

The Impact of the 2008 World Financial Crisis on Tourism and the Singapore Economy and Policy Responses: A CGE Analysis

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Abstract—Mega events such as the World Financial Crisis in 2008 have tremendous negative economic effects, particularly on tourism. This study employs recent Singaporean tourism survey data, the updated Singaporean input-output tables, and a Computable General Equilibrium (CGE) model to gauge the negative effects of the 2008 World Financial Crisis on Singapore and to simulate the effects of selected policy responses. The CGE simulation results demonstrate that at the macro level, although almost all variables are negatively affected, exports benefit greatly. At the industry level, a negative tourism shock impacts severely on the tourism-related sectors, impacts only slightly on sectors weakly linked to tourism, but tourism-competing sectors expand. In commodity market, prices and outputs decrease for most products but real household consumption and exports increase. In the labor market, low skilled workers are harshly affected, but some occupational groups benefit at the expense of others. The simulation results also suggest that, in response to an event like the 2008 World Financial Crisis, a slightly decrease in the GST rate is more effective than a significant increase in the tourism tax rate.

Index Terms—CGE Modelling, financial crisis, tourism demand, Singaporean economy

I. INTRODUCTION

World tourism has experienced substantial growth in the recent half-century, making tourism one of the most important global industries. Singapore is a good example. When the Singapore Tourism Promotion Board was established in 1964 visitor arrivals totalled just 91,000. In 2007, the Singapore tourism sector set a new record of 10.3 million visitor arrivals (STB, 2009) and generated US\$9.4 billion in tourism receipts, accounting for 3% of Singapore's GDP (RNCOS, 2009). According to Euromonitor (2007), Singapore is the world's fourth most visited city in terms of visitor arrivals. However, the 2008 World Financial Crisis affected the worldwide economy greatly, especially the tourism industry. In Singapore, tourism declined 13.5% in the first half of 2009 compared with the first half of 2008 (STB, 2009). The Ministry of Trade and Industry (MTI, 2009) expects Singapore's GDP to contract by 6.0 to 9.0 per cent in 2009. This study employs the latest Singaporean tourism survey data, the updated input-output tables, and newer methodology, in the form of CGE modelling, to gauge the

effects of 2008 World Financial Crisis on Singapore's tourism and economy.

The remainder of this paper is organized as follows. The next section reviews previous studies. Section 3 describes the model structure, dataset and simulation designs. Section 4 is devoted to the analyses of the simulation results. The final section provides some concluding comments.

II. PREVIOUS STUDIES

Despite the development of the tourism industry and its significant effect on the Singapore economy, research undertaken on the economic impact of tourism in Singapore appears to be limited. Moreover, existing studies (e.g. Seow, 1981; Khan et al. 1990; and Heng and Low, 1990) have some limitations. Firstly, the data are 20 to 30 years old, and therefore cannot uncover the role of tourism in the modern Singaporean economy. Secondly, the methodology used – input-output (I-O) modelling is problematic. Recent studies unanimously agree that input-output modelling has serious limitations (Briassoulis, 1991; Johnson, 1999; and Blake, 2000).

However, there is a large body of literature on the application of CGE modelling to tourism. For the purpose of this study, only those on the effects of negative mega events on tourism and the economy are reviewed.

The estimation of the event effect normally consists of two parts. First, the effect of an event on tourism demand is estimated; then a CGE model is employed to gauge the economic effect of the change in tourism demand.

Adams et al. (2002) estimated the impact of the September 11 terrorist attacks on tourism in Australia and on the Australian economy.. They used a Monash dynamic CGE model to generate macro and sectoral base-case forecasts on pre-September 11 assumptions and an alternate simulation including the downturn caused by the 911 event. Through the comparison of the base-case forecast and the alternate simulation, the study claims that the 911 event results in a sharp downturn in the international tourism industry, which has negative impacts on real GDP, aggregate consumption and aggregate imports, and that it reduces Australia's terms of trade and causes serious adverse effects on employment in some heavily tourist-dependent regions and sub-regions. However, the model shows the overall reductions in employment will be not much more than 10 per cent.

Blake and Sinclair (2003) used a 98-sector CGE model of the US economy to estimate the impact of 911-event in the

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absence of any offsetting policy response and under different policy responses. In the absence of offsetting policies, the model suggests that the terrorist attacks would have had severe effect: the fall in tourism expenditures reduces GDP by \$30 billion and worsens the government budget by over \$7 billion; the loss of employment is as high as 383,000 full time equivalents. Among the total 559,000 jobs lost, 203,000 are in airlines and 174,000 are in accommodation establishments. The model also shows that the implementation of crisis management policies is very effective in reducing the adverse effects of the 911 events, but the relative effectiveness of the different policy responses varies considerably - the directing of subsidies to the sector that is most severely affected by the crisis is the most efficient policy response in terms of both GDP and the total number of jobs saved.

Blake et al. (2003) used a CGE model to analyse the impacts of Foot and Mouth Disease (FMD) on tourism and the UK economy. First, a Micro regional tourism simulation model was employed to estimate the reduction of tourism expenditures due to FMD. The model estimated a fall of almost £7.5 billion in total tourism revenue in 2001. A CGE model was then used to estimate the economic impact of a tourism contraction. The results indicates that the economic impact of a tourism contraction is much bigger than the effect of reduction in affected agricultural products. The total fall in GDP due to the FMD crisis is an estimated £2.5 billion pounds, of which the fall in GDP as a result of tourism expenditure reduction accounts for £1.93 billion. Moreover, the model suggests that FMD will affect tourism and the economy for several years.

Narayan (2003) applied a CGE model to estimate the long term economic impacts of the May-2000 Fiji coup. The paper used post-coup statistical data as the basis for modelling. For example, following the insurgence visitor arrivals fell by 39.4%, investment fell by 33.1%, private transfers aboard increased by F\$36.6 million, government expenditure increased by 9.9% and the real interest rate increased by 3.5%. Since the focus of the paper concerns the long run effects, the CGE model assumes that capital is mobile across the sectors and the capital stock is adjusted to a fixed rate of return to capital. The main findings of model are that real GDP falls by around 8.2%, exports decline by around 14.9%, the BOP deficit increases by F\$4.8 million and government revenue falls by around 4.8%. At the sector level, the real outputs of the hotel, transportation, commerce, and business services industries are among the most affected, largely due to the sharp fall in visitor arrivals.

III. THE MODEL, DATA AND SIMULATION DESIGN

CGE modelling involves a number of assumptions, the use of disaggregated data and the specification of supply and demand functions, behavioural-parameter values, and simulation shocks. This section briefly discusses each in turn.

A. A CGE model for Singapore tourism and the economy

The model developed for this study is a static CGE model

based on ORANI G (Horridge 2000) and belongs to the Johansen class of CGE models. The TABLO language is used to build the model and GEMPACK 10 is used to implement the simulations. The model employs the classical economic assumptions: perfectly competitive economy with constant returns to scale; cost minimisation for industries and utility maximization for households; continuous market clearance; labour is perfectly mobile across industries while capital is treated as industry-specific. Zero profit conditions are assumed for all industries because of perfect competition in the economy. Since Singapore is a small open economy, it is assumed that it is a price taker in the world market.

The Singapore economy is represented by 34 industries which produce 34 goods and services, one representative investor, one household sector, one government and eight occupation groups. Tourism shopping and non-shopping demands are extracted from exports as independent final demands for the purpose of the study. The production function is a 4-level nested CET-Leontief-CES function: the top level is a CET function allowing for firms to change products with some flexibility; the second level is a Leontief function reflecting fixed proportions among the composite intermediate inputs and composite primary factors; the third level is a CES function reflecting the substitution effect between import and domestic inputs and between labour and capital; and the bottom level is a CES function reflecting the substitution effect among different labour groups. The household demand function is a 2-level nested LES-CES function. The LES function at the top reflects the ability of households to adjust their combination of consumption in response to income changes. The CES function at the bottom reflects the flexible choice between imported and domestic goods in household consumption. The tourism non-shopping demand is a 2-level nested Leontief-CES function and the tourism shopping demand is a 2-level nested CD-CES function.

B. Data and parameters

Data needed for this study are mainly input-output data and tourism expenditure data. The input-output data are readily available from the 2000 Singapore I-O tables. These data are adjusted for use in this CGE model. Firstly, the data are updated to a base year of 2006 by employing the RAS method. Secondly, the 152 industries and commodities in the Singapore input-output table are aggregated to fit the purpose of the study.

The tourism expenditure data are from the Singapore tourism survey. Since shopping expenditure is the bulk of total tourism spending, we break down the data according to the tourism shopping pattern in the Singapore tourism survey.

The behavioural parameters in this study mainly consist of Armington elasticities, factor substitution elasticities, product transformation elasticities, consumer demand elasticities and export demand elasticities. The Armington elasticities, factor substitution elasticities, household demand elasticity and expenditure elasticity are adopted from the GTAP 6 database. Following the practice of Siriwardana and Schulze (2000), the elasticities of substitution between different labourer types were assigned a value of 0.5 for

every industry. There are no econometric estimates for product transformation elasticities for Singapore. However, estimates of CRETH transformation parameters in the ORANI model for the Australian economy have values between 0.06 and 4.55, with most of the estimates around 0.3-0.5 and 1.3-1.6 in value. We adopt 0.4 as an estimate for the agriculture sector in Singapore and 1.5 for other sectors.

A value of -20.0 was assigned to the foreign demand elasticity for Singapore's non-manufactured exports. In the case of manufactured goods, Singapore has huge capacity in the production of oil products, non-metal chemical products and electronic goods. Hence, values of -5.5 were assigned to those sectors and -10.0 for the other manufacturing sectors.

C. Model closure and simulation scenarios

Since the total number of variables in the model is more than the number of equations, some variables need to be set exogenous. For the purpose of this study, the following variables were specified as exogenous for all simulations: technical changes, consumer taste changes, tax rates, exchange rates, government spending, tourism demand, and inventory. For short run simulation, investment, real wages and real private consumption were also specified as exogenous. In the long run, employment and the rate of return on capital were set as exogenous variables.

According to the STB, Singaporean tourism receipts in the first half of 2009 were estimated at 6.4 billion Singapore dollars, a decline of 13.5 per cent compared with the first half of 2008. Consequently, a 15% negative shock to Singapore tourism demand was chosen for the simulations. Consideration of tourism shopping and non-shopping demand, the long run and short run effects, and policy

responses, yields the following six simulation scenarios.

Scenario (I): 15% decrease in total tourism expenditure in the short run;

Scenario (II): 15% decrease in tourism shopping expenditure in the short run;

Scenario (III): 15% decrease in total tourism expenditure in the long run;

Scenario (IV): 15% decrease in tourism shopping expenditure in the long run;

Scenario (V): Scenario I plus 10% drop in the tourism tax rate;

Scenario (VI): Scenario I plus 1% decrease in the GST rate.

IV. SIMULATION RESULTS

The above four scenarios were simulated using a CGE model and GEM PACK version 10 software. It is arguable that the results may be sensitive to parameter specification, so sensitivity tests were performed for each simulation by doubling the elasticity parameter values one by one. The results (available upon request) were found to be reasonably insensitive to the specification of these parameters. The simulation results are shown in Tables 1 to 5. Values in the tables are shown as percentage changes compared with the baseline case.

A. Macroeconomic effects

Table 1 displays the projected macroeconomic effects of all simulation scenarios.

TABLE 1: MACROECONOMIC EFFECTS OF TOURISM DEMAND SHOCKS

Macros	15% decrease in total tourism expenditure in the short run (I)	15% decrease in tourism shopping expenditure in the short run (II)	15% decrease in total tourism expenditure in the long run (III)	15% decrease in tourism shopping expenditure in the long run (IV)
Employment	-0.195	-0.105	0	0
Real wage	0	0	-0.105	-0.060
Real devaluation	0.157	0.060	0.180	0.075
Terms of trade	-0.043	-0.030	-0.045	-0.030
CPI	-0.134	-0.015	-0.150	-0.030
Nominal GDP	-0.285	-0.120	-0.225	-0.105
Real GDP	-0.134	-0.060	-0.045	-0.015
Real private consumption	0	0	0.090	0.015
Real export	0.559	0.375	0.690	0.450
Tariff revenue*	-6.014	-1.530	-4.065	-0.030

*Nominal change: Singapore dollars (million).

From Table 1 we can grasp the main features of the macroeconomic effects of a 15% negative shock to tourism demand in Singapore. Firstly, the terms of trade and the CPI are affected negatively but insignificantly. The real devaluation of Singapore dollars is also insignificant. Although these effects are insignificant, their impact on exports and nominal GDP may be magnified. Secondly, real exports benefit from the decrease in tourism demand. A 15%

decrease in total tourism spending will increase total Singaporean exports by 0.6% in the short run and 0.69% in the long run. This effect may result from two channels. One is that tourists tend to buy products in Singapore and take them back home. These products would otherwise be part of exports. The significant effects of a decrease in tourism shopping expenditure on exports (0.38% in short run and 0.45% in the long run) support this reasoning. The other

channel may be the impact of real devaluation of the Singapore dollar. The decrease in tourism demand leads to deflation and thus real devaluation of the Singapore dollar (under the assumption that nominal exchange rate is fixed). The weakened Singapore dollar makes domestic prices relatively lower than world prices and thus stimulates exports. Thirdly, Singaporean GDP is affected significantly and negatively, especially nominal GDP. It is of interest to note that the impact of real GDP in the long run is much less than in the short run. This may be because that, in the face of a decrease in tourism demand, in the long run, capital is transferred from the tourism sector to other sectors. Fourthly, employment and the real wage are also affected significantly. Since we assume the real wage is unchanged in the short run and employment is unchanged in the long run, the results only show the employment change in the short run and the real the wage change in the long run. The results indicate that a 15% drop in total tourism demand leads to employment decreasing by 0.2% in the short run and the real wage

decreasing by 0.1% in the long run. Finally, the results show a significant effect on tariff revenue. A 15% decrease in total tourism expenditure leads to a 6.02 million dollar decrease in tariff revenue in the short run and a 4.07 million dollar decrease in the long run. This effect may come as a surprise because Singapore is a country with few tariffs. Although most items are tariff free in Singapore, there are very high tariff rates imposed on items such as liquors, tobacco, petroleum products and motor vehicles. The consumption of these items by tourists is quite high (in the form of drinks, cigarettes, and transportation), so the large decrease in tariff revenue is understandable.

B. Industrial effects

There are 34 industries in the model, but for simplicity only nine representative sectors were selected. The short-run effects of a 15% decrease in total tourism demand on these industries are shown in Table 2.

TABLE 2: INDUSTRIAL EFFECT OF 15% DECREASE IN TOTAL TOURISM DEMAND IN THE SHORT RUN

Industry	Employment	Labour Price	Capital price	Value-added
Drink & tobacco	-8.085	-0.135	-7.365	-3.870
Clothing	-12.105	-0.135	-9.810	-7.815
Oil manufacturing	0.075	-0.135	-0.075	0.015
Food & Beverage	-3.690	-0.135	-2.340	-2.595
Accommodation	-12.810	-0.135	-7.875	-12.345
Finance Service	-0.075	-0.135	-0.210	-0.030
Real Estate	-0.255	-0.135	-0.345	-0.045
Business service	0.555	-0.135	0.300	0.255
Healthcare	-6.195	-0.135	-5.070	-3.885

Not surprisingly, the labour price (wage rate) in each sector drops by the same magnitude because labour is assumed completely mobile among sectors. The effects of a negative tourism shock for different sectors are diverse. First of all, the accommodation sector is hit hardest by the negative tourism shock: employment drops by 12.81%, output drops by 12.35%, and the capital price drops by 7.88%. These results come as little surprise because tourists are the main customers of this sector. According to the STB annually tourism survey, most tourists choose to stay in hotels, so the performance of the accommodation sector will closely follow tourism demand. Some other sectors such as clothing, drink & tobacco and healthcare are hit hard because they are heavily involved in, or related to, the tourism industry. The clothing industry suffers because of a decrease in tourism purchases. The drink & tobacco industry and the healthcare industry are hit hard because tourists are important costumers. The impacts onthe F&B sector, which is closely aligned with the accommodation sector, are not as large – only a 3.69% drop in employment and a 2.60% decline in value-added. According to the STB survey, F&B is an important part of the tourism industry. However, in Singapore culture, local residents tend to eat out, so a significant proportion of F&B products are consumed by locals. As a result, the F&B sector is only modestly affected by a decrease in tourism demand.

Some sectors such as the finance services and real estate sectors are affected negatively to a slight degree. These mild effects indicate that these sectors are weakly linked to the tourism industry. Finally, some sectors such as the oil manufacturing and business services sectors are affected positively. This indicates that these sectors are tourism-competing industries.

C. Effects on commodity markets

The long-run effects of a 15% decrease in total tourism demand on commodity markets are shown in Table 3.

TABLE 3: THE LONG RUN EFFECT OF 15% DECREASE IN TOTAL TOURISM DEMAND ON COMMODITY MARKETS

Commodity	Basic price	Output	Real household consumption	Real export
Drink & tobacco	-1.05	-3.915	0.105	1.665
Clothing	-0.93	-7.68	0.03	19.8
Wood & print	-0.375	-1.02	0.105	2.055
Oil manufacturing	-0.015	0.06	0.01	0.06
Precise engineering	-0.96	-2.04	0.03	1.665
Trade	-0.015	0.48	0.015	1.665
Food & Beverage	-0.435	-2.49	0.255	1.665
Accommodation	-0.33	-12.3	0.165	1.665
Land Transportation	-0.69	-0.93	0.345	14.22
Sight Seeing	-0.36	-2.7	0.18	1.665
Business service	0.03	0.375	-0.015	1.665
Healthcare	-1.2	-3.48	0.75	1.665

Generally speaking, Table 3 demonstrates that, with a few exceptions, the prices and outputs of most commodities displayed decrease while real household consumption and exports of these goods and services increase. Consider each column in turn. Firstly, with the exception of business services, there is a decrease in all commodity prices. During economic downturns, such as the one caused by 2008 World Financial Crisis, investors are likely to seek professional advice to cope with adverse situations. Changing business circumstances during hard times, such as takeovers and bankruptcy, may also increase the demand for legal services, which comprise a part of business services. The higher demand will bid up the price for those services. In general, the prices of tourism related products, such as drink & tobacco, healthcare, precise engineering and clothing, decrease proportionately more than the prices of products less involved in tourism (e.g. oil manufacturing). However, for some commodities this is not the case. The basic price for trade only drops marginally even though it is linked to tourism through tourism shopping. A plausible explanation is that tourism shopping is a very small part of the huge amount of international trade in Singapore. Some products such as food & beverage, accommodation and sightseeing are the core components of the tourism industry, but their prices also experience only modest falls (0.44%, 0.33% and 0.36% respectively). The reason may lie in the high competitiveness of these low-tech industries. Fierce competition presses prices close to operating costs, so there is limited scope for price reductions. This reasoning is supported by the very significant decreases in output for these products. In short, the supply of these commodities is very elastic.

Secondly, the outputs of the displayed commodities largely follow the rule that tourism related products suffer more from the decrease in tourism demand. There are a few exceptions, each of which is explained in turn. Land transportation outputs decrease only mildly (less than 1%) because of the inelastic nature of its supply (as indicated by its large price change) and because of the increased demand for land transportation from other sectors such as households (an increase of 0.35%) and exporters (an increase of 14.22%).

The positive change in the trade output may be due to the increase in real exports induced by real devaluation of the Singapore dollar. The positive increase in outputs of the oil manufacturing and business services, as stated earlier, may indicate those industries are competitors of the tourism industry.

Thirdly, with the exception of business services, real household consumption for the products displayed increases moderately. The increases in household consumption may be explained by the own-price effects of each commodity. As the price of a commodity decreases, the demand for that commodity will increase. But the small magnitudes suggest that household demand is less affected by a decrease in tourism demand.

Finally, real exports for all commodities of interest increase in the face of a decrease in tourism demand, which strongly suggests that export demand and tourism demand are highly competitive. Clothing and land transportation are prime examples with their real exports increasing by 19.80% and 14.22%, respectively. The increase in clothing exports may be the result of potential tourists having to purchase these products, during and shortly after the 2008 World Financial Crisis, as imported goods rather than purchasing them in Singapore during their travels (according to Singapore's tourism survey clothing is one of the main items purchased by tourists). The increased use of land transportation for exports may be an indication of the large increase in total real exports, considering land transportation is the necessary auxiliary service for exports. The marginal increase in oil manufacturing exports may reflect the large amount of intra-industrial trade in oil products due to Singapore's lack of crude oil reserves. While the real devaluation of Singapore's dollar stimulates exports, it hinders imports of crude oil, which limits production in oil manufacture.

D. Effects on labour market

The effects on employment in the short run and on the real wage in the long run are shown in Table 4.

TABLE 4: EMPLOYMENT AND REAL WAGE EFFECTS

Occupations	Employment change due to 15% decrease in total tourism expenditure in the short run (I)	Employment change due to 15% decrease in tourism shopping expenditure in the short run (II)	Real wage change due to 15% decrease in total tourism expenditure in the long run (III)	Real wage change due to 15% decrease in tourism shopping expenditure in the long run (IV)
Managers	-0.015	-0.105	0.195	0.015
Professionals	-0.090	-0.105	0.090	0.000
technicians	-0.075	-0.090	0.120	0.015
Tradesmen	-0.120	-0.060	0.075	0.060
Clerks	-1.095	0.015	-0.900	0.120
Salesmen	-0.225	-0.285	-0.120	-0.240
Plant workers	-0.210	-0.270	0.000	-0.135
Other Labourers	-1.440	-0.045	-1.305	0.015

An apparent feature of the table is that the figures in the last 4 rows are much higher than those in the first four rows, which suggests that low skilled occupation groups are more heavily affected by a negative shock on tourism demand. This result is consistent with the fact that larger numbers of unskilled workers are involved in the tourism or tourism-related industries. As tourism demand declines, some of these unskilled workers, for example clerks and labourers, are the victims – either becoming unemployed or having to accept lower wages. The second prominent feature of the table is that a decrease in tourism shopping or non-shopping expenditure affects occupational groups differently. In the second column we see that tourism shopping expenditure affects salesmen and plant workers the most, affects the top two groups significantly but affects clerks and other labourers insignificantly. However, in the first column we see that clerks and other labourers are the worst affected with managers barely affected. This difference is likely caused by the fact that tourism non-shopping expenditure is more service-oriented and more clerks and

labourers are involved in the tourism service. Finally, not all employees are adversely impacted by a negative tourism shock. The second column indicates that employment of clerks' increases in the face of a drop in tourism shopping expenditure. The third and the fourth columns highlight that the real wages of some groups increase at the expense of the other groups. The increased employment in the short run and increased real wage in the long run are likely the result of expansion in tourism-competing sectors, e.g. the exports-related sectors.

E. Effects of policy responses

As a policy response to an event like the 2008 World Financial Crisis, two tax reduction plans are considered, a 1% decrease in the GST and a 10% fall in the tourism tax rate. The 1% reduction in GST stands for a mild but economy-wide approach and the 10% reduction in the tourism tax rate represents a more tourism-focused approach. The effects of these approaches are shown in Table 5.

TABLE 5: COMPARISON OF TWO TAX REDUCTION POLICIES

Macros	15% decrease in total tourism expenditure in the short run (I)	Scenario (I) plus 10% decrease in tourism tax rate (V)	Scenario (I) plus 1% decrease in GST rate (VI)
BOT/real GDP	0.863	0.866	3.776
Tariff revenue*	-6.014	-6.014	22.357
Indirect taxes*	-34.591	-34.591	-5945.304
employment	-0.195	-0.195	6.521
Consumption/GDP	0.151	0.734	-2.036
Real devaluation	0.157	0.783	1.704
Terms of trade	-0.043	-0.043	-0.543
Average capital rental	-0.180	-0.180	5.278
Nominal wage	-0.140	-0.140	-0.997
CPI	-0.140	-0.140	-0.997
Export price	-0.043	-0.043	-0.543
Tourism shopping price	-0.331	-10.303	-0.994
Tourism non-shopping price	-0.488	-10.447	-1.959

Volume of imports	-0.105	-0.105	3.555
Volume of exports	0.559	0.559	5.684
Nominal GDP	-0.290	-0.869	1.057
Real GDP	-0.134	-0.091	2.777
Nominal household consumption	-0.140	-0.140	-0.997
Tourism shopping expenditure	-15.289	-23.987	-15.868
Tourism non-shopping expenditure	-15.426	-24.112	-16.710

*Nominal change: Singapore dollars (million).

We start with scenario (V). First impression of the effects of a reduction in the tourism tax rate (scenario V) is that the policy response is largely confined to the tourism sector. Compared with scenario (I) – no offsetting policy case, the majority of variables have barely changed, but the tourism related variables exhibit large changes. The prices of tourism related products (both shopping and non-shopping) decrease further (by around 10%) in contrast with scenario (I) because of the removal of the wedge between prices paid by tourists and prices received by producers. The decreases in prices in turn explain the decrease in nominal tourism expenditure, because real tourism expenditure is assumed to decrease by 15% in the simulation. Second, according to nominal GDP, the Singapore economy is worse off under the offsetting policy (a further 0.58% decrease). However, the real GDP results suggest that this policy response does help to improve Singapore's economic performance with real GDP decreasing by 0.09% compared to 0.13% decrease without this offsetting policy. Finally, this policy leads to the higher household consumption and further real devaluation of the Singapore dollar. These effects can be explained by the larger decreases in the prices of tourism related products. On one hand the lower prices induce higher consumption by local residents while on the other hand, reduce the real value of the Singapore dollar (under the assumption of a fixed exchange rate).

Scenario (VI) tells a quite different story. In comparison to scenario (I) every variable in Table 5 has changed significantly, corresponding to the scope of this offsetting policy. Firstly, both nominal and real GDP display positive growth. A higher real GDP growth rate of almost 3%, compared with scenario (I), shows the power of this policy instrument. The 6.52% increase in employment further confirms this finding. Secondly, the positive effect of this policy response is mainly achieved through international trade. While there are large increases in both imports and exports, the increase in export volume is much bigger than in the volume of imports. Household nominal and real consumption as percentage of real GDP decreases significantly. This outcome can be deduced from the significant real devaluation of Singapore dollar (1.70%) and the deterioration of terms of trade (0.54%), both of which likely originate from the significant decrease in the price level (the CPI decreases by almost 1%) as a consequence of the tax reduction. Third, this policy seems to affect the tourism sector only slightly, as tourism expenditure and the prices of tourism products change minimally from the baseline case. This result is not surprising because the policy response is mild (only a 1% change in the tax rate) although

its scope is economy-wide. Finally, the negative side of this policy is that, the government must be prepared for a loss in government revenue – this policy will lead to \$5.945 billion loss in indirect taxes.

V. CONCLUSIONS

Generally, the CGE simulation results demonstrate that an event like the 2008 World Financial Crisis tends to have large negative effects on Singapore's tourism and on the Singapore economy. At the macro level, although almost all variables are negatively affected, exports benefits greatly. At the industry level, a negative tourism shock impacts severely on the tourism-related sectors, with the exception of the F&B sector, which suffers only mild impacts. While sectors weakly linked to tourism exhibit slight adverse effects, the tourism-competing sectors expand. In the commodity markets prices and outputs decrease for most products but real household consumption and exports for those products increase. Employment and real wage results tend to suggest that low skilled workers are harshly affected by a decrease in tourism demand, but some occupational groups benefit at the expense of others. In comparing two taxation-based policy responses to a negative tourism shock, the simulation results suggest that a mild decrease in the GST has a much larger positive effect on Singapore's economy than does a more significant decrease in the tourism tax rate. However, the government must be prepared to give up a large amount of revenue as a consequence of a decline in indirect taxes. On the other hand, decreasing the tourism tax rate is shown to have a much more influential effect on Singapore's tourism industry.

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