Development of QGEMF-T

A Dynamic Economy-Wide Model of Tourism

A Working Paper
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**Abbreviations**

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<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<tr>
<td>CGE</td>
<td>Computable General Equilibrium</td>
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<tr>
<td>CS</td>
<td>Comparative Static</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GE</td>
<td>General Equilibrium</td>
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<td>GSP</td>
<td>Gross State Product</td>
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<tr>
<td>I-O</td>
<td>Input-Output</td>
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<tr>
<td>OESR</td>
<td>Office of Economic and Statistical Research – Queensland Treasury</td>
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<tr>
<td>QGEMF</td>
<td>Queensland Recursive-Dynamic General Equilibrium Model</td>
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<tr>
<td>QGEMF-T</td>
<td>Queensland Recursive-Dynamic General Equilibrium Model - Tourism</td>
</tr>
<tr>
<td>ROA</td>
<td>Rest-of-Australia</td>
</tr>
<tr>
<td>TQ</td>
<td>Tourism Queensland</td>
</tr>
<tr>
<td>TRA</td>
<td>Tourism Research Australia</td>
</tr>
<tr>
<td>VFR</td>
<td>Visiting Friends and Relatives</td>
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Glossary

Business-as-usual....................... the state of the economy, individual industry output or employment levels, without the policy change.

Closure................................. the set of user-specified exogenous variables within a model is referred to as the model’s closure. Typically, the closure embodies assumptions about economy-wide constraints, and sets the economic environment for the policy change.

CGE model................................ a mathematical representation of an economy. At the core of the model is a set of equations describing the behaviour of various economic agents (for example consumers and producers) when faced with changes in key economic variables.

Disaggregation......................... the process of splitting aggregate data to a finer level of detail (for example, splitting aggregate tourism expenditure data across four purpose of visit categories).

Exogenous Variable...................... a variable determined outside the model (i.e. its value is determined outside the model and imposed on the model).

Endogenous Variable.................... a variable determined within the model (i.e. its value is determined by the model’s calculations).

Factor markets.......................... the QGEMF-T model incorporates three factors of production; labour, fixed capital (e.g. machines, and plant and equipment) and agricultural land.

GDP......................................... the total market value of goods and services produced in a country in a given period after deducting the cost of goods and services used in the process of production but before deducting allowances for the consumption of fixed capital (i.e. depreciation).

GDP at factor cost....................... consists of compensation of employees (i.e. wages), gross operating surplus (i.e. profit) and gross mixed income (i.e. profits of unincorporated businesses). It is equivalent to GDP less net taxes on products and production.

GSP ......................................... as per GDP above, but for States, not the entire country.

GSP at factor cost....................... as per GDP at factor cost above, but for a State, not the entire country.

Inbound visitor......................... international visitor to Queensland and/or Rest-of-Australia.

Input-Output table....................... a system of economic accounts that shows, in value terms, the supply and disposal of goods and services produced within an economy over one year.
QGEMF-T........................an enhanced version of the Queensland Recursive-Dynamic General Equilibrium Model that allows for improved modelling of the economic impacts affecting tourism in Queensland and the Rest-of-Australia.

Margins.....................the difference between the sale price of a good (less net taxes), and the cost of its production. Margins include such services as transport, wholesale and retail trade.

Outbound visitor .............. Queensland and/or Rest-of-Australia resident travelling overseas.

Taxes on production.......... net taxes (excluding net taxes on products) incurred by enterprises as a result of engaging in production.

Taxes on products............ net taxes payable per unit of output on some good or service.

Tourism....................... is a broad term used to define the various travel types that are specifically modelled using QGEMF-T (refer to Section 4.2 for detail of the scope of the model).

Tourism Categories.......... eighteen types of tourism expenditure split according to:

1) Three purposes of visit (Holiday, Visiting Friends and Relatives, and Business), and

2) Three destinations (intrastate, interstate and overseas). Where interstate and overseas expenditure is split according to expenditure in the home or destination region.
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Executive Summary

Background

- In April 2001, the Office of Economic and Statistical Research (OESR) was commissioned by Tourism Queensland (TQ) and Queensland Treasury to develop two industry level economic models capable of analysing tourism related issues within a whole of economy perspective.

- This report describes the development of the second of these models, QGEMF-T, which is a dynamic computable general equilibrium (CGE) model.

- The development of QGEMF-T builds on earlier research by OESR on the direct linkages of tourism with the Queensland economy and also builds on a previous research report that described a static economy-wide tourism model.

- The need for a whole of economy model, such as QGEMF-T, flows from two alternative perspectives:
  - QGEMF-T can be used to analyse policies or economic shocks directly related to tourism. For example, the model could be used to provide industry-specific projections in response to changes in international tourism demand.
  - Alternatively, QGEMF-T can be used to analyse the impact, on tourism, of policies or economic shocks that are seemingly unrelated to tourism. The objective being that when a policy issue is analysed in terms of the normal broad economic indicators, the model will generate a set of information providing estimates of the tourism impacts for decision makers to consider.

Scope

- Tourism activity is very broad in scope, and not all types of tourism are separately identified in QGEMF-T. With respect to tourism, the scope of the work undertaken to date by OESR has three important elements:
  - Visitor sources and destinations - QGEMF-T explicitly models visitor expenditure flows within and between Queensland and the Rest-of-Australia, and between these two regions and Overseas. Finer levels of detail (for example, sub-state regions of Queensland, or individual overseas countries) are not separately identified by QGEMF-T.
  - The purpose of tourism visit - QGEMF-T explicitly models expenditure related to visits for the purpose of Holiday, Visiting-Friends-and-Relatives (VFR) and Business. All visitor expenditure for ‘Other’ reasons is not explicitly modelled.
  - The length of stay - QGEMF-T explicitly models expenditure related to Overnight visits. All day-visitor expenditure is not explicitly modelled. Instead, day-visitor expenditure makes up part of the relevant commodity flows in the non-tourism section of QGEMF-T, for example general household consumption expenditure.
Methodology

• QGEMF-T is a large mathematical model that simulates the behaviour of industries, investors and households in response to imposed economic changes (or ‘shocks’).
• QGEMF-T captures both the direct and indirect effects of economic changes, taking into account impacts on both prices and quantities.
• QGEMF-T is a dynamic model that has several advantages over the earlier static model in that it:
  − Traces out the time path of economic adjustments occurring in response to the policy change or economic shock;
  − Facilitates modelling scenarios where the policy changes or economic shocks are spread over several years; and
  − Provides the information necessary to facilitate a net present value calculation of the total impact of the policy over the observed period.

Key Tourism Features of QGEMF-T

• QGEMF-T provides the capacity to model expenditure relating to eighteen distinct tourism categories. The eighteen tourism categories arise from:
  − Three purposes of visit (Holiday, VFR and Business);
  − Three destinations for domestic travellers (intrastate, interstate, and overseas);
  − For domestic travellers going interstate or overseas, expenditure at the destination versus local travel-related expenditure is separately categorised; and
  − Visitors from overseas, by each purpose of visit.

• The response of each of the eighteen categories to economic stimuli varies according to the purpose of travel. For example, holiday expenditure is assumed to be more price-sensitive than VFR and Business travel expenditure.
• Substitution between tourism destinations is catered for in QGEMF-T. This occurs in different degrees, according to the reason for travel. For household tourism expenditure, changes in relative prices drive this destination substitution. For Business tourism expenditure, changes in the geographical distribution of the industry’s sales are also taken into account.

The Economic Modelling Scenario

• In order to demonstrate QGEMF-T’s tourism modelling capabilities, a hypothetical modelling scenario was devised involving regulatory change affecting aviation in Australia. The scenario involves the Federal Government mandating an increase in security standards within the ‘Air Transport’ industry following the terrorist attacks in America on September 11, 2001.
• As a result of this hypothetical regulatory change, increased security-related costs are assumed to be incurred by the Air Transport industry, and additional costs are also assumed to be imposed on all other industries through increased business travelling time.
• These issues were modelled as productivity losses in the relevant industries.
Overview of Results

- QGEMF-T results represent the state of the economy with the policy change relative to the state of the economy without the policy change. More specifically, QGEMF-T provides projections of the deviation of the economy away from the business as usual situation (referred to as the basecase) in response to the policy change.
- As expected, the simulated permanent productivity decline leads to a net negative economic impact. At the macroeconomic level, this is reflected in a loss in:
  - Overall activity, as measured by Gross State Product (GSP);
  - Household consumption expenditure, due to a decline in real household incomes; and
  - Overseas exports, due to the reduced competitiveness of some exported goods and services.
- The negative economic impact, both in terms of household consumption and economic activity, peaks in the second year, with Queensland’s GSP projected to decline by 0.27% and real Queensland household consumption projected to decline by 0.20%. In the long run the Queensland economy recovers somewhat so that by year 12 the decline in Queensland’s GSP is only 0.14% and the decline in household consumption is 0.12%.
- The most significant aspect of the longer term adjustment occurs through the labour market. Real wage adjustments allow employment, which is negatively affected in the initial years, to return to business as usual levels by the end of the simulation period.
- Overall, Queensland households are less adversely affected, in terms of real household consumption - the model’s welfare measure - than is the Rest-of-Australia.

Figure E.4 Tourism’s Contribution to Change in Real GSP
(cumulative deviation from basecase)
As shown in Figure E.4, above, tourism’s contribution to the change in GSP is greater than the overall change in GSP, indicating that the decline in GSP is offset to some extent by policy-induced changes to the rest of the economy.

The partial offset of the tourism-related decline in GSP is mainly due to increased output in Queensland’s commodity exports, and industries which service Queensland’s exporters.

An interesting feature of Figure E.4 is that tourism’s contribution to the decline in GSP increases over time. This result demonstrates the dynamic properties of QGEMF-T.

Tourism is more adversely affected in the Rest-of-Australia than in Queensland. As shown in Figure E.5, the time-path for the change in aggregate tourism expenditure is similar for both regions. However, the change in aggregate tourism expenditure in the Rest-of-Australia remains somewhat below that for Queensland for most of the simulation period.

The direct impact of the simulated productivity losses is to increase output prices in the affected industries. These price increases are the mechanism by which the impacts of the productivity losses are transmitted to the broader economy.

The greatest price impact is on the Air Transport industry, with a projected increase of 10.12% by year 2. In the long run the cost pressures on Air Transport soften such that the price of Air Transport is projected to increase by only 5.77% above the basecase level by year 12. The changes to the price of Air Transport are the key to understanding many of the simulation results in relation to the specific tourism categories identified in QGEMF-T.

Figure E.5  Impact on Aggregate Tourism Expenditure  
(cumulative deviation from basecase)
The impact on tourism activity varies considerably across the range of tourism as categorised by purpose of visit, destination and the origin of visitor. Tables E.1 and E.2 summarise the projected expenditure and price changes for tourism categories by purpose of visit for Queensland.

### Table E.1 Aggregate Tourism Expenditure by Purpose of Visit, Queensland
(cumulative deviation from basecase)

<table>
<thead>
<tr>
<th>Queensland</th>
<th>Year 1 (%) change</th>
<th>Year 2 (%) change</th>
<th>Year 12 (%) change</th>
</tr>
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<tbody>
<tr>
<td>Visiting Friends and Relatives</td>
<td>-1.02</td>
<td>-1.52</td>
<td>-0.91</td>
</tr>
<tr>
<td>Holiday</td>
<td>-0.72</td>
<td>-1.09</td>
<td>-0.62</td>
</tr>
<tr>
<td>Business.</td>
<td>-0.20</td>
<td>-0.31</td>
<td>-0.12</td>
</tr>
</tbody>
</table>

### Table E.2 Aggregate Tourism Category Price by Purpose of Visit, Queensland
(cumulative deviation from basecase)

<table>
<thead>
<tr>
<th>Queensland</th>
<th>Year 1 (%) change</th>
<th>Year 2 (%) change</th>
<th>Year 12 (%) change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visiting Friends and Relatives</td>
<td>0.95</td>
<td>1.43</td>
<td>0.80</td>
</tr>
<tr>
<td>Holiday</td>
<td>0.34</td>
<td>0.53</td>
<td>0.35</td>
</tr>
<tr>
<td>Business.</td>
<td>-0.04</td>
<td>-0.06</td>
<td>-0.07</td>
</tr>
</tbody>
</table>

- Aggregate expenditure by tourists Visiting-Friends-and-Relatives (VFR) is significantly more adversely affected than aggregate expenditure on Holiday travel. This reflects the relative price change of these tourism categories. For example the aggregate price of VFR travel by Queensland residents is projected to increase more than Holiday travel.

- Aggregate expenditure on Business travel is affected less adversely than other tourism by purpose of visit. This result demonstrates that the factors that determine demand for Business travel are different than the factors that determine the demand for other tourism categories.

- Tourists from the various source regions (overseas, interstate and home region) respond differently to the hypothetical policy scenario. For example, in Queensland, holiday expenditure by overseas visitors is more adversely affected than holiday expenditure by interstate visitors, while holiday expenditure by locals (Queenslanders in Queensland) is hardly affected at all.

- The relative contribution of the various tourism categories to the decline in total tourism activity is shown in Figure E.6. It shows that the decline in tourism activity in Queensland is mainly due to a decline in holiday expenditure by overseas (Inbound Holiday) and interstate visitors (Interstate Holiday).
Future Research

- OESR has undertaken a significant amount of research to produce the tourism data and the dynamic tourism model. While developing QGEMF-T, several areas for possible future research have been identified. Key elements identified were:
  - Analysis of the most appropriate treatment for tourism-related industries which operate nationally rather than conducting region-specific operations. That is, industries which operate nationally in the sense that their cost structure is only marginally influenced by factors pertinent to one particular state. For example, airlines whose staff and planes are not limited to working within specific state boundaries;
  - Analysis of the business travel theory. More specifically, treating the business tourism category as a ‘margin’ good that is used by firms to facilitate carrying out their standard business activity; and
  - The impact of changes in the future profile of the terms of trade for tourism.
1. Introduction

1.1 Background

This report details the Computable General Equilibrium (CGE) model development undertaken to date by the Office of Economic and Statistical Research (OESR), Queensland Treasury, for Tourism Queensland (TQ). The report forms part of a series on the economic contribution of tourism to the Queensland economy. The purpose of this report is to:

i. Provide an overview of the Queensland Recursive-Dynamic General Equilibrium Model (QGEMF);

ii. Provide information on the tourism-specific enhancements to QGEMF’s database and theoretical structure necessary in order to create the Queensland General Equilibrium Model of Tourism (QGEMF-T); and

iii. Present the results of a hypothetical model simulation using QGEMF-T.

1.2 Reliability of Estimates

As mentioned in OESR’s previous report¹, much of the tourism data used by OESR to produce estimates at the state level are derived from surveys that produce reliable estimates on a national scale, although these surveys have larger standard errors and reduced reliability at the state and regional level. As the data collated and presented in OESR’s previous reports are the major source of tourism data used in the creation of QGEMF-T, a similar degree of care should be adopted when using the material presented in this report.

1.3 Outline of Report

Section 2 provides an overview of CGE modelling and discusses its merits as a method for modelling policy impacts and economic events. Section 3 provides an overview of the standard version of OESR’s recursive-dynamic CGE model, QGEMF. Section 4 of the report documents the process used to incorporate tourism data into the standard QGEMF model while the theoretical extensions underpinning QGEMF-T’s development are discussed in Section 5. Section 6 describes how QGEMF-T is used to develop a set of ‘business as usual’ projections from which the impact of a policy is measured. Section 7 presents a description of a hypothetical scenario that was modelled using both the earlier comparative-static tourism model and QGEMF-T. The results obtained by using each of the models are documented in Section 7 and Section 8. Finally, Section 9 contains a brief conclusion of the report and outlines areas for future research.

2. What is CGE Modelling?

The section below presents a brief overview of CGE modelling. Following this, Section 2.2 discusses the benefits of using CGE modelling for economic analysis, compared with alternative methodologies. For a more detailed introduction to CGE modelling, see Dixon and Parmenter (1994).

2.1 What is a CGE model?

A Computable General Equilibrium (CGE) model is a mathematical representation of an economy. At the core of the model is a set of equations describing the behaviour of various economic agents (for example, industries, households and governments) when faced with changes in key economic variables, for example, and most importantly, relative prices. This theoretical structure is usually derived from neoclassical microeconomics. Under this structure, typically, households maximise utility subject to a budget constraint, and industries minimise costs subject to production functions. The core behavioural equations are supplemented with market clearing equations which equate supply and demand in all commodity and factor markets. The model is calibrated to a numerical database, the central core of which is a set of input-output (I-O) accounts showing, for a given year, the flows of commodities and primary factors between groups of economic agents.

In order to obtain a solution to the model, the model’s equations are solved simultaneously. However, CGE models usually have more variables than equations, which means that the user must specify the values of some variables. This set of user-specified exogenous variables is referred to as the model closure.

Although used as a mathematical tool to help solve the model, the closure plays a more fundamental role by creating the economic environment in which the policy scenario is set. In other words, the closure specifies some variables as exogenous to reflect various assumptions regarding the way economic agents behave, and any economy-wide constraints. For example, the closure typically reflects assumptions about the government budget deficit, capital formation, wages and foreign currency prices.

There are various types of CGE models and one way in which these can be distinguished is according to the treatment of time. A comparative static (CS) model, for example, compares the economy at two distinct points in time, without modelling any explicit time periods or time path. Typically, the two positions compared are the economy with a given policy change and the economy without the policy change. Consequently, this method of analysis does not provide any details of the adjustment path of the economy between the two points in time.

An alternative category of CGE models, recursive dynamic models, deals with time explicitly. These models perform year-to-year simulations with several types of between-year links rather than calculating just a snapshot of the economy before and after the policy implementation. Therefore, these models are able to provide the analyst with information on the adjustment path resulting from a given policy shock.
For some policy simulations, understanding the adjustment path is considered as important to the analyst as the final outcome of the policy shock. In such cases, the results obtained from a recursive dynamic model are more informative and detailed than those obtained from a comparative static model. However, a recursive dynamic model is more complex than its comparative static counterpart and therefore more time and effort is usually required to design, implement and interpret simulations.

Another area in which CGE models can be distinguished is according to their level of spatial detail. A CGE model could, for example, be a national or multi-region model. The level of disaggregation generally depends on user preference and the availability of suitable industry data. In Australia for example, there are many CGE models that are disaggregated to the state level but CGE models at the sub-state level are difficult to implement due to information constraints.

Within the category of multi-region CGE models, a further distinction can be drawn as to how each region is modelled. One method is to use a 'tops-down' procedure that allocates the aggregate national results proportionally across regions according to known regional economic statistics, such as employment by industry. The disadvantage of this approach is that it assumes that the cost and sales structures for a given industry, in each region, are the same as the national industry structure.

Alternatively, providing suitable industry data are available, each region can be modelled according to a 'bottoms-up' procedure. Under this procedure each region is modelled as an economy in its own right with government budget and intra-region, inter-region and international trade flows separately specified. The major advantage of this procedure when using a multi-region model, as opposed to the 'tops-down' procedure, is that each region has separately specified supply constraints. Therefore, a multi-region CGE model that uses the 'bottoms-up' procedure is ideally suited to determining the impact of region-specific economic shocks.

The Queensland General Equilibrium model, QGEMF (discussed in the following section) is a recursive dynamic model that explicitly models two regions (Queensland and the Rest-of-Australia) and the national economy. Currently, no facility exists to provide results at the statistical division level.

### 2.2 Why use CGE modelling to analyse the impact of tourism on the economy?

In analysing the impact of tourism on the economy we need to distinguish between ‘direct’ and ‘indirect’ effects. In the *Tourism Satellite Accounts*\(^2\) the ABS notes:

“The estimates of tourism gross value added and tourism GDP in this publication relate to the direct impact of tourism activity. For an activity to be included as part of tourism, there needs to be a direct relationship (physical and economic) between the visitor and the producer of the good or service. Indirect tourism demand is a broader notion that includes downstream effects of tourism demand and is out of the scope of this study. A full analysis of indirect effects is best done using a general equilibrium model of the economy”.

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\(^2\) ABS (5249.0), Australian National Accounts: Tourism Satellite Account 1997-98.
A method commonly used to value the contribution of tourism to an economy is I-O modelling. However, Dwyer, Forsyth & Spurr (2002) explains, I-O models are insufficient for this task:

“The fundamental problem with I-O analysis is that it is incomplete; it ignores key aspects of the economy. It focuses on the industry which is being directly affected, and on its direct relationships with other parts of the economy. It effectively assumes that there is a free, unrestricted flow of resources to these parts of the economy. The effects which come about because of resource limitations, the workings of the labour and other markets, the interactions between the economy and the rest of the world, are all ignored. As a result, it does not capture the feedback effects, which often work in opposite directions to the initial change. As a consequence, I-O estimates of impacts, on economic activity generally or on specific variables such as employment, are usually overestimates, very often by large margins. Indeed it can even get the direction of the change wrong”.

Whilst the I-O table and the related tourism satellite accounts can be used to determine the direct contribution of tourism, as was done in OESR (2001) (The Contribution of Visitor Expenditure to the Queensland Economy 1998-99), I-O analysis is inadequate for analysing the (direct and indirect) economy-wide impacts of any specific tourism issue. Therefore, a more rigorous evaluation technique is required that addresses the limitations of the I-O method.

One of the most well researched and documented sectoral analysis modelling frameworks is CGE. The CGE framework, as briefly outlined in Section 2.1 above, proceeds on the basis that events in one sector of the economy will have flow-on impacts on the other sectors of the economy. In turn, the impacts on these other sectors may have noticeable feedback effects on the original sector. In effect, general equilibrium analysis captures the impacts of a policy change or specific event on all parts of the economy, by incorporating feedback from all other parts of the economy, while recognising economy-wide constraints.

Dwyer, Forsyth, Spurr & Ho (2002) acknowledge that the CGE approach is a rigorous and appropriate methodology for measuring the net benefits of tourism changes:

“The approach is one of adjusting the estimates of impacts on activity using a CGE model. This is appropriate, since CGE models are recognised as the most rigorous means of estimating quantitative impacts in economies. It is particularly appropriate in the tourism context, because the benefits which tourism produces are the total of small gains and losses spread throughout the economy, and an economy-wide approach to evaluation is needed”.

These features of the CGE approach are essential components for undertaking a thorough and rigorous evaluation of the net benefit of tourism-related, policy changes or economic shocks. Consequently, the CGE framework is the approach adopted by OESR for the Valuing Tourism project.
3. The Queensland Recursive Dynamic General Equilibrium Model

Queensland Treasury initiated the development of its own CGE model in 1994, in order to meet the increasing demand for detailed rigorous analysis focusing on the Queensland economy. Following on from this initial development, the Queensland Recursive Dynamic General Equilibrium Model (QGEMF) was created and has since undergone continual development to incorporate additional theoretical specifications and more recent data.

QGEMF is a recursive dynamic model based on the MONASH-MRF multi-region model developed by the Centre of Policy Studies at Monash University. The MONASH-MRF framework has been tailored by OESR in the following ways:

i. QGEMF identifies only two regions within Australia – Queensland and the Rest-of-Australia (ROA), and utilises data developed by OESR; and

ii. QGEMF provides extensive industry and commodity detail for each of the two regions incorporated in the model.

The current QGEMF database is based on OESR’s 1996-97 I-O data for the Queensland and ROA economies. The level of industry detail has increased over time, and in standard form, now has the capacity to separately identify any of 108 commodities and 108 industries (see Table A.1 in Appendix A for a list of the 108 commodities and industries).

QGEMF is generally used for two types of applications:

i. Policy impact analysis – estimating the economic impact of policy changes, including overall welfare impacts. Examples include:
   - greenhouse gas emission reductions; and
   - reform of sector-specific regulations.

ii. Project impact analysis – estimating the overall economic benefits and costs of major projects.

A description of the theoretical structure and database of QGEMF is provided in the following sections.

3.1 Recursive Dynamic Theory – Capital and Labour Markets

Analysing the results of a recursive dynamic model like QGEMF requires a broad understanding of the key market mechanisms in the model. Two important mechanisms are the adjustment functions in the capital and labour markets.

In QGEMF-T it is assumed that, for each industry, capital adjusts slowly due to a one year lag on investment. More specifically, in the current year, the quantity of capital utilised by an industry is determined by the quantity of capital held in the previous year, plus the quantity of capital arising from investment in the previous year, less depreciation. Therefore, the amount of investment in the current year is the major determinant of the quantity of capital in the following year.

3 See Peter, Horridge, Meagher and Naqvi (1996) and Adams and Horridge (2002).

4 For example, regulatory reform in the Queensland sugar industry see Watts and Townsend (2004).
There are two main mechanisms in the model for determining the level of investment in each industry. Firstly, investors respond to changes in the rate of return on capital for each industry. This investment response is determined by the assumption that investors respond to changes in the expected rate of return with these expectations based on assumed long term stability in capital growth rates. The second function is an adjustment mechanism where disequilibrium between expected rates of return and capital growth rates is eliminated over time. It is assumed that in the long run each industry’s capital growth rate will tend towards a stable growth rate and rate of return.

The adjustment mechanisms in the labour market are also vitally important for interpreting QGEMF-T results. It is assumed that real wages are sticky in the short run but flexible in the long run. Conversely it is assumed that employment is flexible in the short run but sticky in the long run. More specifically, in a policy simulation, it is assumed that wages adjust over time in response to the policy shock such that the underlying level of employment is unchanged in the long run. For example, in a policy simulation that caused output of a particular industry to decline, QGEMF-T results would show an increase in unemployment in the short run (relative to the basecase). However, over time real wages would fall (relative to the basecase) such that other industries’ demand for labour increases. Over time employment will increase to a level equal to the basecase level of employment. The adjustment mechanism in the model typically eliminates the employment effects of a shock after approximately eight years.

The labour market adjustment process operates at both the national and the regional level in QGEMF-T. The adjustment mechanism at the regional level allows real wages to diverge between regions to ensure that both regions (Queensland and ROA) will maintain their long term employment growth. However, whilst both regions will return to their long term employment growth the adjustment paths can be quite different.

A more detailed discussion of the labour and capital market mechanisms in QGEMF-T can be found in Appendix B.

### 3.2 Understanding Dynamic Results

In assessing the impact of a policy change QGEMF-T produces two alternative projections for the Queensland economy, one generated without the policy change, the other with the policy change. The first projection is called the basecase projection (a discussion of the basecase projection is provided in Section 6 below). The basecase establishes the assumed growth path of the economy in the absence of the policy change (i.e. the business-as-usual growth path). The basecase then serves as a control path from which deviations are measured in assessing the effects of the policy change. This concept is illustrated in Figure 3.1.
The solid line in Figure 3.1 represents the basecase projection, while the policy projection is represented by the dotted line. Assume that a policy change occurs in Year t, the impact of which could be represented in two ways for each year that the simulation extends over:

i. The difference between the horizontal axis at “t+1” and point A. This measure represents the change that occurs in the basecase, as well as the change that is a result of the policy change. That is, the value of the variable at point A describes its value in that year. This measure is considered misleading as it does not provide information on the specific impact of the policy change.

ii. The difference between point A and point B. This deviation measures the difference between the basecase projection and the policy projection, and represents the specific impact of the policy by Year t+1. This measure is referred to as a cumulative deviation. In this example, where only one year has elapsed, the annual deviation is equal to the cumulative deviation.

The cumulative deviation caused by the policy change in Year t+2 is measured as the difference between point C and point D, which is made up of two components:

i. The impact that occurred in Year t+1 (i.e. the difference between “A” and “B”); and

ii. The additional (further) impact that occurs in Year t+2. This is measured by subtracting distance AB from the distance CD.
4. Development of QGEMF-T: Data Enhancements

This section details the new tourism module incorporated into QGEMF by OESR to create QGEMF-T. In order to achieve a high degree of realism in the modelling, two issues were considered to be important: differences in expenditure structure, and differences in behaviour between the various categories of tourism. The list of tourism categories are discussed in detail in Section 4.2.2.

Firstly, much effort was focussed on carefully disaggregating the tourism expenditure data to reveal the characteristic expenditure structures of each of these categories. This work was carried out and reported in OESR (2002), hereafter referred to as Task 3A.

Secondly, research was undertaken to determine the important behavioural differences between the tourism categories and to develop an appropriate theoretical and parametric structure within QGEMF to reflect these differences. This theoretical structure is detailed in Section 5 below.

4.1 Scope of the Project

Only Overnight visitors travelling for the purpose of Holidays, VFR and Business are explicitly modelled in QGEMF-T. Hence, QGEMF-T does not separately specify any Day-visitors expenditure or any Other Overnight visitor expenditure. This other expenditure implicitly exists within the QGEMF-T database, but it is not identified as a separate tourism category. That is, it is combined with household non-tourism expenditure.

4.2 The Tourism Data

In its standard form, QGEMF cannot adequately model the expenditure patterns of travellers. This is because the I-O accounts that form a large part of the QGEMF database do not separately classify tourism expenditure. Instead, tourism expenditure is captured within the standard QGEMF database as expenditure on a wide array of commodities. Therefore, when creating QGEMF-T, the tourism expenditure within the QGEMF database was extracted from the full range of industries where it was attributed and aggregated into new tourism “categories”.

The first step of the extraction process involved collecting data to estimate total tourism expenditure. The main data sources used for this tourism data collection included:

i. Tourism Research Australia’s (TRA) National Visitors Survey;

ii. TRA’s International Visitors Survey; and

iii. ABS data.

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5For example, VFR tourists spend proportionately less on accommodation than Holiday tourists do.
6For example, Business travel is influenced not only by relative prices but also by the destination of the industry’s output.
The collated expenditure data then underwent a seven-step incorporation process:

1) Disaggregation by region (Queensland, ROA and foreign);
2) Disaggregation across eighteen tourism categories;
3) Disaggregation across 108 I-O commodities and industries;
4) Disaggregation by source of production (intrastate, interstate and foreign imports);
5) Disaggregation by basic price, margins and taxes;
6) Time adjustment to deflate the tourism expenditure data to 1996-97 values; and
7) Incorporation into QGEMF-T.

The methodology that was employed for the first five steps is consistent with the tourism expenditure data presented in previous OESR reports under the Valuing Tourism project. The full seven-step process adopted by OESR is explained in greater depth below.

4.2.1 Step 1: Disaggregation by Region

The initial step was to allocate the tourism expenditure data across three regions according to the point-of-sale of the actual tourism expenditure. The three regions are: Queensland, ROA and foreign.

4.2.2 Step 2: Disaggregation across Tourism Categories

The expenditure data were then allocated across eighteen tourism categories. These categories are defined according to:

1) Purpose of visit (Holiday, VFR and Business); and
2) Three destinations (intrastate, interstate, and overseas).

For Australians travelling interstate and overseas, expenditure was further disaggregated according to whether the tourism expenditure occurred in the destination or home region.

Figure 4.1 provides a graphical explanation of each of the eighteen tourism categories for Queensland. Additional explanations are also given below for each destination category for the Queensland region (the same explanation is applicable for the ROA region):

**Intrastate**

For each of the three purposes of visit, the category ‘Intrastate’ represents tourism expenditure captured within the home region when travelling intrastate. An example of this would be a Queensland resident travelling within and spending money in Queensland.

**Interstate**

The ‘Interstate’ category represents expenditure in the destination region by travellers from interstate. An example of this would be the money spent at a Queensland hotel by a Victorian travelling within Queensland.

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7 In modelling terms, we have employed the so-called “dummy industry” approach. By this, the model implies each tourism category purchases a range of commodities and then on-sells a single composite output to households or, in the case of Business travel, other industries.
**Going Interstate**

The ‘Going Interstate’ tourism categories for each purpose of visit captures expenditure by travellers in their home region in connection with their interstate visits. An example of such expenditure is when a Queensland resident spends money at a Queensland snow-ski store prior to travelling to a Victorian skiing resort.

**Foreign Inbound**

The ‘Foreign Inbound’ category represents expenditure in the destination region by an inbound visitor. Therefore, any money spent in Queensland by a German resident on a holiday would be captured in this category.

**Foreign Outbound**

Similar to ‘Going Interstate’, the ‘Foreign Outbound’ category captures expenditure within the home region of the traveller in connection with their overseas visits. This could include a Queensland resident using travel agency services prior to a business trip to Ireland. Importantly, the ‘Going Interstate’ and ‘Foreign Outbound’ tourism categories essentially capture expenditure within the home region of the traveller induced by their travel elsewhere.

**Foreign Imports**

Finally, the ‘Foreign Imports’ category represents expenditure by a domestic traveller at their overseas destination. An example would be money spent in Ireland by a Queensland resident on a business trip.

### 4.2.3 Step 3: Disaggregation across I-O Commodities and Industries

The tourism expenditure data that were collected from the sources listed above were originally classified across approximately thirty commodities. This degree of disaggregation lacked sufficient detail for modelling the tourism sector and was inconsistent with the 108 I-O commodity structure of the standard QGEMF database. Therefore, tourism expenditure was further disaggregated across the full 108 I-O commodities and industries listed in the QGEMF database.

Additionally, since Business tourism was incorporated within the model as an input to production, aggregate Business tourism expenditure had to be apportioned across industries. This was done in accordance with industry shares of tourism-related commodity expenditure, sourced from the standard QGEMF database.

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8This was done using the same concordance previously used by OESR to derive its earlier estimates of tourism expenditure.
**Tourism Categories - Queensland Focus**

- **Total Tourism Expenditure**
  - **Tourism Expenditure in ROA**
  - **Tourism Expenditure in Qld**
  - **Tourism Expenditure overseas by ROA resident**
  - **Tourism Expenditure overseas by Qld resident**

**Eighteen Tourism Categories**

- **Purpose of Visit**
  - **Holidays**
  - **VFR**
  - **Business**

**Tourist’s Destination**

- **Queensland**
  - **Tourist’s Destination is Queensland**

- **Tourism Expenditure overseas by ROA resident**
  - **Holidays**
  - **VFR**
  - **Business**

- **Tourism Expenditure overseas by Qld resident**
  - **Holidays**
  - **VFR**
  - **Business**

**Figure 4.1** Graphical Explanation of the Eighteen Tourism Categories
4.2.4 Step 4: Disaggregation by Source of Production

Prior to step 4, the tourism expenditure data have been:

1) Allocated across three regions according to the actual point-of-sale location of the expenditure;
2) Disaggregated across purpose of visit, destination, and whether the expenditure was in the destination or home region; and
3) Disaggregated across 108 commodities and industries.

Following this, disaggregation of the tourism data by source of production was also required. For example, when a person visiting Queensland on a holiday buys food from a local store, not all the food would have been produced in Queensland. Therefore, expenditure on goods was broken down not only to where it was incurred but also to where the good was produced (that is, Queensland, ROA or foreign). This process of disaggregation by source of production was achieved by using the implicit source of production shares already contained in the QGEMF database.

4.2.5 Step 5: Disaggregation by Basic Price, Margins and Taxes

The tourism expenditure data obtained from the various sources was assumed to be measured in purchasers prices (that is, the data includes margins, taxes and basic value components). In QGEMF however, these components are disaggregated to enable separate equations to model each component’s behaviour. Accordingly, the tourism expenditure data were disaggregated across: basic value, nine margin types (see Table A.2 in Appendix A), and taxes, based on the implicit margin and tax shares in the standard QGEMF database.

4.2.6 Step 6: Time Adjustment

The tourism data collected were based on 1997-98 and 1998-99 values, therefore, implicit price deflators sourced from the Queensland State Accounts were applied to the data to make them consistent with the QGEMF starting-point database (which is based on 1996-97 values).

4.2.7 Step 7: Incorporation into the QGEMF Database

The final step in the process of incorporating the tourism data into the model involved extracting the newly disaggregated data from the standard QGEMF database, to prevent double counting, and then merging the two databases.

4.2.8 Parameters

Estimates for various parameters are included in the QGEMF-T database. One such set of parameters are Marginal Household Budget Shares (MHBS), which determine the allocation of each additional dollar of household income. The larger the parameter that is allocated to a commodity, the larger will be the share of additional income a household will spend on that commodity.
Following the completion of Task 3A, OESR undertook further research in relation to the magnitude of the budget share parameters in the QGEMF-T database and concluded that the existing tourism shares were too low. That is, household demand for tourism categories was not responding enough to changes in household income. Consequently the MHBS values for each of the tourism categories were increased; implying that for a given increase in household income there would be a larger increase in the consumption of the tourism categories. The MHBS values for aggregate Holiday and VFR from the Task 3A and the QGEMF-T databases are provided in Table 4.1.

Table 4.1 Assumed Marginal Household Budget Shares, Comparison between Task 3A and QGEMF-T Databases (% change)

<table>
<thead>
<tr>
<th>Purpose of Visit</th>
<th>Task 3A Database</th>
<th>QGEMF-T Database</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QLD</td>
<td>ROA</td>
</tr>
<tr>
<td>Holiday</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>VFR</td>
<td>0.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>

The MHBS values shown are aggregates that have been calculated by summing across all tourism categories for the particular purpose of visit.
5. The Theoretical Structure of Tourism in QGEMF-T

The following sections describe the changes made to the theoretical and parametric structure of OESR’s standard CGE model (QGEMF) in order to model tourism issues in a recursive dynamic framework.

5.1 The Commodity Structure of Tourism Expenditure

Within QGEMF-T, the role of each tourism category is to collate a bundle of goods and services and on-sell them to the various markets that is, domestic, interstate and overseas consumers and industries. Hence, rather than purchasing the goods and services directly, consumers and industries (in the model) purchase the output of the relevant tourism category. The demand for tourism-related goods and services is therefore now an induced demand, or flow-on effect, from changes in expenditure on the various tourism categories. This concept is illustrated in Figure 5.1.

Starting from the top of Figure 5.1, each tourism category comprises a bundle of goods and services from the industries supplying those goods and services. The default assumption in the model is that the proportion of each good and service within the overall bundle is unchanged over time. That is, whilst the total value of each tourism category varies over time, each individual good or service in the bundle varies according to fixed proportions.

The lower levels of Figure 5.1 illustrate the fact that each tourism category can minimise its costs by switching the sourcing of goods, at the margin, in response to changes in relative prices of the goods from each source. For services, however, this option is not available; all services are assumed to be sourced in the relevant tourism destination. For example, it is implausible for tourism service providers in Queensland to source accommodation services from ROA or overseas.

This source-switching behaviour is an important avenue for flow-on effects between Queensland and ROA. For example, one effect of an increase in tourism expenditure in ROA would be a positive flow-on impact to some Queensland producers. This occurs because there would be a general increase in the demand for goods by ROA tourism service providers, a component of which would be goods sourced from Queensland.
Figure 5.1  The Commodity Structure of Tourism Expenditure
5.2 Tourism Expenditure by Domestic Households

Three broad categories of household tourism expenditure are modelled in QGEMF-T: Holidays, VFR and Business (that is, personal expenditure undertaken when travelling for the purpose of Business). The theoretical structure of how QGEMF-T incorporates this expenditure is illustrated in Figure 5.2.

At the top of Figure 5.2 is aggregate household luxury expenditure\(^\text{10}\). The percentage change in this type of expenditure is equal to the percentage change in aggregate household income. Then within the luxury expenditure bundle, the three categories of aggregate tourism expenditure compete with other goods and services for a share of the household budget. This competition is based on relative price changes. At this point then, the household budget allocation for Holidays, VFR and Business travel expenditure are determined, for any given level of household income.

The lower levels in Figure 5.2 then effectively determine the share of each destination within each aggregate. For Holidays, households substitute between the different destinations on the basis of relative price changes. For example, if the price of Interstate Holidays declines relative to the price of Intrastate and Overseas Holidays, then households would spend relatively more, at the margin, on Interstate travel than on the other types. Currently, the elasticity determining this substitution effect is the same for each destination and therefore, the substitution effect applies equally across all destinations.

VFR travel by households is modelled in a similar fashion, except that the elasticity of substitution between destinations is much lower than for Holidays. In other words, for a given relative price change, destination-switching will be much less for VFR travel than for Holiday travel. This is because the destination of VFR travel is, by definition, less discretionary than Holiday travel.

The destination aspect of personal expenditure by Business travellers is modelled slightly differently to Holiday and VFR. For this category, all destinations are calculated in fixed proportions to aggregate Business expenditure by households. This reflects an assumption that personal spending at each destination type does not vary with the frequency of travel. In other words, the Business traveller’s annual budget for personal expenditure while travelling is allocated mainly in accordance with the uniqueness and attractiveness of the destination. Additionally, because of the household budget constraint, an increase in frequency of visits must result in lower expenditure per trip for a given income level.

The lowest level in Figure 5.2 then allocates the expenditure in the home region and at the destination for Interstate and Overseas travel, according to fixed proportions. This ensures that expenditure in the home region and destination region (that is, Interstate and Going-Interstate, and, Foreign Outbound and Foreign Imports) move together, reflecting their assumed status as complements rather than substitutes.

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\(^{10}\) In QGEMF-T, household consumption is split into “luxury” and “necessity” components, changes in the former equalling changes in income and changes in the latter moving by changes in the number of households.
Figure 5.2  Tourism Expenditure by Domestic Households
5.3 Tourism Expenditure by Industries

As mentioned above, households undertake personal expenditure when travelling for Business, however industries in the economy also use Business tourism as an input to their production. In QGEMF-T, the use of every intermediate good by an industry is calculated according to fixed proportions, however, a slightly different approach was adopted for an industry’s use of Business tourism. This is illustrated in Figure 5.3.

The top portion of Figure 5.3 shows that aggregate Business travel expenditure by each industry is calculated in fixed proportions to industry output, as with usage of other goods and services and primary factors.

Moving down a level, the marginal share of each destination within the industry’s Business travel aggregate is then determined by the share of industry sales to that location. For example, Queensland industries sell their output to consumers and producers in Queensland, ROA and overseas. If sales to Queensland (i.e. Intrastate) by an industry increase relative to the average change in sales to all destinations, the industry will increase its demand for Business Intrastate travel, relative to the other Business travel destinations.

Finally, at the lowest level, Figure 5.3 splits Interstate and Overseas travel into its home region and destination expenditure components, in fixed proportions as with tourism expenditure by domestic households.

5.4 Tourism Expenditure by Foreigners in Australia

Changes in expenditure by foreigners in Australia, travelling for the purpose of Holidays and VFR is determined according to changes in the foreign currency price of these tourism categories. As mentioned in Section 5.2 above, it is assumed that the sensitivity of Holiday visitors to price changes is greater than for VFR visitors. Therefore, it is assumed that VFR travel has a lower foreign currency price elasticity than Holiday travel.

Foreign Inbound business travel to Queensland and ROA is dependent on two factors. Firstly, overseas imports of the relevant commodity, and secondly, the foreign currency price of Foreign Inbound Business travel in Australia. A limitation of the demand equation determining Foreign Inbound business travel arises because, in QGEMF-T’s database, Foreign Inbound Business travel only encompasses expenditure in Australia by foreigners. In addition to the cost of Foreign Inbound Business travel in Australia, the travel decisions of foreign business travellers are likely to be influenced by the cost of business travel in their home region in connection with travel to Australia. For example, a business traveller in Japan is faced with both the cost of travel expenditure in Australia (accommodation, meals etc), but also with the cost of any travel expenditure made in the home region prior to travelling (air transport if travelling on Japan Airlines, travel agent fees etc).

QGEMF-T has no acknowledgment of foreigners business travel costs in their country associated with travel to Australia. It is assumed, however, that as the share of this component in the total cost of business travel to Australia increases, foreigners are likely to become less sensitive to changes in the price of the Australian component of business travel (Foreign Inbound Business travel). While QGEMF-T has no explicit recognition of the role of external cost factors, an implicit recognition is made by way of the value assigned to the elasticity of demand for Foreign Inbound travel.
Figure 5.3  Tourism Expenditure by Industries
6. Development of the QGEMF-T Basecase

6.1 Introduction
This section describes the development of the year-on-year datasets required to run QGEMF-T.

In assessing the impact of a policy change QGEMF-T is used to produce two alternative projections for the Queensland economy, one generated without the policy change, the other with the policy in place. The first projection is called the basecase projection. It establishes a current year starting point (eg. 2003-04) for the deviation projection (i.e. the projection which includes the policy changes) and serves as a control path from which deviations are measured in assessing the effects of the policy changes occurring in 2004-05 and beyond.

Following the approach of Dixon and Rimmer (1998), QGEMF-T takes macroeconomic projections from OESR’s macroeconometric model (QMEM) in order to generate a basecase. The basecase is generated by driving forward the 1996-97 CGE database\textsuperscript{11} using QMEM’s macroeconomic projections. This approach allows OESR to utilise the strengths of both macroeconometric and CGE modelling frameworks rather than building a hybrid model.

6.2 Basecase Assumptions and Methodology
The purpose of generating a basecase is to facilitate policy analysis. In order to simplify the policy analysis, an effort has been made to smooth much of the business cycle volatility evident in most projections. While historical data were used to generate the basecase prior to 2002-03, after this a long run steady-state projection was used. This long run steady-state projection was developed using both historical and typical forecast data from OESR’s econometric model. In addition, shocks were applied to both foreign prices and foreign demand with the aim of smoothing tourism demand over the forecast period.

Table 6.1 shows the assumptions for selected macroeconomic variables in Queensland and Australia. The numbers shown are an average of the historical annual growth rates for the period 1996-97 to 2003-04 and the projected annual growth rates for the period 2004-05 to 2013-14.

<table>
<thead>
<tr>
<th>Macroeconomic variable</th>
<th>QLD</th>
<th>AUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP/GSP</td>
<td>4.27</td>
<td>3.23</td>
</tr>
<tr>
<td>Employment</td>
<td>2.34</td>
<td>1.52</td>
</tr>
<tr>
<td>Foreign prices</td>
<td>-0.34</td>
<td>-0.34</td>
</tr>
<tr>
<td>Foreign demand\textsuperscript{12}</td>
<td>1.75</td>
<td>1.75</td>
</tr>
</tbody>
</table>

\textsuperscript{11} The starting point database for our recursive dynamic model is essentially the database used in comparative static modelling.

\textsuperscript{12} Additional shocks were imposed for foreign inbound tourism, resulting in these categories growing at a rate ‘over-and-above’ that implied by the export assumptions.
7. Revisiting the Task 3A Simulation

The hypothetical scenario chosen for the Task 3A report was *An increase in security regulation affecting the domestic aviation market*. Specifically, the scenario encompassed the following components:

i. A 15% increase in labour costs per unit of output for the air transport industry;

ii. A 15% increase in required infrastructure per unit of output for the air transport industry; and

iii. An increase in travel-times/disruption for business travellers and a resulting loss of labour productivity in industries that use business travel as an input into production.

A detailed explanation of this scenario’s results was provided in the Task 3A report. Since completing Task 3A, OESR has made adjustments to some of the parameter values in the underlying database. Therefore, if the previous hypothetical simulation was not repeated using the comparative static model and the new database parameters there could be two potential reasons for the divergence in the QGEMF-T estimates relative to the Task 3A report:

i. Changes in the database parameters; and

ii. Changes stemming from the new dynamic model theory.

To enable a direct comparison of results between Task 3A and QGEMF-T, the hypothetical scenario was firstly repeated using the revised database parameters, but still using the Task 3A comparative static model.

7.1 The Revised Simulation using QGEM-T

7.1.1 Outline of the Comparative Static Macroeconomic Results

When the Task 3A simulation was repeated using the revised database the simulated productivity losses were projected to lead to a larger net economic impact. At the macroeconomic level, this is reflected in greater declines in:

1) Overall activity, as measured by Gross State Product (GSP); and

2) Household consumption expenditure, due to a larger decline in real incomes.

Table 7.1 outlines the projected changes to the macroeconomic aggregates for each of the two regions modelled by QGEM-T, Queensland and ROA.
Table 7.1  Long Run Comparative Static Results for Queensland and ROA

<table>
<thead>
<tr>
<th></th>
<th>Queensland (%) change</th>
<th>ROA (%) change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GSP</td>
<td>-0.13</td>
<td>-0.15</td>
</tr>
<tr>
<td>Real Household Consumption Expenditure</td>
<td>-0.12</td>
<td>-0.15</td>
</tr>
<tr>
<td>International Export Volumes</td>
<td>-0.29</td>
<td>-0.40</td>
</tr>
<tr>
<td>International Import Volumes</td>
<td>-0.13</td>
<td>-0.18</td>
</tr>
<tr>
<td>International Trade Balance</td>
<td>-$21m</td>
<td>-$104m</td>
</tr>
<tr>
<td>Inter-region Trade Balance</td>
<td>$26m</td>
<td>-$26m</td>
</tr>
</tbody>
</table>

The direct impact of the productivity losses is to increase output prices in affected industries. These price increases are the mechanism by which the impacts of the productivity losses are transmitted to the broader economy.

The greatest price impact is on the Air Transport industry, with a projected increase of 6.21%. This price increase is the key to understanding many of the simulation results, particularly those for tourism. Table 7.2 shows the long run results for aggregate tourism in each region.

Table 7.2  Aggregate Tourism Results for Queensland and ROA

<table>
<thead>
<tr>
<th></th>
<th>Queensland (%) change</th>
<th>ROA (%) change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Tourism GSP(^{14})</td>
<td>-2.41</td>
<td>-2.96</td>
</tr>
<tr>
<td>Tourism contribution to change in Real GSP</td>
<td>-0.22</td>
<td>-0.15</td>
</tr>
<tr>
<td>Real Household Tourism Consumption Exp.</td>
<td>-0.90</td>
<td>-1.02</td>
</tr>
<tr>
<td>International Tourism Trade Balance</td>
<td>-$116m</td>
<td>-$452m</td>
</tr>
<tr>
<td>Inter-region Tourism Trade Balance(^{15})</td>
<td>-$29m</td>
<td>+$29m</td>
</tr>
</tbody>
</table>

Comparing the results in Table 7.1 and Table 7.2 yields the following insights:

i. Tourism is a more important determinant of the Queensland results than for the ROA results. Although Queensland tourism is less adversely affected (as measured by a relatively smaller fall in Real Tourism GSP), tourism accounts for much more of the change in overall GSP. That is, tourism alone contributed a change of –0.22% in overall GSP, which is greater than the final net GSP result of –0.13%. Given the similar magnitude of the real GSP impact in Queensland and ROA, this implies that the decline in tourism activity in Queensland has been partially offset by gains in other sectors of the economy.

ii. The international tourism trade balance results follow a similar pattern to the GSP results. There is a projected decline of approximately $116m (see Table 7.2) in the international tourism trade balance from Queensland. However, the net overall decline in Queensland’s international trade balance is approximately $21m (Table 7.1). This is because the decline in tourism exports is partially offset by increased exports of other commodities.

\(^{13}\)Changes in the trade balance (exports minus imports) are shown in $ million in 1996-97 values, to aid interpretation of trade effects across the two regions, and between the overall trade result and the tourism trade results.

\(^{14}\) This measure of Tourism GSP includes indirect effects.

\(^{15}\) Exports of tourism-related goods and services minus imports, in $ million in 1996-97 values.
The greater apparent resilience of the Queensland economy in the face of these hypothetical productivity shocks is related mainly to the performance of Queensland’s commodity export industries, and industries that export agricultural manufactures. In QGEMF-T’s database, these industries have a lower-than-average reliance on air transport, and hence the impact of increased air transport prices on their costs is relatively less. This, coupled with lower prices for other inputs and a projected slight exchange rate depreciation, makes these industries become more competitive in overseas markets. The industries that benefited most from these factors are: Coal, Oil, and Gas; Meat Products; Food Products; Non-ferrous Metals; and Non-ferrous Ores. Together, under this scenario, these industries increased their international export volumes by approximately $40M\textsuperscript{16}.

7.1.2 Tourism Category Results

As explained above, the key industry-level feature of this scenario is the productivity decline in the Air Transport industry, which feeds into a price increase for that industry of around 6%. The key to understanding the flow-on impacts to the tourism categories is therefore the extent to which each tourism category uses domestic air transport. To this end, Figure 7.1 shows the share of domestic air transport in total costs of each tourism category, according to QGEMF-T’s database. For ease of interpretation, the Interstate and Going Interstate categories are combined, as are the Foreign Outbound and Foreign Imports categories.

Figure 7.1 Tourism category by Share of Domestic Air Transport in Total Costs

\[\text{Figure 7.1 Tourism category by Share of Domestic Air Transport in Total Costs}\]

\[\text{Figure 7.1 Tourism category by Share of Domestic Air Transport in Total Costs}\]

\[\text{Figure 7.1 Tourism category by Share of Domestic Air Transport in Total Costs}\]

16 Expressed, in 1996-97 values, for ease of comparison with the trade balance figures in Table 7.1 and Table 7.2.
Examination of Figure 7.1 reveals the following broad features evident in QGEMF-T’s database:

i. ROA tourism categories are slightly more intensive overall in their use of domestic air travel than Queensland tourism categories;\(^{17}\)

ii. The ROA Intrastate categories have higher air transport cost shares than their Queensland counterparts because the former includes travel between the other states;

iii. Within each domestic “purpose of visit”, the Interstate category uses the most domestic air transport per unit of output; and

iv. Overall, Business travel uses domestic air transport the most intensively\(^{18}\), followed by VFR and then Holidays. The VFR air transport shares are greater than for Holidays because VFR travellers spend less on other commodities, such as Accommodation. The exception to this is the Inbound category, presumably reflecting greater air travel within Australia by the Inbound Holiday category than by the Inbound VFR category. That is, Inbound Holiday tourists would presumably visit several locations within Australia, requiring significant air transport. Whereas, presumably a higher proportion of VFR inbound visitors undertake tourism activities only in the location of the friends and relatives they are visiting.

**Figure 7.2** Queensland Tourism Categories - Domestic Air Transport Cost Share and Change in Price

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17 This could simply reflect the fact that ROA includes a wide geographical spread from the eastern seaboard capitals of Sydney and Melbourne across to Perth.

18 Note that these categories do not include the personal consumption component of Business travel, which is assumed to use no air transport. Hence their air transport share is higher than it would be if the personal expenditure component were included.
The simulation results show a close correlation between price changes for the tourism categories and the respective shares of domestic air transport in their total costs. Figure 7.2 demonstrates this situation for the Queensland categories, and Figure 7.3 shows the ROA situation.

As shown in Figure 7.2 and Figure 7.3, the correlation between the air transport database share and the simulation price change is not perfect. This is because the tourism categories, according to QGEMF-T’s database, also purchase differing proportions of other commodities, for which the prices are also changing – some increasing, some decreasing. For example, the price of the Accommodation, Cafes, and Restaurants commodity declines in the simulation. This price change has a greater downward effect on the price of the Holiday categories than on the VFR categories, because the Holiday categories purchase proportionately more of this commodity.

### 7.1.3 Tourism Consumption by Domestic Households

Relative to other goods purchased by domestic households, tourism is assumed to be at the “luxury” end of the scale. Hence, in QGEMF-T, tourism’s share of the household budget varies with household income. For example, if household income falls, other things being equal, tourism will assume a smaller share of the household budget. In other words, it is assumed that households are relatively income elastic in their demand for tourism.

In the current simulation, as explained in the national and state results, household income is falling as a result of this change in policy. Consequently, real household consumption declines by 0.12% in Queensland, and falls by 0.15% in the ROA (see Table 7.1). Because tourism expenditure is assumed to be relatively income elastic, we would expect real aggregate tourism expenditure by households to decline by more than aggregate real household consumption (leaving aside relative price effects).
This expenditure elasticity effect is observed in the simulation results. Aggregate real tourism expenditure by households declines by 0.90% for Queensland, and falls by 1.02% for the ROA (see Table 7.2). Hence, not only is real tourism expenditure projected to decline, but the share of tourism within overall household consumption is also projected to decline.

These estimates of the percentage change for overall household consumption of tourism are weighted averages across all tourism categories. Within overall household tourism consumption, the model firstly determines expenditure related to each purpose of visit – Holiday, VFR and Business. The results for each purpose vary around the average tourism results in accordance with their individual price elasticities, coupled with changes in the price relativities between them. Table 7.3 shows the results of the interaction between these two factors.

Table 7.3  Long Run Impacts on Prices and Quantities, by Purpose of Visit

<table>
<thead>
<tr>
<th>Purpose of visit</th>
<th>Queensland Households</th>
<th>ROA Households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price (%)</td>
<td>Quantity (%)</td>
</tr>
<tr>
<td>Holiday</td>
<td>0.35</td>
<td>-0.89</td>
</tr>
<tr>
<td>VFR</td>
<td>0.83</td>
<td>-1.08</td>
</tr>
<tr>
<td>Business</td>
<td>-0.10</td>
<td>-0.13</td>
</tr>
</tbody>
</table>

For example, from Table 7.3 it can be observed that the projected Queensland quantity changes for Holiday and VFR travel are reasonably similar. This is despite the estimated price change for VFR being more than double the Holiday price increase. The reason for this is that consumption of VFR travel is implicitly assumed to be only half as sensitive to price changes as consumption of Holiday travel. The Holiday and VFR results for the ROA show a similar situation as occurs in the Queensland estimates.

Personal consumption related to Business travel has the smallest price change and is assumed to have a price sensitivity that is similar to VFR expenditure. The quantity response of this category is therefore much less than for Holidays and VFR.

In summary, the effects of the modelled productivity changes on real expenditure by purpose of visit are:

i. Significantly negative results of similar magnitude for household consumption of Holiday and VFR tourism; and

ii. A fairly neutral result for Business travel expenditure by households.

Having determined aggregate tourism expenditure by purpose of visit type in each region, the model then determines, within each visit purpose, household expenditure at each of the three destinations – intrastate, interstate, and overseas. Again, the Holiday category destination-decision is assumed to be more price-sensitive than for the VFR category. This is because VFR travellers are assumed to be significantly constrained in their destination choice by the location of the people they are visiting.

Table 7.4 and Table 7.5 show the destination results within the two purposes of visit, Holiday and VFR, for Queensland and the ROA.
Table 7.4  Long Run Impacts on Changes in Real Tourism Expenditure by Queensland Households, by Purpose of Visit and Destination

<table>
<thead>
<tr>
<th>Destination</th>
<th>Holiday</th>
<th>VFR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price (%)</td>
<td>Quantity (%)</td>
</tr>
<tr>
<td>Intrastate</td>
<td>0.18</td>
<td>-0.19</td>
</tr>
<tr>
<td>Interstate</td>
<td>0.56</td>
<td>-1.70</td>
</tr>
<tr>
<td>Overseas</td>
<td>0.47</td>
<td>-1.35</td>
</tr>
</tbody>
</table>

Table 7.5  Long Run Impacts on Changes in Real Tourism Expenditure by ROA Households, by Purpose of Visit and Destination

<table>
<thead>
<tr>
<th>Destination</th>
<th>Holiday</th>
<th>VFR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price (%)</td>
<td>Quantity (%)</td>
</tr>
<tr>
<td>Intrastate</td>
<td>0.39</td>
<td>-0.50</td>
</tr>
<tr>
<td>Interstate</td>
<td>0.78</td>
<td>-2.01</td>
</tr>
<tr>
<td>Overseas</td>
<td>0.65</td>
<td>-1.52</td>
</tr>
</tbody>
</table>

Looking at the relative quantity changes in Table 7.4 and Table 7.5, it is apparent that, within each region and purpose of visit, households are substituting Intrastate travel for Interstate and Overseas travel. This is because the price of Intrastate travel rises less than the prices of the other destinations. The explanation for this effect is that Intrastate travel uses the least amount of domestic air transport per unit of output (see Figure 7.1 above).

7.1.4 Tourism Expenditure by Foreign Households

Holiday and VFR tourism demand\(^{19}\) by foreign households is assumed to vary with the foreign currency price of the relevant Foreign Inbound tourism category. This implies price-driven substitution between Australia and overseas destinations.

The projected change in the foreign currency price of each tourism category includes changes in domestic prices and changes in the exchange rate. In the simulation, the nominal exchange rate depreciates by around 0.05%, which in isolation would tend to make travel to Australia slightly cheaper relative to other international destinations. However, this exchange rate effect is swamped by the substantial price increase for the domestic air transport component of Australian tourism\(^{20}\).

The simulation results for the Holiday and VFR Foreign Inbound categories (tourism exports) are shown in Table 7.6.

\(^{19}\)Unlike domestic tourism consumption, the personal and industry components of Foreign Inbound Business travel are modelled in aggregate, and the results for these categories are discussed in Section 7.1.6.

\(^{20}\)Recall that the Foreign Inbound tourism categories do not include the use of foreign air transport services in their cost structure. Therefore, this simulation does not take account of any substitution between domestic and foreign air carriers in response to the increase in domestic price of air transportation. A global CGE model would be able to more accurately determine the outcome of any such substitution effect.
Table 7.6  Long Run Impacts on Changes in Quantities and Foreign Currency Prices for Tourism Exports to Foreign Households, by Purpose of Visit

<table>
<thead>
<tr>
<th>Destination</th>
<th>Purpose of visit</th>
<th>Price (%)</th>
<th>Quantity (%)</th>
<th>Price (%)</th>
<th>Quantity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>Holiday</td>
<td>1.30</td>
<td>-6.23</td>
<td>1.84</td>
<td>-8.70</td>
</tr>
<tr>
<td>ROA</td>
<td>VFR</td>
<td>0.83</td>
<td>-2.04</td>
<td>1.65</td>
<td>-4.01</td>
</tr>
</tbody>
</table>

Overseas exports of tourism are assumed to be more price-sensitive than the domestic tourism categories. The underlying assumption is that, for all households (domestic and foreign) the choice amongst a range of overseas destinations is more price-sensitive than the initial choice between domestic and overseas.

For domestic households, the choice between different overseas destinations is not modelled in QGEMF-T. However, the higher price sensitivity of this choice must be taken into account when considering a foreign household’s point of view. Hence tourism exports are assigned this higher price sensitivity, which is reflected in the results shown in Table 7.6, relative to the results in Table 7.5. For example, the price of holidays in Queensland for a foreigner increases by 1.30%, leading to an 6.23% fall in demand by foreign tourists (i.e. a 1% increase in price results in approximately a 5% fall in quantity). Whereas, the price of an overseas holiday for Queenslanders increases by 0.47%, leading to a 1.35% fall in demand by Queensland households (i.e. a 1% increase in the price results in approximately a 3% fall in quantity).

Also apparent from Table 7.6 is the assumption that VFR Inbound travel is only half as price-sensitive as Inbound Holiday travel. For both Queensland and ROA the results shown in Table 7.6 demonstrate that due to the price elasticity parameters in QGEMF-T, the ratio of the VRF quantities and prices are only half of that for the Holiday quantities and prices.

Finally, from Table 7.6, the relative difference between changes in tourism exports from ROA and changes in tourism exports from Queensland can be seen. A feature of the cost structure of the Inbound tourism categories, according to QGEMF-T’s database, is the higher share of domestic air transport in the ROA Inbound Holiday category (see Figure 7.1). Hence, the foreign price of Inbound Holiday in ROA will be more negatively affected by the rise in the price of domestic air transport than the Queensland price. Consequently the quantity results are more negative for ROA than for Queensland.

Following the same logic, similar results are obtained for the VFR category. The ROA Inbound VFR category has a higher share of domestic air transport than the Queensland Inbound VFR category. Therefore, the foreign price for ROA Inbound VFR will increase by more than for Queensland Inbound VFR, and consequently the quantity results are more negative for ROA than for Queensland.
7.1.5 Business Tourism Expenditure by Domestic Industries

Changes in output of all Business travel categories are determined by a combination of factors, namely changes in demand for Business travel by:

i. Domestic industries as an input to their production;

ii. Domestic households as personal expenditure undertaken when travelling for the purpose of Business; and

iii. Foreigners facilitating their sales to Australia by undertaking business travel in Australia.

The previous section analysed changes in personal consumption related to Business travel, and this section will analyse changes in demand for Business travel by industries and foreigners. Table 7.7 below summarises the QGEMF-T estimates for these categories in response to the hypothetical policy scenario.

Table 7.7 Long Run Impacts on Changes in Domestic Demand for Business Travel

<table>
<thead>
<tr>
<th>Destination</th>
<th>By Queensland Industries</th>
<th>By ROA Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrastate</td>
<td>-0.50</td>
<td>-0.33</td>
</tr>
<tr>
<td>Interstate</td>
<td>-0.35</td>
<td>-0.30</td>
</tr>
<tr>
<td>Overseas</td>
<td>-0.26</td>
<td>-0.22</td>
</tr>
</tbody>
</table>

Overall, as a result of this simulation, aggregate output (value-added weights) in Queensland and ROA has declined by 0.13% and 0.15% respectively (see Table 7.1). Therefore, it is expected that, on average, the demand for aggregate Business travel by industries would decline.

From Table 7.7 it can be observed that, on average, demand for Intrastate Business travel by Queensland industries is projected to fall relatively more than demand for Interstate or Overseas Business travel by Queensland industries. This difference in changes in demand for these destinations reflects the fall in the relative share of intrastate sales by Queensland industries and an increase in the relative share of sales by Queensland industries to ROA and overseas.

Similarly, the share of sales by ROA industries to Queensland and overseas rose relative to ROA’s share of sales intrastate. Consequently, ROA industries’ demand for Intrastate Business travel fell slightly, relative to their demand for Interstate and Overseas Business travel.

As discussed in Section 5.3, aggregate Business travel demand by each industry is calculated as a fixed proportion of that industry’s output. To the extent that output declines for industries with a larger share of Business travel in their cost structure, relative to output in industries with a smaller share of Business travel in their cost structure, the relative demand for aggregate Business travel will decline. This concept explains the relative difference between changes in demand for Business travel by Queensland and ROA industries.
7.1.6 Business Tourism Expenditure by Foreign Industries

As discussed in Section 5.4, changes in demand for Inbound Business travel can be decomposed into two components:

i. Relative price of travel; and

ii. Changes in the share of sales within Australia, that is contributed by imports.

Table 7.8 illustrates the simulation results for the Business Foreign Inbound tourism categories.

Table 7.8 Long Run Impacts on Changes in Foreign Demand for Business Travel

<table>
<thead>
<tr>
<th>Destination</th>
<th>Queensland</th>
<th>Price (%)</th>
<th>Quantity (%)</th>
<th>ROA</th>
<th>Price (%)</th>
<th>Quantity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>1.66</td>
<td>-2.57</td>
<td></td>
<td>3.19</td>
<td>-4.77</td>
<td></td>
</tr>
</tbody>
</table>

In QGEMF-T’s database, expenditure on the Australian Air Transport industry represents approximately 50% of total Australian expenditure by Inbound Business travellers. Therefore, the price rise in the Australian Air Transport industry induces a rise in the price of Inbound Business travel. With only a relatively small depreciation in the Australia dollar (0.03%), the price of Business travel faced by foreigners also rises (1.66% and 3.19% for Queensland and ROA respectively). However, the fall in demand for this tourism category is not simply a result of the rise in foreign currency price of Business travel.

Inbound Business travel demand is also assumed to be affected by changes in sales of goods and services from foreigners to Australia. As international imports in aggregate are falling (see Table 7.1) and Business travel by foreigners to Australia is assumed to respond negatively to this change, this impact also contributes to the decline in demand for Inbound Business travel.

As discussed in Section 5.4, it is assumed that Business travel is less price sensitive than Holiday or VFR travel. Therefore, it is expected that exports of Business travel would be less affected by changes in foreign currency prices than Holiday or VFR travel. In other words, business travel is more of a ‘means to an end’ rather than an end in itself. Also, in accordance with the behavioural assumptions for this category, when the total effect on Business travel demand is decomposed into its price and share of sales components, the price component contributes more to the fall in demand than the share of sales component does.

Finally, as shown by Figure 7.1, the share of domestic air transport in the cost structure of the Inbound Business category is greater in ROA than in Queensland. This explains the relatively larger rise in domestic prices in ROA as compared with Queensland, and consequently, the higher foreign currency price (3.19% in ROA compared to 1.66% in Queensland). This higher foreign currency price, combined with a larger decline in international imports into ROA (-0.18%) than into Queensland (-0.13%), explains the relatively larger fall in demand for this category in ROA (-4.77%) than Queensland (-2.57%).

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21Recall that foreign expenditure by foreigners is not modelled in QGEMF-T, and therefore any expenditure by foreigners on, for example, non-Australian air transport services is not included in this model.

22The change is international import volumes for Australia is a weighted sum of the change in international import volumes for Queensland and ROA.
7.1.7 Comparison with Simulation Results from Task 3A

The hypothetical scenario that was undertaken for Task 3A was repeated using the revised database in order to identify any divergence in the estimates caused by changes in the database values and parameters. Consequently, any remaining differences between the QGEM-T and QGEMF-T results are caused by changes stemming from the new dynamic model theory.

When the hypothetical simulation was repeated using the revised database the simulated productivity losses lead to a greater net economic impact. At the macroeconomic level this was reflected in a slightly larger projected impact on real GSP for Queensland and the ROA.

In general, the repeated simulation was projected to cause a larger decline in demand for each of the tourism categories. This is a result of assuming that tourism demand, for Holiday and VFR tourism categories, is more sensitive to changes in household income than was assumed in the Task 3A report. This change in parameter values implies that for a given decline in income the projected fall in demand for tourism categories would be greater.

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23 For a more detailed discussion of the tourism data in QGEMF-T and how tourism expenditure estimates contribute to components of GSP please refer to Appendix C.
8. The Simulation using QGEMF-T

In order to demonstrate the additional information a recursive dynamic model provides over and above the comparative static model, the same hypothetical scenario simulated in QGEM-T has been simulated using QGEMF-T.

The QGEM-T model described in the Task 3A report does not have an explicit treatment of time and therefore is inadequate to demonstrate the changing impacts through time of a simulation that is assumed to have different impacts spread over a number of years. However, as QGEMF-T deals with time explicitly it is possible to expand on the simulation conducted in the Task 3A report by making some assumptions about how the hypothetical scenario would occur over time. The hypothetical increase in security regulation affecting the domestic aviation market is assumed to have a direct impact on the economy that is spread over two years. More specifically, the simulation is assumed to lead to:

i. A 15% reduction in the productivity of capital in the Air Transport industry commencing in Year 1. Reflecting an increase in required infrastructure per unit of output for the Air Transport industry;

ii. A 15% reduction in the productivity of labour in the Air Transport industry commencing in Year 2. Reflecting an increase in labour costs per unit of output for the Air Transport industry; and

iii. A reduction in the productivity of labour in industries that undertake business travel commencing in Year 2. Reflecting an increase in travel-times/disruption for business travellers.

Although the direct impact of the simulation commences over a two year period, it is also assumed that the productivity reductions are sustained for the entire simulation period. That is, the reductions in the productivity of capital and labour are assumed to be permanent. This aspect of the simulation means that the long-run story should be comparable to that simulated in the Task 3A report.

Other assumptions adopted for the simulation include:

i. The supply of labour in each region is fixed, implying that there is no simulation-induced natural increase in population or interstate migration;

ii. The level of employment is flexible and real wages are “sticky” in the short run, but over time real wages adjust such that the level of employment returns to basecase levels in each region;

iii. The level of capital stock in each year is effectively fixed, being determined by investment activity in the previous year. Over time the level of capital adjusts such that rates of return, which deviate in the short run, return to basecase levels;

iv. Real government consumption deviates in line with real household consumption; and

v. Tax rates adjust such that each government’s budget position is unchanged by the policy changes.
The simulation results are provided in the following section. The preferred approach for discussing the simulation results is to provide a reasonably detailed description of the Year 1 results, followed by the results for Year 2. The focus is then turned to describing the long run impacts of the simulation (i.e. the impact 10 years after the last simulation shock was implemented).

Unless otherwise stated, the simulation results are presented as cumulative deviations from the basecase. The concept of cumulative deviations was described in Section 3.2.

8.1 Outline of the National Macroeconomic Results

Year 1: A 15% reduction in the productivity of capital in the Air Transport industry

In Year 1 of the simulation, the domestic Air Transport industry was assumed to require significant additional capital expenditure, equivalent to the current capital becoming 15% less productive. Based on the magnitude of the implemented policy shock it is expected that the direct effect of the Air Transport industry productivity loss is to reduce real GDP by 0.06%. That is, if no induced adjustments were to occur, the assumed loss in capital productivity would reduce real GDP by the amount implied by the lost production from the existing capital stock. However, overall real GDP in Year 1 is projected to decrease by 0.14% (see Figure 8.1) which is approximately three-times the direct effect.

Based on the cost structure of the domestic Air Transport industry, the assumed reduction in the productivity of capital would be expected to increase the Air Transport price nationally by approximately 2%. However, in the short run the capital stock constraints in Air Transport cause the price of capital to rise dramatically which, in turn, causes the price of Air Transport to rise above our a-priori expectations (5.61%).

Figure 8.1 Real GDP and Factor Inputs
(cumulative deviation from basecase)

In the long run, capital stocks are able to adjust in response to the reduction in the productivity of capital enabling prices to fall back to a level that is closer to the a-priori expectations.
The activity of the domestic Air Transport industry is projected to decline by 3.83% in Year 1. The projected decline in the activity of the Air Transport industry is less than that implied by the assumed reduction in the productivity of capital, indicating that the industry’s demand for labour (4.43%) is projected to increase.

The increase in the price of Air Transport increases the price of tourism, leading to a reduction in the demand for tourism related commodities. The output prices of other industries that purchase Air Transport are also projected to increase, leading to a reduction in the demand for their output. These reductions in demand translate into lower levels of industry activity and labour demand. Consequently, national employment in Year 1 is projected to fall by 0.12%. In Year 1, it is assumed that the physical units of capital in the economy are fixed at the basecase level, being predetermined by the previous year’s capital and the level of investment undertaken by industries in the previous year. That is, the projected deviation in national capital stock in any year is driven by forces prevalent in the previous year.

![Figure 8.2 Real GDP, Real Private Consumption and Real Investment (cumulative deviation from basecase)](image)

The projected reduction in demand for labour leads to a reduction in nominal wages, which combined with a lower level of national employment, translates into a reduction in household income. The projected lower average capital rental price combined with the fixed quantity of capital leads to a reduction in capital income and further contributes to the reduction in household income. The projected household income decline leads to a 0.14% fall in real private household consumption, and by assumption, an equal fall in real government consumption.

25 More correctly $K_t = K_{t-1} + I_{t-1} - \text{Depreciation}_{t-1}$

26 Relative to basecase. This can be interpreted as nominal wages rising less than in the basecase.
The assumed reduction in capital productivity in the Air Transport industry is projected to lead to an increase in the capital rental price relative to the construction price of capital in the Air Transport industry. The price of capital construction, which is largely dependent on the price of labour, falls marginally, whereas, because capital in the Air Transport industry has become relatively scarce, the rental price or profitability of each unit of capital in the industry rises.

The combined effect of the changes in the construction price and the rental price leads to an increase in the rate of return on capital in the Air Transport industry and a projected increase in investment by the industry. However, this increase in investment is offset by a projected decline in investment by other industries reflecting the projected decline in their activity. Overall, aggregate investment was projected to decline by 0.07% in Year 1.

The reduction in real private and government consumption leads to a 0.13% projected decline in import volumes in Year 1. Import volumes are projected to decline by slightly more than consumption, partly reflecting the projected real devaluation of the Australian dollar. This decline in the competitiveness of imports leads to some substitution of domestically sourced goods for imports. Additionally, luxury goods make up a sizeable component of imports, and such goods are assumed to be relatively income-elastic. Therefore, the demand for luxury goods would decline more than the total consumption bundle in response to the decline in household income.

The increase in the price of Air Transport leads to an increase in the price of Australian tourism categories. The prices of foreign inbound tourism categories are projected to increase by substantially more than the real devaluation of the Australian dollar. This implies that a holiday to Australia becomes more expensive to foreigners. Consequently, exports of tourism are projected to decrease by 5.86%. However, this reduction in tourism exports is offset to some extent by an increase in export volumes of those commodities that are not significant users of Air Transport (e.g. coal, oil and gas). Overall, national export volumes are projected to decline by 0.22% in Year 1.

**Year 2: A 15% reduction in the productivity of labour in the Air Transport industry**

In Year 2 of the simulation, the domestic Air Transport industry was assumed to require significant additional labour, equivalent to labour becoming 15% less productive. Additionally, labour productivity in industries that undertake business travel was assumed to decline according to the share of business travel in each industry’s cost structure. Based on the magnitude of the implemented policy shock it is expected that the direct effect of Air Transport industry productivity would be to reduce real GDP by 0.16% by Year 2. That is, if no offsetting adjustments were to occur, the assumed loss in labour productivity in the Air Transport industry would reduce real GDP by the amount implied by the lost production from the existing supply of capital and labour.

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27That is, the greater the share of total industry costs business travel accounted for, the greater the assumed decline in labour productivity in that industry.

28The effect of the assumed labour productivity reductions in industries that undertake business travel has not been included in this estimate of the direct impact on real GDP. However, the direct impact of these assumed reductions in labour productivity would be minor.
By Year 2, real GDP is projected to have decreased by 0.27% (see Figure 8.1). That is, since GDP was projected to fall by 0.14% in Year 1, GDP fell by an additional 0.13% in Year 2. Therefore, as was the case in Year 1, the QGEMF-T projection for Year 2 was larger than that implied by the direct effect alone.

Based on the cost structure of the domestic Air Transport industry, the assumed reduction in the productivity of labour would be expected to lead to an increase in the price of Air Transport of approximately 6% by Year 2. This a-priori expectation underestimates the QGEMF-T price rise estimate (9.58%) for the Air Transport industry. The increase in the price of Air Transport is projected to lead to a reduction in demand and consequently a reduction in the activity of the industry (-3.83%).

This decline in the activity of the Air Transport industry is less than the assumed reduction in factor inputs, indicating that the industry’s demand for factor inputs is projected to increase. Employment in Air Transport is projected to increase by 14.41% by Year 2, while the industry’s capital stock is projected to increase by 3.76%, reflecting the projected increase in investment that occurred in Year 1.

The additional increase in the price of Air Transport in Year 2 leads to a further increase in the price of tourism, and consequently a further reduction in the demand for tourism-related commodities. This reduction in activity leads to a further reduction in demand for labour, which is projected to outweigh the increase in demand for labour by the domestic Air Transport industry. Overall, national employment is projected to decline 0.13% by Year 2, implying an additional 0.01 percentage point decline in Year 2.

National capital stocks are projected to slightly increase (0.01%) by Year 2. This is despite a projected reduction in investment in the previous year. This apparent disparity is predominantly due to the different weights, drawn from QGEMF-T’s database, used to calculate these two (capital stock and investment) national aggregates.

The additional reduction in demand for labour in Year 2 leads to a further reduction in nominal wages relative to basecase. This decline in wages combined with a lower level of national employment, translates into a further reduction in household income. The decline in household income leads to a projected 0.26% fall in private household consumption by Year 2.

The increase in investment by Air Transport in Year 1 of the simulation leads to a 3.76% increase in the industry’s capital stock in Year 2. This increase in the capital stock is not sufficient to completely offset the assumed 15% reduction in capital productivity. Consequently the “effective” units of capital available to the industry are still projected to be below the basecase level.

Although the supply of capital increases in Year 2, it is still relatively scarce and the rental price of capital is projected to remain above the construction price of capital for Air Transport. Consequently, the rate of return on capital in Air Transport is projected to remain above the basecase and investment by the industry is also projected to remain above the basecase. However, the increase in investment by Air Transport is offset by a reduction in investment by other industries reflecting the projected decline in their activity. Overall aggregate investment is projected to decline by 0.29% by Year 2.

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29There is a small component due to changing industry shares coupled with different database assumptions concerning the rate of depreciation in each industry.
Aggregate import volumes are projected to decline by 0.36% by Year 2, reflecting the additional projected fall in consumption and investment. A further real depreciation of the Australian dollar (0.14%) is projected to occur in Year 2, leading to the substitution away from imports. Consequently, national import volumes are projected to decline by more than would be expected given the projected decline in consumption and investment.

Tourism exports are projected to decline further in Year 2, reflecting the projected increase in the price of Air Transport. Similar to Year 1, the projected depreciation of the Australian dollar is not large enough to compensate for the projected increase in the price of Australian tourism categories. Offsetting the reduction in tourism exports, is an increase in the export volumes from those industries that are not users of Air Transport.

**The Long Run**

In the long run, ten years after the last shock (i.e. by Year 12), the assumed reduction in the productivity of labour and capital in the domestic Air Transport industry is projected to lead to a permanent increase in the price of Air Transport of approximately 6%. The industry’s use of capital and labour is also projected to increase by approximately 12% by the long run as a result of the assumed productivity reduction. However, this increase in the industry’s use of labour and capital is less than the assumed 15% reduction in productivity. Consequently, the “effective” units of labour and capital available to the industry are projected to be below the basecase in the long run.

In the long run, it is assumed that the levels of investment and capital stocks adjust such that rates of return on capital return to approximately basecase levels. It was previously discussed that the assumed reduction in the productivity of labour and capital in the Air Transport industry led to a projected increase in the industry’s rate of return in the short run. Over time however, the projected increases in the level of investment and capital stock in the industry lead to a reduction in the rental price of capital. Consequently, the earlier positive deviation in the rate of return on capital is gradually eroded.

As a result of these direct effects in the Air Transport industry, real GDP is projected to remain 0.20% below the basecase in the long run. This decline in GDP reflects the assumed permanent reductions in capital and labour productivity which result in a long run reduction in household income relative to the basecase.

Real wages are assumed to adjust over time such that the effect of the policy simulation on employment is zero in the long run. Therefore, by assumption, the negative labour market effect of the productivity reductions is reflected in a reduction in real wages rather than reductions in employment. Real wages are projected to decline by 0.34% in the long run.

National investment is projected to remain slightly below the basecase (-0.06%) ten years after the last shock was implemented. This long run outcome for national investment is the result of the assumption that rates of return on capital fall back to approximately basecase levels in the long-run. It was previously discussed that the projected short run increase in investment in the Air Transport industry was offset by a reduction in investment by other industries. Therefore, in the long run the projected decreases in the level of investment and capital stock by other industries are projected to lead to an increase in the rental price of capital and the rates of return in those industries increase to basecase levels.

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30 The reduction in investment by other industries was caused by the projected decline in the rates of return on capital, in the early years, due to the lower levels of industry activity.
Real consumption (private household and government) is projected to remain below the basecase (-0.21%) in the long run, reflecting the projected reduction in household income.

National import volumes are projected to decline by 0.26% by the long run, slightly greater than the projected deviation in consumption and investment. This is partly a reflection of the substitution of domestically sourced goods for imports, resulting from the projected real devaluation in the exchange rate. Additionally, luxury goods make up a sizeable component of imports, and such goods are assumed to be more income-elastic. Hence, the demand for luxury goods would decline more than the total consumption bundle in response to the projected decline in household income.

National export volumes are projected to decline by 0.34% in the long run. Over this period the real devaluation in the exchange rate reported in Year 2 is projected to be slightly eroded. This implies that the competitiveness of Australia’s exports is still improved, relative to the basecase, but not as much as in Year 2. Therefore, the export increase for those industries that are not users of Air Transport is not projected to exceed the basecase by as much in the long run. Therefore, in the long run these exports have less of an offsetting effect on the projected reduction in tourism exports.

### 8.2 Effects on the Queensland Economy

In Year 1 of the simulation, capital in both Queensland and ROA Air Transport industries was assumed to become 15% less productive. Based on the magnitude of the implemented policy shock the a-priori expectation is that the direct effect of the Air Transport industry productivity loss will be to reduce Queensland’s real GSP by 0.08%. It is also expected that the direct impact of the assumed loss in capital productivity will have a greater impact in Queensland than at the national level. This is because capital rentals in the Air Transport industry account for a greater proportion of the Queensland economy. Overall, in Year 1 Queensland’s real GSP is projected to decrease by 0.20%, 0.06 percentage points more than real GDP (see Figure 8.3).

In Year 2 of the simulation, labour in the Queensland Air Transport industry was assumed to become 15% less productive, while labour productivity in industries that undertake business travel was assumed to decline according to the share of business travel in each industry’s cost structure. The direct impact of the assumed labour productivity losses is expected to have a lesser impact in Queensland than at the national level because employment in the Air Transport industry accounts for a smaller proportion of the Queensland economy. By Year 2, Queensland’s real GSP is projected to decrease by 0.27%. Therefore, the further reduction in Queensland’s real GSP in Year 2 was 0.07% compared to 0.13% in real GDP.
By Year 2 of the simulation, the Queensland and national economies are projected to decline by the same amount (-0.27%).

However, in the long-run, Queensland’s real private consumption (-0.12%) is projected to be less adversely affected by the simulation than national real private consumption (-0.21%). This is predominantly because household incomes are not projected to fall by as much in Queensland as in the ROA.

A general expectation would be that real consumption in a region would move with changes in income. However, by Year 12 real consumption in Queensland is not projected to fall by as much as would be expected given the reduction in Queensland real GSP (see Figure 8.4). If real consumption had moved in proportion to changes in real GSP then real consumption in QLD would have fallen by 0.14% not 0.12%.
As real consumption broadly moves with changes in disposable income, and income taxes are assumed to move by the same proportion in both regions, it can be concluded that pre-tax income in Queensland is not projected to fall by as much as in ROA. There are many reasons to explain the difference but the two key reasons are:

i. Differences in the aggregate quantity of capital stock in the two regions; and

ii. Changes to the domestic terms of trade (i.e. the price of interstate exports compared to the price of interstate imports for each region).

Firstly, the aggregate capital rental price in both regions moves by approximately the same amount, whereas the aggregate change in the quantity of capital is significantly different between the regions. Capital stock in ROA by Year 12 falls slightly (-0.02%), whereas Queensland’s capital stock is slightly above the basecase (+0.16%). A major component of the increase in Queensland’s capital stock is the strong increase in the capital stock of the Air Transport industry. Accentuating this effect is that, whilst the change in the aggregate capital rental price is similar in both regions, the rental price change for Air Transport is significantly more positive in Queensland than in ROA. The effect this has on Queensland’s income is somewhat spurious as it arises from the methodology used to implement the notion that Air Transport approximates a national industry. As noted in Section 9, an area for future research is how to more appropriately treat “national” industries such as Air Transport.

The second positive influence on household income in Queensland is the domestic terms of trade. The domestic terms of trade projections in this simulation are heavily influenced by the projected price story for Interstate Holiday and VFR travel. The projected price of Interstate travel to Queensland increases significantly more than Interstate travel to ROA. This effect improves the income (purchasing power) story for Queensland relative to ROA.
8.3 Aggregate Tourism Results

Figure 8.5 shows the change in Queensland GSP over the simulation period and tourism’s contribution to this change. It indicates that tourism contributes a greater share to the decline in GSP than the contribution from rest of the economy. This is not unexpected since tourism is highly dependent on Air Transport which is directly affected by the policy change. An interesting feature of Figure 8.5 is that tourism’s contribution to the decline in GSP increases over time. This fact demonstrates the dynamic features of QGEMF-T. It arises because, in QGEMF-T’s basecase, tourism activity is growing slightly faster than GSP. In the policy simulation tourism is more adversely affected than the overall economy which leads to minor share effects.

Figure 8.5 Comparison of Real GSP and Tourism’s Contribution to Real GSP
(cumulative deviation from basecase)

Aggregate tourism results for Queensland are reported in Table 8.1 below. It shows the following:

i. Real tourism GSP declines by 3.81% by Year 2, but is projected, in the long term, to recover significantly from the initial decline. As will be shown in the following section, the projected tourism adjustment follows closely the adjustment of the Air Transport industry following the initial policy shocks.

ii. Real household tourism expenditure is projected to decline significantly by Year 2, although it makes a partial recovery as household income makes a partial recovery following an initial decline.

iii. The Inter-region tourism trade balance is projected to deteriorate. This is largely due to a decrease in tourism expenditure in Queensland by residents of ROA (i.e. a decline in interstate travel from ROA). There are two reasons for this decline. Firstly, ROA

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31This effect takes account of the idea that the policy shocks can change the rate of economic growth by changing the structure of the economy (Dixon and Rimmer 2002).
household incomes are projected to decline more than Queensland household incomes. Because tourism is classified as a luxury good in QGEMF-T, this causes total tourism consumption by ROA households to decline more than for Queensland households. Secondly, the price of interstate travel is projected to rise relative to other travel, causing ROA households to substitute travel to other destinations for travel to Queensland.

iv. The international tourism trade balance is projected to decline, reflecting the significant projected reduction in Foreign Inbound travel to Queensland.

v. Both the international and inter-regional trade balances worsen throughout the simulation period. This can be explained as a compositional effect arising from tourism’s growth during the basecase.

<table>
<thead>
<tr>
<th>Table 8.1 Aggregate Tourism Results for Queensland</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>(cumulative deviation from basecase)</td>
<td>(%) change</td>
<td>(%) change</td>
<td>(%) change</td>
</tr>
<tr>
<td>Queensland</td>
<td>-2.61</td>
<td>-3.81</td>
<td>-2.68</td>
</tr>
<tr>
<td>Real tourism GSP</td>
<td>-0.31</td>
<td>-0.47</td>
<td>-0.44</td>
</tr>
<tr>
<td>Tourism contribution to change in Real GSP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real household tourism consumption expenditure.</td>
<td>-0.78</td>
<td>-1.17</td>
<td>-0.68</td>
</tr>
<tr>
<td>International tourism trade balance</td>
<td>-$256m</td>
<td>-$374m</td>
<td>-$399m</td>
</tr>
<tr>
<td>Inter-region tourism trade balance</td>
<td>-$44m</td>
<td>-$81m</td>
<td>-$85m</td>
</tr>
</tbody>
</table>

8.4 Impact on Queensland Tourism

The overall impact of the policy simulation on Queensland tourism can be calculated by summing the activity of the following tourism categories:

- Intrastate holiday, VFR and business travel by Queensland residents;
- Interstate holiday, VFR and business travel by ROA residents; and
- Foreign inbound holiday VFR and business travel by foreign residents.

The overall impact on tourism activity in Queensland and ROA is shown in Figure 8.6. It shows that tourism activity in ROA is slightly more adversely affected than activity in Queensland.

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32 This measure of the change in tourism GSP includes indirect effects.
33 Exports of tourism-related goods and services minus imports, in millions of $1996-97.
Figure 8.6  Projected Changes in Tourism Activity – Queensland and the Rest of Australia
(cumulative deviation from basecase)

There are two main reasons why tourism activity declines slightly more in ROA than in Queensland. The first relates to the effects of the policy on foreign travellers. Foreign holiday expenditure makes up a large component of total tourism expenditure in both regions\(^{34}\). However, the simulation results in a larger change in the price of foreign holidays to ROA than to Queensland. As it is assumed that foreigners are relatively price sensitive with regard to their travel destination, this price differential results in a significant reduction in foreign travel expenditure in ROA relative to Queensland.

The second important explanatory factor for the larger impact of the policy shock on tourism activity in ROA relates to intrastate travel. Intrastate travel accounts for a large percentage of total tourism expenditure in ROA in QGEMF-T’s database (approximately 29%) and is more negatively affected than intrastate travel in Queensland. Intrastate travel in ROA\(^{35}\) is more negatively affected because it uses a greater share of Air Transport than intrastate travel in Queensland counterpart and because household incomes in ROA are more negatively affected than Queensland household incomes.

The relative contributions of the various tourism categories on total activity of tourism in Queensland are highlighted in Figure 8.7. It shows that by far the most significant contribution to the decline in tourism activity comes from the decline in Inbound Holiday travel. The next most significant contributor is the decline in Interstate Holiday travel, while small increases in intrastate travel help to offset, to some extent, the decline in the remaining tourism categories.

\(^{34}\) According to the QGEMF_T database, expenditure by foreigners on holiday accounts for 26% of total tourism expenditure in Queensland and 22% in ROA.

\(^{35}\) In QGEMF-T the various states and territories that make up ROA are considered to be one region, therefore, Intrastate travel in ROA incorporates both travel within and between the states and territories that make up ROA.
Figure 8.7 Contributions of Selected Tourism Categories to Changes in Total Queensland Tourism Activity.

Figure 8.8 Contributions of selected tourism categories to changes in total Rest of Australia tourism activity.

* “Other tourism categories” is the sum of intrastate, interstate and Inbound VFR travel and intrastate, interstate and inbound business travel.

Figure 8.8 shows the contributions of the same tourism categories to the change in total ROA tourism activity. It highlights the difference between the contributions of Interstate Holiday travel between the two regions. In ROA, Interstate Holiday travel makes almost no contribution to the decline in overall tourism expenditure.
8.5 Tourism Category Results

In QGEMF-T, changes in demand for tourism commodities are, for the most part, determined by price changes. The extent to which these price changes bring about changes to demand depends on the behavioural rules assumed to apply to the different tourism categories in the model. As discussed previously, the key to understanding the price changes in each of the tourism categories is the extent to which each category uses Air Transport. As discussed in the previous chapter, Figure 7.1 shows the share of domestic Air Transport in the cost structure of each of the various tourism categories in the QGEMF-T database. It shows that Interstate Business and Intrastate Business categories have the highest domestic Air Transport cost shares, and hence show the highest price increases in response to the assumed fall in Air Transport productivity.

The projected price changes for selected tourism categories resulting from the policy shock are summarised in Figure 8.9. Note that, for illustrative purposes, the projected price changes to Air transport have been scaled down by a factor of three.

Figure 8.9 shows that the price of Air Transport is projected to increase markedly in the first few years of the simulation before returning to a level closer to the basecase as capital and labour adjustments occur over time.

The extent to which the tourism categories follow the price changes occurring in Air Transport depends on two factors:

i. The extent to which they use Air transport; and

ii. The price changes that occur to other inputs. For example, the Accommodation Cafes and Restaurants industry makes up a large share of the costs of many of the tourism categories, and its price change is quite different than the Air Transport industry.

To illustrate, the Inbound Holiday Tourism category most closely follows the pricing changes that occur in Air Transport. Approximately 25% of the total costs of this category arise from purchases of Air Transport. On the other hand, Air Transport accounts for less than 10% of the total expenditure by Queensland residents taking domestic holidays. This is reflected in the pricing changes that occur in the Domestic Holiday category shown in Figure 8.9.

36 The “Interstate” variables are reported as aggregate “Interstate” plus “Going interstate” variables for convenience.
37 The capital and labour adjustment mechanisms in QGEMF-T are discussed in Section 3.1.
38 Domestic holidays incorporate “Interstate”, “Going Interstate” and “Intrastate” holidays.
Figure 8.9  The Price of Queensland Tourism Categories  
(cumulative deviation from basecase)

* Air Transport price changes have been scaled down by a factor of three in order to highlight the price changes occurring in the selected tourism categories

Figure 8.10 shows the projected price changes in each year of the simulation for selected non-tourism industries. These industries were selected on the basis that they are all significant inputs into the various tourism categories. While Figure 8.10 shows that the projected price changes vary considerably, they all decline. This decline in the price of tourism inputs helps to offset the cost increases arising from increases in the price of Air Transport. The extent to which the price decreases in these commodities offsets cost increases arising from changes in the price of Air Transport varies depending on each tourism category’s usage of these commodities.

There are a number of reasons why the prices of these key tourism inputs decline in the first year of the simulation and then rise again after Year 3. One key reason has to do with the adjustment that occurs in the labour market. In the first few years of the simulation, employment falls and hence household income falls. The fall in household income decreases demand for the commodities shown in Figure 8.10. As demand falls, prices also fall. In the later years of the simulation, wages adjust such that employment increases. As employment increases, so does household income, which in turn stimulates demand for these commodities. As demand increases, the price of these commodities also increases.
The extent to which economic agents (e.g. household and business tourists) respond to these price changes depends on the behavioural rules and parameters assumed in QGEMT-F regarding the demand for the various tourism categories. The behavioural rules assumed for household and business tourists fall into three categories:

i. Foreign demand for Holiday and VFR travel;

ii. Domestic demand for Holiday and VFR travel; and

iii. Demand for Business travel.

Each of these categories are discussed in turn in the following sections.

8.5.1 Tourism Consumption by Domestic Households

The assumptions used in the comparative static version of the model, described in chapter 7, have been preserved in QGEMF-T. Domestic demand for tourism is assumed to vary with changes in the price of tourism (and the sensitivity of households to these price changes) and changes in household income. Relative to other goods, tourism purchases by households are assumed to be at the luxury end of the scale and hence sensitive to income changes.

In QGEMF-T, household income determines the level of luxury expenditure undertaken by households. As shown in Figure 5.2, the relative price of each tourism category determines the share of luxury expenditure devoted to each of the tourism categories. For example, the aggregate price of Holiday travel determines the share of luxury expenditure allocated to Holiday travel. The relative price of travel to each destination (intrastate, interstate and
overseas) determines the share of total Holiday travel expenditure that is allocated to each destination.

As discussed in Section 8.1, household income is projected to fall substantially in the first few years of the simulation before returning to a level just below the basecase by Year 12. Because tourism expenditure is assumed to be relatively income elastic, it is expected that real aggregate tourism expenditure by households would decline more than aggregate real private consumption (in the absence of any relative price effects). This is illustrated in Figure 8.11, which shows that aggregate real tourism consumption by households declines by considerably more than real household consumption. Therefore, not only is tourism expenditure by households declining, but the share of tourism in total household consumption is also declining.

**Figure 8.11  Real Household Consumption and Aggregate Tourism Consumption by Queensland households**

(Cumulative deviation from basecase)

- Within overall household tourism expenditure, the model firstly determines expenditure related to each *purpose of visit* – Holiday, VFR and Business. The results for each of these *purposes of visit* vary according to their individual price elasticities, coupled with the changes in the price relativities between each of the *purposes of visit*. Figure 8.12 shows the projected changes to household consumption of tourism by *purpose of visit*. It shows that household consumption of travel for the purpose of visiting friends and relatives is projected to decline significantly more than holiday travel. The relative changes in household consumption reflect the relative changes in the price of each of the *purposes of visit* tourism aggregates.

For example, the aggregate price of VFR travel by Queensland residents is projected to increase (0.95% in Year 1 and 0.79% by Year 12) more than Holiday travel (0.33% in Year 1 and 0.35% by Year 12). The projected price changes reflect the higher relative cost share of Air Transport in the VFR tourism categories.
The results reported in Figure 8.12 are the weighted averages of tourism household expenditure for each type of tourism by reason of travel. Within these purposes of visit, the model allows households to choose between three destinations – intrastate, interstate and overseas. It is assumed households make decisions about travel destination based on price. However, the assumed sensitivity of households to relative price changes varies according to the purpose of visit. For example, it is assumed that VFR travellers are more constrained in their destination of choice by the location of the people they are visiting. That is, they are less likely to change travel destination in response to changes in the relative price of travel to each region.

The projected price and quantity changes for travel to each region, by purpose of visit are presented in Table 8.2 and Table 8.3 below.
### Table 8.2 Holiday Tourism Expenditure by Queensland Households by Destination (cumulative deviation from basecase)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Year 1 (Quantity %)</th>
<th>Year 2 (Quantity %)</th>
<th>Year 12 (Quantity %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>-1.55</td>
<td>-2.27</td>
<td>-1.28</td>
</tr>
<tr>
<td></td>
<td>0.55</td>
<td>0.83</td>
<td>0.52</td>
</tr>
<tr>
<td>Intrastate</td>
<td>0.22</td>
<td>0.19</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td>Overseas</td>
<td>-1.98</td>
<td>-2.75</td>
<td>-1.19</td>
</tr>
<tr>
<td></td>
<td>0.66</td>
<td>0.96</td>
<td>0.49</td>
</tr>
</tbody>
</table>

### Table 8.3 VFR Tourism Expenditure by Queensland Households by Destination (cumulative deviation from basecase)

<table>
<thead>
<tr>
<th>Destination</th>
<th>Year 1 (Quantity %)</th>
<th>Year 2 (Quantity %)</th>
<th>Year 12 (Quantity %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>-1.31</td>
<td>-1.70</td>
<td>-1.01</td>
</tr>
<tr>
<td></td>
<td>1.38</td>
<td>2.15</td>
<td>1.24</td>
</tr>
<tr>
<td>Intrastate</td>
<td>-0.87</td>
<td>-1.29</td>
<td>-0.78</td>
</tr>
<tr>
<td></td>
<td>0.32</td>
<td>0.49</td>
<td>0.28</td>
</tr>
<tr>
<td>Overseas</td>
<td>-1.14</td>
<td>-1.67</td>
<td>-0.97</td>
</tr>
<tr>
<td></td>
<td>1.42</td>
<td>2.02</td>
<td>1.07</td>
</tr>
</tbody>
</table>

### 8.5.2 Tourism Consumption by Foreign Households

The demand for holiday and VFR travel by foreign households is assumed to vary with the foreign currency price of the relevant tourism category. This implies that foreign travellers respond to price changes when deciding whether to travel to Australia or to some other overseas destination.

The foreign currency price of tourism is inclusive of any variations in the exchange rate. In the simulation the exchange rate is projected to depreciate by 0.23% in the first year before depreciating a further 0.14% in the second year (giving a total depreciation of 0.37% over two years). From year 3 the exchange rate appreciates (relative to year 2) as the economy adjusts, such that by Year 12 the overall depreciation is only 0.15%. In isolation, the exchange rate changes makes Australia a slightly cheaper destination relative to other destinations. However, the increase in the Air Transport price more than offsets the exchange rate effect, resulting in a substantial increase in the price of Australian tourism.

The extent that foreign households respond to price changes is assumed to vary with the purpose of visit. For example, as shown in Table 8.4, the demand for Queensland Holidays by foreigners is projected to decrease by 8.74% by the second year of the simulation, in response to a 2.28% increase in price. Queensland VFR exports experience a similar price change (3.10%), however, the change in demand is projected to decrease by only 2.74%.

The difference in the response to the price change is explained by the choice of price elasticity parameters used in the export demand equations in QGEMF-T. It is assumed that
foreigners travelling to Queensland for the purposes of visiting friends and relatives have fewer options about their choice of destination than foreigners visiting for the purpose of holidays and hence are less sensitive to price changes. The export price elasticity parameters in QGEMF-T imply that foreign demand for VFR travel is approximately half as price sensitive as foreign demand for holiday travel.

Table 8.4 Foreign Household Demand for Tourism  
(cumulative deviation from basecase)

<table>
<thead>
<tr>
<th>Purpose of visit</th>
<th>Destination</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holidays</td>
<td>QLD</td>
<td>-6.28</td>
<td>-8.74</td>
<td>-5.72</td>
</tr>
<tr>
<td></td>
<td>ROA</td>
<td>-6.62</td>
<td>-11.91</td>
<td>-8.41</td>
</tr>
<tr>
<td>VFR</td>
<td>QLD</td>
<td>-1.96</td>
<td>-2.74</td>
<td>-1.80</td>
</tr>
<tr>
<td></td>
<td>ROA</td>
<td>-3.06</td>
<td>-5.59</td>
<td>-3.87</td>
</tr>
</tbody>
</table>

Differences in demand for tourism between the two regions (Queensland and ROA) occur because of compositional differences. Foreign inbound Holiday and VFR travellers visiting ROA use a higher share of Air Transport than their counterparts in Queensland\(^{39}\). This causes the price of Foreign inbound Holiday and VFR travel to ROA to increase more than to Queensland, and subsequently has a greater impact on demand. The relative changes in demand that occur from year 1 to year 2 of the simulation occur because of compositional differences between the Air Transport industries in Queensland and ROA. The Air Transport industry in Queensland is more capital intensive than the Air Transport industry in ROA. For this reason, the impact of the capital productivity shock in the first year has a greater impact in Queensland.

8.5.3 Business Tourism Consumption by Domestic Industries

Demand for business travel by each industry is determined in QGEMF-T by a combination of the following factors:

i. Industry activity. Use of the business tourism aggregate by each industry is assumed to vary in fixed proportion to output. In this respect business tourism is like any other business input in QGEMF-T.

ii. Relative changes in the sales share to each region. If an industry increases sales to a region (intrastate, interstate or overseas) relative to the other regions, it is assumed they will require more business travel to that region in order to facilitate those sales. Therefore this aspect changes the distribution of business travel for any given level of business travel.

Since business travel demand is assumed to vary with activity, it is expected that aggregate business travel demand would track relatively closely with aggregate activity.

Figure 8.13 demonstrates the relationship between aggregate activity (measured as real GSP) and aggregate business tourism demand for Queensland. The correlation between total output and aggregate business travel demand is not perfect since each industry uses different shares of business travel in its production function and not all industries are affected the same by the policy shocks.

\(^{39}\) According to QGEMF-T’s database.
As mentioned above, the demand for business travel in QGEMF-T is determined by both activity and the changes in the sales shares to each region. Table 8.5 demonstrates the effects of the latter assumption. It shows that demand for intrastate business travel is projected to decline relatively more than demand for business travel to the other regions. This is despite the price of intrastate business travel being projected to increase by relatively less than interstate travel. This effect is driven by the projection of a slight relative decline in the local share of sales by Queensland industries and a rise in the relative share of sales to the other destinations.

Note that business travel rebounds faster than GSP such that, by the end of the simulation the ratio of business travel to GSP has increased. This effect arises because those industries that use relatively high shares of business travel are less adversely affected than the economy-wide average.

### Table 8.5 Changes in real business tourism expenditure by Queensland industries by destination

<table>
<thead>
<tr>
<th>Destination</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>Quantity (%)</td>
<td>-0.60</td>
<td>-0.74</td>
</tr>
<tr>
<td></td>
<td>Price (%)</td>
<td>2.20</td>
<td>3.48</td>
</tr>
<tr>
<td>Intrastate</td>
<td>Quantity (%)</td>
<td>-0.71</td>
<td>-0.97</td>
</tr>
<tr>
<td></td>
<td>Price (%)</td>
<td>2.16</td>
<td>3.12</td>
</tr>
<tr>
<td>Overseas</td>
<td>Quantity (%)</td>
<td>-0.38</td>
<td>-0.50</td>
</tr>
<tr>
<td></td>
<td>Price (%)</td>
<td>1.24</td>
<td>2.23</td>
</tr>
</tbody>
</table>
8.5.4 Business Tourism Consumption by Foreign Industries

As mentioned previously, changes in the demand for Inbound Business travel can be decomposed into two components:

i. The relative price of Inbound Business travel; and

ii. Changes in the volumes of imported goods sold in Australia.

Figure 8.14 shows the relationship between import volumes, the price of Inbound Business travel and the demand for business travel to Queensland by foreign businesses. It shows that the domestic price effects are responsible for the majority of the foreign price change. It is assumed that foreign business travellers are relatively sensitive to price changes – a price elasticity of 1.5 is used in QGEMF-T – this implies that for a 1% change in the (foreign currency) price of business travel, foreign demand for business travel will change by 1.5%. This price elasticity assumption means that, while the decrease in import volumes contributes to the projected decrease in demand, the price increases are the main explanatory factor for the decline in demand for business travel by foreign businesses.

Figure 8.14 Business Travel to Queensland by Foreign Industries
(cumulative deviation from basecase)
8.6 Specific industry effects (non-tourism categories)

QGEMF-T provides industry results for 108 industries in addition to the 18 tourism categories. Normally, in a simulation report these industry results are discussed in detail. However, as the purpose of this report is to illustrate the range of information that a recursive dynamic tourism model is able to provide, this report limits the industry discussion to a few indicative industry results.

Figure 8.15 shows the cumulative changes to output for the three most adversely affected industries in Queensland.

Not surprisingly, Air Transport is the most adversely affected industry. In the first two years of the simulation the shocks to capital and labour productivity raise industry costs per unit of output. The price of Air Transport is projected to rise by 10.12% by the second year of the simulation. The direct effect of this price rise is that households and foreign travellers substitute away from air travel. Indirectly, the price rise in Air Transport raise the costs of those industries that use Air Transport. In turn, this causes output from these industries to decline. As output for those industries decline, they need fewer inputs, including Air Transport.

In the remaining ten years of the simulation, output of the Air Transport industry recovers significantly from the initial decline and stabilises around 2% below the basecase level of output. The recovery of the Air Transport industry occurs for two main reasons. Firstly, as outlined in Section 3.1 it takes a number of years for an industry to adapt its capital stocks in response to a shock. In the first two years of the simulation, the Air Transport industry has a shortage of capital stock, which forces the rental rate higher and therefore increases costs. However, as the simulation progresses, the Air Transport industry is able to attract more capital and the rental rates fall, helping to reduce costs in the out years of the simulation. The second reason for the partial recovery of the Air Transport industry is that the price of labour falls as wages adjust to maintain the basecase level of employment. An overview of the recursive dynamic mechanisms behind the capital and labour markets modelled in QGEMF-T can be found in Section 3.1 and in more detail in Appendix B.

The next most adversely affected industry is Accommodation, Cafes and Restaurants. There are two factors that explain the decline in the output for this industry. The first lies with the tourism categories use of Accommodation, Cafes and Restaurants. According to QGEMF-T’s database, the tourism categories purchase approximately 48% of the output of Accommodation, Cafes and Restaurants. As has been shown in the previous sections, output of tourism services declines markedly over the simulation period. As tourism output declines, so does demand for tourism inputs, including Accommodation, Cafes and Restaurants.

The second reason behind the decline in Accommodation, Cafes and Restaurants is that household consumption is responsible for an additional 33% of the total usage of Accommodation, Cafes and Restaurants. As shown in Section 8.1 above, household income, and hence consumption, declines over the simulation period.

---

40 That is, non-tourism consumption of Accommodation, Cafes and Restaurants.
Another adversely affected industry is the Queensland Aircraft Manufacturing\textsuperscript{41} industry. According to QGEMF-T’s database, approximately 50\% of the output of this industry is sold to the Air Transport industry as intermediate goods. The adverse impacts on the Aircraft manufacturing industry can be explained in these terms. As Air Transport activity declines its demand for Aircraft also declines.

**Figure 8.15  Output for Selected Adversely Effected Queensland Industries**  
(cumulative deviation from basecase)

Figure 8.16 shows the changes to output for three of the most positively affected industries in Queensland. The results for these industries are interesting since they show very different patterns over the simulation time frame. All three industries do well because of the changes in the exchange rate (the exchange rate\textsuperscript{42} changes are also plotted in Figure 8.16). However, differences in the costs and sales of these industries make the projected output for the three industries vary considerably over the simulation period.

In QGEMF-T there is no explicit determination of exchange rates. The model has no currency market nor mechanisms for future expectations to influence exchange rates as may exist in other models. Rather, in QGEMF-T, the exchange rate facilitates goods and service markets to clear. In this simulation a supply side shock occurs which causes output of a number of industries to decline. This frees up resources in the economy. In the model it is assumed that foreign demand is relatively elastic and so exchange rates move such that demand increases so that these resources are absorbed.

\textsuperscript{41}According to QGEMF-T’s database, approximately 76\% of the output of the Queensland Aircraft Manufacturing industry is sold as intermediate goods, suggesting activity is directed towards the manufacture of parts rather than entire aircraft.

\textsuperscript{42}The exchange rate is shown as $\text{AUS}/\text{SF}$. An increase in the exchange rate represents a depreciation in the Australian dollar such that it makes the foreign currency price of exports lower.
Output of Services to Agriculture is projected to increase significantly over the first few years before declining to a level still above the basecase. According to QGEMF-T’s database, over 50% of the output of Services to Agriculture is exported\(^43\), with most of the remainder sold to other export intensive industries. For this reason output for this industry follows a very similar pattern as the projected changes to the exchange rate. As shown in Figure 8.16, exchange rates are projected to depreciate\(^44\) sharply in the first two years before tracking back to a level just above the basecase.

**Figure 8.16  Output for Selected Queensland Industries (cumulative deviation from basecase)**

![Figure 8.16](image)

Whilst Footwear Manufacturing only makes up a very small share of the Queensland economy, the results for this industry illustrate the adjustment mechanisms in QGEMF-T. Output from Footwear Manufacturing is projected to increase rapidly in the first few years and then continue to slowly increase during the simulation period. Initially the Footwear industry benefits from the exchange rate depreciation; however, unlike Services to Agriculture, it is able to continue to increase output as exchange rates begin to appreciate after year two of the simulation. The explanation for this is related to the labour market adjustment process in QGEMF-T.

\(^{43}\) According to the Queensland Input Output tables these are direct sales overseas, not sales to domestic agricultural firms engaged in export activity.

\(^{44}\) Reducing the foreign currency price of exports.
Unlike Services to Agriculture, Footwear is very labour intensive (labour makes up approximately 61% of total costs) and so benefits from the fall in labour prices\textsuperscript{45} as the simulation progresses through time. Decreased labour prices allow the Footwear industry to maintain its competitiveness despite an appreciation of the exchange rate in the latter half of the simulation period.

Finally, the output of the Queensland Motor Vehicles and Parts industry is projected to increase in the early years and then maintain this level of output. The industry is characterised by a relatively high share of sales to households (approximately 20%), a relatively high share of labour costs (approximately 20% of total costs), and by being trade exposed\textsuperscript{46}. In the early years motor vehicles benefit from the changes to the exchange rate. The industry doesn’t benefit as much as many other industries however, because of declining household income. By year three of the simulation, household income begins to make a partial recovery boosting sales of motor vehicles. At the same time however, exchange rates begin to appreciate, making domestic production relatively more expensive than in the previous years of the simulation. The impact of the exchange rate on the competitiveness of the industry is offset by declining labour costs and rising household incomes such that the industry is able to maintain output at a relatively constant rate in the final years of the simulation.

\textsuperscript{45}The fall in labour prices occurs as wages adjust such that the pre-existing level of employment is reached by the end of the simulation. A discussion of the labour market adjustment process in QGEMF-T can be found in Section 3.1.

\textsuperscript{46}That is, the domestic industry faces extensive import competition.
9. Future Work

Since the completion of the Task 3A report, OESR has undertaken a significant amount of research to develop a recursive dynamic model of tourism QGEMF-T. While developing QGEMF-T several areas for possible future research have been identified:

i. In undertaking the hypothetical simulation (as described in Section 7) OESR identified that further research could be undertaken on how to more appropriately model the behaviour of industries that are thought to operate as “national” industries, for example the Air Transport industry. As QGEMF-T models Queensland and ROA as economies in their own right, the Air Transport industries in both regions have the ability to respond differently to a simulation. However, to the extent that Air Transport firms operate as a national firm, the industries in the two regions should respond similarly to a simulation;

ii. Further research on the business travel theory, so that the Business tourism category is treated as a margin good that is used by firms in order to conduct their business. It is thought that this new behavioural theory of Business tourism is a more realistic representation of firms demand for business travel; and

iii. Research on the impact that dynamic-share effects in the basecase simulation have on the policy simulation results. In particular, the impacts of how the terms of trade of tourism categories evolve over time.

iv. In QGEMF-T there is currently no facility to provide results at the statistical division level but development of this capacity may occur in the future. This may be in conjunction with OESR’s research on the construction of comprehensive industry data at the statistical division level in Queensland.
10. Bibliography


## Appendix A - Commodities and Industries in QGEMF-T

### Table A.1  Commodities and Industries in QGEMF-T

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sheep</td>
<td>56</td>
<td>Basic non-ferrous metals and products</td>
</tr>
<tr>
<td>2</td>
<td>Grains</td>
<td>57</td>
<td>Structural metal products</td>
</tr>
<tr>
<td>3</td>
<td>Beef cattle</td>
<td>58</td>
<td>Sheet metal products</td>
</tr>
<tr>
<td>4</td>
<td>Dairy cattle</td>
<td>59</td>
<td>Fabricated metal products</td>
</tr>
<tr>
<td>5</td>
<td>Pigs</td>
<td>60</td>
<td>Motor vehicles and parts etc</td>
</tr>
<tr>
<td>6</td>
<td>Poultry</td>
<td>61</td>
<td>Ships and boats</td>
</tr>
<tr>
<td>7</td>
<td>Other agriculture</td>
<td>62</td>
<td>Railway equipment</td>
</tr>
<tr>
<td>8</td>
<td>Sugar cane growing</td>
<td>63</td>
<td>Aircraft</td>
</tr>
<tr>
<td>9</td>
<td>Services to agriculture; hunting and trapping</td>
<td>64</td>
<td>Photographic and scientific equipment</td>
</tr>
<tr>
<td>10</td>
<td>Forestry and logging</td>
<td>65</td>
<td>Electronic equipment</td>
</tr>
<tr>
<td>11</td>
<td>Commercial fishing</td>
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<td>Household appliances</td>
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<tr>
<td>12</td>
<td>Coal; oil and gas</td>
<td>67</td>
<td>Other electrical equipment</td>
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<td>Iron ores</td>
<td>68</td>
<td>Agricultural, mining etc machinery</td>
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<tr>
<td>14</td>
<td>Non-ferrous metal ores</td>
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<td>Other machinery and equipment</td>
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<td>Services to mining</td>
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<td>Meat and meat products</td>
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<td>73</td>
<td>Electricity supply</td>
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<td>Fruit and vegetable products</td>
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<td>Gas supply</td>
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<td>Oils and fats</td>
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<td>Water supply, sewerage and drainage</td>
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<td>Flour mill products and cereal foods</td>
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<td>Residential building construction</td>
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<td>Bakery products</td>
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<td>Other construction (non-residential construction)</td>
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<td>Confectionery</td>
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<td>Wine and spirits</td>
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<td>Accommodation, cafes and restaurants</td>
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<tr>
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<td>Tobacco products</td>
<td>83</td>
<td>Road transport</td>
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<td>Textile fibres, yarns and woven fabrics</td>
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<td>Rail, pipeline and other transport</td>
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<td>Clothing</td>
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<td>Footwear</td>
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<td>Communication services</td>
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<td>Insurance</td>
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<td>Paperboard containers; paper bags and sacks</td>
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<td>Ownership of dwellings</td>
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<td>Printing and services to printing</td>
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<td>Other property services</td>
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<td>Scientific research, technical and computer services</td>
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<td>Health services</td>
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<td>Community services</td>
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<td>Rubber products</td>
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<td>Motion picture, radio and television services</td>
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<tr>
<td>49</td>
<td>Plastic products</td>
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<td>105</td>
<td>Sport, gambling and recreational services</td>
</tr>
<tr>
<td>51</td>
<td>Ceramic products</td>
<td>106</td>
<td>Personal services</td>
</tr>
<tr>
<td>52</td>
<td>Cement, lime and concrete slurry</td>
<td>107</td>
<td>Other services</td>
</tr>
<tr>
<td>53</td>
<td>Plaster and other concrete products</td>
<td>108</td>
<td>Non-competing imports</td>
</tr>
<tr>
<td>54</td>
<td>Other non-metallic mineral products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Iron and steel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table A.2  Margin Commodities in QGEMF-T

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wholesale trade</td>
</tr>
<tr>
<td>2</td>
<td>Retail trade</td>
</tr>
<tr>
<td>3</td>
<td>Accommodation, cafes and restaurants</td>
</tr>
<tr>
<td>4</td>
<td>Road transport</td>
</tr>
<tr>
<td>5</td>
<td>Rail, pipeline and other transport</td>
</tr>
<tr>
<td>6</td>
<td>Water transport</td>
</tr>
<tr>
<td>7</td>
<td>Air and space transport</td>
</tr>
<tr>
<td>8</td>
<td>Services to transport; storage</td>
</tr>
<tr>
<td>9</td>
<td>Insurance</td>
</tr>
</tbody>
</table>
Appendix B - Recursive Dynamic Theory: Capital and Labour Markets

B.1 Capital Market

Two broad treatments of capital, investment and rates of return are employed in QGEMF-T. The first is for comparative-static simulations, similar to those carried out in Task 3A. For long-run comparative static simulations industry capital stocks are assumed to respond endogenously to exogenously imposed shocks, eliminating any disturbances in the rates of return. This is achieved via a closure in which rates of return are exogenous and industry capital stocks are endogenous. Having determined the percentage changes in capital we can then tie down the effect on investment, by industry, by assuming no change in industry investment/capital ratios.

For short-run comparative static simulations it is assumed that industry rates of return respond endogenously to eliminate any disturbances to industry capital stocks. This is achieved by making rates of return endogenous and industry capital stocks exogenous (and set to zero change). Again, investment is tied down by assuming no change in investment/capital ratios.

The second broad treatment of capital, investment and rates of return in QGEMF-T is for year-to-year simulations in which explicit time paths for variables are traced out. In each year it is assumed that an industry’s capital growth rate (and hence investment) is constrained by the supply of funds available for investment. The model specifies that investors are willing to supply increased funds for investment in each industry in response to an increase in the expected rate of return on capital in the industry. Also it is assumed that the capital supply functions limit the growth in each industry’s capital stock so that disturbances in the industry’s rate of return are eliminated gradually.

In QGEMF-T, investors are assumed to have static expectations. Therefore, if investors expect no change in the tax rate, then they will expect that rental rates and asset prices will increase uniformly by the current rate of inflation.

In year-to-year simulations, the capital stock of an industry available for production in the solution year, year t, is the capital stock from the previous year, year t-1, plus any investment that occurred in year t-1, less depreciation. Investment in year t (which determines the capital available in the next year, t+1) is determined by the expectations, in year t, of owners of capital for each industry’s rate of return in period t+1. The expectations of owners of capital can be split into two parts. One part is the expected equilibrium rate of return. This is the expected rate of return required to sustain indefinitely the current rate of capital growth in each industry. The second part is a measure of the disequilibrium in each industry’s current expected rate of return. That is, the difference between the actual rate of return and the rate of return necessary to sustain the current capital growth rate.

\[ \text{EROR} = \text{EEQROR} + \text{DISEQROR} \]

where \text{EROR, EEQROR} and \text{DISEQROR} are the levels in year t of the expected rate of return, the expected equilibrium rate of the return and the disequilibrium in the expected rate of return.
QGEMF-T investment theory in year-to-year simulations then relates the expected equilibrium rate of return for each industry to the industry’s current rate of growth of capital. As shown in Figure B.1, the relationship has an inverse logistic form where:

- $RORN$ is a coefficient representing the industry’s historically normal rate of return;
- $K_{GR\_{MIN}}$ is a coefficient, which sets the minimum possible rate of growth of capital;
- $K_{GR\_{MAX}}$ is a coefficient which sets the maximum possible rate of growth of capital; and
- $TREND$ is a coefficient set equal to the industry’s historically normal rate of capital growth.

**Figure B.1 The Equilibrium Expected Rate of Return Schedule**

![Diagram showing the equilibrium expected rate of return schedule](image)

The following explanation of the concepts that lie behind Figure B.1 are taken from Dixon, Parmenter and Rimmer (1998). Suppose that initially the disequilibrium in the expected rate of return is zero. Then for an industry to attract sufficient investment in year $t$ to achieve a capital growth rate of $TREND$ it must have an expected rate of return equal to its long-term average ($RORN$).

For the industry to attract sufficient investment in year $t$ for its capital growth to exceed its long-term average ($TREND$), its expected rate of return ($EEQROR$) must be greater than $RORN$. Conversely, if the expected rate of return on the industry’s capital falls below $RORN$,
then investors will restrict their supply of capital to the industry to a level below that required to sustain capital growth at the rate of \( TRENDR \).

If an initial disequilibrium in the expected rate of return is present, it is gradually eliminated over time using a constant parameter. This parameter determines the speed at which the disequilibrium moves towards zero.

**B.2 Regional Employment and Regional Wages**

The regional\(^{47}\) labour market module of QGEMF-T relates regional population and regional population of working age and regional labour supply. It also defines regional unemployment rates in terms of regional demand and supply of labour.

There are four elements that could be targeted in QGEMF-T to construct a plausible economic closure. These are labour supply, through the regional migration variable, the regional unemployment rate, the local price of labour and the regional wage differential. In theory this gives us four possible regional labour market closures:

i. Regional labour supply and unemployment rates are fixed (exogenous) and the regional wage differentials adjust to clear the labour market;

ii. Regional wage differentials and unemployment rates are exogenous and regional labour supply is endogenous (i.e. we allow interstate migration to clear the labour market);

iii. Regional labour supply and wage differentials are exogenous and regional unemployment rates are endogenous; and

iv. Both labour supply and the unemployment rate are endogenous and regional wage differentials are exogenous.

QGEMF-T, however, does not have a suitable mechanism to resolve a closure where both labour supply and the unemployment rate are endogenous. Therefore, the last closure is not feasible in practice. In addition, while it is possible to allow labour supply to adjust through interstate migration, we recognize that the model does not (as yet) suitably account for the adjustment costs that are implicit in the decision for a household to move between regions. For this reason we tend to have labour supply exogenous when running policy simulations with QGEMF-T.

In comparative static analysis with QGEM-T, one of the following two assumptions is made about the operations of the labour market at the national and or state level:

i. real wages adjust so that any policy shock has no effect on employment; or

ii. real wages are unaffected by the shock and employment adjusts.

In conducting year-to-year policy simulations with QGEMF-T it is possible to take an intermediate position. This allows real wages to be sticky in the short run but flexible in the long run and employment to be flexible in the short-run but sticky in the long run.

More specifically, when deriving the QGEMF-T basecase, we explicitly target labour supply (see Section 6.2 for more detail) and implicitly target unemployment. When running QGEMF-T in policy mode we assume that real wages adjust over time such that the employment effects of a shock are largely eliminated after eight years (i.e. eight years after

\[^{47}\) The two regions in QGEMF-T are Queensland and ROA.
the shock is applied the deviation in the unemployment rate from the base case rate is approximately zero).

The real wage adjustment process described above occurs at both the national and the regional level. At the national level, the national wage rate adjusts over time such that the policy induced change in national unemployment is zero. At the regional level, the Queensland wage adjusts relative to the national wage such that the policy induced Queensland unemployment is also zero.

The coefficient of adjustment is chosen so that the employment effects of a shock are largely eliminated after eight years. This labour market structure in QGEMF-T is consistent with macroeconomic modelling in which the Non-Accelerating Inflation Rate of Unemployment (NAIRU) is exogenous.
Appendix C – Calculating the Economic Contribution of Tourism

Previous OESR reports have estimated both tourism expenditure and the contribution of tourism to the Queensland economy. Tourism expenditure is simply a measure of expenditure occurring in a region regardless of the origin of the goods purchased. A contribution measure, on the other hand, attempts to measure the net effect of this expenditure on the economy. Contribution measures consider the source of goods purchased since imports from overseas and interstate do not add to GSP. For tourism this is especially true since a large proportion of tourism activity is trade related.

Typically, CGE models like QGEMF-T are used to estimate the net economic impact of particular policies or events, and therefore are more concerned with the net effects of a policy (for example the net trade effects of a policy) rather than measures such as gross expenditure. For these reasons tourism’s contribution to GSP rather than tourism expenditure is the primary focus of QGEMF-T.

GSP can be calculated from both the expenditure and income\textsuperscript{48} sides of the economy. However, when calculating an industry’s contribution to GSP this is traditionally done from the income side. Attempting to calculate an industry’s contribution to GSP from the expenditure side would be misleading since each industry’s output can be sold for intermediate usage (i.e. to other industries), which does not contribute to GSP from an expenditure perspective, or final usage, which does contribute to GSP.

Some difficulties arise when attempting to measure tourism’s contribution to GSP. These difficulties arises because, in QGEMF-T tourism is not classified as an industry.\textsuperscript{49} Rather, tourism is considered to be a category of demand. More specifically, it is expenditure on the output of a number of industries for the purpose of undertaking tourism activities. For this reason it makes sense to measure tourism’s contribution to GSP from the expenditure side. This is the approach adopted in the body of this report.

One consequence of measuring GSP from the expenditure side is that it does not provide a measure for comparing, or ranking, tourism against industry activity. OESR’s report “The Contribution of International and Domestic Visitor Expenditure to the Queensland Economy: 1998-99”, provides a proxy for the contribution of tourism from the income side in order to allow a comparison of tourism’s contribution to GSP. In order to facilitate some comparison between the tourism estimates in the OESR contribution report and the estimates in the QGEMF-T database, OESR has calculated a similar proxy measure for tourism’s contribution to GSP using the estimates in the QGEMF-T database.

The 1998-99 estimates of tourism expenditure and tourism contribution from the income side presented in the OESR contribution report are presented below (see Table C.1). Also presented in Table C.1 are the 1996-97 estimates of tourism contribution from the income side that have been calculated using the QGEMF-T database. Note, however, that the

\textsuperscript{48} The expenditure side of the economy is the sum of household and government consumption, investment and exports less imports. The income side is the sum of the returns to primary factors (labour, capital and land) plus indirect taxes.

\textsuperscript{49} QGEMF-T industry classification is based on the Australian and New Zealand Standard Industrial Classification (ANZSIC).

1996-97 estimates are not directly comparable with the GSP contribution estimates in the body of this report.

Table C.1 Comparison of Tourism GSP at Factor Cost Estimates
($million in current prices)

<table>
<thead>
<tr>
<th>Tourism Categories</th>
<th>Overnight Interstate</th>
<th>Overnight Intrastate (a)</th>
<th>International</th>
<th>Outbound</th>
</tr>
</thead>
<tbody>
<tr>
<td>OESR contribution report (1998-99 estimates)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tourism expenditure</td>
<td>4705</td>
<td>4435</td>
<td>3039</td>
<td>415</td>
</tr>
<tr>
<td>Tourism contribution to GSP at factor cost</td>
<td>1590</td>
<td>1478</td>
<td>1040</td>
<td>112</td>
</tr>
<tr>
<td>QGEMF-T database (1996-97 estimates)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tourism contribution to GSP at factor cost</td>
<td>1328</td>
<td>1040</td>
<td>981</td>
<td>147</td>
</tr>
</tbody>
</table>

(a) Includes Queensland residents travelling interstate.

The two sets of estimates for tourism contribution to GSP presented in Table C.1 are not directly comparable as:

i. The estimates in the OESR contribution report are in 1998-99 prices and quantities. Whereas the estimates in the QGEMF-T database are in 1996-97 prices and quantities;

ii. The contribution of “Other” tourism expenditure is included in the 1998-99 estimates but not in the 1996-97 estimates;

iii. The contribution of personal expenditure by households while undertaking business travel is included in the 1998-88 estimates but not in the 1996-97 estimates. This is because the contribution of personal expenditure by households while undertaking business travel is separately identified in the QGEMF-T database;

iv. The OESR contribution report estimates were derived using the provisional 1996-97 Queensland input-output table, while the QGEMF-T database estimates were derived using the final 1996-97 Queensland input-output table;

v. The commodity composition of the tourism categories is different between the two sets of estimates; and

vi. The methodology used to derive foreign outbound expenditure was further developed after the release of the OESR contribution report. The revision to the methodology resulted in the 1996-97 contribution estimates for foreign outbound being higher than the 1998-99 contribution estimates.

The tourism contribution to Queensland GSP estimates presented in Table C.1:

- Include the value of Queensland sourced goods and services consumed by tourists visiting Queensland; and
• Exclude the value of imported (international or interstate) goods consumed by tourists visiting Queensland.

Resulting from this, any additional tourism expenditure that occurs because of an increase in the consumption of imported goods by tourists visiting in Queensland would have no effect on tourism GSP.

The current structure of QGEMF-T makes it difficult to separately specify the expenditure on interstate and international imports by foreigners visiting Australia. Consequently the tourism GSP estimates for Queensland in the QGEMF-T database do not currently include:

• Queensland goods sold to businesses in ROA and then consumed by foreigners visiting ROA; and

• Taxes and Queensland sourced transport margins applied to the sales of interstate and international imports consumed by foreigners visiting Queensland.

Whilst the magnitude of the above two items is not significant when compared to the aggregate tourism GSP estimates, the economic contribution of these types of activity are captured in the QGEMF-T database but are not directly linked to tourism activity.