component. Total international tourism expenditure disaggregation by market and by expenditure components were used as a starting point for calculating the international tourism consumption levels necessary to construct our tourism database vector.

In addition to the above disaggregation, total tourist nights were calculated by using tourist arrivals and average duration of stay by each market. Such nights were converted into expenditure values by multiplying average expenditure per night per tourist and finally, we mapped total tourism earnings with our calculated expenditures. Up to this stage, our tourism expenditure data comprises five main categories: Rs. Mn. 23,913 for Accommodation, Rs. Mn. 5,503 for Food & Beverages, Rs. Mn. 9,251 for Shopping, Rs. Mn. 2,203 for Transport and Rs. Mn. 1,716 for Other. The next step involved mapping the five components of international tourism consumption into relevant product categories in our standard I-O database. We followed the Standard Product Classification of TSA (United Nations, 2008) to identify tourism related products in our I-O table. This table includes 64 product categories but only 17 product categories are tourism-related.

Table 3 shows the mapping of the main tourism products to commodity categories in the I-O table. The total value of these 17 sectors in the I-O table is divided in to four[1] main categories of tourism expenditures. The total value of the tourism expenditure in the I-O table is Rs. Mn.443,551 and this is allocated according to four main tourism expenditures as Rs. Mn.30,761 for Accommodation, Food & Beverages, Rs. Mn.99,657 for Shopping, Rs. Mn.197,414 for Transport and Rs. Mn.18,719 for other tourism expenditure.

[1] Accommodation and Food & Beverages have been combined as I-O data are not compatible with accommodation alone.

Table 3: Mapping of the Main Tourism Products to I-O Table Commodities

Expenditure Components	Mapped I-O table Commodities	Sector No
Accommodation, Food & Beverages	Lodging; food and beverage serving services	52
	fruits (fresh)	9
	Meat and prepared fish, fruit, vegetables and fats	17
	Dairy products	18
	Grain mill products (rice, wheat and other)	19
	Food products nec.	20
	Beverages (soft drinks and alcohol)	21
Shopping	Yarn and thread; woven and tufted textile fabrics	23
	Textile articles other than apparel	24
	Knitted or crocheted fabrics	25
	Wearing apparel	26
	Leather and leather products; footwear	27
Transport	Land transport services	53
	Water transport services	54
	Air transport services	55
	Supporting and auxiliary transport services	55
Other	Other Services	64

Finally, to generate the data on tourism consumption expenditure required for the CGE modelling exercise, total tourism expenditure of Rs. Mn. 42,586 is mapped into tourism related products in the I-O table valued Rs. Mn.443,551 by using the following two steps.

The first step is to divide total tourism earnings into Accommodation, Food & Beverages, Shopping, Transport and Other expenditure. The second is to separate tourism expenditure of each sector into that associated with the respective I-O table sectors by using the ratio of tourism expenditure of each component. Following the above procedure international the tourism expenditure is disaggregated into a TSA product classification as shown in final column of Table 4.

Table 4 Disaggregated International Tourism Consumption (LKR Mn)

Sector No	Intourism				
	Tourism Commodities	**Basic Price**	**Taxes**	**Margins**	**Purchasers' Price**
9	Fruit	83.04	6.66	19.87	109.57
17	MetFhFrtVgPr	2,653.61	117.95	929.33	3,700.90
18	DairyProduct	512.64	1.46	133.21	647.31
19	GrainMilProd	888.37	53.03	478.51	1,419.91
20	OtherFodProd	3,581.72	223.89	1,674.34	5,479.96
21	Beverages	5,433.30	724.36	487.06	6,644.72
23	Textiles	726.78	1.31	0.89	728.98
24	OtherTextile	247.37	8.29	0.41	256.07
25	Knt_CrocFabr	1,200.62	33.91	9.79	1,244.31
26	WearigAparel	3,241.58	749.29	2,843.35	6,834.22
27	LethPro_Fotw	151.34	12.54	23.06	186.94
52	Hotel_Restut	9,219.51	2,194.55	0.00	11,414.07
53	LndTrp_Pipln	1,006.83	17.33	0.00	1,024.16
54	WaterTranspt	215.75	0.01	0.00	215.76
55	AirTransport	615.22	1.79	0.00	617.01
56	Sup_AuxTranp	345.09	0.73	0.00	345.82
64	OtherService	1,462.86	252.95	0.00	1,715.80
	Total	**31,585.63**	**4,400.05**	**6,599.83**	**42,585.50**

Source: Author's calculation

These figures are at purchasers' prices that include taxes and expenditure on trade and transport margin services. However, our model requires disaggregated figures on tourism consumption expenditure at basic values and associated taxes and expenditure on margin services. Therefore, the next step is to disaggregate international tourism consumption figures into basic values, taxes and expenditure on margin services. Furthermore, expenditure figures on margins should be further disaggregated into the four margin sectors of the standard database as trade, land transport, water transport and air transport.

To obtain the tax vector and each trade and transport margin vectors for our tourism commodities, tax and margin rates of each commodity it is assumed that the trade and transport margin rates associated with tourism expenditure on different commodities are similar to the rates associated with domestic household demand for these same commodities. Although tax rates are different for domestic household consumption compared with tourism consumption, it was decided to use the above method to generate tax rate on tourism expenditure since there exists no reliable data to support any other approach. The disaggregated figures of international tourism consumption at domestic basic prices and associated trade and transport margins and net taxes derived from application of our chosen approach are shown in Table 4.

Figures in this table represent the transactions of the international tourism dummy sector with the rest of the economy. This sector does not produce a commodity. Nevertheless, it purchases different components of the composite domestic tourism product from related sectors and on sells the composite

product international tourists. For example, it shows international tourism consumption of commodities in the Sri Lankan economy in both basic prices and purchasers' prices, payment of taxes on consumption and the use of margin services. For instance, international visitors in Sri Lanka have purchased Rs.83.04 million worth goods (columns 3) from the fruit products sector and incur indirect taxes of Rs.6.66 million (columns 4). Furthermore, the table shows that the total expenditure for the use of margin services to deliver the output of the food products sector to intemational visitors is Rs 19.87 million (column 5).

3.3.3. Incorporation of the New Tourism Sector into the Core I-O Database

The final stage in the construction of tourism database for SLCGE – Tourism is to incorporate the new tourism sector into the core I-O database. This can be done in three steps: first, figures appearing in the tourism expenditure vectors needed to be extracted from the relevant export demand vectors of the core I-O database since tourism expenditures are considered as export earnings. Secondly, these total extracted figures (total tourism earnings) are added to export vector separately as a new commodity (international tourism) in the core I-O database. Finally, the extracted figures are established as a new industry (international tourism) in the core database in order to balance cost and sales. The same procedure was performed for all expenditure vectors such as basic prices, taxes and margins. Table 5a and 5b numerically illustrate the merger of the tourism vector within the core data base. Table 5a presents the ‘before merge the tourism sector’ structure, while Table 5b shows the ‘after merge the tourism sector’ structure.

Table 5a I-O Table without Tourism Sector

	Intermediate Sectors				Final Demands				InTourism
	Agric	**Manuf**	**Servi**	**HhdCon**	**Gov Con**	**CapFom**	**Invnt**	**Export**	
Agric	17,119	193,625	9,902	215,339		2,342	21,809	68,490	110
Manuf	35,913	221,347	229,413	540,840		464,461	10,352	408,272	27,143
Servi	51,216	258,491	397,373	746,276	446,784	45,364	24,966	367,961	15,333
Tot. Cost & Sale	***104,248***	***673,463***	***636,688***	***1,502,455***	***446,784***	***512,167***	***57,127***	***844,723***	***42,586***
Tax - Subs	-2,321	56,352	80,888	63,190	4,282	46,637	5,483	40,653	
WageSaly	161,219	418,159	935,357						
OperSupl	229,410	397,694	501,675						
GDP									
Imports	36,068	364,934	183,822		407,971	372	172,105	28,723	

Table 5b I-O Table after Mapping Tourism Sector

	Intermediate sectors					Final demand			
	Agric	**Manuf**	**Servi**	**InTourism**	**HhdCon**	**Gov Con**	**CapFom**	**Invnt**	**Export**
Agric	17,119	193,625	9,902	*110*	215,339		2,342	21,809	68,380
Manuf	35,913	221,347	229,413	*27,143*	540,840		464,461	10,352	381,129
Servi	51,216	258,491	397,373	*15,333*	746,276	446,784	45,364	24,966	352,628
InTourrism	-	-	-	-	-	-	-	-	*42,586*
Total	***104,248***	***673,463***	***636,688***	***42,586***	***1,502,455***	***446,784***	***512,167***	***57,127***	***844,723***
Tax - Subs	-2,321	56,352	80,888		63,190	4,282	46,637	5,483	
WageSaly	161,219	418,159	935,357						
OperSupl	229,410	397,694	501,675						
Imports	36,068	364,934	183,822		407,971	372	172,105	28,723	

4. The Analysis of Economy-Wide Effects of Tourism

A simulation in relation to the tourism as usual business (BASE scenario) is carried out using a short run closure or macroeconomic environment. The international tourist arrivals in Sri Lanka frequently fluctuated in the past four decades prior to the end of war in 2009 (Fernando et al., 2013a, Fernando et al., 2013b). As a result of these fluctuations tourism related activities and their impacts have also fluctuated. Therefore, simulation is carried out with the model to examine the effects of expansion of tourism on the Sri Lankan economy using the historical pattern of tourist arrivals.

4.1 Policy Simulations and Their Economic Environments

The simulation is carried out by using a 10 per cent increase in tourist earnings based on the average annual growth rate of over four decades (1966-2009) of international tourist arrivals in order to examine the effects of tourism sector on the Sri Lankan economy under the BASE scenario. Therefore, the BASE scenario can be used to explain the effects of tourism on the Sri Lankan economy in a political environment characterised by ups and downs of tourist arrivals associated with political violence, peace and war episodes prevailed in the country.

The choice of exogenous variables imposes some important assumptions on policy simulations (Horridge et al., 1993). Thus, the selection of exogenous and endogenous variables relating to primary factors from the supply side and the selection of endogenous and exogenous aggregate expenditure variables from the demand side play a crucial role in such simulations. There are a large numbers of exogenous variables in the standard short-run closure of the ORANI tradition. It is not important to describe all exogenous variables in detail since the focus here is only on the important exogenous variables which influence the projections of tourism related policy simulations.

A stylised representation of the macroeconomic closure (for example Adams and Parmenter, 1995a) underlying model projections is given in Figure 4. In this figure, exogenous variables are identified by rectangles and endogenous variables by ovals. The arrows demonstrate plausible directions of linkages between variables in the model. Changes in tourism earnings affect the GDP from the demand side as well as from the supply side. The supply side (income side) of GDP associated with our macroeconomic closure is presented in the upper part of Figure 4 and the demand side (expenditure side) is presented in the lower part of Figure 4.

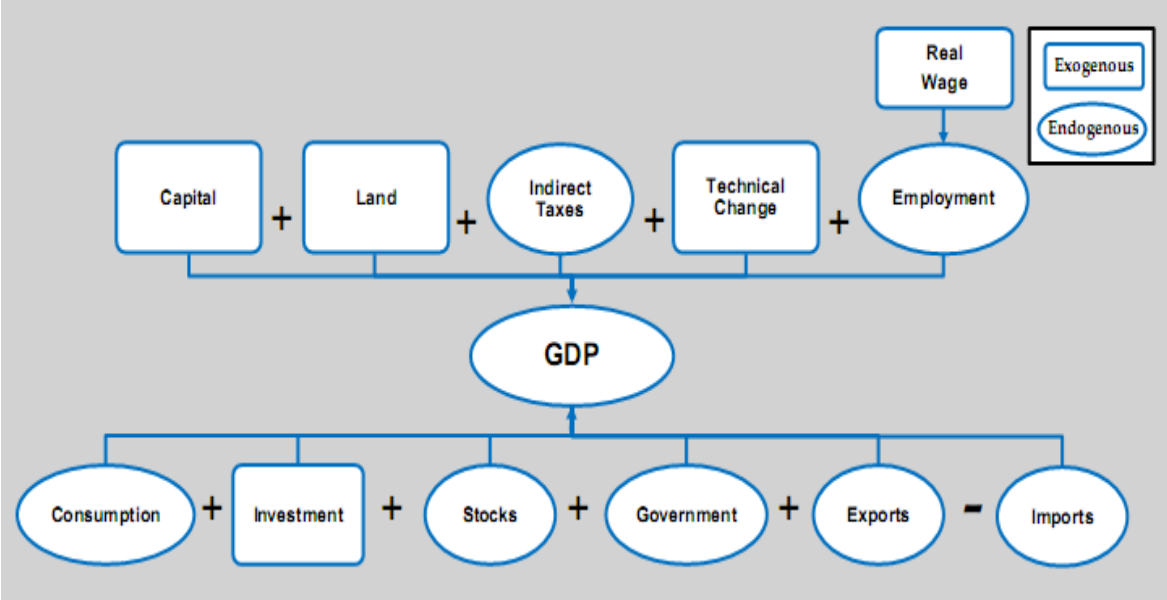

Figure 4. Macro-economic closure in the short run

On the supply (or income) side, industry-specific capital stocks and land are fixed or exogenous while real rates of returns on capital and land are endogenous. The technical change variables are also fixed or set exogenously assuming that there is no technical progress in the economy in the short run. On the other hand both aggregate employment and indirect taxes on the supply side are allowed to vary and so are endogenous as shown in Figure 4. The above specification on the supply side reflects the idea that capital stocks take time to install and the short timescale does not allow for any technological improvements. However, it is assumed that the supply of labour is perfectly elastic with a pool of unemployed workers waiting to be hired. Therefore, assumptions regarding the labour market in the short-run have some important implications. When the real wage rate is determined exogenously, aggregate employment should be determined endogenously. This means that labour is the only mobile factor in the short-run, given that industry-specific capital stock is exogenous. This implies that the labour usage could change in industries according to changes in output. For example, if the output of an industry declines due to a change in tourism earnings, the factor usage should decline accordingly. Given that labour is the only mobile factor in the short-run, the reduction in output in one sector means that the demand for labour declines in the affected sector. Therefore, there will be unemployed labour in that sector. In a general equilibrium setting, it is understood that other sectors would absorb the unemployed labour. For this to happen, the wage rate should decline. This implies that in the short-run, there would be an economy-wide reduction in the nominal wage rate given that the real wage rate is fixed. Therefore, we define that the real wage rate is determined exogenously while aggregate employment is determined endogenously.

On the demand side while household consumption and government consumption are endogenous, investment is determined exogenously. Changes in GDP in our simulations are adjusted using the balance of trade as the swing variable. Thus, export and import volumes are determined endogenously. Trade balance, in price, is cleared by changes in the exchange rate, which is defined as the ratio of world to local prices. Thus the balance of trade and the real devaluation are also endogenously determined by the model.

In the SLCGE-tourism model earnings from international tourism is considered as an export from the tourism sector in the economy. In policy simulations, tourism exports are set as exogenous variables so that we can impose tourism demand shocks to the export of tourism sector.

Finally, the Consumer Price Index (CPI) is selected as an exogenous variable to set it as the *numeraire* in the model. In many typical ORANI type CGE applications the exchange rate acts as the numeraire. However, following other tourism related CGE modelling exercises in the ORANI tradition (for example, Ihalanayake, 2012, Meng et al., 2013), the CPI is selected as a *numeraire* in this study. Since tourism earnings are related to earnings of foreign currency, changes in exchange rate will be realized as changes in the domestic inflation rate relative to the exchange rate or local currency/$world.

4.2 Analysis of the Simulation Results

Our intention is to examine the effects of tourism in the Sri Lankan economy. For this purpose, the business as usual simulation (labelled as the "BASE scenario") is carried out in order to examine the magnitude of the effects of tourism on the Sri Lankan economy.

This section presents the possible effects of each simulation by explaining the effects on macro variables and industry output levels separately. First, the next sub-section examines the macroeconomic effects of these simulations. Second, the industry level effects are analysed in Sub-section 4.2.2 sub-section.

4.2.1. Macro Economic Effects of Tourism Earnings

Table 6 presents the percentage changes in the macroeconomic variables of the simulation. It is important to note here that these projections are derived from a comparative static model and they are not compatible with historically observed data related to macro variables as projections are only related to the magnitude of the shock associated with an increase in tourism earnings. However, these results are useful to identify the patterns and directions of the effects of an increase in tourism earnings.

Table 6 Macroeconomic Results (% changes) BASE Simulations

No	Description	Percentage Changes
	Volumes	
1.	GDP	0.0406

2.	Household Demand	0.0700
3.	Investment Demand	0.0000
4.	Government Demand	0.0700
5.	Change in Balance of Trade (BOT)	-0.0197
6.	Imports Demand	0.0702
7.	Export Supply	0.0291
8.	Aggregate Employment	0.0596
	Prices	
9.	CPI: Numeraire	-
10.	Exchange Rate (local currency/$world)	-0.0960
11.	Real Devaluation (Real exchange rate)	-0.1253
12.	GDP price Index	0.0294
13.	Export Price Index	0.0102
14.	Import Price Index	-0.0960
15.	Terms of Trade	0.1063
16.	Average Land Rental	0.1437
17.	Average Capital Rental	0.0665
18.	Average Real Wage	0.0000

The results of the BASE scenario demonstrate that GDP is projected to increase by 0.1048 per cent (row 1, Table 6) in the Sri Lankan economy. Under the model closure with the constant or exogenous investment, an increase in GDP is mainly driven by an increase in real household consumption and government consumption. As expected, the balance of trade is projected to diminish as a result of an increase in domestic absorption (household consumption together with government consumption, rows 2 – 4 of Table 6) which is higher than the rise in GDP. Therefore, the model generates a deficit in the trade balance (row 5, Table 6) in order to restore the equilibrium on the expenditure side of GDP. This trade balance deterioration is consistent with the results of aggregate imports and the aggregate exports, i.e., higher rise in imports compared to lower rise in exports (0.0702 vs. 0.0291).

Furthermore, when considering possible price changes, the nature of the exchange rate regime is a crucial determinant of the economic impacts of foreign inbound tourism. Its changes impact on the destination price competitiveness (Dwyer et al., 2000). An increase in real absorption is expected to drive the GDP price index up (row 12, Table 6) and this causes an appreciation in the real exchange rate (row 11, Table 6). The exchange rate appreciation, on the one hand, makes domestic prices relatively higher than world prices (row 10, Table 6) and reduces the international competiveness for traditional exports, as can be seen from an increase in the terms of trade (row 15, Table 6). The Sri Lankan rupee, on the other hand, is projected to strengthen and imports are projected to increase as imports now becoming cheaper as a result of a decline in the import price index (row 14, Table 6). The changes of imports price index and GDP price index cause a real devaluation[2] (row 11, Table 6). The rise of export price index and decline of import price index causes the terms of trade to rise (row 15, Table 6). As a result exports are more expensive by 0.1063 per cent in the simulation than they would otherwise have been. These effects give rise to an increase in import volume that is higher than the projected increase in export volume (rows 6 & 7, Table 6).

[2] The real devaluation is determined by a ratio of imports price index to GDP price index.

Now consider the income side or supply side of GDP with supply of fixed land, capital and technical changes. An increase in real absorption is projected to generate growth in domestic demands creating an increased in demand for labour. The positive employment effect arises from our assumption of a slack labour market, i.e., the labour supply is perfectly elastic. Therefore, the simulation results indicate that the expansion of tourism sector is projected to drive aggregate employment growth (row 8, Table 6). Similarly, the weighted-average of the real rate of return on capital and on land are projected to rise (rows 17 & 16 of Table 6, respectively). The rising of these factor prices as a result of demand changes are projected to affect both export-oriented (tradable goods) industries and domestic-oriented industries (non-tradable goods). Thus, it is necessary to examine the industry-level effects to understand the link between macro and industry-level effects.

The above projections exhibit all of the broad characteristics of the economy. Figure 5 presents the GDP decomposition of the BASE scenario in order to trace the factors contributing to each aggregate that makes up GDP from both income and expenditure sides. This analysis assists us to understand the macro level results.

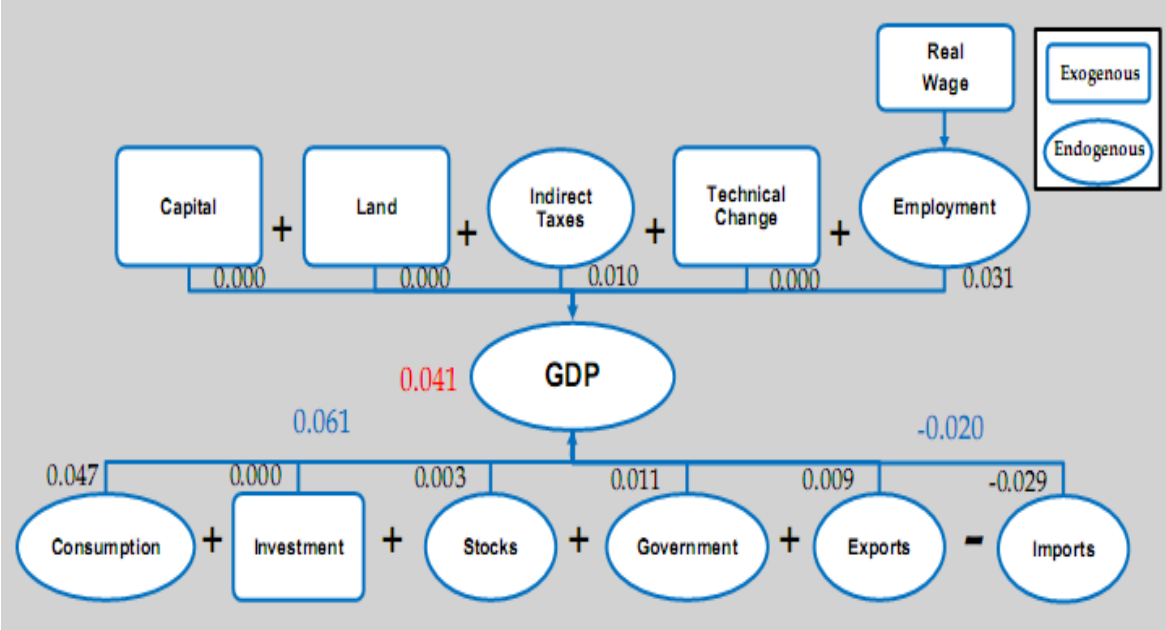

Figure 5 Changes of contributions to restore the equilibrium on the GDP (in per cent)

As shown in Figure 5, in a macro-economic closure with no technical changes and fixed capital and land in the short run, an increase in international tourism raises real GDP by 0.041 per cent under the BASE case scenario. From the income side, the GDP expansion is anchored on changes in aggregate employment and indirect taxes which respectively contribute 0.031 and 0.010 percentage points of the total GDP growth of 0.041 per cent. On the expenditure side, since the total real investment is held fixed, the changes in GDP originate from a deterioration in trade balance (-0.20) with the contribution to GDP of changes in imports greater than the contribution to GDP of higher exports (-0.0291 vs.0.009

per cent) and increase of real absorption[3] (0.061) which has been dominated by higher household demand (0.047 per cent).

4.2.2. Industry Level Effects of Tourism Earnings

The SLCGE–Tourism model consists of 64 sectors plus the tourism dummy sector. It is not appropriate or meaningful to report and analyse outcomes of the BASE scenario on each and every sector separately here. Rather, a number of sectoral aggregations are used to describe some important impacts of an increase in tourism earnings in more meaningful ways. In this study, an aggregation is carried out to group similar kind of sectors together in order to analyse 'performing well' and 'not performing well' industries as a result of our simulated 10 per cent increase in tourism. The following subsection discusses the effects of industry-specific variables such as output and employment.

Following the categorisation used by Wattanakuljarus and Coxhead (2008), different sectors are grouped into two categories as "performing well" and "non-performing" industries using the GDP results of the simulation. Accordingly, the industries with projected growth rates higher than the projected GDP growth (0.0406) are classified as performing well industries while industries with growth rates lower than the projected GDP growth rate are classified as non-performing industries. The sectoral output results of the tourism boom simulation are presented in Table 9. Changes in sectoral output occur as a result of changes in labour, since labour is the only mobile sector in the short run. Therefore, changes of employment are also presented in Table 9.

[3] From our base I-O table, the domestic absorption consists of household consumption share (67.16%), government consumption share (24.87%), investment share (15.36) and stock share (3.11). Therefore, the total domestic absorption increases approximately by: (67.16)* (0.0700%) + (24.87)*(0%) + (15.36)*(0.0700%) + (3.110)*(0.0832%) = 0.061%.

Table 9 Sectoral Effects on Broad Aggregation: BASE Scenario and Tourism Boom Simulations

No	Description	Total Outputs	Employment
	Performing well Sectors		
1	Hotel & Restaurant (52)	3.8565	10.5201
2	Textiles (23 to 25)	0.1141	0.3905
3	Other Food Products (20)	0.0598	0.1267
4	Services (57,60 to 64)	0.0551	0.0578
5	Finance & Insurance (58,59)	0.0489	-0.0389
	Non-performing Sectors		
6	Cereals (Sectors 1 to 3)	0.0368	0.0299
7	Beverage & Tobacco products (21&22)	0.0297	0.0827
8	Vegetable & Fruit (4,5 &9)	0.0286	0.1042
9	Food Product (17 to 19)	0.0247	0.0781
10	Manufacturing Services (48 to 50)	0.0139	0.0543
11	Trade (51)	0.0048	0.0074
12	Plantation (6 to 8)	0.0045	-0.0027
13	Petroliam Product (30)	0.0043	0.0092
14	Live Stock, Dairy & Fishing (11&15)	-0.0009	-0.0023
15	Forest & Hunting (12 to 14)	-0.0066	-0.0084
16	Mining (16)	-0.0143	-0.0368
17	Other Beverage & Spices (10)	-0.0214	-0.0505
18	Transports (53 to 56)	-0.0241	-0.2787
19	Machinery & Equipment (38 to44)	-0.0376	-0.1772
20	Furniture (45)	-0.0515	-0.1349
21	Apparel & Footwear (26 &27)	-0.0629	-0.0683
22	Manufacture (28,29 to 31 to 37 & 46,47)	-0.1005	-0.2309

Table 9 demonstrates that a number of non-tradable sectors are projected to perform well as a result of a tourism boom. As expected, the hotel and restaurant sector (row 1, Table 9), which is highly dependent on tourism, is projected to expand significantly in terms of output (the projected increase is almost 10 per cent). As a labour intensive sector, its employment is projected to expand even at a higher rate (27 per cent). In addition to the hotel and restaurants sector, other non-tradable sectors such as services sectors and finance related sectors can be identified as falling into the 'performing well' category.

Textile related sectors (row 2, Table 9) and other food products (row 9, Table 9) sectors are 'performing well' in terms of output although they are tradable sectors. The main reason is that tourism is strongly related to these sectors.

According to Table 9, most export-oriented sectors are not performing well. In fact, industries such as apparel industry (row 21, Table 9) and manufacturing (row 22, Table 9) suffer heavily. This is mainly because that these industries are not competitive following the real exchange rate appreciation associated with the tourism boom. This is as predicted in the Dutch disease model (Corden, 1984, Corden, 1982).

5. Conclusion

The main objective of this paper was to develop a tourism-focused CGE model for the Sri Lankan economy, labelled as SLCGE-Tourism, and demonstrate how it can be used to analyse the economy-wide effects of tourism on the Sri Lankan economy. In the process of achieving the above objective the paper addressed a knowledge gap. The limited past empirical studies in the area have mainly used a partial equilibrium approach and the contribution of those studies to on-going policy making and/or policy evaluation has been limited. There was a lack of an integrated economy-wide modelling approach capable of use for examining the impact of tourism on the Sri Lankan economy. This paper has addressed this knowledge gap by developing a tourism focused CGE model (SLCGE–Tourism).The paper also demonstrated how a tourism-focused CGE model can be used to examine the economy-wide effects of an expansion of tourism on the Sri Lankan economy by carrying out a policy simulation in business as usual scenario or BASE scenario. The projected results support the view that tourism can play a major role in the post-war development in Sri Lanka in terms of economic growth and employment generation.

References

ABEYRATNE, S. 2004. Economic roots of political conflict: the case of Sri Lanka. *World Economy,* 27**,** 1295-1314.

ADAMS, P. D. & PARMENTER, B. R. 1995b. An applied general equilibrium analysis of the economic effects of tourism in a quite small, quite open economy. *Applied Economics,* 27**,** 985-994.

ANDREW, B. P. 1997. Tourism and the economic development of Cornwall. *Annals of Tourism Research,* 24**,** 721-735.

ARCHER, B. 1995. Importance of tourism for the economy of Bermuda. *Annals of Tourism Research,* 22**,** 918-930.

ARCHER, B. & FLETCHER, J. 1996. The economic impact of tourism in the Seychelles. *Annals of Tourism Research,* 23**,** 32-47.

BANDARA, J. S. 1989. *A multisectoral general equlibrium model of the Sri Lankan economy with applications to the analysis of the effect of external shockes.* Unpublished PhD Thesis, La Trob University.

BANDARA, J. S. 1991. Computable general equilibrium models for development policy analysis in LDCs. *Journal of Economic Surveys,* 5**,** 3-69.

BANDARA, J. S. 1997. The impact of the civil war on tourism and the regional economy. *South Asia,* 20**,** 269-279.

BANDARA, J. S. 2014. Compilation of input-output table for Sri Lanka and its possible applications in policy analysis. Unpublished: National Accounts Division of the Department of Census and Statistics and National Planning Department, Ministry of Finance and Planning, Colombo, Sri Lanka.

BANDARA, J. S., CHISHOLM, A., EKANAYAKE, A. & JAYASURIYA, S. 2001. Environmental cost of soil erosion in Sri Lanka: tax/subsidy policy options. *Environmental Modelling & software,* 16**,** 497-508.

BANDARA, J. S. & COXHEAD, I. 1999. Can trade liberalization have environmental benefits in developing country agriculture? A Sri Lankan case study. *Journal of Policy Modeling,* 21**,** 349-374.

BLAKE, A., ARBACHE, J. S., SINCLAIR, M. T. & TELES, V. 2008. Tourism and poverty relief. *Annals of Tourism Research,* 35**,** 107-126.

BLITZER, C. R. & ECKAUS, R. S. 1986. Modeling energy-economy interactions in small developing countries: a case study of Sri Lanka. *Journal of Policy Modeling,* 8**,** 471-501.

BUULTJENS, J. W., RATNAYAKE, I. & GNANAPALA, W. K. A. C. 2015. Post-conflict tourism development in Sri Lanka: implications for building resilience. *Current Issues in Tourism,* Published online: 23 Jan 2015**,** 1-18.

CENTRE FOR INTERNATIONAL ECONOMICS- CIE 1992. The composition and level of effective taxes for exporting and import competing production in Sri Lanka. CIA, Canberra.

CLARK, M., DENT, S. & WATTS, G. 2004. Influence of travel decision parameters in a CGE model incorporating tourism. Available: http://www.copsmodels.com/regional/wattpap.pdf.

CORDEN, W. M. 1982. *Booming sector and de-industrialisation in a small open economy,* Royal Economic Society - RES.

CORDEN, W. M. 1984. Booming sector and Dutch Disease economics: survey and consolidation. *Oxford Economic Papers,* 36**,** 359-380.

DE MELO, M. H. 1978. *A general equlibrium investigation of agricultural policies and development strategies: A case study of Sri Lanka.* Unpublished PhD Thesis, University of Maryland.

DE MELO, M. H. 1979. Agricultural policies and development : a socio-economic investigation applied to Sri Lanka / Martha H. de Melo. *Journal of Policy Modeling,* 1**,** 217-234.

DE MELO, M. H. 1982. A simulation of development strategies in an economy-wide model. *Economic Development and Cultural Change,* 30**,** 335-349.

DIXON, P. B., PARMENTER, B. R., SUTTON, J. & VINCENT, D. P. 1997. *ORANI: A Multisectoral Model of the Australian Economy,* North-Holland Publishing Company; Amsterdam - New York - Oxford.

DUE, E. 1980. *Tourism and development examining the case of Sri Lanka.* Unbublished M.A. Thesis, McMaster University (Canada).

DWYER, L., FORSYTH, P., MADDEN, J. & SPURR, R. 2000. Economic impacts of inbound tourism under different assumptions regarding the macroeconomy. *Current Issues in Tourism,* 3**,** 325-363.

DWYER, L., FORSYTH, P. & SPURR, R. 2003. Inter-industry effects of tourism growth: implications for destination managers. *Tourism Economics,* 9**,** 117-132.

DWYER, L., FORSYTH, P. & SPURR, R. 2004. Evaluating tourism's economic effects: new and old approaches. *Tourism Management,* 25**,** 307-317.

DWYER, L., PHAM, T., JAGO, L., BAILEY, G. & MARSHALL, J. 2014. Modeling the Impact of Australia's Mining Boom on Tourism: A Classic Case of Dutch Disease. *Journal of Travel Research, online July 2014*.

DWYER, L. & PHAM, T. D. 2013. CGE modeling. *Handbook of Research Methods in Tourism: Quantitative and Qualitative Approaches.* Edward Elgar Publishing Ltd, UK.

FERNANDO, S., BANDARA, J. S., LIYANAARACHCH, S., JAYATHILAKA, R. & SMITH, C. 2013a. Political violence and volatility in international tourist arrivals: the case of Sri Lanka. *Tourism Analysis,* 18**,** 575-586.

FERNANDO, S., BANDARA, J. S. & SMITH, C. 2013b. Regaining missed opportunities: the role of tourism in post-war development in Sri Lanka. *Asia Pacific Journal of Tourism Research,* 18**,** 685-711.

FLEISCHER, A. & FREEMAN, D. 1997. Multiregional input-output analysis. *Annals of Tourism Research,* 24**,** 998-1001.

FLETCHER, J. E. 1989. Input-output analysis and tourism impact studies. *Annals of Tourism Research,* 16**,** 514-529.

FORST, T. 1999. Economic Analysis and Tourism. *In:* CORCORAN, K., ALLCOCK, A., FROST, T. & JOHNSON, L. (eds.) *Valuing Tourism: Methods and Techniques.* . Bureau of Tourism Research, Canberra.: Bureau of Tourism Research, Canberra.

GAMAGE, A. 1978. Tourism in the economy of Sri Lanka. *Unpublished Masters Thesis.* Scottish Hotel School.

GAMAGE, A., SHAW, R. N. & IHALANAYAKE, R. 1997. The cost of political upheaval to international tourism in Sri Lanka. *Asia Pacific Journal of Tourism Research,* 2**,** 75-87.

HARRISON, J. & HORRIDGE, M. 2001. Preparing data files for a CGE model using GEMPACK, *Centre of Policy Studies,* Monash University.

HARRISON, J. W. & PEARSON, K. R. 1994. Computing solutions for large general equilibrium models using GEMPACK. Impact Project, Monash University.

HARRISON, W. J. & PEARSON, K. R. 1996. Computing solutions for large general equilibrium models using GEMPACK. *Computational Economics,* 9**,** 83-127.

HENG, T. M. & LOW, L. 1990. Economic impact of tourism in Singapore. *Annals of Tourism Research,* 17**,** 246-269.

HENRY, E. W. & DEANE, B. 1997. The contribution of tourism to the economy of Ireland in 1990 and 1995. *Tourism Management,* 18**,** 535-553.

HORRIDGE, J. M. 2014. ORANI-G : A generic single-country computable general equilibrium model. *Practical GE Modelling Course, Centre of Policy Studies and Impact Project, Victoria University, Australia.* http://www.copsmodels.com/oranig.htm [Online].

HORRIDGE, J. M., PARMENTER, B. R. & PEARSON, K. R. 1993. ORANI-F - A general equilibrium model of the Australian economy. *A Journal ol the European Economlcs and Flnanclal Centre,* Volume 3, number 2, Summer.

IHALANAYAKE, R. 2007. *Economics of tourism taxation a study of tourism taxes in Australia.* Unbublished PhD Thesis, Victoria University.

IHALANAYAKE, R. 2012. Economic effects of tourism tax changes in Australia: empirical evidence from a computable general equilibrium model. *Tourism Economics,* 18**,** 181-202.

JUPP, J. 1999. Sri Lanka: Third world democracy after twenty-one Years', paper presented at the Asia, Sri Lanka and diasporic communities. *International Conference on Sri Lankan Studies, .* Canberra, .

KANDIAH, K. 1999. *A computable general equilibrium model of the Sri Lankan economy with applications to analysis of the effects of the financial liberalisation* Unpublished Ph.D. Thesis School of Economics, Brisbane: Griffith University.

KHAN, H., SENG, C. F. & CHEONG, W. K. 1990. Tourism multiplier effects on Singapore. *Annals of Tourism Research,* 17**,** 408-418.

KIRIELLA, M. B. 2011. *Reaping the benefits of the peace; selling destination Sri Lanka* [Online]. SLTDA. Available: http://www.sltda.gov.lk/home [Accessed July 26 2011].

KWEKA, J., MORRISSEY, O. & BLAKE, A. 2003. The economic potential of tourism in Tanzania. *Journal of International Development,* 15**,** 335-351.

LEJÁRRAGA, I. & WALKENHORST, P. 2008. On linkages and leakages: measuring the secondary effects of tourism. *Applied Economics Letters,* 17**,** 417-421.

LIYANAARACHCHI, T. S., BANDARA, J. S. & NARANPANAWA, A. 2014. A quantitative evaluation of the potential effects of trade policy reversal in Sri Lanka: a computable general equilibrium analysis. *Sri Lanka Journal of Agricultural Economics,* 16, 1-18.

LIYANAARACHCHI, T. S., NARANPANAWA, A. & BANDARA, J. S. 2015. The impact of trade liberalisation on labour markets and poverty in Sri Lanka; Computable general equilibrium and microsimulation analysis. *Griffith University Working Paper Series, Australia*.

MADDEN, J. & THAPA, P. 2000. The contribution of tourism to the New South Wales economy: A multi-regional general equilibrium analysis. Centre for Regional Economic Analysis, University of Tasmania.

MENG, X., SIRIWARDANA, M. & PHAM, T. 2013. A CGE assessment of Singapore's tourism policies. *Tourism Management,* 34**,** 25-36.

MINISTRY OF ECONOMIC DEVELOPMENT 2011. Tourism development strategy 2011 - 2016: Ministry of Economic Development, Colombo, Sri Lanka.

NARANPANAWA, A. 2005. *Trade liberalisation and poverty in a CGE model in Sri Lankan case.* Unpublished PhD thesis, Griffith University, Australia.

NARANPANAWA, A., BANDARA, J. S. & SELVANATHAN, S. 2011. Trade and poverty nexus: A case study of Sri Lanka. *Journal of Policy Modeling*, 33**,** 328-346.

O'HARE, G. & BARRETT, H. 1994. Effects of market fluctuations on the Sri Lankan tourist industry: resilience and change, 1981–1991. *Tijdschrift voor economische en sociale geografie,* 85**,** 39-52.

PERERA, S., SIRIWARDANA, M. & MOUNTER, S. 2014. Reducing poverty and income inequality in Sri Lanka: does trade liberalisation help? *Journal of the Asia Pacific Economy,* 19**,** 629-655.

PHAM, T., JAGO, L., SPURR, R. & MARSHALL, J. 2015. The Dutch Disease effects on tourism – The case of Australia. *Tourism Management,* 46**,** 610-622.

PHAM, T. D. & DWYER, L. 2013. Tourism satellite account and its applications in CGE modelling. *In:* TISDELL, A. C. (ed.) *Handbook of Tourism Economics : Analysis, New Applications and Case Studies.* World Scientific Publishing Co.Singapore.

PHAM, T. D., DWYER, L. & SPURR, R. 2008. Constructing a regional tourism satellite account: the case of Queensland. *Tourism Analysis,* 13**,** 445-460.

PYATT, G. & ROE, A. R. 1977. *Social accounting for development planning with special references to Sri Lanka* Cambridge University Press: Cambridge, UK.

SELVANATHAN, S. 2006. The effect of war and other factors on Sri Lankan tourism. *Applied Economics Letters,* 14**,** 35-38.

SLTDA 2006. Airport survey. Sri Lanka Tourist Board; Colombo, Sri Lanka.

SLTDA 2012. Annual statistical report of Sri Lanka tourism. Sri Lanka Tourist Board Authority; Colombo, Sri Lanka.

SOMARATNE, W. G. 1998. *Policy Reforms and the Environment: A General Equilibrium Analysis of Land degradation in Sri Lanka* Unpublished Ph.D. Thesis School of Business, Melbourne: La Trobe University.

SUGIYARTO, G., BLAKE, A. & SINCLAIR, M. T. 2003. Tourism and globalization: economic impact in indonesia. *Annals of Tourism Research,* 30**,** 683-701.

TISDELL, C. A. & BANDARA, R. R. 2005. *Tourism and economic development in Sri Lanka*, Serials Publications; New Delhi

UNITED NATION 1993. The economic impact of tourism in Sri Lanka. *Economic and Social Commission for asia and Pacific.* New York: United Nations.

UNITED NATIONS 2008. International recommendations for tourism statistics New York: United Nation.

VALLE, E. & YOBESIA, M. N. 2009. Economic contribution of tourism in kenya. *Tourism Analysis,* 14**,** 401-414.

WAGNER, J. E. 1997. Estimating the economic impacts of tourism. *Annals of Tourism Research,* 24**,** 592-608.

WICKREMASINGHE, G. B. & IHALANAYAKE, R. 2006. The causal relationship between tourism and economic growth in Sri Lanka: Some empirical evidence. *WP2006.10* [Online], School of Applied Economics, Victoria University.

ZHOU, D., YANAGIDA, J. F., CHAKRAVORTY, U. & LEUNG, P. 1997. Estimating economic impacts from tourism. *Annals of Tourism Research,* 24**,** 76-89.