TOURISM TAXES AND NEGATIVE EXTERNALITIES IN TOURISM IN AUSTRALIA: A CGE APPROACH

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Abstract

In this paper we analyse general equilibrium effects of an increase in a tourism tax which we hypothetically designed to internalise negative externalities of international tourism in Australia. Several simulations were carried out using a computable general equilibrium (CGE) model of the Australian economy. The simulations were carried out assuming two different economic environments, the short-run and the long-run. The simulation results suggest that due to an increase in tourism taxes, the international tourism sector tends to contract while the other sectors expand. Overall, an increase in tourism taxes appears to be welfare improving in the long-run though it generates a marginal contraction in overall economic activities in the short run.

Keywords: Tourism Taxation, Negative externalities, CGE, Australian Tourism

JEL classification: D58, D62, L83

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This paper is based on a study funded by CRC Sustainable Tourism (Grant # 53005). The views are those of the author and should not be attributed the sponsoring agency.

1. Introduction

Taxing tourism sectors are justified based on several economic arguments: internalising negative externalities, public goods, rent extraction and government revenue generation. Of these, issues related to internalising tourism related negative externalities have received a considerable attention in recent literature (Clarke and Ng 1993; Divisekera, 1995; Clarke 1997; Tisdell 2001; Gooroochurn and Sinclair 2003). The key argument underlying most of these studies is that tourism generates negative externalities such as environmental degradation and congestion and thus economic instruments such as taxes and levies could be used to internalise them.

However, little attention has been given to analyse possible effects of such instruments and in particular in a general equilibrium context (see for example, Palmer and Riera 2003; Palmer, Riera and Rosello 2007). Palmer and Riera provided a critical review of the "Balearic ecotax" that was proposed by the Government of the Autonomous Community of Balearic Islands to handle tourism related negative externalities. This study highlights two main conclusions. First, the internalisation of the negative externalities in tourism is vital to guarantee the continued sustainable growth in tourism. Second, a tax or a levy such as the "Balearic ecotax" is capable of raising government revenue necessary to finance activities aimed at improving the environment or developing infrastructure needed for tourism sector.

Palmer, Riera and Rosello (2007) used count models to examine different ways of modelling the demand for hire cars in Mallorca (Spain). They then considered a fixed rate tax on daily numbers of hire cars that are believed to be involved with externalities. This study analyses descriptively whether the tax is effective in terms of internalisation of negative externalities, optimality, fiscal effectiveness, the economic and distributive impact and social acceptance. The study concludes that while the tax imposed on rental cars is less effective as a short-term corrective measure, it could well be used as a tourism tax based on its success in other factors considered in the study.

While the available studies make a substantial contribution to our understanding of the various theoretical aspects of tourism related negative externalities and potential corrective measures, one of the major limitations is the lack empirical evidence. This is a major drawback from a policy perspective since a clear understanding of how tourism taxes could be used to internalise externalities in tourism and economy wide effects of such taxes is necessary for any meaningful policy discussion about tourism taxation. Against this background, the aim of this paper is to examine the importance of economic instruments such as taxes to internalize externalities associated with tourism and to analyse their economy wide implications in the context of Australian tourism using a CGE model.

This remainder of this paper is organised as follows. In the next section, theoretical underpinning of negative externalities related to tourism is presented and an estimation of the external cost of tourism in Australia is explained. In Section three, the Computable General Equilibrium model (CGE) used in carrying out simulations is presented with special reference to its features and model assumptions are described. In the subsequent section, simulations carried out are explained and the results are analysed. The final section offers conclusions and outlines the wider implications of tourism taxes.

2. Internalising Negative Externalities of Tourism

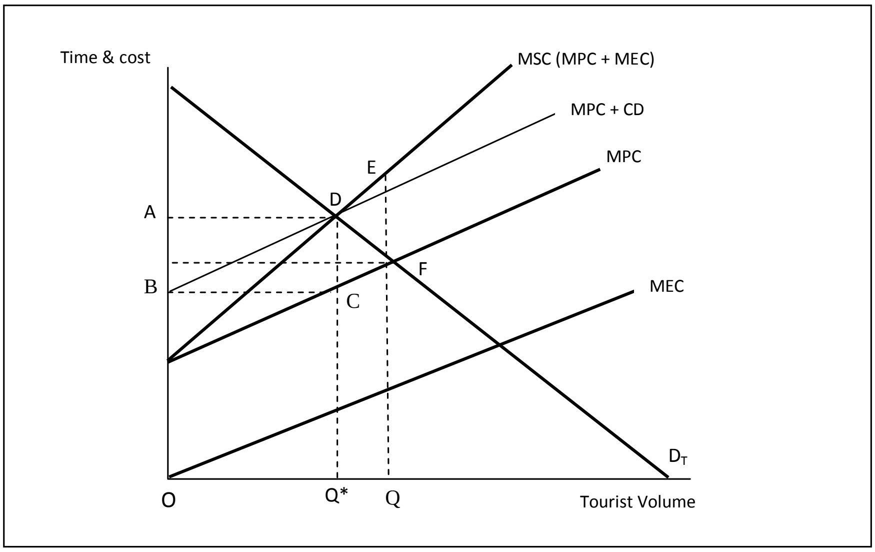
The externality argument has two aspects. The first aspect of the externality argument is related to the premise that tourism gives rise to negative externalities such as environmental degradation and congestion, which are described as the environmental cost of tourism (Hughes 1981; Divisekara 1995; Jensen & Wanhill 2002). In addition to the private costs, decisions of tourists to undertake a trip induce additional costs, on service providers, other tourists visiting the same place and on the host country.

Tourism-related costs to other tourists and to the host society are referred to as the negative externality/external cost of tourism. In the economic sense, negative externalities of tourism arise when the activities of the tourist (activities of one agent) within the destination have an impact on the welfare of other tourists or of the hosts (the other agents), without the impact having been taken into account by the tourist (the first agent) and thus the effect is not reflected in market transactions (Nash, *et al*. 2004; Nicholson 2005).

The existence of tourism affects many aspects of the environment of the host nation. Natural resources such as flora and fauna, beaches, wilderness areas, forests, mines and lakes are often degraded and polluted. Tourism might destroy habitats and change the ecology of an area. Man-made resources such as heritage sites, historical cities, museums, relics and recreational facilities have often been used beyond their carrying capacity. This could degrade the historical value of these resources that cannot be replaced. Human resources such as a country's resident population, institutions, and artistic and cultural activities are often disturbed (Forsyth, Dwyer and Clarke, 1995). The extra tourist influx increases traffic congestion.

Crowding, long queues at popular places, traffic congestion and untidy environments affect both the host nation as well as the tourists (Gooroochurn and Sinclair 2003). Increased adverse environmental effects, therefore, can result in the discouragement of visitors to a particular destination. Tisdell (1988) proved how increased pollution, using marine pollution as an example, results in reduced surpluses to both visitors and tourism service providers, using a partial equilibrium model. This happens as a result of the reduced demand for tourism/recreation due to the pollution. Thus, from both the tourism sector's and host society's viewpoints, there should be appropriate policies to address tourism-related externality issues, which would optimise the tourism volume as well.

Figure 1. Negative Tourism Externalities and Optimal Tourism Taxes



The economic case of tourism-related negative externalities could further be explored by applying the theoretical view of congestion introduced by Pigou (Nash *et al.* 2004, Bureau of Transport & Communications Economics 1996). In Figure 1, the vertical axis represents the cost of visiting a particular destination (price of tourism) and this may include the monetary cost incurred to the tourist as well as the money value of travelling time within the destination. The horizontal axis shows tourism volume. Tourism demand (D_T curve) is based on the perceived value of tourists visiting the destination in terms of the cost and time (marginal benefits of tourism). If the cost is lower, the tourist's perceived value is higher (higher demand) and hence a higher tourism volume within the destination. Marginal Private Cost (*MPC*) represents the cost that individual tourist takes into account in making decisions to visit the destination. Each individual tourist might incur increasing cost as his or her stay increases in the destination. The increasing cost may include increasing expenditure within the destination plus additional time taken in travelling within the destination. For instance, when tourist numbers are higher in a destination, tourists have to spend additional time searching for parking facilities, queuing, and the like.

The competitive equilibrium level of tourism volume in the destination is given at point *F*, the intersection of the *MPC* and the demand curve (D_T). The equilibrium level *OQ* is determined purely based on the private cost for each tourist (*QF*). Up to this level, the marginal benefit of tourism is higher than the private cost and thus, they still maximise individual welfare. However, from society's viewpoint, *OQ* is inefficient as it takes into account only *MPC* and disregards the possible external costs.

Marginal External Cost (*MEC*) that arises as a result of visitation is presented by the *MEC* curve and it is up-sloping representing the greater visitor numbers with increasing external costs. However, visitors do not take into account such external costs in their decision to travel. Against this background, in order to determine the efficient level of tourism volume as perceived by local residents (society's point of view) Marginal Social Cost (*MSC*) should be considered and it represents the sum of the marginal private and marginal external costs (*MPC* + *MEC*). The up-sloping MSC curve represents the increasing level of social cost arising from the increasing level of tourism.

When marginal social cost is considered, the efficient level (socially optimal level) of tourism is determined at point *D* where the *MSC* curve intersects the demand curve and it gives the optimal tourism volume of *OQ**. This analysis shows that tourism is beneficial as long as marginal benefits (reflected in D_T curve) exceed marginal social cost, and thus the efficient or socially optimal level of tourism is at point D. At point E, clearly marginal social cost exceeds marginal benefits by an amount equal to the distance shown as *FE*, the vertical distance between *MSC* and *MPC* curves. By construction, the distance between these two curves represents the marginal external cost arising from tourism.

The above analysis shows that the parties involved in tourism are less than likely to come to an agreement on the efficient level of tourism, thus government intervention into the market is desired. Accordingly, it is argued that a Pigouvian tax can be levied to correct the negative externality. Pigouvian tax theory suggests that a tax equivalent to the difference between marginal social cost and marginal private cost (i.e. *MEC*) could be levied at the efficient level of tourism (Bailey 1995; Pindyck and Rubinfeld 2001; Rosen 2005; Tisdell 1993).

According to Figure 1, a tourism tax equivalent to the distance *CD* could be imposed.[22] The area *ABCD* represents the total revenue from such tourism taxes. Although, the welfare of current tourists (*OQ**: post tax level) is reduced due to the tax, the total welfare is not affected. Moreover, national welfare can be improved if the government tax revenue (shown in *ABCD*) is redistributed among the residents. The net social gain from taxing tourists to internalise negative externalities is shown by ΔDEF. The tourism volume falls from *Q* to *Q** and this is socially desirable. If the tourism volume declines further, the tourism sector would suffer from such reductions. Therefore, taxes should not exceed the optimal level.

2.1 Estimation of the External Cost of Tourism and Optimal Level of Tax

The preceding section shows how the optimality is achieved through a tourism tax when externalities exist. However, determining the optimum level of the tax does not seem to be an easy task. This might involve knowledge of the tourism demand function, the private costs function of tourism and the external marginal cost function (Palmer and Riera 2003). The information regarding tourism demand function for Australia, in particular demand elasticities are available (Divisekara, 1995; 2003; 2008; 2009)). However, to the best of our knowledge, information regarding the remaining functions is not readily available. Therefore, the level of the tourism tax in this study is estimated using the following procedure.

The external cost of tourism was estimated using currently available information from several sources. It is assumed that the estimated cost is a reasonable proxy to represent the actual cost. Of the various aspects of tourism-related external costs, this assessment considered four aspects including traffic

[22] Divisekara (1995), Clarke (1997), Jenson & Wanhill (2002) and Tisdell (2001) also held a similar view that government could intervene in imposing taxes on the tourism product to redress the induced environmental problems.

congestion, aircraft noise, air pollution by motor traffic and marine pollution, for which secondary data sources were available for the estimation.

The Auslink White Paper (Department of Transport and Regional Services, 2004, hereafter DOTARS) is the first key source used. This estimates that the total cost of traffic congestion to the Australian economy was $12.8 billion in 1995 and forecast that this would increase to $29.7 billion by 2015. According to this estimation, on average, the cost of congestion increases by nearly 7 per cent a year. Furthermore, it estimates that the cost of urban air pollution from motor vehicles in Australia was approximately 0.2 to 0.3 per cent of the GDP. Following DOTARS (2004), the costs of traffic congestion and air pollution attributable to the Australia tourism sector were estimated and are presented in Table 1. Since this source does not quantify the external cost by the type of industry, some rational base should be used to extract tourism sector contribution. We allocated a portion of the total cost of congestion and air pollution to the tourism industry based on the tourism industry's value added share in total value added (We used the share of Australian tourism in the total gross value added derived from the Australian Tourism Satellite Account to allocate tourism industry's share of cost of traffic congestion and air pollution).

The cost of aircraft noise was estimated based on available information about the ANL (Aircraft Noise Levy). This levy is imposed on each passenger arrival in a jet aircraft to specified Australian airports (The levy is $3.40 per passenger currently and is operative only at Sydney and Adelaide airports. These two are currently recognised as airports that generate excessive noise in surrounding areas). The levy is based on the noise levels (noise characteristics) of aircraft and thus it is reasonable to assume that the monetary value of the levy represents the external cost of aircraft noise. It was assumed that the total collections from the levy are equal to the total external cost of noise pollution due to tourism in the surrounding areas. Similarly, we assumed that the total amount collected from the EMC (Environmental Management Charge) is also equal to total pollution at the Great Barrier Reef Marine Park due to tourism (for detailed estimation of tourism taxes see Ihalanayake and Divisekara 2006).

Table 1. External Cost of the Australian Tourism Sector 1997 ($ mn)

Type of cost	**International tourism**	**Domestic tourism**	**Total**
Traffic congestion[a]	141	481	622
Air pollution of motor traffic[a]	1	4	5
Aircraft noise[b]	11.6	27.4	39
Marine pollution[c]	0.5	1.5	2
	154.1	513.9	668.0

Source: (a) estimated using data from DOTARS (2004), (b) Ministry of Transport & Regional Services (2004), (c) Great Barrier Reef Marine Park Authority (1997)

Table 1 shows the estimated total external cost associated with the four aspects of externality attributable to the Australian tourism sector. The total cost was disaggregated into domestic and international tourism based on the share/weight of each sector in the total tourism consumption. Table 1 shows that $668 million in total external costs is attributed to the Australian tourism sector out of which international tourism accounts for $154 million in 1997 (base year).

The cost of negative externalities attributable to domestic tourism was disregarded in the estimation since domestic tourists (Australian residents) make a significant contribution to the Commonwealth, State and local government tax revenues whereby approximately 40 per cent of total tax revenue is derived from personal income tax. This is an important difference between domestic visitors and international visitors since the latter do not contribute to personal income taxes.

Based on the number of visitor arrivals (4,318,000) in the base year, the per visitor external cost of international tourism was estimated at $35.66. Within the context of the above conceptual framework, this implies that each international visitor to Australia would be liable to pay a tax of $35.66 to compensate for the external cost arising from their presence as visitors.

However, these estimations are subject to some limitations since they could over/under estimate the actual cost. In addition to the four aspects considered in the estimation, there appears to be several other causes of tourism-related negative externalities such as pollution of beaches, national parks, marine parks, heritage sites, and pollution or negative impact on the man-made environment. One major problem in relation to the estimation of such externalities, to the best our knowledge, is the lack of reliable sources of information, similar to the ones we used in the current estimation. Moreover, the theory of externality implies that zero pollution in general is not socially desirable. The socially optimum level of tourism occurs at some positive level of external cost relating to externalities (Rosen 2005). Therefore, in summary, the estimation of the total external cost arising from all possible pollutants and the imposition of taxes to cover the cost seems to be beyond the scope of the current study, and, moreover not necessary.

Upon the estimation the per visitor external cost ($35.66) it should be considered whether international visitors already pay taxes to cover the external cost before estimating the appropriate level of the tax. Ihalanayake and Divisekara (2006) have noted earlier that international visitors have already contributed to Australian tax revenue. Against this background, those taxes and charges which are directly identifiable as being imposed upon international visitors for the purpose of recovering the cost of environmental damage are considered. There are two such taxes in Australia and these are the ANL and the EMC.

The total revenue collected from the ANL was $38.7 million for the base year out of which international visitors paid $11.6 million.[23] Moreover, a total of $2 million has been collected from the EMC for the base year and the contribution of international visitors is $0.4 million (based on share of international tourism in total tourism consumption). In addition to the above two taxes, the PMC (Passenger Movement Charge) paid by international visitors which totals $99.5 million for the base year was also considered (Ihalanayake and Divisekara 2006)[24]. Although, PMC is not officially labelled as a tax to cover external costs, as the largest special tourism tax paid by international visitors in Australia, it is reasonable to consider PMC as a part of the total tax revenue in this assessment.

The total revenue from these three taxes, i.e. ANL, EMC and PMC, advanced from international visitors, is estimated to be $111 million for the base year and this suggests that the per visitor tax contribution is $25.70. Our early estimations showed that per visitor external cost of tourism is $35.66. This suggests that per visitor tax contribution of $25.70 is insufficient to cover the external cost of international tourism. This leads us to derive the following policy scenario:

"The current tax contribution of the Australian international tourism sector seems to be inadequate to cover the external cost of the international tourism sector, and, accordingly, there is a case for further taxing international visitors."

If further government intervention is desired, what is the appropriate policy change? It is clear that the current tourism tax structure may be extended further. According to the above estimations, the tax increase could be $9.96 per international visitor in Australia (i.e. the balance between $35.66 - $25.70). Upon deciding the size of the tax, the next task is to decide the most suitable tax tool. In section four, simulations regarding the possible tax change are carried out and the changes of taxes are introduced.

3. The Model and Model Assumptions

The model applied in carrying out simulations in this paper is the Tourism Tax Model (TTM) developed by incorporating two tourism sectors and is a CGE model of the Johansen class (please see Ihalanayake 2007, 2012 for more details about the development of TTM).[25] The model consists of five groups of equations describing final demand (by households, government, investors, and exporters), industry demand for primary factors and intermediate inputs, pricing structure, market clearing conditions, and miscellaneous macroeconomic conditions. An essential feature of the model is that it is based on the neoclassical assumptions of pure competition.

On the supply side, the model includes 37 industries/sectors (including two tourism sectors) each producing a single commodity (The theoretical aspect of tourism sectors are given below since it is important for the central theme of this paper). The industries/sectors are faced with the problem of cost minimization. Production technology in general is explained by a system of nested combinations. The demand-side is represented by investment demand, a single representative household, the government, and export's demand. The industry demand for inputs for capital formation is explained by a nesting structure, which has two levels. The single representative household is faced with the problem of utility maximisation subject to budget constraints and thus household demand is formulated using a two level-nesting structure similar to the investment demand. Government demand describes the demand for locally produced and imported commodities by government institutions. Government demand in the model is assumed to be moving with real aggregate household consumption. Export demand for Australian-made commodities is determined by the foreign currency prices of exports. The demand for margin services is dependent upon the demand for related commodities for which margin services play the vital role of transferring commodities between producers and consumers.

The model includes import tariffs and sales taxes on intermediate consumption, investment, household

[23] The total amount collected from ANL for the base year was $38.7 million. Based on international visitor arrivals, interstate visitor arrivals and arrivals of Australian residents to NSW, we disaggregate the total into domestic and international tourism. Accordingly, domestic and international tourism account for, respectively, $27.09 million and $11.61 million in ANL in 1996-97.

[24] Total PMC collected was $174.5 million for 1996-97. Based on departures of short-term international visitors and short-term Australian residents, the total was disaggregated into international tourism ($99.45 million) and domestic tourism ($70.67 million).

[25] Johansen type models are special in that the model is represented as a system of linear equations in percentage changes of the variables.

consumption and exports. Tariffs and sales taxes are treated as *ad valorem* on basic values, with the tax variable in the linearised model being the percentage change in powers of the taxes. In addition to the basic structural components of the model given above, it also includes several other economic aggregates. Among these, aggregate volume of imports, exports and the balance of trade, consumer price index, aggregate employment and aggregate capital stock are important. Finally, the model assumes that wages and other costs are indexed to the consumer price index.

3.1 Tourism Theoretical Structure

On the supply side, there are two tourism sectors (domestic tourism and international tourism) in the model and they are incorporated into the intermediate matrix. Thus, the production technology of the tourism sectors is very similar to that of other conventional sectors in the model.

Equations (1) and (2) explain the demand for intermediate commodities from the domestic and international tourism sectors. The variables in the equations have four subscripts indicating from where demand arises. The variables indicate that it is the intermediate demand (subscript 1) for commodity *i* (*i* = 1 to 35) from source *s* (*s* = 1 domestic, *s* = 2 imported) by each tourism industry (*DT* = domestic tourism, *IT* = international tourism).

$$x_{1(is)DT} = z_{DT} - \sigma_{1(i)DT}\left(p_{1(is)DT} - \sum_{s=1}^{2} S_{1(is)DT}\, p_{1(is)DT} \right) + a_{1(is)DT} \quad (1)$$

i = 1, …., 35, s = 1, 2, DT = Domestic Tourism

$$x_{1(is)IT} = z_{IT} - \sigma_{1(i)IT}\left(p_{1(is)IT} - \sum_{s=1}^{2} S_{1(is)IT}\, p_{1(is)IT} \right) + a_{1(is)IT} \quad (2)$$

i = 1, …., 35, s = 1, 2, IT = International Tourism

Where, $x_{1(is)DT}$ and $x_{1(is)IT}$ denote the percentage change in demand for intermediate commodities from the domestic and international tourism sectors respectively, z is the activity level of each tourism sector (*DT* or *IT*) and p's, $\sigma_{1(i)}$ and $S_{1(is)}$ are price variables, substitution elasticities and cost shares of each tourism sector, respectively. The technical change variables of each tourism sector are denoted as a's.

The equations indicate that in the absence of changes in the relative prices of commodities and technical changes, the intermediate demand for the commodities of each tourism sector is a function of the activity level of the relevant tourism sector.[26] This reflects the constant returns to scale assumption in production. This means that if a tourism sector wants to increase its output by one per cent, it has to increase its aggregate use of intermediate commodities by one per cent. However, in a situation where relative prices change, the tourism sector's demand for commodities would change by an amount less than the activity level.

On the demand side, tourism demand consists of two categories: domestic tourism demand and international tourism demand. Domestic tourism demand is modelled similarly to household demand.[27] The assumption is that domestic visitors are assumed to be choosing commodities to maximize utility subject to budget constraints. Therefore, domestic tourism demand equations are derived from a two-level nesting structure. Of the two levels, the lower level is not relevant to domestic tourism demand since the household sector purchases a composite tourism product. The lower level applies only to other commodities that the household sector demands. Therefore, domestic tourism demand is derived from the top-level of the nest. Following Dixon *et al*. (1982), the demand for domestic tourism can be specified as follows:

$$x_{3DT} = \varepsilon_{DT} c + \sum_{k=1}^{37} \eta_{ik}\, p_{3k} + a_{3DT} \quad (3)$$

Where, x_{3DT} is the percentage change in the demand for domestic tourism, c is the percentage change in aggregate household nominal consumption, p_{3k} is the percentage change in the price of commodities, a_{3DT} is a taste change variable and ε_{DT} and η_{ik}'s are expenditure and own and cross price elasticities.[28]

In deriving Equation (3), the model assumes the Klein-Rubin utility function. This implies that Equation (3) is derived using a linear expenditure system (LES) and it reflects that demand is a linear function of prices and expenditure. Accordingly, the

[26] The activity level is the total capacity or the total output of a sector.

[27] Blake (2000), and Gooroochurn and Sinclair (2005) modelled domestic tourism demand similarly to household demand in that domestic visitors maximize utility subject to budget constraint.

[28] Variable ε_{DT} measures how responsive household demand is for domestic tourism to the changes in average household expenditure (c) while the change in household demand for domestic tourism to the changes in general price of good k is given in η_{ik} (where for $i = k$, η_{ik} is the own price elasticity and for $i \neq k$ η_{ik} is the cross price elasticity).

demand for domestic tourism is divided into two parts: subsistence demand and supernumerary or luxury demand. Subsistence demand is fixed in the model (hence, elasticity of demand for subsistence is zero). Changes in demand for domestic tourism could arise only as a result of changes in luxury demand. The responsiveness of demand for domestic tourism to such changes is determined by the size of demand elasticity.[29]

On the other hand, international tourism demand is modelled similarly to export demand and thus it is assumed that tourism demand is inversely related to the foreign currency price of international tourism. Following Dixon *et al*. (1982), the demand for international tourism in Australia is specified as follows:

$$x_{4IT} = -\beta_{IT}\, p_{4IT} - f_{4IT} \qquad (4)$$

Where, x_{4IT} is the percentage change in demand for international tourism, β is the price elasticity of demand for international tourism, p_{4IT} is the percentage change in the purchaser's (foreign currency) price of international tourism in Australia and f_{4IT} is a shift variable that allows an exogenous change in international tourism demand.

In the equation, the percentage change in demand for international tourism in Australia is a function of the percentage change in the foreign currency price of international tourism. For instance, a tax-induced increase in the percentage change of price will have a negative impact on the percentage change of demand for international tourism. The degree of the demand responsiveness to price changes is determined by the size of parameter β (price elasticity of demand). The purchaser's price of international tourism (p_{4IT}) reflects the price of a composite international tourism product. This facilitates the implementation of our idea that international visitors are buying a bundle of goods and services and that their decisions are motivated by the single price term. A similar approach to model international tourism has been adapted by Adams, Horridge and Wittwer (2003); B1ake (2000); Dixon and Rimmer (2002); Gooroochurn and Sinclair (2005) and Sugiyarto *et al.* (2003).

3.2 Model Assumptions

The simulations are carried out within two different economic environments, representing the short-run and the long run. In each economic environment, a set of assumptions regarding the model is made. In other words, a set of exogenous variables is specified in each case which is also known as the specification of the closure of the model. The database used in this study contains 37 industries, 37 commodities, a single representative household, the government, an aggregate export demand, 9 skill labor groups, and 6 industries whose investment is determined exogenously.

Tariff terms, ad valorem and sales tax terms, export tax terms, technological and taste change terms, shift variables, and number of households are assumed to be exogenous in both the short-run and the long-run economic environments. Further assumptions regarding the selection of additional exogenous variables in each economic environment are made.

In addition to those exogenous variables noted above, there are several important selections of exogenous variables in the short-run. Among these, selection of variables relating to primary factors and aggregate expenditure variables are the most crucial. Of the three primary factors: capital, land and labor, the industry-specific current capital stock is fixed in the short-run closure. This implies that the rate of return on capital is determined endogenously. The use of agricultural land in the production process is also exogenised. Aggregate employment is determined endogenously, while the real wage rate is fixed.

On the demand side, all components of real gross national expenditure, namely household consumption, private investment, government expenditure and inventories, are exogenised. Changes in the GDP in simulations, on the expenditure side, are adjusted using the balance of trade as the swing variable. Thus, export and import volumes can be endogenously determined. This implies that, depending on the shock, a change in real GDP is represented as a change in the balance of trade, a deficit or a surplus, reflecting national dis-saving or national saving. This choice is important for the needs of simulations carried out in this study. In our model, we assume elastic demand for export including international tourism. Thus, a change in tourism taxes can be expected to change international tourism consumption via changes in tourism prices. Such changes in tourism consumption can change the exports volume. Given that the balance of trade is endogenous, it is easier to track down changes in real GDP arising from tourism tax changes. Moreover, as the small country assumption is adopted in simulations, import prices are fixed, implying the inability of Australian demand to change world market prices. The nominal exchange rate is the numeraire, which is also exogenous.

In the long-run, selection of primary factors and expenditure aggregates for the exogenous list differs

[29] The second part of demand, supernumerary demand, is modelled as Cobb-Douglas and thus demand elasticity is near –1 in the model. Dixon *et al.* (1982) argued that one advantage of assuming a Klein-Rubin utility function is the model's ability to source outside elasticities. Expenditure elasticities are sourced from the literature and price elasticities (η_{ik}) are estimated using the Frish formula for relating price elasticities to expenditure elasticities in the context of an additive utility specification.

from that of the short-run. The most important is the selection of the current capital stock to be determined by the model. Instead of the current capital stock, the rate of return on capital is assumed to be exogenous. In the long-run, aggregate employment is assumed to be exogenous since it is determined by other factors such as demographic changes, the natural rate of unemployment and the participation rate. In the case of exogenous aggregate employment, the real wage rate should be determined by the model. However, industry composition of labor can vary according to changes in other related variables.

As far as aggregate expenditure variables are concerned, real government spending and real investment are assumed to be exogenous. Exogenous real investment implies that Australian savings are only sufficient to maintain domestically-funded investment. Changes in real income available to Australians due to tax changes are reflected by changes in real household consumption and thus real household consumption is endogenous.

These assumptions mean that changes in capital stock purely reflect changes in foreign-owned capital. For example, if the capital stock is increased as a result of tax changes, there is an increase in the quantity of foreign-owned capital. Subsequently, the trade surplus is set to equal the increase in returns to capital, to pay foreign capital owners for additional capital that they finance. Thus, real household consumption is the only endogenous variable in the domestic absorption in this closure. The most important policy implication of this particular closure is that the changes in real consumption provide a valid indicator of the welfare changes arising from tax simulations. The nominal exchange rate is the numeraire in the long-run as well.

In relation to government finance, all tourism tax simulations are carried out as budget neutral simulations. Thus, the real budget deficit is exogenous while the income tax rate (both the rate of tax on wages and salaries/PAYE tax rate and the rate of tax on non-labor income) is endogenous. This implies that changes in tourism taxes and subsequent changes in government tax revenue are reflected in changes in income tax rates. For example, if tourism taxes are increased, income tax rates tend to fall given the exogenous budget deficit. This is similar to a situation where increased tax revenue is redistributed among households. Subsequently, the after-tax wage rate and household disposable income will represent the effects of changes in income tax rates arising from tourism tax simulations. Both the after-tax real wage rate and real disposable household income are introduced in the finance module. Furthermore, a link between real household disposable income and real consumption was also established and thus real consumption in our model is a good measure of tax-induced welfare changes.

The model is solved using the GEMPAK software (Harrison and Pearson 1996). GEMPAK can carry out simulations using specified databases. Moreover, since the CGE model we used is a comparative static model, in solutions it generates a linearisation error. It is observed that the extent of the error is greater when the policy change is larger. Thus, in order to minimize the linearisation error, a multi-step solution method should be applied. In our simulations, the Euler multi-step solution technique was applied.

4. Simulations and Simulation Results

In section three it was estimated, based on available evidence, that an increase of the international tourism tax by $9.96 per international visitor in Australia could be used to internalise the negative externality. What are the available alternative tax tools in the current structure to implement the above-mentioned tax change? As far as the current tax structure is concerned, the ANL (aircraft noise levy) is the only major tax imposed in relation to the internalisation of negative externalities. The levy is earmarked for the noise insulation projects at two identified airports. Thus, there would be difficulties in justifying increases in ANL, as it is a project-specific tax and therefore, a different tax should be considered. This leaves us only PMC and visa charges, as other possible candidates. The current policy of the Australian Government towards the visa-issuing process is to expedite the process by allowing applicants to use electronic applications. This leads us to suggest that the appropriate existing tax for this purpose is the PMC.

The choice of PMC for the experiment is supported by two factors: (i) it has been increased on several occasions since its introduction in 1978, and (ii) administration is relatively easy as it is collected through respective airlines and shipping companies. We assume an increase in PMC by $10 per international visitor. The PMC as a unit tax is imposed on each departing passenger from Australian airports and seaports. Based on the number of visitor departures in the base year (Australia had 4,217,000 international visitor departures), this would raise $42 million, which is sufficient to cover total external costs. Two alternative policy scenarios are considered:

i. The principal policy: PMC is increased for international visitors only assuming that an exemption is given to Australian residents departing.

ii. The alternative policy: as an alternative the increase in PMC is considered for both international visitors and Australian residents to see whether there are major differences in results.

Two simulations based on two different economic environments explained in the previous section under the model assumptions are carried out and the simulation results are presented as macroeconomic effects and industry effects in the following two sub sections.

a) Macroeconomic Effects

Table 2 presents the macroeconomic results of all simulation experiments in the percentage change form. The results suggest that, under the principal policy, the short-run yields a decline in GDP (by 0.005 per cent). This implies that the PMC increase has generated overall negative effects within the economy. The contraction in GDP can be explained/justified mainly in two ways: from the income side and from the expenditure side. From the income side, the macroeconomic results show that aggregate employment declines (0.007 per cent). Real GDP at factor cost has declined by 0.005 per cent. What causes this decline in GDP at factor cost? The model assumes that the percentage change in real GDP at factor cost is equal to the sum of change in employment and change in capital. As the stock of capital is fixed in the short-run, GDP at factor cost should move with aggregate employment.

The most important macro explanation for the changes in aggregate employment is that it depends on the real producer price of labour or the marginal product of labour (MP_L), a variable that has increased as a result of increase in PMC in the short-run. The increase in the marginal product of labour results in reduced aggregate employment. What are the reasons behind the increase in MP_L? In order for MP_L to increase (the real producer wage), real consumer wages should increase. However, the short-run closure assumes that real consumer wages remain unchanged. In the absence of real consumer wage changes, MP_L (the real producer wage) is driven by changes in the terms of trade and indirect taxes. Given that the increase in PMC increases the terms of trade and indirect taxes, MP_L (the real producer wage rate) rises.

From the expenditure side, in the short-run closure, all components of the domestic absorption (household consumption, investment, government consumption and inventories) are fixed and the trade balance is the swing variable. In this context, the reduction in GDP can be explained by a worsening trade balance (severe reductions in exports). This means that balance of trade should move towards a deficit in the short-run. The impact of the balance of trade deficit in changing GDP is explained by the variable, contribution of BOT to the real expenditure side GDP, as it declines by the same rate as GDP decline (0.005). The reduction of this variable is initiated by the contribution of exports to GDP by –0.0081 and the contribution of imports to GDP by 0.0027.

Table 2. Macroeconomic Results (% change)

Variable description	Principal Policy		Alternative Policy	
	SR	LR	SR	LR
Real GDP (expenditure side)	-0.005	0.001	-0.011	0.001
Real GDP (at factor cost)	-0.005	0.002	-0.011	0.002
Aggregate employment	-0.007	-	-0.016	-
Real wage (before tax)	n.a.	-0.007	n.a.	-0.018
Real wage (after tax)	n.a.	0.010	n.a.	0.011
Aggregate capital stock	-	0.005	-	0.006
Real household consumption	-	0.008	-	0.008
Real household disposable income	0.005	0.012	0.000	0.012
Income tax rates	-0.045	-0.061	-0.065	-0.101
Export volume	-0.044	-0.031	-0.076	-0.029
Import volume	-0.015	-0.010	-0.015	-0.011
Terms of trade	0.031	0.028	0.040	0.027
Contribution of BOT to real GDP (expenditure side).	-0.005	-0.004	-0.011	-0.003

SR = short-run & LR = long-run effects

The PMC increase considered in simulations should have an increasing effect on the price of the composite international tourism product which in turn could push the export price index up. Such an increase in export price index leads to a significant reduction in export volume by 0.044 per cent. The model assumes an elastic demand for exports, including international tourism. This results in a considerable change in export volume to a smaller change in export prices. On the other hand, the import volume has declined by 0.015 per cent. What is the impact of these changes on the real foreign trade balance? These changes generate a considerable deficit in the trade balance and GDP should decline to restore the equilibrium on the expenditure side. The significant reduction in export volume can also be explained as mainly due to a reduction in international tourism consumption. Moreover, the contraction in export volume causes the terms of trade to rise, as shown in Table 2.

In contrast to the short-run contractionary effects, an increase in PMC, leads to a marginal expansion of the economy in the long-run. This is represented by an increase in real GDP of 0.001 per cent. As explained above, changes in GDP can be analysed in two aspects: income side and expenditure side. In the income side, it can be explained due to changes in primary factors. In our model, aggregate employment is fixed in the long-run. Thus, the major contributory factor for the GDP increase is aggregate capital stock. Table 2, column 3 shows that aggregate capital stock has increased by 0.005 per cent which leads the GDP increase.

Changes in aggregate capital stock may be explained by referring to the changes of marginal product of capital (MP_K). In order for aggregate capital stock to rise, MP_K should fall. In our model, MP_K is a negative function of the terms of trade. This implies that if the terms of trade rise, MP_K would fall. Our results confirm that the terms of trade rise by 0.028 per cent (Table 2) and thus it can cause a decrease in MP_K. A decrease in MP_K requires that the K/L ratio to improve. Given that aggregate employment is fixed in the long-run, the capital stock increases. It should also be mentioned here that the increase in the capital stock is not a part of domestically-financed capital but a part of foreign-financed capital since we have explicitly linked changes in capital with the foreign capital.

From the expenditure side, the GDP increase can be explained by referring to the changes of the domestic absorption. In our model, only real household consumption is endogenous. The other two components of the domestic absorption, real government spending and real investment, are assumed to be exogenous. Therefore, the major contributory factor behind the GDP increase is the increase in real household consumption (see for example, Table 2 shows that real household consumption has increased by 0.008 and this can be considered as the welfare improvement of tourism taxes).

What is the reason behind the increase in real household consumption? This could be linked to the improved K/L ratio due to increased terms of trade. As noted above, the aggregate capital stock increased because of improvements in the K/L ratio. The K/L ratio and MP_L change in the same direction. This implies that MP_L in the long-run increases and such increases result in a rise in the after-tax real wage rate. Our results confirm that the after-tax real wage rate improves by 0.010. Thus, the increased income arising from increased MP_L causes an increase in real consumption. Moreover, the improvement in the terms of trade implies that more imports can be obtained for a given level of exports for local consumption. In summary, our results suggest that the total improvement of the terms of trade due to tourism taxes is reflected in increased real consumption and it fully represents a welfare improvement.[30]

Another positive aspect of a tourism tax increase, which has some important long-run implications, is the improvement in real household disposable income. The results show that in the long-run, real household disposable income rises by 0.012 per cent. This improvement results from both reductions in income tax rates and the CPI. The results show that income tax rates fall by 0.061 per cent due to the redistribution of increased government tax revenue arising from tourism taxes. As our model has created a link between real household disposable income and real consumption, the increase in real consumption explained above can also be linked to improved household income.

As expected, the results of the alternative policy simulation show that all macroeconomic variables change in the same direction in the short-run but the results are more pronounced than in the principal policy. For instance, real GDP reduction is more than twice as high in the alternative policy than in the principal policy. The reduction in real GDP is driven by higher unemployment. By contrast, the alternative policy in the long-run has mostly generated similar results as in the principal policy. For instance, real GDP rises by the same amount and from the expenditure side this is represented by a similar increase in real consumption. It is also noticeable that contraction in exports volume is marginally less in the alternative simulation. Overall, as emphasised earlier, although the alternative policy brings similar changes in most macro variables in the long-run, considering short-run severe reductions in GDP, employment, and exports, including international tourism consumption, it appears that the principal policy is a better alternative.

b) Industry Effects

One of the important implications of a change in tax is that it distorts the producers' choice of production technique and factor employment. These distortions arise since producers respond to tax-induced changes in demand for commodities and hence output changes. Table 3 records changes in outputs and employment of mostly tourism-related industries. These industries are selected based on tourism sector purchases of the components of its composite product. Table 4, on the other hand, presents the industry results of all other industries.

In the short-run simulation, the increase in PMC has contractionary effects among the tourism-related sectors. As mentioned earlier, the tax increase leads to

[30] Note that the long-run closure adopted in this simulation assumes that only real consumption is flexible among the components of domestic absorption. This implies that any cost or benefit arising from tax changes is represented by a change in consumption. Accordingly, changes in consumption arising from tourism tax changes provide a valid indicator of the welfare effects of such tax changes. Dixon and Rimmer (1999a) and Wittwer and Anderson (1999) adopted a similar closure in their studies that measure impact of GST tax package.

an increase in the price of international tourism and this increase in price reduces international tourism consumption. The reduction is almost two times higher than the price increase.[31] The international tourism (dummy) sector sells its output only to the export sector and thus the entire reduction in tourism consumption is reflected in the output contraction of the international tourism sector.

As the demand for international tourism contracts, the tourism-related sectors (being the main suppliers of the tourism sectors incorporated into our model) show similar output contractions. For instance, it is mostly the tourism-related sectors such as hotels & cafes, transport, beverages & cigarettes, petroleum & refinery, clothing & footwear, transport services, communications, finance services, education, other entertainment, library, museums and arts, gambling & recreation and other services sectors that are affected and contracted. Moreover, these industries can be considered mostly as non-traded industries in the absence of tourism. They are strongly influenced by changes in local demand patterns rather than changes in export demand. Following output contractions, these sectors then experience contractions in factor employment. As noted in the previous section, in the short-run labour is the mobile factor (industry-specific capital is fixed) and thus employment falls in each of these sectors. As shown in Table 3, the reduction in employment is greater than the output reductions.

[31] This can be explained by looking at the international tourism demand equation of our model (Equation 4)) and the international tourism demand parameter applied. In the model we used –2 for the demand elasticity of international tourism in Australia. Given that demand elasticity is –2, the tax induced price increase leads to a reduction in tourism demand by almost two times (-2*0.334 = -0.665 a close proxy of the value given).

Table 3. Industry Results (% changes) - Tourism-related Industries

Industry	Principal Policy				Alternative Policy			
	Short-run		Long-run		Short-run		Long-run	
	Output	Emp	Output	Emp	Output	Emp	Output	Emp
Food products	0.001	0.002	0.004	0.006	-0.014	-0.019	0.003	0.005
Bev. & Cigarettes	-0.008	-0.020	-0.012	-0.009	-0.021	-0.051	-0.018	-0.014
Clothing & footwear	-0.001	-0.001	0.002	0.003	-0.019	-0.021	0.001	0.001
Petroleum & refinery	-0.016	-0.057	-0.013	-0.008	-0.027	-0.096	-0.018	-0.013
Retail	-0.009	-0.010	-0.002	-0.002	-0.009	-0.010	-0.003	-0.002
Repairs	-0.006	-0.008	0.001	0.003	-0.009	-0.012	0.001	0.003
Hotels & cafes	-0.051	-0.067	-0.048	-0.047	-0.064	-0.084	-0.058	-0.056
Road transport	-0.019	-0.024	-0.014	-0.013	-0.029	-0.036	-0.015	-0.014
Rail transport	-0.027	-0.032	-0.018	-0.018	-0.037	-0.044	-0.020	-0.019
Water transport	-0.139	-0.266	-0.164	-0.161	-0.155	-0.296	-0.165	-0.162
Air transport	-0.113	-0.142	-0.116	-0.115	-0.131	-0.165	-0.123	-0.122
Transport services	-0.016	-0.032	-0.016	-0.014	-0.026	-0.051	-0.018	-0.016
Communications	-0.005	-0.009	0.000	0.002	-0.010	-0.020	0.000	0.003
Finance services	-0.004	-0.005	0.002	0.003	-0.010	-0.014	0.002	0.003
Public service	-0.001	-0.001	0.001	0.001	-0.002	-0.002	0.002	0.002
Education	-0.022	-0.024	-0.020	-0.020	-0.028	-0.030	-0.019	-0.018
Other entertainment	-0.010	-0.013	-0.006	-0.005	-0.020	-0.027	-0.010	-0.008
Lib., museums & Arts	-0.018	-0.021	-0.015	-0.015	-0.025	-0.028	-0.020	-0.020
Gambling & recreation	-0.009	-0.015	-0.003	-0.002	-0.011	-0.017	-0.004	-0.002
Other services	-0.004	-0.005	0.003	0.004	-0.004	-0.005	0.004	0.005
Domestic tourism	0.001	n.a.	0.008	n.a.	-0.036	n.a.	-0.033	n.a.
International tourism	-0.665	n.a.	-0.686	n.a.	-0.692	n.a.	-0.684	n.a.

Emp. = employment.

The only exception shown in the table is the food products industry which experiences a marginal increase in output. As a strong tourism-related industry, tourism demand for food products declines but an increase in exports outweighs the reductions caused by the tourism contraction. Output changes of a similar pattern are evident among some of the other tourism-related sectors shown in Table 4 such as textiles and chemicals.

Table 3 also presents the long-run industry results and the results indicate that contractionary effects are somewhat moderate in the long-run. International tourism demand declines at a fractionally higher rate than in the short-run but most sectors show marginally less reduction in output. For instance, even hotel and cafes and some transport sectors (except air transport) that are strongly tourism-related are affected moderately. In fact, several sectors experience a marginal increase in output while one sector (communication) is unaffected. For example, the finance, public and other services sectors show very little increase in output and these sectors receive a relatively lesser proportion of total international tourism consumption. As expected, the employment effects are fully in line with output changes.

The output effects of all the other industries are recorded in Table 4 and the results indicate that most industries have shown expansions. Most of the industries shown in Table 4 are traded industries except for a few non-traded sectors such as electricity, gas and water supply, wholesale and retail. Output of the traded industries is strongly driven by movements in competitiveness. The results suggest that the PMC increase has brought about a favourable price advantage for traded industries in the world market. Among the industries that expand, relatively significant output increases are recorded in the textiles, agriculture, other manufacture and mining industries and, in fact, the share of exports in the total output of these industries is relatively higher than all the other industries. (The output results presented here are generally in line with prior expectations. In a CGE setting, the taxed sector output contracts due to a decline in demand and the untaxed sector (sectors) expands as a result of increased demand. More specifically, our results confirm those of Alavalapati and Adamowicz (2000). They found a tax imposed on the tourism sector leads to a significant contraction in the sector (price of tourism product increases, demand declines and thus output contracts) while the other sector expands (two sector model))

Table 4. Industry Results (% changes) - All Other Industries

Industry	Principal Policy				Alternative Policy			
	Short-run		Long-run		Short-run		Long-run	
	Output	Emp	Output	Emp	Output	Emp	Output	Emp
Agriculture	0.010	0.021	0.015	0.024	-0.004	-0.008	0.016	0.026
Forestry & fishing	0.003	0.004	0.007	0.008	-0.009	-0.012	0.007	0.008
Mining	0.009	0.025	0.045	0.048	-0.002	-0.005	0.044	0.048
Textiles	0.016	0.019	0.024	0.025	-0.009	-0.010	0.025	0.026
Other manufacturing	0.010	0.012	0.017	0.018	-0.009	-0.011	0.017	0.018
Wood, paper etc.	0.002	0.002	0.007	0.009	-0.008	-0.012	0.007	0.009
Chemicals	0.012	0.018	0.020	0.022	-0.006	-0.009	0.020	0.023
Non-metallic mineral	0.005	0.007	0.009	0.011	-0.003	-0.005	0.009	0.012
Metallic products	0.016	0.002	0.028	0.030	-0.005	-0.007	0.029	0.031
Motor vehicle & parts	0.013	0.021	0.028	0.030	-0.005	-0.008	0.028	0.031
Aircraft	-0.044	-0.051	-0.051	-0.050	-0.071	-0.083	-0.054	-0.053
Electricity, gas, water	-0.002	-0.005	0.006	0.008	-0.005	-0.016	0.007	0.010
Construction	0.001	0.001	0.000	0.001	0.004	0.005	0.000	0.001
Wholesale	-0.001	-0.001	0.005	0.005	-0.009	-0.011	0.005	0.005
Owner dwelling	0.000	-0.002	0.012	0.015	0.000	-0.001	0.018	0.021

Emp. = employment.

In the short-run, the main components of domestic absorption: household, government and investment demand, are exogenised. Therefore, the available alternative in order for the industries to expand their output is to increase exports and intermediate sales, and it is essential that these industries reduce output prices. The results indicate that the output prices of all industries fall. This is the logic behind the outcome for the industries. Traded industries (shown in Table 4) face a relatively elastic demand while non-traded or tourism-related industries face inelastic demand. As the short-run supply curves of all industries shifts down due to the reduction in variable costs, traded industries manage to expand output considerably (given the elastic demand) while non-traded industries experience a relatively small increase in output expansion with high price reduction. As explained above, non-traded industries face a severe reduction in demand, crippling net output effects.

As far as the results of the alternative policy are concerned, there are two important points that need to highlight. First, the results suggest that the short-run contractionary effects among tourism-related sectors are greater than those of the principal policy. Second, the results show that even traded industries experience output contractions (in the short-run) unlike in the principal policy where those sectors expand (c.f. Table 4). In the alternative policy simulation, the increase in PMC is applied to all departures and hence it has a greater influence than the principal policy.

5. Conclusion and Policy Implications

This paper considers an important tourism related policy issue i.e. whether to internalise negative externalities in tourism in Australia using an economic instrument such as a tax and if so what effects are brought about by such changes. Using a conceptual framework and estimations of the external cost of international tourism in Australia, it was decided that an increase in tourism taxes could be considered for internalisation of the external cost. Several simulations were carried out assuming that PMC is increased by $10 for each international visitor in Australia. Simulations were carried out using the TTM, a CGE model of the Australian economy in which the tourism sector is represented by two sectors. Macroeconomic effects and industry effects of changes in tourism taxes were analysed.

As far as macroeconomic effects are concerned, the short-run results indicate that the Australian economy experiences a contraction when tourism taxes are increased. The economic contraction is in the nature of reduced GDP and increased unemployment. In contrast, the long-run macroeconomic results show that the economy benefits marginally from the increase in tourism taxes. Real GDP increases and the aggregate capital stock rises because of increased foreign-owned capital in Australia. From the expenditure side, real household consumption increases resulting from an increase in the terms of trade. Moreover, when increased government tax revenue is redistributed as reductions in income taxes, real household disposable income tends to rise. Subsequently, real household consumption is encouraged by improved household disposable income. Based on such favourable results, it appears that tourism taxes are welfare-improving in the long-run.

The industry results are consistent with prior expectations that increased tourism taxes can cause reductions in tourism consumption and hence tourism-related sectors are adversely affected.

Adverse effects are explained in terms of both output reductions and increased unemployment in these sectors. However, the results suggest that in the long-run such adverse effects are easing to a certain degree due to relaxation of some of the assumptions. Overall, the industry results highlight several important points. First, it appears that tourism taxes (based on a PMC increase) can be expansionary for traded industries. Second, such expansionary effects are more pronounced in the long-run than in the short-run. Although industries gain output expansions in the short-run, only the labour market is flexible enough to respond to an increased demand for labour. Thus, it may supply enough labour to those industries (mainly traded industries). However, as there are capital constraints in the short-run, positive output effects are less pronounced. Third, tourism taxes can be contractionary for tourism-related (or non-traded) industries. Fourth, these contractionary effects are more pronounced if the tax increase is effective for both international and domestic tourists.

In summary, although increased tourism taxes are appealing in terms of their long-run expansionary effects and revenue-generating abilities, they could also be contractionary in terms of reduced international tourism consumption and subsequent adverse effects on related sectors. Given this mixed nature of the effects of tourism taxes, from a policy perspective, tax-induced adverse effects on the sector and related sectors become crucial. Therefore, it appears that there is little room for using the international tourism sector as a potential source of raising government tax revenue. However, in relation to tourism-related externalities there appears to be a case for consideration of either increasing existing taxes or imposing a new tax, since the existing taxes do not yield sufficient revenue to recover the externality cost. Although, such tax changes could have negative effects on the tourism sector, on efficiency grounds they may be justified. However, certain level of care should be exercised when our findings are used for policy making purposes. Our findings are subject to limitations of our estimations and the model. Further studies should be conducted to find out general equilibrium effects using dynamic models.

References

1. Adams, P. D., Horridge, M., and Wittwer, G. (2003), "MMRF-GREEN: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, based on the MMR and MONASH Models", *A Draft Documentation Prepared for the Regional GE Modelling Course 2003*, Centre of Policy Studies and the Impact Project, Monash University, Melbourne.
2. Bailey, S. J. (1995), *Public Sector Economics*, Macmillan Press Ltd, London.
3. Blake, A. (2000), "The Economic Effects of Tourism in Spain", *Discussion Paper No. 2000/2*, Christel DeHaan Tourism and Travel Research Institute, University of Nottingham, Nottingham.
4. Bureau of Transport and Communications Economics, (1996), *Traffic Congestion and Road User Charges in Australian Capital Cities*, Bureau of Transport and Communications Economics, Canberra.
5. Clarke, H. R. (1997), "Australian Tourism Industry Policy: A New View", *Tourism Economics*, Vol 3 No 4, pp. 361-377.
6. Divisekara, S. (1995), *Economics of International Travel and Tourism: An Australian Perspective*, Unpublished PhD Thesis, La Trobe University, Bundoora.
7. DOTARS (2004), *Auslink White Paper*, Department of Transport & Regional Services, Canberra, Available from http://www.btre.gov.au, Accessed 01 December 2004.
8. Dixon, P. B., and Rimmer, M. T. (2002), *Dynamic General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH*, North-Holland, Amsterdam.
9. Dixon, P. B., Parmenter, B. R., Sutton, J., and Vincent, D. P. (1982), *ORANI: A Multisectoral Model of the Australian Economy*, North-Holland, Amsterdam.
10. Forsyth, P., Dwyer, L., and Clarke, H. (1995), "Problems in Use of Economic Instruments to Reduce Adverse Environmental Impacts of Tourism", *Tourism Economics*, Vol 1 No 3, pp. 265-282.
11. Gooroochurn, N., and Sinclair, M. T. (2003), "The Welfare Effects of Tourism Taxation", *Discussion Papers*, 2003/2, Christel DeHaan Tourism and Travel Research Institutute, University Business School, Notingham, Available from http://www.nottingham.ac.uk/ttri/.
12. Gooroochurn, N., and Sinclair, M. (2005), "Economics of Tourism Taxation: Evidence from Mauritius", *Annals of Tourism Research*, Vol 32 No 2, pp. 478-798.
13. Great Barrier Reef Marine Park Authority (1997), *Annual Report 1996-1997*, Great Barrier Reef Marine Park Authority, Townsville.
14. Harrison, W. J., and Perason, K.R. (1996), "Computing Solutions for Large General Equilibrium Models Using GEMPACK", *Computational Economics*, Vol 9, pp. 83-127.
15. Hughes, H. L. (1981), "A Tourism Tax- the Cases for and Against", *International Journal of Tourism Management*, Vol 2 No 3, pp. 196-206.
16. Ihalanayake, R. (2007), *Economics of Tourism Taxation: A Study of Tourism Taxes in Australia*, Unpublished PhD Thesis, Victoria University, Melbourne.
17. Ihalanayake, R. (2012), "Economic Effects of Tourism Tax Changes in Australia: Empirical Evidence from a Computable General Equilibrium Model", *Tourism Economics* ***18(1)****: 181-202*.
18. Ihalanayake, R., and Divisekara, S. (2006), "Tourism Tax Burden: Evidence from Australia", *Tourism Economics*, Vol 12 No 2, pp. 247-262.
19. Jensen, T. C., and Wanhill, S. (2002), "Tourism's Taxing Times: Value Added Tax in Europe and Denmark", *Tourism Management*, Vol 23, pp. 67-79.
20. Palmer, T., Riera, A. (2003), "Tourism and Environmental Taxes with Special Reference to the Balearic Ecotax", *Tourism Management*, Vol 24, pp. 665-674.
21. Palmer, T., Riera, A., and Rosello, R. (2007), "Taxing Tourism: The Case of Rental Cars in Mallorca", *Tourism Management*, Vol 28, pp. 271-279.

22. Pindyck, R. S., and Rubinfeld, D. L. (2001), *Microeconomics,* Prentice-Hall, New Jersey.
23. Nash, C., Mackie, P., Shires, J., and Nellthorp, J. (2004), *The Economic Efficiency: Case for Road User Charging*, A Report by the Department for Transport, Department for Transport, London.
24. Nicholson, W. (2005), *Microeconomic Theory: Basic Principles and Extensions,* South-Western, Ohio.
25. Rosen, H. S. (2005), *Public Finance*, The McGraw-Hill Companies Inc, New York.
26. Sugiyarto, G., Blake, A., and Sinclair, M. T. (2003), "Tourism and Globalization: Economic Impact in Indonesia", *Annals of Tourism Research*, Vol 30 No 3, pp. 683-701.
27. Tisdell, C. A. (1988), "*Measuring the Costs to Tourism of Pollution, Especially Marine Pollution: Analysis and Concepts"*, in: Tisdell, C. A., Aislabie, C. J., Stanton, P.J., (Eds.), Tourism Economics, University of Newcastle, Callaghan.
28. Tisdell, C. A. (2001), *Tourism Economics, the Environment and Development: Analysis and Policy*, Edward Elgar, Cheltenham.