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# Accurately Estimate Tourism Impacts: Tourism Satellite Account and Input-Output Analysis

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## Abstract

The main purpose of TSA is to provide a system of statistics consistent with the national account. If TSA can be extended by incorporating the economic evaluation and estimation models, it can serve not only as a statistic framework but also an analytical tool. In this paper, we discuss the framework of Taiwan TSA, and an evaluation system of Taiwan TSA, including a tourism expenditure model, a tourism input-output model, and a tourism CGE model. We also use the tourism input-output model to calculate the impacts of a tourism policy (opening up to Chinese tourism) on the economy.

**Keywords:** TSA, Taiwan TSA, tourism input-output model, tourism CGE model, tourism expenditure function.

## Introduction

Tourism plays an important role in the global economy, and it makes significant contribution to the economies in many countries and regions. Tourism activity is not explicitly measured in the system of national accounts (SMA) as a separate sector. Thus, it is difficult to accurately measure the total impacts of tourism from the information provided by the current national accounting system.

While the economic aspects of tourism were becoming increasingly crucial for both government and the private sectors, the measurement of tourism impact on the economy was usually based on incomplete statistical datasets. In response to the surge of importance of tourism as an industry, the World Tourism Organization (UNWTO) proposed a TSA methodological framework in 2000 (UNWTO, 2001). The TSA is designed and developed to provide an international harmonization of tourism statistics necessary for improving the measurement of tourism activities and their impacts. The statistics provided by TSA can measure the scope of a nation's tourism in terms of output, expenditure and employment.

The TSA is drawing an increasing amount of attention from the international community. In 2001, Taiwan Tourism Bureau undertook the development of a Taiwan Tourism Satellite Account (Taiwan TSA). After ten years, the Taiwan TSAs for years 1996 and 1999 thru 2009 have been completed. In addition to the Taiwan TSA, a mathematical function of tourism expenditure, a tourism input-output model and a tourism CGE (computable general equilibrium) model are developed. The tourism expenditure function, which can be used to estimate the amount of tourism expenditure for different visitors, was established using data on domestic and inbound visitors compiled by the Tourism Bureau. The tourism input-output and CGE models are policy evaluation models that can be used to assess the impacts of government tourism policies on the output value, gross value added, and employment levels of all sectors (including tourism industries). In the meanwhile, the tourism input-output and

CGE models can also be used to calculate the direct and indirect effects of tourism activities. The tourism expenditure model, tourism input-output model, and tourism CGE model are established to enhance the accuracy and comprehensiveness of Taiwan TSA. These models are integrated to the Taiwan TSA, and referred to “The Evaluation System of Taiwan TSA”.

In this article, we first describe the content and framework of Taiwan TSA, and then discuss the evaluation system of Taiwan TSA. In application, we use Taiwan tourism input-output model to evaluate the economic impacts of “opening up to Chinese tourism” policy. The results show that the output value, GDP and employment increase with the number of inbound Chinese visitors.

## **Taiwan TSA**

After considering the characteristics of Taiwan’s tourism industry and reviewing relevant TSA information published by UNWTO (UNWTO, 2001) and other countries, such as Australia (Trewin, 2000), Canada (Meis, 1999), New Zealand (Statistics New Zealand, 1999, 2002), and the U.S. (Kass & Okubo, 2000), the following TSA content and framework specific to Taiwan were proposed:

### **1. Definition of Tourism**

In order to achieve a uniform basis for comparison with other countries, “tourism” has been defined by the UNWTO as “the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited.” (UNWTO, 2001)

When attempting to define “usual environment,” many countries use “distance” as the criterion. For example, 80 km is used in Canada. In other words, one must travel a distance of more than 80 kilometers before the trip can be considered as tourism. Other countries use different measures, e.g. 50 miles for the U.S. and 40 Km for Australia and New Zealand. Due to Taiwan’s small size, a large proportion of tourism activities would be excluded if distance were used as the defining criterion. Therefore, the question of whether an activity is outside of one’s usual environment is determined in a subjective manner, i.e., the visitor decides if his or her activities are conducted outside the usual environment.

### **2. Tourism Products and their Categorization**

From a statistical point of view, it is necessary to identify goods and services that are intimately related to tourist consumption based on their nature and degree of importance. After considering the approaches the UNWTO, other organizations and countries have taken to define tourism products, we have arrived at the following classification: (1) tourism characteristic products: accommodation services, food and beverage serving services, passenger transport services (including land and air), travel services, car rental, recreation and other entertainment services; (2) tourism connected products: retail trade services.

### **3. Scope and Classification of the Tourism Industries**

By mapping the above-mentioned tourism specific products into their corresponding supply-side industries that produce these products, we can break down the tourism industries into two parts: tourism characteristic and tourism-connected

industries. Adopting the Taiwan Standard Classification of Industries, Seven Revised Edition, Taiwan's tourism characteristic industries can be further subdivided into the following: hotels and lodging, restaurants, road passenger transport, air passenger transport, car rental, travel agencies, cultural and recreational services. Tourism-connected industries include: retailers.

#### **4. Tourism Satellite Account Tables**

The main purpose of the tourism satellite account is to provide a system of statistics consistent with the national accounts, so that the importance of the tourism-related economic activities can be identified and recognized. Compilation of the TSA data can provide important tourism information, such as the supply of and demand for tourism, investment in tourism and employment of tourism industries. The above-mentioned information is crucial to government policy analysis, market research, tourism industry performance evaluation and tourism forecast.

A TSA, as defined by the UNWTO, is a tourism statistics framework developed based on goods and services consumed in tourist activities and contains a total of 10 tables. Having reviewed Taiwan's tourism-related statistics and taken into consideration TSA data from the UNWTO and other countries, we have established a set of six tables on the TSA for Taiwan. The six tables include: tourism consumption expenditure table, tourism products supply table, tourism ratio of tourism products table, tourism ratio of tourism industries, tourism industries gross domestic product table, and employment in the tourism industries.

##### **(1) Table 1: Tourism consumption expenditure in Taiwan (by products and by types of visitors)**

In Taiwan TSA, tourism expenditure refers to all expenses incurred specifically for tourism purposes before, during and after the period of trip. Tourism expenditure includes spending by inbound visitors, domestic visitors, and outbound visitors.

Tourism expenditures are the most important statistics in the TSA. Tourism consumption expenditure data may come from different surveys and sources of statistical information. Raw data from Taiwan Tourism Bureau visitor survey are used to calculate the expenditures for Taiwan.

Apart from tourism expenditures linked directly to visitors, it also includes public sector spending and business investment. Due to the many issues that still exist with the collection of statistics for these latter two areas, the UNWTO's current emphasis is on tourism expenditure by visitors. For this reason, investment spending is currently not included in Taiwan TSA.

##### **(2) Table 2: Tourism Products Supply in Taiwan**

Tourism products supply is another basic statistical account used to track the supply of important tourism products in Taiwan's tourism-related industries. Tourism products supply and tourism consumption expenditure use the same product categories and classifications so the tourism ratios of products can be derived. To reflect the overall supply in each tourism industry, "other non-tourism products" was added to the product section to represent tourism industry output not sold for tourism purposes, such as the freight component of the transportation industry.

The tourism industry uses national income as the control totals for tourism

industry output. If the tourism industry classification is consistent with the national income accounts, the data is used directly. If the industry classification is inconsistent with each other, the census results from the most recent year are used to break down the accounts for each industry. When the industry classification is consistent with Taiwan input-output table, the growth rate from the preceding and subsequent year is used to arrive at an estimate. If they are inconsistent, the industry growth rate from the classification with higher codes from the national income accounts is used instead.

### **(3)Table 3: Tourism Ratios of Tourism Products in Taiwan**

Tourism consumption expenditure table provides the statistics on tourist demand for each tourism product. Tourism products supply table reflects the supply of tourism products in domestic industries. Most tourism products are not produced solely for “tourism” purposes. To separate the “tourism” and “non-tourism” components for a product, tourism spending was extracted from tourism product supply to give the tourism ratio of products.

The ratio measures the proportion of domestic tourism product supply sold to visitors. Generally speaking, tourism characteristic products have a higher tourism ratio, while tourism-connected products have a lower ratio.

### **(4)Table 4: Tourism Ratios of Tourism Industries in Taiwan**

The tourism ratios of tourism industries table is used for calculating the ratio of tourism industry output sold to visitors, or the “tourism ratio” of tourism industries. As the purpose of the TSA is to measure the contribution from tourism activities to national production, calculating the tourism ratio of the tourism industry output allows the contribution from “tourism” to each industry to be determined.

### **(5)Table 5: Tourism GDP in Taiwan**

Industry gross product is measured using the value-added created by the industry. This is derived by calculating the value added after deducting intermediate inputs from the gross output for that industry. The gross domestic product of tourism industries created by “tourism” is estimated by the same method, and results are shown in the tourism GDP table.

### **(6)Table 6: Employment in Tourism Industries in Taiwan**

Employment opportunities are one of the key contributions that tourism makes to the domestic economy. The employment in tourism industries table measures the employment opportunities created by tourism. The table estimates the number of employed persons provided by each tourism industry. The hiring of part-time workers and unpaid family members is a common phenomenon in the tourism industries. These types of workers should be included when calculating tourism employment statistics. By "deflating" the number of part-time employees using a set ratio then adding the full-time employees and self-employed, it is possible to estimate the number of employed workers in terms of full-time equivalent employee (FTE). Multiplying the number of employed workers in each tourism industry by that industry's tourism ratio gives the number of employees created by that industry. The sum gives the total number of employment opportunities created by tourism in Taiwan.

## **The Evaluation System of Taiwan TSA**

One of the main objectives of the Taiwan TSA is to provide decision makers with detailed information on tourism consumption expenditure and tourism industries. As mentioned, the evaluation system of Taiwan TSA consists of four components, there are (1) The Taiwan TSA, (2) Tourism expenditure model, (3) Tourism input-output model, (4) Tourism CGE model.

### **1. Tourism expenditure model**

Assume that there are just two types of goods, general goods and tourism. Suppose the visitor decides the amount to spend on general goods and tourism in order to maximize his or her utility with personal income as a constraint. After deciding the amount of his/her income to spend in tourism, the visitor allocates this limited income among tourism products. In other words, the visitor decides how tourism expenditure is divided among accommodation, food and beverage, transport, entertainment, shopping, and others.

Assuming that the visitor has a constant elasticity of substitution (CES) utility function where substitution exists between accommodation and food, and other tourism products. Utility maximization gives a function of tourism expenditures. This function can be used to estimate the expenditures on different tourism products.

### **2. Taiwan tourism input-output model**

Taiwan tourism input-out model and tourism CGE model were also constructed to show the tourism industry's inter-dependence with other industries, to estimate the indirect and induced effects of tourism activities and evaluate the effects of Taiwan's tourism policy on the economy and industries. These models provided a macro-economic evaluation tool for tourism.

The tourism input-output model was first established in 2003 using the 1999 input-output tables (with 45 sectors) from the DGBAS (2002). The tourism industry included hotel, restaurants, passenger transport (road and air), car rental, travel agencies, cultural and recreational services, and retailers. These tourism industries did not correspond on a one-to-one basis with the standard 45-sector input-output tables. To better manage the nature and classification of the tourism industries, the compilation team broke down the sectors in the 1999 input-output table and made tourism industries into separate sectors, resulting in a total of 52 sectors table.

Currently, Taiwan tourism input-output model has been updated using the newest input-output tables, the 2006 52-sector table, from the DGBAS (2009). This model is referred to 2006 Taiwan tourism input-output model, with 58 industrial sectors.

The tourism input-output table allowed an industry inter-dependence coefficients matrix to be constructed. Such a matrix can be used to evaluate the direct and indirect effects of tourism activities. Apart from calculating the effects of tourism activities, the most important function of the input-output model is to evaluate tourism policy impact.

### **3. Taiwan CGE model**

Using the Australia's ORANI-G model as a basis, we built a tourism CGE model tailored to Taiwan's tourism characteristics as well as the tourism industries defined in the Taiwan TSA. The economic entities in the model included the industrial, household, government and foreign sectors. The goal of firms in an industrial sector is to maximize their profits. Under the principle of profit maximization, a firm decides the level of primary factors and the requirements for intermediate inputs, and thus the output level determined accordingly. The household sector seeks maximum utility from a limited budget and selects the most appropriate consumer product combination (including tourism). Government and foreign sectors are exogenous. All markets reach their equilibrium at the end.

The tourism CGE model was built in 2004, using the 1999 input-output table from the DGBAS. As a result, the previously defined 52 sectors in the tourism input-output model defined the scope of sectors.

#### **Application of the Taiwan TSA and its Evaluation System**

The tourism input-output model and the tourism CGE model can both be used for evaluating tourism policy. Both models were used in 2003 for evaluating "Double Tourists Plan", the most important tourism policy at the time aimed to double the number of inbound tourists. As the results, the tourism input-output model showed that every NT dollar spend by foreign visitors generated NT\$1.52 in total value of output. However, the tourism CGE model showed the output value generated was NT\$1.47. The tourism CGE model gave a smaller multiplier because the model incorporated the price factor. Both models showed the output of all industries increased, with the top six industries being tourism industries.

In this article, we demonstrate a policy evaluation using the information for Taiwan TSA and 2006 Taiwan tourism input-output model. "Opening up to Chinese tourism" is an on-going tourism policy in Taiwan. The policy implementation process can be broken down into four phases in accordance with the degree of openness. Phase 1: In January of 2002, the Executive Yuan of Taiwan officially started to open up tourism for the Mainland Chinese and allowed "category 3" Mainland Chinese to visit Taiwan. Phase 2: In May of 2002, "category 2" visitors were further permitted to visit the Island. Phase 3: In July of 2008, Taipei and Beijing agreed to start direct flights between Taiwan and Mainland China. The tourism was further open up to "category 1" visitors, but the visitors might only come to visit Taiwan in a tour group at the maximum number of 3,000 every day.

"Category 1" visitors are those traveling directly from China, "category 2" visitors are those visiting a third-party country, and "category 3" visitors are those residing or studying overseas. Currently, Taiwan Tourism Bureau has pushed a relaxation in legislation governing Chinese tourism in Taiwan, and opening up Taiwan tourism to individual tourists from China is under cross-strait tourism negotiation.

Table 1 shows the number of inbound Chinese visitors for the years 2002-2011. Although facing the global recession, the number of inbound Chinese visitors jumped to near 1 million in 2009 due to the third phase of open up tourism policy. The number of visitors to Taiwan from Mainland China was over 1.6 millions in 2010. If the new FIT agreement can be in place as expected, the figure is expected to climb to

2 millions in 2011. With the soaring number of the inbound visitors from mainland China, it is expected the associated tourism expenditure will contribute significantly to GDP growth.

**Table 1 Number of Inbound Chinese Visitors**

Years	Number of inbound Chinese visitors	Annual growth rate (%)
2002	172,462	-
2003	154,535	-10.39
2004	161,599	4.57
2005	211,253	30.73
2006	299,821	41.93
2007	306,776	2.32
2008	329,204	7.31
2009	972,123	195.30
2010	1,630,735	67.75

Source: Tourism Bureau (2011)

### 1. Taiwan Tourism Input-Output Model

In despite of the well-documented limitations of input-output model (see for example, Briassoulis, 1991; Dwyer, Forsyth, & Spurr, 2004), the model is still commonly used to evaluate the economic impacts of tourism expenditure and of tourism policies. The basic structure of the input-output model is specified as following equations:

$$X = AX + Y$$

$$(I - A) X = Y$$

$$X = (I - A)^{-1}Y$$

$$\Delta X = (I - A)^{-1}\Delta Y$$

where  $I$  is the identity matrix,  $A$  is an  $n \times n$  technical coefficient matrix,  $X$  is an  $n \times 1$  vector of gross output,  $Y$  is an  $n \times 1$  vector of final demand,  $\Delta$  represents “change in”, and  $(I - A)^{-1}$  is the Leontief inverse or the total requirements matrix.

If we take into the consideration of import, and assume that the import is competitive, then the input-output model becomes

$$X + M_X + M_F = AX + Y' + E$$

$$X + m_X AX + m_Y Y = AX + Y' + E$$

$$(I - (I - M)A)^{-1}X = (1 - m_Y)Y' + E = Y^*$$

$$X = (I - (I - M)A)^{-1}Y^*$$

$$\Delta X = (I - (I - M)A)^{-1}\Delta Y^* \quad (\text{equation 1})$$

where  $M_X$  is an  $n \times 1$  vector of intermediate goods imports,  $M_F$  is an  $n \times 1$  vector of



final demand imports,  $Y'$  is an  $n \times 1$  vector of domestic final demand,  $E$  is an  $n \times 1$  vector of exports,  $m_X$  is an  $n \times n$  matrix of intermediate input's import coefficient,  $m_Y$  is an  $n \times 1$  vector of final demand import coefficient,  $M$  is an  $n \times n$  diagonal matrix with element of diagonal equals to  $m_i$ .

The proportion of imports in intermediate inputs is relatively high in Taiwan. Therefore, we utilize the multiplier,  $X = (I - (I - M)A)^{-1}Y^*$ , to calculate the direct and indirect impacts of a change in final demand.

## 2. The Data

The data for 2006 Taiwan tourism input-output are mainly taken from the 2006 Taiwan input-output table (DGBAS, 2009). In addition to this data, we need to specify the associated tourism expenditure of the inbound Chinese visitors in order to calculate economic impacts of the policy. Due to the data availability, we compute the expenditures for years 2006-2009. The tourism expenditure of inbound Chinese visitors is estimated using the data from Taiwan TSA and visitor survey data. Table 2 shows the tourism expenditures of inbound visitors from Taiwan TSA (Chou et al. 2011, Chou et al. 2010). We then calculate the ratio of the number of inbound Chinese visitors to the number of total inbound visitors, and the ratio of the average expenditure of inbound Chinese visitors to the average expenditure of total inbound visitors (Tourism Bureau, 2006, 2007, 2008, and 2009). Using these ratios and the tourism expenditure of inbound visitors from Taiwan TSAs, we can further compute the tourism expenditure of inbound Chinese visitors, showed as in Table 3.

**Table 2 Tourism Expenditure of Inbound Visitors, 2006-2009 (million NTS)**

Tourism Products	2006	2007	2008	2009
<b>Tourism Characteristic Products</b>				
Accommodation	48,296	55,415	55,729	43,845
Food and beverage	127,580	122,372	119,779	126,507
Road passenger transport	72,263	68,600	72,575	74,458
Air passenger transport	115,858	131,499	128,576	128,602
Car rental	21,158	21,181	19,440	17,989
Travel services	16,570	16,640	18,092	16,977
Recreation and other entertainment	22,971	22,407	28,635	30,115
<b>Tourism-connected Products</b>				
Retail Trade (shopping)	140,210	114,652	121,776	111,355
<b>Other Tourism Products</b>	13,313	14,719	21,096	19,859
<b>Total</b>	<b>578,217</b>	<b>567,485</b>	<b>585,698</b>	<b>569,707</b>

Source: Chou et al (2010, 2011).

**Table 3 Tourism Expenditure of Mainland China Visitors, 2006-2009 (million NTS)**

Tourism Products	2006	2007	2008	2009
<b>Tourism Characteristic Products</b>				
Accommodation	2,088.0	2,340.0	2,224.7	6,382.8
Food and beverage	7,057.4	6,724.8	7,374.3	20,365.6
Road passenger transport	1,404.8	1,384.8	1,402.8	4,503.6
Air passenger transport	2,589.1	3,447.6	3,578.5	8,969.4
Car rental	58.0	62.4	76.3	217.1
Travel services	221.6	253.2	189.7	715.0
Recreation and other entertainment	1,371.1	1,297.2	1,157.6	3,099.6
<b>Tourism-connected Products</b>				
Retail Trade (shopping)	3,757.2	4,633.2	4,740.4	18,177.5

<b>Other Tourism Products</b>	591.6	506.4	448.0	1,003.3
<b>Total</b>	19,138.8	20,649.6	21,192.3	63,433.9

In the inbound visitor survey, Taiwan Tourism Bureau provides the detailed information of shopping items for Chinese visitor, showed in Table 3. Accordingly, Chinese visitors' shopping items include apparel and accessories, jewelry and precious stones, souvenirs and handcraft products, cosmetics and perfumes, featured food and special products, tobacco, alcohol and wines, Chinese herbal medicine and health food, 3C and electric appliances, tea, and others. Using the shares, we can map the spending of each shopping item to the corresponding sector in 2006 Taiwan tourism input-output table. We apply the expenditure data of each shopping item plus the tourism expenditure data of the rest of tourism products to equation 1 and calculate the economic impacts of the tourism policy.

**Table 4 Shopping Items of Inbound Visitors from Mainland China, 2006-2009 (%)**

<b>Shopping Items</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Apparel and accessories	3.55	5.37	13.04	12.60
Jewelry and precious stones	34.09	23.37	22.40	25.20
Souvenirs and handcraft products	14.44	12.92	11.72	8.57
Cosmetics and perfumes	5.31	3.36	2.82	5.97
Featured food and special products	19.23	34.14	25.14	29.73
Tobacco and alcohol	3.39	1.96	4.86	5.69
Chinese herbal medicine and health food	2.37	2.80	1.18	0.88
3C and electric appliances	2.48	2.58	1.14	1.04
Tea	13.61	12.59	10.41	9.17
Others	1.53	0.90	7.28	1.15
<b>Total</b>	<b>100.00</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Sources: Tourism Bureau (2006, 2007, 2008, 2009).

### 3. Empirical Results

The empirical results for the period of 2006-2009 are presented in Table 5. The number of inbound Chinese visitors increased from 299,821 to 972,123 in years of 2006-2009. In particular, with the third phase of the "opening up to Chinese tourism" policy implementation, the output value, GDP and employment increase dramatically in 2009. The GDP created by the inbound tourism is reached to 0.352% of total GDP. Not surprisingly, the results conclude that the value of macroeconomic variables increases with the number of inbound Chinese visitors.

It is acknowledged that the input-output model has limitations. In the future, the impact analysis can be conducted using the tourism CGE model, which is currently under updating. Furthermore, if the expenditure function in the evaluation system can be utilized to estimate the tourism expenditure for Chinese visitors, the evaluation of the tourism policy is expected to increase its accuracy.

**Table 5 Empirical Results of Opening up to Chinese Tourism on the Economy**

	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Direct plus indirect effects(million NT\$)	31,210.23	34,226.90	35,703.24	106,815.95
GDP (million NT\$)	13,381.23	14,261.89	14,726.50	43,717.60
Employment (number of workers)	132,211	135,460	154,403	328,713
Tourism GDP/Total GDP (%)	0.109	0.11	0.116	0.352

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