Chapter 21

Estimating Tourism Impacts using CGE Models: A Historical Review and Future Developments

Stephen Pratt

University of the South Pacific, Fiji Islands

Abstract: The economic impacts of tourism have been estimated and evaluated via a range of different methodologies by researchers and policymakers for many decades. This chapter discusses research found in the tourism literature that has been undertaken using Computable General Equilibrium modelling. Initially, generic tourism booms and busts were modelled with this methodology before other areas of interest such as tourism and trade; tourism and taxation and disasters, (both man-made and natural) and their impacts on tourism were modelled. The economic impact of special events such as the FIFA World Cup and the Olympics are another branch of research that has received significant attention by tourism economists implementing CGE models. After an evaluation of the main contributions in this area, this review highlights future directions of tourism and inter-industry modelling (such as the integration of environmental and energy accounts) with conventional tourism economic impacts to explore sustainable tourism economic impacts.

Keywords: Computable general equilibrium models, economic impacts, environmental and energy accounts, input-output analysis, inter-industry modelling

21.1. Introduction

Economic impacts have been estimated and evaluated via a range of different methodologies by researchers and policy-makers for many decades. Estimating economic impacts of policy decisions, shocks or events is grounded, not surprisingly, in economic theory. The traditional

way to investigate the economic impact of tourism on an economy is through an Input-Output model. While this type of analysis is of some benefit, more sophisticated techniques which are better able to represent a real economy, are now available. To keep using IO analysis to estimate tourism impacts would not take advantage of the advances in economic modelling. It may lead to bias in reporting all possible economic impacts.

Computable General Equilibrium (CGE) models (also referred to as Applied General Equilibrium Models) are now starting to be used to estimate economic impacts on an economy in a tourism context. CGE modelling has been used extensively in other areas of economic policy inquiry, yet it is still somewhat under-utilised when examining tourism impacts.

The chapter is set out as follows: Section 21.2 evaluates the research to date on the economic impacts of tourism estimated using CGE models. Section 21.3 points out where future developments in CGE modelling of tourism's economic impacts can be made and Section 21.4 concludes with a call to cease the debate about Input-Output versus CGE modelling and intelligently address research questions using the appropriate methodology and 'catch up' with the other economic literature.

21.2. Review of Applied CGE Modelling

Over the last three decades, with the increasing power and reliability of microcomputers and the development of sophisticated software, CGE models have been widely used in empirical economic policy analysis for developed and, increasingly, for developing countries.

It is only more recently that CGE modelling has also been undertaken specifically in the area of tourism. Adams and Parmenter (1992a, 1992b, 1995) first modelled the impact of tourism on the Australian economy. Since then, several authors have used CGE models to determine the effects of international tourism on Australia (Madden and Thapa, 2000, Skene, 1993a, Skene, 1993b) and the rest of the world: USA (Blake and Sinclair, 2002), Hawaii (Zhou *et al*., 1997), Spain (Blake, 2000) and the U.K. (Blake *et al.*, 2001b). A list of the CGE models applicable to tourism are presented in Table 21.1. As can be seen in the table, tourism impact studies have been carried out using CGE models in a variety of contexts. A variety of issues have been investigated and are reviewed below.

Table 21.1. 36 Applications to 18 Economies

Study	Economy	Authors	Research Focus
1	Australia	Adams and Parmenter (1992a, 1992b, 1995)	Generic Tourism Boom
2	Australia	Dwyer *et al*. (2003)	Generic Tourism Boom in NSW economy
3		Dwyer *et al*.(2006)	Impact of SARs and Iraq War on Australian economy
4	Australia	Dwyer, Forsyth and Spurr (2005)	Qantas Australian Grand Prix 2000
5	Australia	Dwyer, Forsyth and Spurr (2007b)	Comparison of TSAs and CGE results for different tourism segments
6	Australia	Dwyer *et al*. (2007a)	Yield measurements for different market segments in Australia
7	Australia	Econtech (2001)	September 11 Attacks and Ansett Airline Collapse
8	Balearics, Spain	Polo and Valle (2008)	Generic Tourism Bust - IO and CGE Comparison
9	Brazil	Blake *et al.* (2008)	Tourism and poverty
10	China	Li and Blake (2007)	2008 Beijing Olympics
11	China	Li, Blake and Cooper (2010)	Impact of Global Financial Crisis on China
12	China	Li and Blake (2009)	2008 Beijing Olympics-related investment and expenditure
13	Cyprus	Blake *et al.* (2003)	Tourism and Trade: Accession to the EU
14	Fiji	Narayan (2003)	Impact of 2003 South Pacific Games in Fiji
15	Fiji	Narayan (2004)	Generic tourism boom
16	Fiji	Pratt (2011)	Devaluation of the Fiji dollar
17	Florida, USA	Zhang and Lee (2007)	Impact of September 11 attacks on wildlife recreational activity in Florida
18	Hawaii, USA	Zhou *et al.* (1997);	Generic Tourism Boom - IO and CGE Comparison
19	Hawaii, USA	Kim and Konan (2004)	Infrastructure demand water (electricity, utility gas, solid waste disposal, and petroleum)
20	Hawaii, USA	Pratt and Blake (2009)	Hawaii's cruise industry
21	Hawaii, USA	Pratt (2011)	Impacts across the Tourism Area Life Cycle
22	Indonesia	Sugiyarto, Blake and Sinclair. (2003)	Tourism and trade
23	Indonesia	Pambudi, McCaughey and Smyth (2009)	Impact of Bali bombing on the Indonesian economy
24	South Korea	Lee, Moon and Mjelde (2010)	Impact of September 11 attacks and the 2002 FIFA World Cup on the South Korean economy
25	Malta	Blake *et al.* (2003)	Tourism and trade: Accession to the EU
26	Mauritius	Gooroochurn and Milner (2004)	Tourism and tax
27	Mauritius	Gooroochurn and Sinclair (2005)	Tourism and tax
28	Scotland	Blake *et al.*(2006a)	Integration with econometric forecasts of tourist arrivals and expenditure in different countries
29	Scotland	Yeoman *et al.* (2007)	Tourism and Energy/Oil
30	South Africa	Bohlmann and van Heerden, (2005)	Investment for the 2010 FIFA World Cup on the South Africa economy
31	Spain	Blake (2000)	Generic tourism boom; Tourism and tax
32	Thailand	Wattanakuljarus (2005)	Economic and environmental impacts of tourism in Thailand
33	UK	Blake (2005)	Impact of the 2012 London Olympics
34	UK	Blake, Sinclair and Sugiyarto (2003)	Impact of foot and mouth disease on the UK economy
35	USA	Blake and Sinclair (2003)	Impact of September 11 Terrorist Attacks
36	USA	Blake *et al.* (2001a);	IO and CGE Comparison

21.2.1. Generic Tourism Booms and Busts

Simulations using CGE models to estimate the economic impact of tourism have covered a range of different scenarios and policy possibilities. As such, these simulations could be categorised in a number of ways. The first category type examines tourism booms or adverse shocks. That is, a stylised increase or decrease in tourism demand, for example of 10%. Economic impacts are then estimated, examining the post-simulation economy compared to the base line economy.

Reviewing the 'generic tourism boom' studies, while some of the specifics differ, the general findings are that an increase in tourism demand leads to an appreciation in the exchange rate, which leads to import substitution and the contraction of the traditional export sectors of mining and agriculture. This, together with the high import content of the tourism sector, leads to a worsening of the balance of trade. On the other hand, the tourism expansion helps to reduce the debt/GDP ratio. Adams and Parmenter (1995) find that on an economy-wide basis, real GDP increases by 0.4%. Analysis on a regional level highlights interesting distributional effects of the simulated tourism boom. Queensland, the Australian State which is more oriented towards servicing overseas tourists than the other states, was a net loser from an economy-wide expansion of tourism. While there were strong "first-round" effects for Queensland, this state was relatively hard hit by the crowding out of traditional export activities. Victoria, another Australian State, which does not rely heavily on traditional exports but has a large international airport, was found to have the most to gain from a 10% annual increase in tourism its GSP (gross state product) increases by 6.4%.

Blake (2000) undertakes a simulation of a ten percent increase in tourism for Spain as well as analysing the effects of tourism taxes. He found that national welfare increases by 0.05 percent of GDP, with a 0.61 percent appreciation of the real exchange rate, and that there are small increases in real private consumption, domestic tourism and investment. He further found that reductions in the value of non-tourism exports and increases in imports offset the increased revenues from tourism.

Another tourism economic impact study that simulates a ten percent increase in tourism expenditures is Narayan's Fijian model (Narayan, 2004). A simulated ten percent increase in tourist expenditure results in an increase in total exports (1.7%) which outweighs the increase in total imports (1.1%), resulting in an improvement in the balance of payments. The additional tourism expenditure is estimated to have a positive impact on real GDP, which will grow by 0.5%, and the resultant increase in wages will contribute to a 1.9% increase in private

disposable incomes leading to an increase in national welfare of 0.7%. Fiji's traditional export sectors of kava and fish and in manufacturing, including processed food, are expected to fall. This can be attributed to the fact that additional tourist expenditures induces a real appreciation of the exchange rate so the associated increases in domestic prices of goods and services and wage rates relative to foreign prices decrease Fiji's international competitiveness, especially for the traditional export sectors. This result has been noted by other researchers who model a tourist boom (Adams and Parmenter, 1992a, Adams and Parmenter, 1992b, Adams and Parmenter, 1995, Blake *et al*., 2001a, Zhou *et al*., 1997).

Dwyer *et al.* (2003) employ a multi-regional general equilibrium model to estimate the effects of increased tourism on the economy of New South Wales and the rest of Australia. Simulations were undertaken of the effects of an increase of 10% in world, interstate and intrastate tourism on the economy of New South Wales focussing on the assumptions that generate maximum impacts. The impacts from intrastate markets depend on the extent to which intrastate tourism is substituted for tourism in the rest of Australia. Not surprisingly, international tourists generate the largest GDP and employment from an Australia-wide perspective as these represent net injections into the economy whereas for domestic tourists there is a degree of substitution between consumption in non-tourism goods and services.

Blake *et al.* (2008) simulate a 10% increase in tourism demand by foreign tourists to Brazil to study the economic impacts and distributional effects of tourism expenditure. The results show that tourism benefits the lowest-income sections of the Brazilian population and has the potential to reduce income inequality. The welfare gain to Brazil is $0.45 for every $1 unit of additional spending. Yet the lowest-income households are not the main beneficiaries of an international tourism increase as next-to-low income households benefit to a greater degree due to earning and price channel effects of tourism expansion.

Several pieces of research have attempted to compare and contrast the results from IO analysis and a CGE model using the same IO table. These studies have compared the same simulated scenario using both an IO model and a CGE model with the same set of data. Used as a way of comparing the differing methods of analysis, studies of this nature have begun to highlight the advantages of CGE modelling over IO modelling. One such study was conducted by Zhou *et al.* (1997), who simulate a ten percent decrease in visitor spending in Hawaii using both a CGE model and an IO model. They find, not surprisingly, that output is reduced in the tourism-oriented sectors such as hotels, transportation and restaurants and bars more than in other sectors in the economy for both models. While output changes are generally of the same order of magnitude for each sector, the IO model results are larger in terms of percentage reductions. This, it is argued, is due the generated price effects in the CGE model (that are

absent from the IO model). The CGE model allows for resource reallocation between sectors and allows greater modelling flexibility. It is deemed to have clear advantages over IO modelling for tourism. Polo and Valle (2008) conduct a similar analysis (a ten percent reduction in tourist expenditures) for the Balearic economy using an IO model, a SAM (Social Accounting Matrix) model and a CGE model. The results in their paper reinforce the findings of Zhou *et al.* (1997).

21.2.2. Tourism and Disasters

Estimating the economic impact of disasters, both natural and man-made has been the focus of a significant amount of research using CGE modelling. For example, Blake and Sinclair analyse the impacts of September 11 on the US economy (Blake and Sinclair, 2003). The September 11 study analyses not only the effects of the downturn in tourism but simulates the potential and actual policy responses to the crisis.

Blake and Sinclair categorise these policy responses in two ways. The first category involves policies of relatively low cost aimed at restoring confidence and increasing liquidity, such as the provision of credit or loans, low cost tax allowances and measures to limit the liability of businesses to acts of terrorism. The second category involves significant costs such as expenditure on compensation to airlines and measures to increase airline safety. As to the economic impact of this event, without any offsetting policy responses, the fall in tourism expenditures reduces Gross Domestic Product (GDP) by almost $US30 billion. With the implementation of these policies, the figure reduces to under $US10 billion.

For the same tourism shock (September 11 terrorist attacks), Econtech, an independent economic consulting firm, estimated the economic effects on the Australian economy (Econtech, 2001). Around the same time of the attacks, Ansett Airlines, Australia's second domestic airline collapsed, reducing the capacity of the domestic aviation industry in Australia. Both these events are modelled separately and in combination using a CGE model. The combined effects of these two simulations were estimated to incur a loss of travel exports of about 15% (A$500 million); a loss of transport GDP of about 3% ($A210 million); a loss of accommodation, cafes and restaurants GDP of about 4% ($A140 million); an overall GDP decrease of 0.6% ($A1 billion) and an employmenent decrease of 0.3% (28,000 jobs). The effects were forecast to be temporary in nature, gradually fading away over the subsequent two years.

Another act of terror and its impact on tourism is the focus of a paper by Pambudi *et al.* (2009). These researchers employ a multi-regional CGE model of the Indonesian economy to

estimate the short-run effect of a decline in tourism following the 2002 Bali bombings on the Indonesian economy. Not surprisingly, the location of the attack, Bali, is worst affected by the negative shock followed by other popular tourist destinations, such as Jakarta and Yogyakarta. Within Bali, the tourism-related and non-tradable sectors contain the worst affected industries while export-oriented industries, such as textiles, clothing and footwear, and import competing industries, such as machinery and electronics expand.

Dwyer *et al.* (2006b) explore the economic effects of the tourism crises of the Iraq War and SARS in 2003 on the Australian economy. They recognise that, while these events resulted in less inbound tourism, they also resulted in less outbound tourism so that the net effect on Australia was not as severe as it might have been and depends to a certain extent on where the cancelled or postponed outbound travel is allocated to savings, domestic tourism or other non-tourism consumption.

More recently, Li *et al.* (2010) model the impact of the 2008 Global Financial Crisis on China's tourism. The paper looks at the extent that domestic tourism can offset the slowdown in international tourism associated with the global financial crisis. The research designs two scenarios for 2010: pessimistic and optimistic scenarios. Simulations for 2011 and 2012 reveal that China's tourism will recover and then contribute positively to the local economy from 2012. However, the increase in domestic tourism will only partially offset the downturn in international tourism.

The economic impact of Foot and Mouth Disease on the UK economy and its implications for tourism is modelled by Blake and Sinclair using a CGE model. The authors show that Foot and Mouth Disease (FMD) has considerable effects not only on agricultural production and farming industries but also on the tourism sector due to the inter-sectoral linkages and the effects of the ways in which the UK government handled the outbreak. The results show that total tourism revenue in 2001 fell by almost £7.5 billion, which reduced GDP in 2001 by £1.93 billion as a direct result of tourism expenditure reductions. The total fall in GDP due to the FMD crisis for 2001 was £2.5 billion (around 0.3% of GDP). The fact that the fall in GDP is less than a quarter of the drop in tourism expenditures is due to "crowding in" – the opposite effect of the more familiar "crowding out" phenomenon. Labour and capital that was previously employed in industries satisfying tourism demand have substituted away to other forms of production. Blake and Sinclair argue that the imposition of "restricted areas" that include historic sites and tourist attractions, closed countryside walking paths and waterways, and cancelled or postponed sports and public events had a larger impact on tourism than agriculture during the crisis.

21.2.3 Tourism and Trade

The issue of globalisation (trade) and tourism is investigated in the context of the Indonesian economy by Sugiyarto *et al.* (2003). A CGE model of the Indonesian economy is developed to examine the effects of globalisation, specifically tariff reductions as a stand-alone policy and in conjunction with tourism growth. Tourism is a key sector for the Indonesian economy with the number of foreign visitor arrivals in 2005 estimated to be around 11 million, generating export receipts of $US15 billion. Three different scenarios as well as a combination of the scenarios are modelled. “Partial globalisation” is represented through a 20% reduction in the tariffs on imported commodities. “Far-reaching globalisation” is modelled through the previously mentioned tariff cuts as well as a 20% reduction in indirect taxation levied on domestic commodities. The increase in demand by foreign tourists is set at 10%.

The analysis concluded that the increase in foreign tourism demand will increase output (GDP increases by 0.1%) and employment (increases by 0.2%). When tourism growth is combined with increased globalisation, foreign tourism growth amplifies the positive effects of globalisation and, simultaneously reduces its adverse effects. The levels of GDP and employment are higher and, while the trade balance is in deficit, the deficit is lower than in the case of trade and tax liberalisation without tourism growth. The balance of payments deficit is also in a better position, owing to the increased income from foreign tourism.

Another economic impact study relating primarily to trade involves the CGE models of the Maltese and Cypriot economies and the impact of their accession to the European Union (EU) (Blake *et al.*, 2003). Nine effects of accession were simulated individually and as a collective. These effects were simulated for both the short-run and the long-run through varying the elasticity values in the models with long-run elasticities generally higher than the short-run model, because production technologies can be replaced over a long period of time. Overall, EU accession was found to be unambiguously and significantly beneficial to both the Maltese and Cypriot economies. In Malta, GDP will increase by almost four percent in the long-run because of accession. The welfare benefits of accession are 14% of incomes. In Cyprus, GDP is estimated to increase by almost 3.5 percent in the long-run because of accession with welfare increasing by 6.2% of incomes. In terms of the impact on tourism, the effects of accession on tourism in Malta are negative but positive in Cyprus. The explanation for this is that the greater effects from trade and funding allocations lead to greater demand for factors of production in Malta that increase wages and divert resources away from tourism. In Cyprus, effects that benefit tourism outweigh the other general equilibrium trade-off effects.

21.2.4. Tourism and Tax

In the area of tourism tax, Blake (2000) examined the marginal impact of taxation across the whole Spanish economy and found that in Spain tourism and travel is relatively under-taxed compared to other sectors, mainly as a result of the large subsidies given to transportation sectors. Differences exist in the tax regime based on whether tourism is domestic or foreign in origin. Foreign tourism activities in Spain are highly taxed, relative to other sectors, but domestic activities are subsidised due to the lower rates of tax on tourism and the subsidised domestic travel. Blake is able to show that raising the levels of taxation on foreign tourism may increase welfare because taxing foreign tourism effectively reduces some of the distortions created by the low levels of tax on domestic tourism.

Tourism tax is also the subject of research conducted for the Mauritian economy (Gooroochurn and Milner, 2004, Gooroochurn and Sinclair, 2005). Gooroochurn and Milner examine the effects of the reform of the current structure of indirect taxes in Mauritius, using a CGE model to explore the relative efficiency of changing rates of indirect taxation on tourist and non-tourist related sectors. The main finding is that for all simulated tax reforms, the tourism sectors are shown to be currently under-taxed. The authors find that the Marginal Excess Burden (MEB), the additional welfare cost of raising extra revenues from an already existing tax while holding other taxes constant, is lower for sales tax simulations than for the production tax simulations, for all sectors.

The results found by Gooroochurn and Milner (2004) are confirmed and extended by Gooroochurn and Sinclair (2005). Tourism taxes can increase domestic welfare since international tourists bear most of the welfare loss associated with the higher revenue. The two main tourism sectors (restaurants/hotels and transport/communications) have the highest MEB, resulting from the monopoly power associated with the differentiated tourism products, that is, tourist destinations and attractions are differentiated in terms of types and quality by destination.

21.2.5. Tourism and the Environment

The issue of sustainable tourism has grown as a research interest in recent years. Tourism and its impact on the environment has been the focus of several studies. Wattanakuljarus (2005) applied a CGE model of Thailand to look at the nationwide economic and environmental impacts of tourism. The expansion of tourism had predictable effects; an increase in real GDP, improvement in the current account deficit, an increase in the domestic inflation rate and an

appreciation in the real exchange rate; but the tourism expansion resulted in extra water usage, relatively more piped water for non-agriculture sectors than for irrigated water for agriculture. Hence, net piped water usage and net wastewater discharges from the manufacturing sectors are higher than they otherwise would have been.

The issue of tourism and infrastructure demand has been examined by Kim and Konan (2004), contributing to the literature in the area of sustainable development. This research examines alternative scenarios for population growth and visitor spending in Hawaii in terms of the economic impact on urban infrastructure services (such as water, electricity, solid waste). The results are then projected into the future taking into account population, labour force and visitor expenditure growth rates (estimated exogenously from the CGE model). The key findings from this research include the result that economic activity and the resulting environmental consequences generated by residents are far greater than those generated by visitors. The impact of population growth is much more significant than visitor spending. This is a case where volume exceeds value, for while visitors consume more resources on a per day basis, there are approximately ten times the number of Hawaii residents as visitors present in Hawaii on any given day. These findings contrast with Tabatchnaia-Tamirisa *et al.* (1997) who estimated the derived demand for a primary input (energy) using input-output analysis and found that tourists account for a significant share (averaging 60%) of total energy and fuel use in Hawaii.

Yeoman *et al.* (2007) consider the relationship of oil and the global economy and its relationship to Scottish tourism. Two scenarios are modelled. The first scenario, labelled ‘energy inflation’, includes a 500% increase in the price of oil, 300% increase in gas prices, 200% increase in electricity prices, all over 10 years and a 10% drop in capacity in Scottish petroleum due to falling oil reserves. The second scenario, labelled ‘paying for climate change’, includes a 250% increase in oil prices, 100% increase in gas and electricity prices, 20% sales tax (VAT) for the economy, 20% subsidy on rail transport and the same failing oil reserves assumption as the first scenario. At a macro level, the economic impact on overnight tourism is £1.3 billion for the ‘energy inflation’ scenario and £1 billion for the ‘paying for climate change’ scenario, reducing the growth rate for tourism from a 50% base line assumption to 28% in the first scenario and 22% in the second scenario.

21.2.6. Tourism and Special Events

It is now commonplace to conduct an economic impact study in conjunction with the bidding for sporting events (or other special events) to estimate the economic stimulus from the one-off event. The undertaking of an economic impact study can often be done to justify the governments' generous funding incentives and increased spending on event infrastructure. The general consensus is that hosting one-off games or international events brings social and economic benefits to a nation or region and hence, these events are now highly sought after in many countries and regions internationally. Seven examples of economic impact studies appearing in recent literature using CGE models are the Australian Grand Prix 2000 (Dwyer *et al.*, 2005), the 2000 Sydney Olympics (Madden, 2002), the 2002 FIFA World Cup held in South Korea (Lee *et al.*, 2010), the 2003 South Pacific Games hosted by the Fiji Islands (Narayan, 2003), the 2010 FIFA World Cup held in South Africa (Bohlmann and van Heerden, 2005), the 2008 Beijing Olympics (Li and Blake, 2009, Li *et al.*, 2011) and the 2012 London Olympics (Blake, 2005).

Dwyer *et al.* (2006a) show how CGE models can be adapted to estimate the displacement effects of events, their fiscal impacts, intraregional effects, event subsidies, and multistate effects – all of which are factors to consider when assessing the economic impact of events. In general, the hosting of these large one-off events generates additional economic activity, bringing with it additional tourism.

Madden (2002) assesses the economic impact of the Sydney Olympics on the New South Wales (NSW) and Australian economy. The effects of Olympics construction and operating expenditure and of spending by Games visitors and additional tourists are modelled over a 12 year period, under specific assumptions regarding the Australian labour market, capital supply constraints and Australian government policy on foreign debt. For the tourism simulation, the number of international visitors associated with the Olympics is 1.6 million over an eight-year period; 132,000 being Games and Games-related, the remaining 1.5 million being additional tourists visiting Australia as a result of the promotional effect of the Games. Extra tourism export receipts are estimated to be just over $A2.9 billion as a result of the Olympics with over $A2.7 billion being the induced effect. The macroeconomic effects of the Games include an estimated increase of almost $A490 million in NSW Gross State Product in an average year over the 12 years ending in 2005/06. Cumulatively, this has a present value of $A5.1 billion. Nationally, the present value impact of the Olympics on GDP was estimated at $A6.5 billion (0.12% on average over the 12 years). Hence, a large majority of the economic impact remained in the host state of NSW. Only around 40% of the increase in GSP comprised an

increase in real household consumption. Most of the Olympics-induced increase in GSP/GDP went into increased investment and foreign borrowing for capital expenditures.

Lee, Moon and Mjelde (2010) attempt to disentangle the effects on the South Korean economy of the 9/11 terrorist attacks from the short-run effects of hosting the 2002 World Cup. The CGE methodology is able to provide this sort of analysis, separating out the economic impacts of two events that occur close in time. The authors find that the terrorist attacks of 9/11 had larger negative effects on the South Korean economy than the positive effects of the 2002 FIFA World Cup.

Narayan (2003) simulates the impact from the South Pacific Games on the Fijian economy of 10,000 additional visitors. These additional visitors comprise 5,000 participants and officials and 5,000 spectators from outside Fiji. The simulation reveals a 0.4 percent increase in GDP with the increase in exports (1.2 percent) outweighing the increase in total imports (0.9 percent) leading to a balance of payments surplus. Again, an injection of tourism receipts brings about an appreciation of the exchange rate, coupled with increasing domestic prices and wages, the traditional export sectors experience a decline, leading to declining exports. Yet the decline in the traditional export sector is more than offset by the increase in tourism and non-traditional exports.

The 2008 Beijing Olympics has been the foci of two studies, one by Li and Blake (2009) and the other by Li, Blake and Cooper (2011). Li and Blake (2009) develop a framework for separating impacts according to whether they occur before, during or after the event itself. They report that the economic impacts of such events can have very different distributional effects between the host city and the rest of an economy, and can have opposite signs. Li, Blake and Cooper (2011) estimate the economic impact of 2008 Beijing Olympics by examining the net injection of the difference between international tourism spending with and without holding the Beijing Olympics, including only those visitors whose main purpose was to attend the Being Olympics.

Bohlmann and van Heerden (2005) examine the impact of the pre-event phase expenditure attributable to the hosting of the 2010 FIFA World Cup on the South African economy. This phase is mainly geared towards the construction and improvement of infrastructure required to successfully host the event. The simulated shock to the capital stock in the construction and transport industries and a capital-augmenting technological change in these same industries is estimated to have a positive impact on most macroeconomic variables, including GDP and employment.

Blake (2005) examines the economic benefits and costs of hosting the 2012 Summer Olympics using a dynamic CGE model of the UK and London economies over a period of 12

years: 2005-2016. As a result of London hosting the 2012 Olympics, the total net UK GDP change is £1.9 billion. This impact can be separated into a pre-Games impact, during-Games impact and post-Games impact. The main GDP gain occurs in the Games year, 2012 (£1,067 million), with larger gains occurring in the post-Games period (£622 million) than the pre-Games period (£248 million). For the city of London itself, there will be a larger impact on GDP, with £925 million additional GDP in 2012, £3,362 million in the pre-Games period and £1,613 extra GDP post-Games. The regional impacts are larger than the national impacts for several reasons: spending in London by non-London UK residents visiting for the Games and the movement of the labour and capital to the capital as higher wages and lottery funding attract workers and money to London.

Several key issues arise for these economic impact studies on sporting events (or cultural events). Firstly, even for an event as large and complex as the Olympics Games, the overall economic impact is quite small (Madden, 2002). The overall estimated impact on Australian GDP is that it would be 0.12% higher over the 12 years than if the 2000 Games had not been held in Sydney. For the 2012 London Olympics, the total economy-wide impact for the UK over the 2005-2016 period is only 0.12% of total UK GDP at 2004 prices. It is important not to make over-optimistic projections of the effects of mega-events. Secondly, there are a large number of smaller sporting and cultural events. Typically, event organisers tend to expect their events to be economic boons. While at a regional level, these events can boost the local economy; on a national level the events tend to attract resources to these activities, away from other activities. Li *et al.* (2011) also highlight the issue that while many *ex ante* predictions of special events are estimated to be positive, the economic impact of many of these special events are negative in the *ex post* estimation. In the case of the 2008 Beijing Olympics, Li, Blake and Cooper attribute this to the restrictions on visa rules due to Olympic security needs, which counteracted and exceeded the positive aspect.

21.2.7. Tourism and Market Segments

Several CGE models have been implemented to examine the economic impact of particular segments. Zhang and Lee (2007) look at the impact of the terrorist attacks of September 11, 2001 on wildlife recreational activity in Florida, USA. In 2001, wildlife recreation activities generated $US5.8 billion in direct exenditure for the Florida economy, with out-of-state visitors contributing $USD1.2 billion. Using a state-level dynamic CGE model, Zhang and Lee estimate that the cumulative decline in Gross State Product from 2001 to 2010 is between $US1 billion and $US8 billion depending on the assumed speed of recovery. These losses are

for only one part of the recreation sector, and while many other sectors were impacted as a result of 9/11, these were not included in the analysis.

Hawaii's cruise industry is the subject of research by Pratt and Blake (2009). Using the 2002 inter-county input-output table as the benchmark data, the multi-region CGE model takes the direct expenditure of cruise passengers, expenditure by cruise crews and the direct expenditure of cruise lines as the simulations into the model. The research estimates that the cruise industry generates between $US68 million and $US86 million of additional revenue to the economy of Hawaii, depending on assumptions made regarding the mobility of labour and capital. The greater the substitutability between labour and capital, the lower the estimated benefits. Further, the county of Honolulu is estimated to receive the largest benefits, compared to the other three counties in the state of Hawaii for two reasons – first, it is the largest economy in the state and second, the international airport is located there so many of the fly-cruise or cruise-fly passengers transit through Honolulu.

21.3. Future Developments

Section 21.2 outlines many of the applied CGE models that can be found in the tourism literature to date. However, as more tourism economists apply CGE models rather than IO models, so CGE modellers need to address some of the criticisms of the modelling and become more sophisticated in its use. This section notes several ways that this can be achieved.

21.3.1. Sensitivity Analysis

One of the main limitations of CGE models in general is the dependence of the results on the estimated values of key parameters (Blake *et al.*, 2006b). This limitation means that it is difficult to choose appropriate elasticity and other parameter values. Very rarely are the elasticities to be used in the specific CGE model estimated econometrically for the same economy for the same time period (Shoven and Whalley, 1984). Hence it is prudent to conduct sensitivity analyses with regard to the value of the elasticities used in the models. Despite this, sensitivity analysis is the exception rather than the rule.

To determine how sensitive his findings are, Blake (2000) undertakes a limited sensitivity analysis where, for the six elasticities in the model, the parameters are doubled in value. Blake concludes that the results are reasonably insensitive to changes in these elasticity values. Sugiyarto *et al.* (2003) and Li et al (2011) conduct a similar sensitivity analyses to test the robustness of their results. Blake *et al.* (2003) add further analytical rigour to the Malta and

Cyprus EU Accession research by implementing a systematic sensitivity analysis with regard to elasticity parameters, where a 'Monte Carlo' procedure was used to construct a range around the central estimate of the parameters used in the main model and 100 simulations were conducted. A recent paper by Pratt (2011b) also conducts a systematic sensitivity analysis of elasticities.

21.3.2. Dynamics

Most of the studies reviewed are solely static in nature. In many of the papers outlined, some elements of a time dynamic occur. However, the dynamic element is essentially practical and not based on the existence of intertemporal individual profit or utility functions but instead built around the adoption of greater values for production elasticities (Blake *et al.*, 2003), internal mobility of capital (Blake *et al.*, 2003, Zhou *et al.*, 1997) or exogenous changes in pre-determined variables such as population or visitor growth rates (Kim and Konan, 2004).

When the research questions involves understanding the adjustment path and involves issues related to capital and investment, then dynamic CGE models are a more appropriate tool to use. Blake (2009) demonstrates the economic impact of an additional £1 billion of tourism expenditure into the UK economy using three different dynamic scenarios. Dynamic modelling allows economic agents to foresee what will happen in the future, which not only affects behaviour following the shock but also affects behaviour leading up to the shock. Blake shows that unanticipated shocks differ significantly from anticipated shocks. Of the studies cited above, Zhang and Lee (2007) and Lee, Moon and Mjelde (2010) use an intertemporal model to explain their results.

21.3.3. Other Developments

Apart from the areas of research discussed above, which could be expanded and built upon, there are other areas and methodological advances that could be used by tourism economists. For example in the area of infrastructure, additional tourism will make use of public infrastructure, such as roads, imposing costs in providing and maintaining it (Kim *et al.*, 2004). Other extensions pertaining to this area include congestion costs, environmental damage, and positive externalities from tourism such as gains from economies of density, for example more frequent flights between cities as a result of additional tourism. Ferguson, McGregor, Swales, Turner, and Ping Yin. (2005) incorporate sustainability indicators into a CGE model of the Scottish economy. Conventional CGE modelling does not incorporate the costs of

environmental degradation or loss of scenic attractions that are valued for their contribution to their standard of living, but do not appear in the industry cost of production. In principle, these issues could be included in a CGE model. Dwyer *et al.* (2000) suggest that the CGE model output could then be utilised for cost-benefit analyses of such issues.

Blake *et al.* (2008) examined the extent to which tourism is pro-poor in Brazil but more work needs to be completed in this area, especially in developing countries. One common way to assess economic impacts relating to poverty is via a CGE macro-microsimulation analysis (Vos and De Jong, 2003, Cogneau and Robilliard, 2000, Reimer, 2002). This technique usually involves using a CGE model to disentangle the general equilibrium effects of different policy scenarios on sector output, employment, factor incomes and household consumption. The microsimulation approach then uses the 'macro' simulation results of the CGE model and examines these in the context of job status and remuneration of individual workers and hence, household income distribution and poverty via household survey data. To date, this has not been attempted for any tourism studies.

Tourism economic impact research needs to become more creative, incorporating other data and meshing it with input-output tables and tourism satellite accounts. For example, Pratt (2011a) examines the economic impact of tourism across the tourism area life cycle for the economy of Hawaii. He finds that the size of tourism's economic contribution is dependent on the import propensity of tourists' spending as well as the import propensities of tourism-oriented sectors and their backward and forward linkages while the CGE model highlights the fact that welfare is maximised at the zenith of tourism growth, with the transportation sector being the driving industry for growth.

21.4. Conclusions

In the empirical context, CGE models investigate the consequences of an expansion in tourism demand which results in the increased use of resources. Increases in prices attract resources into the tourism-related sectors, increasing the industries' costs and making the destination less competitive. The size of these increased costs depends on the supply of the factors of production and what proportion of the tourism-related industries' total production costs are accounted for by these factors. In the case where resources are drawn away from traditional export-oriented industries, increased production costs occur for these industries resulting in a loss of production and employment. If tourism growth increases investment, then pressure is exerted on the real exchange rate, increasing the feedback effects for the period of capital inflow (Dwyer *et al.*, 2000). If tax increases or borrowing is used to finance any increased

government consumption associated with tourism growth, then private consumption may be crowded out, limiting the positive effects on income and employment. The impacts outlined here can be simulated in CGE models but cannot be taken into account in IO models.

Despite the clear advantages of CGE modelling over IO modelling, several objections to CGE models remain. Dwyer *et al.* (2004) outline both the objections and respond to the objections. When CGE models first started to be introduced into the literature, it was argued they were too time consuming to build and too complicated to use. In response to this, it should be noted that increasingly powerful personal computers and faster algorithms are now available. Moreover, much of the time needed to build the model can be due to the construction of the underlying IO table or SAM, which are used in both model methodologies. Further, the issue of a more realistic model should outweigh convenience.

Another line of argument is that CGE modelling and IO modelling produce very similar output so the additional complexity of CGE modelling is unjustified. However, as shown above with the comparative studies, the results can be very different. It can be true that if CGE modelling is specified with the same restrictive assumptions as an IO model, then the results may be similar but with more plausible assumptions, which recognise resource constraints and the ways in which the labour market works, IO models and CGE models will typically give very different results.

For analysing local impacts, though, there may be an argument for using IO modelling over CGE modelling. So if the research objective is to examine the economic impacts of a local event or project on the local area, then a local IO analysis could be undertaken. The reason for this is that the IO assumption of freely available resources is closer to reality in the local case, as labour and capital can flow into the area from other areas and the change in quantities supplied and demanded at the local level will not impact prices.

Tourism economists need to use the most appropriate methodology available. Additionally, CGE modellers need to address important policy questions and move beyond the standard CGE models and embrace some of the techniques used in the mainstream economics literature.

References

Adams, PD and BR Parmenter (1992a). *The Medium Term Significance of International Tourism for the Australian Economy*. Centre of Policy Studies, Monash University,

Adams, PD and BR Parmenter (1992b). The Medium Term Significance of International Tourism for the State Economies. Centre of Policy Studies, Monash University,

Adams, PD and BR Parmenter (1995). An applied general equilibrium analysis of the economic effects of tourism in a quite small, quite open economy. *Applied Economics,* 27**,** 985-994.

Blake, A. 2000. *The Economic Effects of Tourism in Spain*. University of Nottingham, Nottingham. Retrieved March 23 2006 from http://www.nottingham.ac.uk/ttri/pdf/2000_2.pdf

Blake, A. 2005. *The Economic Impact of the London 2012 Olympics*. University of Nottingham, Nottingham. Retrieved April 19 2006 from http://www.nottingham.ac.uk/ttri/pdf/2005_5.PDF

Blake, A (2009). The dynamics of the economic impact of tourism. *Tourism Economics*, 15**,** 615-628.

Blake, A, JS Arbache, MT Sinclair and V Teles (2008). Tourism and poverty relief. *Annals of Tourism Research,* 35**,** 107-126.

Blake, A, R Durbarry, JL Eugenio-Martin, N Gooroochurn, B Hay, JJ Lennon, M Sinclair, Thea, G Sugiyarto and I Yeoman (2006a). Integrating forecasting and CGE models: the case of tourism in Scotland. *Tourism Management,* 27**,** 292-305.

Blake, A, R Durbarry, MT Sinclair and G Sugiyarto. 2001a. *Modelling Tourism and Travel using Tourism Satellite Accounts and Tourism Policy and Forecasting Models*. University of Nottingham, Nottingham. Retrieved March 23 2006 from http://www.nottingham.ac.uk/ttri/pdf/2001_4.PDF

Blake, A, J Gillham and MT Sinclair (2006b). CGE tourism analysis and policy modelling. In L Dwyer and P Forsyth (eds.) *International Handbook on the Economics of Tourism.* Edward Elgar Publishing, Cheltenham.

Blake, A and MT Sinclair. 2002. *Managing Tourism Shocks: CGE Analysis of September 11*. University of Nottingham, Nottingham. Retrieved March 23 2006 from http://www.nottingham.ac.uk/ttri/pdf/2002_7.pdf

Blake, A and MT Sinclair (2003). Tourism crisis management US response to September 11. *Annals of Tourism Research*, 30**,** 813-832.

Blake, A, MT Sinclair and G Sugiyarto. 2001b. *The Economy-Wide Effects of Foot and Mouth Disease in the UK Economy*. University of Nottingham, Nottingham. Retrieved March 23 2006 from http://www.nottingham.ac.uk/ttri/pdf/2001_3.PDF

Blake, A, MT Sinclair and G Sugiyarto. 2003. *Tourism and EU Accession in Malta and Cyprus*. University of Nottingham, Nottingham. Retrieved March 23 2006 from http://www.nottingham.ac.uk/ttri/pdf/2003_7.pdf

Bohlmann, HR and JH Van Heerden (2005). The Impact of Hosting a Major Sporting Event on the South African Economy. Department of Economics Working Paper Series, Pp. 2005-9 University of Pretoria,

Cogneau, D and A-S Robilliard (2000). Growth, Distribution and Poverty in Madagascar: Learning from a Microsimulation Model in a General Equilibrium Framework. *IFPRI TMD Discussion Paper 61*.

Dwyer, L, P Forsyth, L Fredline, M Deery, L Jago and S Lundie (2007a). Yield measures for special-interest Australian inbound tourism markets. *Tourism Economics,* 13**,** 421-440.

Dwyer, L, P Forsyth, J Madden and R Spurr (2000). Economic impacts of inbound tourism under different assumptions regarding the macroeconomy. *Current Issues in Tourism,* 3**,** 325-363.

Dwyer, L, P Forsyth and R Spurr (2004). Evaluating tourism's economic effects: new and old approaches. *Tourism Management,* 25**,** 307-317.

Dwyer, L, P Forsyth and R Spurr (2005). Estimating the impact of special events on an economy. *Journal of Travel Research,* 43**,** 351-359.

Dwyer, L, P Forsyth and R Spurr (2006a). Assessing the economic impacts of events: a computable general equilibrium approach. *Journal of Travel Research,* 45**,** 59-66.

Dwyer, L, P Forsyth and R Spurr (2007b). Contrasting the uses of TSAs and CGE models: measuring tourism yield and productivity. *Tourism Economics,* 13**,** 537-551.

Dwyer, L, P Forsyth, R Spurr and T Van Ho (2003). Tourism's contribution to a state economy: a multi-regional general equilibrium analysis. *Tourism Economics,* 9**,** 431-448.

Dwyer, L, P Forsyth, R Spurr and T Van Ho (2006b). Economic effects of the world tourism crisis on Australia. *Tourism Economics,* 12**,** 171-186.

Econtech. 2001. *Economic Effects of the Recent Tourism-Related Events on the Tourism Sector and the Economy.* Sydney. Retrieved March 30 2006 from http://www.econtech.com.au/Information/Documents/Word/EcontechFinalReport.doc

Ferguson, L, PG Mcgregor, JK Swales, KR Turner and Y Ping Yin (2005). Incorporating sustainability indicators into a computable general equilibrium model of the Scottish economy. *Economic Systems Research,* 17**,** 103-140.

Gooroochurn, N and C Milner. 2004. *Efficiency Effects of Tourism Taxes: A Computable General Equilibrium Analysis*. University of Nottingham, Nottingham. Retrieved March 23 2006 from http://www.nottingham.ac.uk/ttri/pdf/2004_1.pdf

Gooroochurn, N and MT Sinclair (2005). Economics of tourism taxation: evidence from Mauritius. *Annals of Tourism Research,* 32**,** 478-498.

Kim, E, GJD Hewings and C Hong (2004). An application of an integrated transport network-multiregional CGE model: a framework for the economic analysis of highway projects. *Economic Systems Research,* 16**,** 235-258.

Kim, K and DE Konan. Year. Using I-O analysis and CGE modeling to estimate infrastructure demand in Hawaii. *In* EcoMod Conference Input-output and General Equilibrium Modeling, September 2 - 4, 2004 2004 Brussels, Belgium. EcoMod Conference.

Lee, C-K, S Moon and JW Mjelde (2010). Disentangling the effects on the Korean economy of the 9/11 terrorist attacks from the short-run effects of hosting the 2002 World Cup, using the CGE model. *Tourism Economics,* 16**,** 611-628.

Li, S and A Blake (2009). Estimating Olympic-related investment and expenditure. *International Journal of Tourism Research,* 11**,** 337–356.

Li, S, A Blake and C Cooper (2010). China's tourism in a global financial crisis: a computable general equilibrium approach. *Current Issues in Tourism,* 13**,** 435-453.

Li, S, A Blake and C Cooper (2011). Modelling the economic impact of international tourism on the Chinese economy: a CGE analysis of the Beijing 2008 Olympics. *Tourism Economics,* 17**,** 279-303.

Madden, J (2002). The economic consequences of the Sydney Olympics: The CREA/Arthur Andersen Study. *Current Issues in Tourism,* 5**,** 7-21.

Madden, J and P Thapa (2000). The Contribution of Tourism to the New South Wales Economy. Centre for Regional Economic Analysis, University of Tasmania,

Narayan, PK (2003). Economic impact of the 2003 South Pacific Games on Fiji. *Economic Papers,* 22**,** 60-73.

Narayan, PK (2004). Economic impact of tourism on Fiji's economy: empirical evidence from the computable general equilibrium model. *Tourism Economics,* 10**,** 419-433.

Pambudi, D, N Mccaughey and R Smyth (2009). Computable general equilibrium estimates of the impact of the Bali bombing on the Indonesian economy. *Tourism Management,* 30**,** 232-239.

Polo, C and E Valle (2008). A general equilibrium assessment of the impact of a fall in tourism under alternative closure rules: the case of the Balearic Islands. *International Regional Science Review,* 31**,** 3-34.

Pratt, S (2011a). Economic linkages and impacts across the TALC. *Annals of Tourism Research,* 38**,** 630–650.

Pratt, S (2011b). The Impact of a Devaluation of a Destination's Currency on Tourism: The Case of Fiji *3rd Conference of the International Association for Tourism Economics* Bournemouth, UK.

Pratt, S and A Blake (2009). The economic impact of Hawaii's cruise industry. *Tourism Analysis,* 14**,** 337-352.

Reimer, JJ. 2002. *Estimating the Poverty Impacts of Trade Liberalization*. Center for Global Trade Analysis, Purdue University. Retrieved 2004/10/15 2002 from www.gtap.agecon.purdue.edu/resources/working_papers.asp

Shoven, JB and J Whalley (1984). Applied general equilbrium models of taxation and international trade: an introduction and survey. *Journal of Economic Literature,* 22**,** 1007-1051.

Skene, J (1993a). The Economic Impact of the Growth in Visitor Expenditure: A Quantitative Assessment. Working Paper No. 92 Bureau of Industry Economics, Canberra.

Skene, J (1993b). Some Short-run Effects of an Increase in Visitor Expenditure. Working Paper No. 93 Bureau of Industry Economics, Canberra.

Sugiyarto, G, A Blake and M Sinclair, Thea (2003). Tourism and globalization: economic impact in Indonesia. *Annals of Tourism Research,* 30**,** 683-701.

Tabatchnaia-Tamirisa, N, MK Loke, P Leung and KA Tucker (1997). Energy and tourism in Hawaii. *Annals of Tourism Research,* 24**,** 390-401.

Vos, R and N De Jong (2003). Trade liberalization and poverty in Ecuador: a CGE macro-microsimulation analysis. *Economic Systems Research,* 15**,** 211-232.

Wattanakuljarus, A (2005). *The Nationwide Economic and Environmental Impacts of Tourism: A Computable General Equilibrium Approach for Thailand*. Department of Agricultural and Applied Economics, University of Wisconsin-Madison. Retrieved April 6 2006 from http://web.idrc.ca/uploads/user-S/11738541401Anan_FReport.pdf

Yeoman, I, JJ Lennon, A Blake, M Galt, C Greenwood and U Mcmahon-Beattie (2007). Oil depletion: what does this mean for Scottish tourism? *Tourism Management,* 28**,** 1354-1365.

Zhang, J and D Lee, J. (2007). The effect of wildlife recreational activity on Florida's economy. *Tourism Economics,* 13**,** 87-110.

Zhou, D, JF Yanagida, U Chakravorty and P Leung (1997). Estimating economic impacts from tourism. *Annals of Tourism Research*, 24**,** 76-89.

About the Author

Dr. Stephen Pratt (pratt_s@usp.ac.fj) is currently Senior Lecturer at the University of the South Pacific. He has been there since January 2009. Before that, he completed his PhD at the University of Nottingham, United Kingdom, under the supervisor of Professors Thea Sinclair and Adam Blake. His PhD topic focused on the economic impact of tourism in Hawaii and the consequences for the economy when tourism demand is uncertain. Prior to undertaking my PhD, I was a Research Director for several marketing consultancies both in Hawaii and Australia. He obtained a Bachelor of Economics and Masters of Economics from the University of Sydney. His research interests include the economic impacts of tourism; destination marketing; cruise tourism and film tourism.