New Zealand Cruise Industry Study

Prepared for

MINISTRY OF ECONOMIC DEVELOPMENT

CRUISE NEW ZEALAND

TOURISM NEW ZEALAND

by Market Economics Ltd, Auckland

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Disclaimer

Executive Summary

Since 1996 Cruise New Zealand has commissioned a biennial or annual study of the economic role of the industry within New Zealand. This study builds on that work to establish the economic role of the industry for 2009/10 season and forecasts for the 2010/11 and 2011/12 seasons.

This study confirms that the cruise sector is an important part of the tourism industry in New Zealand. The sector creates significant inflows of foreign expenditure which impacts positively on the New Zealand economy.

The level of activity within the sector has grown rapidly in the past decade and is expected to continue to do so. This pace and scale of growth has caused concerns about the ability of New Zealand to capitalise on this influx as there are emerging issues around capacity in some essential services for the sector.

A key goal of this work was to update key data sets which feed into the economic modelling. As a part of this work key players in the industry, including; providores, ground handlers, air services (airport and airlines), marine engineers and shipping agents were interviewed. These companies provided both financial (actual) and anecdotal (based on experience) data for the 2009/10 cruise season to inform the economic modelling.

A second goal of the study is to examine the role that Auckland plays as an exchange port, a key component in ensuring the industry operates effectively and efficiently.

This study also highlights gaps in the knowledge base of industry and tourists activity within New Zealand. A gap analysis of the quality of data has indicated a lack of knowledge about tourist discretionary expenditure whilst on New Zealand cruises.

One of the key findings of this report is that cruise passenger behaviour has been steadily shifting from organised tours to free independent travellers. From a research and planning perspective this change of behaviour has created additional issues around the measurement and understanding of the industry.

Forecasts for the 2010/11 and 2011/12 Seasons

The 2010/11 season sees growth in the numbers of cruises and passengers visiting New Zealand waters. In total, 34 cruise ships are expected to carry 138,200 passengers along with 56,400 crew in 2010/11. Over the course of the season, these vessels undertake 96 cruises and stay 559 days in New Zealand ports and stop over points. This represents growth over the previous season of 19% in cruises and some 26% in passengers. Again, larger vessels dominate, accounting for 91% of total passengers. Cruise passengers are expected to spend 736,600 days in New Zealand ports contributing $305.4m directly to the economy, representing growth of around 13% in real terms over the 2009/10 season. It is expected that the season will contribute $223.0m in total value added to the New Zealand economy and sustain the equivalent of 3,606 jobs (Employment Count (EC)). Activity is again focused on Auckland Region where direct spend of $177.4m generates total value added of $70.9m sustaining 1,044 ECs.

The 2011/12 season sees an increase in the numbers of cruises and passengers visiting New Zealand waters. In total, 29 cruise ships are expected to carry 199,900 passengers along with 80,800 crew. Over the course of the season, these vessels undertake 124 cruises and stay 750 days in New Zealand ports and stop over points. This represents growth of 29% in cruises but some 45% in passengers compared to 2010/11 season. Cruise passengers are expected to spend 1,152,900 days in New Zealand ports contributing $470.7m directly to the economy, representing growth of around 54% in real terms over the 2010/11 season. It is expected that the season will contribute $346.0m in total value added to the New Zealand economy and sustain the equivalent of 5,606 jobs (ECs). Activity is focused on Auckland Region where direct spend of $268.5m generates total value added of $106.9m sustaining employment equivalent to 1,575 jobs.

The industry has grown reasonably steadily in New Zealand over the past decade and a half. In the 1996/97 season 27 cruises brought 19,400 passengers to New Zealand. The industry has grown on average by 14% per annum since then. This trend is likely to continue into the future, with passenger numbers increasing by 26% in 2010/2011 and 45% in 2011/12. In the 2011/2012 season the cruise industry will become the third largest market for international visitors to New Zealand, behind Australia, United Kingdom and United States of America[1]. Early port bookings indicate that growth will continue into 2012/13 season.

The global economic environment is not expected to have any significant impacts on passenger numbers for the forthcoming seasons. If the economic conditions continue to improve and fuel prices remain low it is expected that the American passenger market will recover and grow strongly. Future bookings indicate significant growth potential in this market in the coming seasons. In addition to this positive outlook we expect the rapid growth of the Australian market to continue driven by a buoyant economy.

Economic Impacts of the 2009/10 Season

The 2009/10 cruise ship season began on 16th of October 2009 with the arrival of the Star Princess in Auckland and carried on into the winter of 2010 with the last cruise, the Dawn Princess, heading up to the Pacific Islands on 31 August 2010 from Auckland.

Overall, it is estimated that 109,951 tourists embarked and/or disembarked or were in transit in New Zealand as a direct result of the cruise season. In addition, over 46,600 crew visited during the season. Over the course of the season, 25 vessels offering 81 cruises visited New Zealand, carrying passengers and making 483 visits to 32 ports and stop over points. In total, more than 555,000 passenger days were spent in New Zealand ports or stops by international visitors.

The majority of passengers arrived on large vessels of 50,000 tonnes or more, these ships accounted for 77% of total passengers. North Americans and Australians continue to dominate international passenger numbers. Collectively they accounted for 72% of international passengers (61% of all passengers). While this dominance is consistent with the activity within the industry since 1996 we note that there has been a significant reduction in American tourists which has been offset by the growth in the Australian market. The 2007/08 study showed that Americans alone accounted for 39%

[1]Tourism New Zealand 2011-12 forecasts of international visitors predict 1.2m visitors from Australia, 256,000 from UK and 232,000 from USA which compares to 183,000 international cruise passengers.

of international passengers while in the 2009/10 year Americans represented 25% of the passengers. Passengers from Australia have overtaken Americans as the largest segment in the industry. In 2007/08 they accounted for around 24% of international cruise passengers while in 2009/10 just under half of the international passengers were Australian (47%). New Zealanders, who mostly undertake winter cruises to the Pacific, account for 15% of all passengers.

Auckland attracted the most cruise activity with passenger exchanges focussed on this port. Approximately 91,000 passenger days were spent in Auckland by international and domestic passengers or around 16% of all passenger days spent in New Zealand. The exchanging passengers also spend a significant number of nights in Auckland and New Zealand before and after the voyage[2].

The cruise industry generated $271.2m in direct spend during the 2009/10 season. The majority of this spend "sticks" to the New Zealand economy, however a significant portion (around 38%) flows offshore to purchase imports. For example, the majority of the expenditure on fuel and airfares is excluded as much of this spend flows offshore to purchase goods and services overseas. The remaining $168.9m was generated by passengers and crew on the one hand and the cruise lines and their agents on the other. The nature of spend varies greatly between these two groups, both in terms of its geographic and sectoral distribution. Passengers and crew spend in much the same way as other groups of international tourists, their spend was concentrated in the port cities and focused on entertainment/sightseeing, retail and hospitality sectors[3]. Cruise line and agent spend is more focused in the major interchange ports and primarily on berthage as well as servicing and maintaining the needs of the ship and passengers whilst on the cruise.

The direct spend generated over $410.1m in total gross output, once all the flow on effects are included. Of this, around $190.9m contributed to the nation's wealth in the form of value added (synonymous with GDP). The cruise industry sustained, either directly or indirectly, 3,100 jobs (EC). Each passenger that travels on a cruise ship to New Zealand generates around $1,700 in value added for the economy.

During the 2009/10 season, Auckland region received $163.3m of total cruise industry direct expenditure including airfares and bunkering – this equates to around 60% of the national direct spend. The total effect of this injection into the regional economies generated $63.0m of value added in Auckland region[4]. The study shows that Auckland region and the Ports of Auckland are the most significant area of passenger and crew exchanges and industry expenditure.

Cruise Industry Capacity Issues

There are several areas of concern surrounding capacity of key supply links which are required to supply seamless services to cruise passengers as well as the ability for current infrastructure to sustain the growth forecast. The industry is worried that with more, and larger, ships forecast to visit New Zealand, the inadequate infrastructure may inhibit the growth of the industry causing a loss of future economic wealth for the country.

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[2] In the 2009-10 season around 45,000 nights were spent in New Zealand by international cruise passengers after or before cruise voyages. The majority of these nights will have been spent in Auckland hotels.

[3] Cruise passengers and crew do not spend a similar amount on accommodation as the average international tourist.

[4] Note this includes the flow on effects from Auckland's portion of international airfares and fuel bunkering.

In our research most of the capacity constraints relate to the port side operation and transport to and from the port. The constraints include, number of ship berths, passenger exchange handling (both portside and airside), port facilities, coach and transport links, air travel facilities (airport processing capacity) and tourist activities.

For example, with more, and larger ships, forecast to visit New Zealand, existing port infrastructure throughout New Zealand will struggle to accommodate large ships of this size[5]. This has a significant potential to limit the growth of this sector which will impact on the cruise economic benefits to New Zealand's regions. The lack of adequate ship berths is even more crucial in Auckland, with constraints possibly resulting in lucrative exchange activity moving to Australia. Auckland accounted for 63,800 exchanges in the 2009/2010 cruise season.

Industry players also indicate that more information about passenger exchange behaviour is required. As the number of free independent cruise travellers increases, the ability of Auckland suppliers in particular, to provide seamless exchange is becoming more difficult. There are major implications for baggage handlers, ground transport and airlines. An increased understanding of passenger needs would allow operators to forecast volumes more accurately. This will enable the industry to provide better services to passengers. Auckland is the terminal port for New Zealand where passengers both join & leave ships. The exchange experience can impact either their first or last impression of New Zealand as a destination, therefore what happens in Auckland has a long term impact on the future of the Cruise industry.

[5] This issue will be even more apparent when more than one large ship visits at the same time.

Glossary

- *Bunkering*: The expenditure by cruise ships on fuel and other oils.

- *Direct Impacts*: also termed the first round effects. They cover the direct spending that occurs by all players in the industry (i.e. passenger spend, cruise vessel spend and crew spend). This direct spending sustains a certain amount of direct employment to meet these direct needs, and generates a certain amount of direct value added ($).

- *Exchange*: A passenger or crew member is defined as exchanging if they embark or disembark from a cruise ship within New Zealand waters. There are four possible outcomes for each passenger or crew member; (1) only embark, (2) only disembark, (3) embark and disembark or (4) transit. The first two outcomes result in one exchange being recorded for the passenger or crew member. The third outcome is recorded as two exchanges, one for the embarkation and one for the disembarking. The final outcome is recorded as no exchange, these cruise passengers transit through New Zealand often on round the world cruises, and therefore never exchange.

    - *Seaport Exchange*: Is recorded at the time when the passenger or crew member ends or starts the voyage at a New Zealand seaport.

    - *Airport Exchange*: Is recorded once the passenger boards or leaves an aircraft in a New Zealand airport. The air exchange can occur many days after the seaport exchange.

- *Employment Count (EC)*: Head count of salary and wage earners sourced from taxation data. Usually a higher count than FTEs – see below.

- *Free Independent Traveller (FIT)*: a traveller that organises all or some activities separately from the cruise lines. Historically cruise passengers have purchased packages from the cruise lines which included flights, day excursions and exchanges. There is a trend towards FIT behaviour with the majority of flights and other activities now being organised by the traveller independently of the cruise line.

- *Full Time Equivalent (FTE)*: An estimate of full-time equivalent employees, where part time employees are counted as less than a full time employee. Statistics New Zealand defines FTE employment as the number of full time employees plus half the number of part time employees, where full time employment is defined as working more than 30 hours per week.

- *Gross Domestic Product (GDP)*: measures value-added of products produced within a country's borders. In this study the value of production is expressed in the prices of a base year so that comparison can be made with inflation removed (base year 2009).

- *Gross Registered Tonnage (GRT)*: represents the total internal volume of a vessel, where a registered ton is equal to a volume of water of 100 cubic feet.

- *Ground Handlers*: These businesses mainly provide passenger exchange services and port excursions. The round handlers provide services directly to the cruise ship operators and cruise passengers. Some ground handlers organise other activities such as, special entertainment nights or meet other passenger related needs.

- *Indirect Impacts*: are the effects that occur when suppliers to the directly impacted businesses have to increase their production to meet the increase in demand for goods and services. This requires the further purchase of other goods and services from their suppliers. Indirect effects are calculated in terms of indirect gross output ($),value added ($) and employment (FTEs).

- *Induced Impact*: the effect of additional wages and salaries paid into the economy inducing additional expenditure. Businesses, either directly or indirectly impacted, are assumed to be operating at maximum capacity and therefore additional demand causes them to either hire additional workers or pay overtime. This means more money is available to households in the economy. The induced effect covers how this money then flows through the system as people spend more.

- *Input Output Model (IO)*: A model of the economy that measures the interdependence of industries and households (see Appendix A for detail).

- *Port Day*: is a measure of when a ship or passenger enters a port or a stop within New Zealand waters. In this study a ship that visits two ports in one day is counted as spending half a port day in each port.

- *Providore*: An agent that supplies produce and any other supplies to the cruise ships. In the New Zealand cruise industry this service mainly relates to supplying fresh food and sundry grocery items.

- *Shipping Agents*: The Shipping Agents organise the majority of ship related spend in New Zealand. This includes port fees, customs, security, minor repairs and utilities. The agents also organise a small proportion of the exchange activity, such as baggage handling, crew exchange and sometimes passenger exchange.

- *Valued Added (VA)*: measures all payments to factors of production (land, labour and capital), and excludes all purchases of intermediate inputs. It broadly equates with gross domestic product (GDP) as a measure of economic activity at the national level, and gross regional product at the regional level. Components of value added include compensation of employees (salary and wages), operating surplus (company profits), consumption of fixed capital (depreciation), and taxes less subsidies.

1 Introduction

In recent times the worldwide cruise industry has grown to more than 17m passengers (2010), up 70% on 2000 and up 54% on 2002[6]. This represents an impressive growth path compared to other tourism sectors, in total a 400% increase in passenger numbers over the past 20 years.

The cruise industry in New Zealand has shown strong growth in recent years, from 27 cruises catering for 19,400 passengers in the 1996/97 season, to 81 cruises catering for 109,951 passengers in 2009/10 and potentially over 199,943 passengers in 2011/12. Total direct expenditure has increased from $42m in 1996/97 to over $271m in 2009/10. This result does not include any estimate of the impact from return visitations as a result of the cruise introducing passengers to New Zealand as a destination.

As the industry grows in New Zealand it constantly stimulates new activity and initiatives. Many ports around the country are improving their facilities to handle cruise ships. Coach line companies (that play a key role in transporting cruise passengers on tours and pre- and post-cruise packages) are also investing to increase capacity. There has been a commensurate increase in international flights with passengers either joining or leaving a cruise ship in New Zealand. The Auckland hotel industry has, likewise, benefited from pre and post cruise bookings. There is also now a dedicated cadet training programme in New Zealand, which allows navigation and engineering officer graduates to move directly into cruise related employment. In addition, cruise lines are visiting hospitality schools and technical institutes to directly recruit trainees into the onboard hotel, hospitality and technical divisions of the lines.

The industry has identified the need for additional port infrastructure at Auckland as being critical, to ensure that both local and nationwide growth is continued. Auckland, along with Sydney have become the recognised hub ports for the South Pacific for passenger exchanges. The international airports, hotels, transport and the wharf terminals that define a hub port are all present in Auckland, but require investment to ensure opportunities are maximised. The industry also notes airport capacity constraints as a more general issue. In the future upwards of 3,400 people per day will exchange through Auckland Airport, which is over 10% of the average daily passenger number through the international terminal. It is noted that the cruise industry passenger numbers are able to be accommodated by existing airline capacity and that any capacity constraints relating to air movements relate to the processing of passengers.

Note that all figures presented in this report are in New Zealand dollars. At the time of writing the $NZ/$US exchange rate was 0.73.

1.1 Background and Scope

The economic impact of the New Zealand cruise ship season has been assessed every year or every second year since its inception in 1997. The first study involved in-depth investigation of the structure of the industry and the expenditure in the New Zealand economy resulting from the cruise ship activity. This enabled the development of a set of spend ratios and economic multipliers that reflected the

[6] *'Global Changes in the Cruise Industry 2003-2010' July 2003, Tony Peisley*

nature of the industry at that time. These ratios and multipliers were subsequently applied each year since 1997 – inflation adjusted – to new cruise and passenger numbers.

In 2003, the ratios and multipliers were updated to reflect changes in the global cruise industry (namely advancements in ship operation, ship capacity, ship technology and how ships are serviced locally and globally), changes in the scale of the industry in New Zealand (over time the number of cruises have increased but also the number and variety of businesses involved with and servicing the cruise ships whilst in New Zealand ports has increased), and because more up to date economic input-output tables became available from Statistics New Zealand. This 2003 base model (with inflation adjustments) has been applied up until the 2007/08.

This study updates the core data to 2009/2010 season data. The study involved in-depth investigation of the structure of the industry and the expenditure in the New Zealand economy resulting from the cruise ship activity. We have talked to many of the key players in the industry, including providores, ground handlers, air services (airport and airlines), marine engineers and shipping agents. These companies provided both financial (actual) and anecdotal (based on experience) data for the 2009/10 cruise season. This data has been used in the economic modelling and to add real world context to the results of the modelling. As no robust survey of passenger spend for New Zealand cruises is available, this study has relied on international literature to update passenger expenditure estimates.

This report also differs from previous reports as it does not present detailed regional or port level data. However, the scope of this assessment is essentially unchanged from earlier studies; the more detailed results are still calculated in the course of the assessment.

1.2 Objectives

This paper has four main objectives and a number of related secondary objectives. The first is to establish the size and nature of the cruise industry in New Zealand for the 2009/10 season by collating the number of passengers, ships, and cruises that visited New Zealand, and to estimate the impact the industry has on the economy. This has involved the following:

- Estimating the total economic output or direct spend generated by ship visits;
- Calculating the direct, indirect and induced contribution to gross output, value added and GDP;
- Estimating the effective employment generated, as employment counts (ECs);

A second key objective involves providing some estimates of economic impact for the upcoming 2010/11 and 2011/12 season based on pre-bookings and current expenditure ratios. This is to provide guidance and information to port authorities, local authorities and Cruise New Zealand seeking to secure cooperation and consideration of the needs of this high value sector of the tourist market.

The third key object was to update the core data sets from 2003/04 data to 2009/10. The goal was to strengthen the analysis of expenditure by sector. This work focuses on updating the cruise-related expenditure data (e.g. bunker fuels, airfares, port charges, marine expenses, maintenance, security, providoring and pre- and post-cruise accommodation). This work also includes an analysis of passenger expenditure taking into account that the basic data is weak, so a defensible method has been included to provide some best estimates of the expenditure involved. A secondary objective of

this work is the identification of data gaps and recommendations on how best to address these, in order to assist in development of the best long term data system for the sector.

The fourth key objective was to assess the demand (capacity) implications for the tourist services sector, in particular the international aviation sector. As a secondary objective, this study provides a detailed analysis of Auckland's role as the main embarkation/disembarkation and cruise ship servicing port.

1.3 Report Structure

Section 2 of this report explains the methodology used, data collection, industry direct spend, economic impact analysis and the Auckland exchange model. Section 3 reports on the direct spend results and economic impacts for the 2009/10 season and Section 4 provides the forecasts for 2010/11 and 2011/12 seasons at the national level. The annual national impacts are compared for the past 10 seasons in Section 6. Section 7 outlines the results of economic impacts for the Auckland region and the Auckland exchange model. Section 8 provides an analysis of the data strengths and weaknesses, with a range of suggestions to improve the modelling of the industry. Section 9 includes a brief summary of the findings from this study.

2 Methodology

2.1 Introduction

There are two main models specifically developed for this study. The first is the economic model which measures the impact of the industry on the New Zealand economy for the past season and the coming two seasons. The second focuses on the exchange behaviour in Auckland for the past season and the coming two seasons.

Both of these models rely on the Cruise New Zealand industry activity dataset which records passenger numbers, crew, voyages and port calls (see subsection 2.2) for the past seasons. The two future seasons are estimated using future bookings and average occupancy rates from the 2009/10 season.

There are two main steps in assessing the economic impacts. First the direct expenditure is estimated by applying industry expenditure data from 2009/10 season (see subsection 2.3) to activity levels recorded in the past season and forecast activity levels. The second step takes this direct expenditure and applies an Economic Input Output model (2007, inflation adjusted) that calculates the flow on effects of direct expenditure generated by the cruise lines, their passengers and crew whilst in New Zealand. The model is generated at a national level and therefore generates multipliers for New Zealand as a whole.

The exchange model estimates the number of airport exchange movements in Auckland and the timing of those movements. This model draws on the cruise industry activity and survey data to establish daily airport exchange numbers for the past season and the coming two seasons (see subsection 2.5).

2.2 Cruise Data Collection

A schedule of all port arrivals by date and vessel was provided by Cruise New Zealand through Tourism New Zealand for the 2009/10 season. This dataset includes port visits, ship size, ship class, passenger numbers by country of origin, crew numbers and exchange numbers (embarking/disembarking and crew/passengers). Cruise New Zealand was also able to provide detailed forward books for the next two seasons and a directory of the ships which includes vital characteristics (i.e. GRT, passenger capacity, crew capacity). The future seasons are forecast by combining the passenger and crew capacity per ship from the 2009/10 season with the forward bookings schedule and the directory of the future ships' characteristics.

This data provides us with the following information which feeds into the modelling of economic impacts,

- Passenger port days: This data is split by each port by class of ship and country of origin. The data is used to estimate passenger spend during a voyage.
- Passenger Exchange: This data is used to estimate the spend pre and post cruise. The data provides an estimate of the passenger exchanges in each port by class of ship and country of origin. It also allows an estimate of the current and future demand for air travel by origin.

- Crew port days: This data provides a count of the number of crew days in each port. There is no ability to establish the country of origin for crew members, however nearly all crew are internationals.
- Crew exchange by port: This data provides a count of the number of crew exchanges in each port. As with the crew port days there is no ability to establish the country of origin for crew members.
- Ship Visits: This data shows the number of ship visits to each port. The data is used to estimate vessel related spend in each port.

The cruise data described above are the general activity measures or the scale of the industry.

2.3 Ship, Crew and Passenger Expenditure

Having established the scale of the industry in terms of numbers of vessels, cruises, crew and passengers, the next step is to quantify their impacts on New Zealand's economy.

Direct expenditure from the cruise industry has been classified into its component parts:

- Cruise Vessel related

  This covers all expenditure related to the cruise and the operation of the cruise vessel. It includes ship specific expenses such as; port costs, marine expenses, bunkering and maintenance as well as; passenger flights to join the cruise, pre- and post-cruise packages booked with the cruise, re-provisioning costs, and various crew related expenses such as crew exchanges, crew accommodation and re-positioning flights.

- Cruise Passenger related

  This covers all incidental expenditure that occurs as a result of a cruise but is not necessarily part of the cruise itself. It includes items such as; all retail expenditure on shore, all café and restaurant expenditure on shore, sightseeing day trips whilst in port (excursions) and other services such as visits to doctors.

- Cruise Crew related

  This includes all staff spending whilst in port – except that related to crew changes that are paid for by the cruise lines. It includes spend on: retail goods, personal services, casinos, recreational activities and transport.

Cruise vessels, their crews and passengers spend money on a wide range of goods and services in the New Zealand economy. It is beyond the scope of this report to investigate the details of every transaction that occurred. By necessity averages have been applied, the spend data has been combined with the activity data to establish per unit average spend. These averages vary depending on the costs which are measured. The averages used in this study include per season, per cruise, per port, per GRT, per crew, per passenger, per exchange and combinations (i.e. average per port by GRT).

The modelling also excludes some ports and stop in the estimation of certain spend types because these activities cannot occur at the port or stop. As an example, each of the ports and stops are coded as either having retail opportunity (shopping available) or not, this avoids impossible outcomes

such as passengers or crew spending in stops such as Kawau Island or Mercury Island where no retail exists. This method also applies to some cruise related spend which will only occur in certain ports.

All the averages are then combined with forward bookings for the next two seasons to forecast industry activity and output.

2.3.1 Cruise Vessel related data

The majority of cruise vessel related spend is well known and robust. Most of the spend by vessels is recorded directly in financial accounts of shipping agents, bunkering companies, providores, marine engineers and container handlers.

During the course of this research we have been given access to financial accounts and data which records in detail the amount of spend by port and ship for the 2009/10 season. In the following section we have defined three spend categories, Bunkering, Providoring, Crew Exchange and Other Vessel Spend.

Bunkering

The largest single expenditure by vessels is the associated spend on fuel and bunkering. In this study we have obtained bi-weekly US dollar price per tonne for IFO180 and AGO at Auckland and Tauranga (April 2009 to April 2010). Cruise New Zealand has conducted an email survey of fuel tonnage taken on board by port for the 2009/10 season. Combining the tonnage of fuel with the known ship we are able to estimate the average fuel per GRT by port. The average price over the season allows us to estimate the fuel value taken on board per ship per port.

In the modelling we have removed the portion of bunkering expenditure that is related to imports. Previous work and interviews of bunkering companies has been used to identify a breakdown of expenditure between domestic products, company margins, operating costs (wages) and the imported component – i.e. the fuel itself. The money spent on imports is excluded from the analysis as this money flows offshore resulting in no impact on the New Zealand economy. As is common in the petrochemical industry, the majority of the sales value is used to purchase imports (fuel) from overseas. The interviews indicate that a small proportion of the bunkering (around 10%) 'sticks' to New Zealand in the form of domestic products, company margins and operating costs.

This spend category is significant in terms of the analysis which means that the results from the model will be sensitive to this data, around 13% of industry spend is related to bunkering. While the estimate is based on robust data it is noted that past CNZ data indicates that bunkering expenditure was significantly higher in previous seasons (CNZ data shows 4 times more bunkering expenditure in previous seasons).

It is likely that bunkering expenditure varies significantly from year to year depending on where the Australian (swing) and round the world voyages choose to bunker. It is suggested that further analysis of this spend category be undertaken. In 2009/10 the global economic recession resulted in altered cruise itineraries, the outcome of which was a reduced bunkering requirement in NZ.

Providoring

The centralised global buying policies of cruise lines and the relatively high New Zealand dollar in relation to the US dollar restricts the ability of New Zealand to supply a wider range of goods to cruise lines. The majority of food stuffs are freighted into New Zealand in climate controlled containers and loaded aboard. This ensures consistency of product and often ensures that the tastes of passengers are met.

Given that cruise lines are extremely price conscious they are often buying product globally at specific price points. For example, many are reluctant to pay more than $US3-$US5 for a bottle of wine. They, in some instances, also require the wine to be available globally. Many New Zealand suppliers simply cannot meet these requirements and therefore do not get the opportunity to supply the sector. Often the only time significant volumes of product is used is when a ship has a specific "New Zealand" night in the dining halls.

This has led to a reduction in the volume of product sourced locally and intense pressure on New Zealand based suppliers to offer the most cost effective options. The economic impact of this is a reduction overall in the amounts being spent locally and an increase in the amount of product shipped into New Zealand to meet the needs of cruise passengers and ships.

The New Zealand providores are mainly asked to provide fresh vegetables and fruit as well as some dairy products for cruise vessels rather than providing a comprehensive range of food stuffs. New Zealand providores also supply food up to the Pacific Islands for cruise ships as suitable food supplies are hard to obtain in some ports. However, some items such as New Zealand meat cuts are supplied to vessels internationally through New Zealand exporters' distribution channels and are not included in this study.

In this study we have collected anecdotal evidence from providores and ground handlers. This data indicates that providoring is a relatively minor part of the industry within New Zealand. The modelling shows that providoring makes up less than 1.3% of expenditure in the industry. It would be desirable to undertake further analysis of providoring activity to confirm these figures with some accuracy. It is believed that the provodoring activity is probably higher than that estimated in this study[7].

Crew Exchange

The exchange of crew occurs predominantly in Auckland with nearly 2,000 crew exchanging during the 2009/10 season. The spend surrounding this activity includes accommodation, flights, transport and meals. There is no hard data to establish the exact nature and quantity of this spend. In this study we have used average airline ticket prices, room prices and average food and transport expenditure (assuming one night stayed). The model predicts that the cruise industry will be paying around $1,900 per crew personnel exchanged. The majority of the crew exchange expenditure flows directly offshore

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[7] For example P&O Cruises, the only cruise business to homeport from New Zealand, buys up to $2m worth of produce from 11 New Zealand suppliers each cruise season. The model estimates that total providoring sales in New Zealand is valued at less than $4m.

as it is associated with airline transport[8]. It is also worth noting that some crew members undertake pre and post cruise holidays, this additional spend is discussed in the crew spend category (see page 17).

Other Vessel Spend

This category of spend includes most of the spend which is undertaken on behalf of the cruise vessels by shipping agents and represents about 7% of cruise industry spend in any one year. This study draws heavily from a large financial data set from the main shipping agent in New Zealand. The dataset is a financial record of actual spend by cruise ships in New Zealand waters, which covers 85 spend categories and over 5,000 data points. The data is a reasonable sample from which to estimate Other Vessel related spend as it covers the vast majority of cruise ships (except Crystal Symphony and Saga Rose). The data set covers berth hire, customs, towage, utilities, vessel survey, government fees, transport of crew and passengers, baggage handling, communications and security.

We note that there are three issues with this dataset with respect to coverage. First the data set does not cover or capture the full spend with respect to repairs, ship equipment and container handling. Additional meetings have been undertaken with some of the businesses involved, to attempt to fill this gap as detailed below.

The repairs and ship equipment spend was estimated using data from the shipping agent and anecdotal information from marine engineers. The repairs and ship equipment spend is an estimate only, however as this spend is only a small fraction of overall activity in the industry (around 0.5%) inaccuracies in the data are unlikely to impact significantly on the results from the model.

The second data issue relates to container handling, the shipping agents believe that around 75% of handling is managed by the ship. Investigation and interviews of container handlers confirms this belief and the modelling has been modified to include this accordingly. The expenditure on container handling is very small relative to the total spend by the industry (only 0.3%). There is little need to study this spend in detail as it will have little to no impact on the final result.

The third data issue relates to maintenance expenditures which occur infrequently between the seasons. Discussions with shipping agents and marine engineers indicates that this could be up to one million dollars per season or as little as a few hundred thousand dollars. For the purposes of this study the spend has been estimated using the shipping agent data and marine engineers anecdotal information. The maintenance spend represents a small proportion of total spend (only 0.2%).

2.3.2 Cruise Passenger related data

Cruise passenger related expenditure is that spent directly by the passenger whilst in port or on shore based excursions. This covers the excursions themselves and retail expenditure by passengers on food, entertainment and souvenirs. It also includes spend by passengers or on their behalf on pre and post cruise activities, which includes exchange activity.

[8] See section 2.3.2, where the calculation is discussed in detail for passenger airfare expenditure.

Passenger Spend in Port and Pre/Post Cruise

Passenger spend is the most significant spend category, in the 2009/10 season 38% of total industry spend was related to passenger activity in ports or pre/post cruise. This means that assumptions surrounding passenger spend are critical to the modelling. The best method of estimation would be to undertake a survey of passenger spend behaviour. As this is beyond the scope of this study, three sources of information have been relied upon to estimate the passenger spend; New Zealand survey data, international survey data and information from ground handlers.

New Zealand Survey data: There have been two surveys of cruise passenger behaviour conducted in New Zealand. The most significant survey was conducted during the 2006/07 season by Tourism New Zealand. This survey asked a range of questions relating to activity, experiences and satisfaction whilst cruising in New Zealand and questions about expenditure. The survey represented a snapshot of a portion of the industry, as the majority of respondents originated on two vessels (Statendam and the Sapphire Princess made up around 92% of the 550 responses). The second survey of cruise passengers was conducted for Auckland Regional Council in 2008/09 season. This survey covered five ships, Aurora, Millennium, Volendam, Seven Seas Mariner and Silver Shadow which accounts for about 35% of passengers in the season. This survey was focused on the need for a cruise ship terminal and questioned some 241 passengers. While both of these surveys are useful they do not present a full picture of the passenger spend geographically or by ship type, and the sample sizes may result in biased results. This data has been used to estimate the length of stay pre and post cruise, it is estimated that 45,000 nights are spent in New Zealand by international cruise passengers during the period between the seaport exchange and airport exchange (the majority of which will be spent in Auckland hotels).

International Surveys: In addition to these domestic surveys there have been many studies overseas. In our study we have drawn together as many of these studies as possible to allow better understanding of the passenger activity and spend behaviour. The international studies used in this research include studies from most of the large cruise markets, including Australia, Florida-Caribbean, Mediterranean, North America, Pacific Islands and South East Asia cruise markets (see references).

Ground Handlers: Interviews with the main ground handlers provided information about excursion expenditure. The ground handlers are the largest suppliers of shore excursions to passengers. In the past nearly all passengers undertook tours from the ground handlers. Over the last few seasons the passenger behaviour has changed markedly, there has been an increase in Free Independent Travellers (FIT). While the ground handlers are the single largest supplier of shore excursions for cruise passengers, in total, FITs make up slightly more than half, at present. This change in behaviour creates issues for suppliers as demand has become less predictable. From the researchers' point of view the increase in FIT cruise passengers means that data from the ground handlers has become less useful for assessing passenger activity. However, there is anecdotal evidence that the passenger behaviour varies in each port. The ground handlers believe that in some ports the majority of passengers undertake organised activities. While in other ports, such as Auckland, the majority undertake activities independent of the cruise or ground handlers.

The model relies on spend assumptions drawn from all three sources and applies different spend averages by origin of passenger and class of cruise. The model applies spend behaviour for passengers by seven countries of origin, Australia, Canada, Japan, Germany, United Kingdom,

America and Other (rest of the world). Spend by passengers is then split by class of ship, where higher class ship passengers are assumed to spend more on average than passengers of the same origin on a lower class ship. Average spend for the 2009/10 season is estimated at around $141 per port day, which includes retail spend, transport, café/restaurant, excursion spend and a small amount of overland tours. This spend is comparable to the international and domestic survey data which indicates that spend per passenger port day is around $168.

It is noted that as this is the most significant spend category the robustness and reliability of the results could be greatly improved if research time was invested in a survey of passenger spend and behaviour. It would also be useful to conduct a full survey of ground handlers, there are very few players which means that this could be done relatively effectively and efficiently.

Passenger Exchange

The passenger exchange spend is predominantly air transport with small spend on land based exchange (transport, hospitality and other). The passenger exchange spend category is around 30% of total industry spend in the 2009/10 season although most of the spend does not "stick" to New Zealand, as a large proportion of international airfares flow offshore.

In previous studies the flights associated with passenger exchanges had been coded as industry related spend. The shift in passenger behaviour from organised tours to FIT behaviour has meant that the majority of flights are now booked independently of the cruise booking. To reflect the reality of this change in passenger behaviour half of this spend has been re-coded to cruise passengers expenditure.

The passenger exchange spend category relies directly on assumptions about spend per passenger. The ground handlers provided anecdotal information about the land side exchange costs. Ground handlers suggest that land exchange costs are around $50 per passenger (transport, hospitality and other costs). As this spend represents less than 0.1% of total industry spend there is little chance that these assumptions will reduce the robustness of the model and the results. The cruise passengers also spend money on retail, day trips, food and accommodation during the period between the voyage and entering/leaving the country. This spend is estimated in the model and is defined as pre/post cruise expenditure (see page 14).

The cruise passenger expenditure on international airfares was calculated using airline expenditure, average airfares and market share data collected directly from one of the major airline operators. This data indicates average ticket price by route and expenditure by route[9]. Combined with the market share we are able to estimate the amount of spend that sticks to New Zealand. The process requires two steps.

- First, we established the proportion of each expenditure type likely to be spent in New Zealand. This was done separately for the national flag carrier and overseas airlines, with most expenditure categories having the opposite assumption for the national flag carrier when compared to overseas airlines. For example, we assume that all airline ticket value that

[9] We have been supplied with 14 expenditure categories, including fuel, crew wages, maintenance, landing fees, inflight costs, sales/marketing, contract handling, cost of sales, other variable costs, airport passenger fees, passenger services charge, passenger security charge, other overheads and ownership costs.

relates to maintenance, crew wages and overheads is spent in the home country of each airline. This means that 100% of spend (in these categories) by the national flag carrier sticks to New Zealand, while none of the overseas carriers spend sticks (0%). Fuel spend is the only category where this method is not applied. We have also assumed that all of the fuel expenditure by airlines is either spent overseas or flows offshore to purchase imports (0% sticks to the New Zealand economy).

- The second step is applying the market share by route to establish the proportion of tickets purchased on international carriers and domestic carriers that sticks. The proportion of expenditure that sticks to New Zealand varies by route and by the airline home country (i.e. New Zealand national flag carrier and overseas airlines).

2.3.3 Cruise Crew related data

Crew related expenditure is that spent directly by the crew whilst in port or on shore based excursions. This covers the excursions themselves and retail expenditure on food, entertainment and souvenirs. It also includes spend by crew on pre and post cruise activities.

The New Zealand crew related expenditure and activity has not been studied with detail. Crew related expenditure figures reported are estimates and do not have the rigour that would come from a structured survey of spending habits.

Crew Port Spend

In the previous study the model used crew spend data from an Australian Survey conducted by AEC Group (2007). The literature search has provided additional estimates of crew spend behaviour to draw from. The literature indicates that crew spend on average around $100 per port day. We note that crew may tend to spend more in major ports which means that the average spend in New Zealand is likely to be lower than shown in the international studies. The expenditure patterns applied are based on the AEC survey, as this is believed to provide the closest approximation of the New Zealand situation. The average spend per crew port day is $87 for the 2009/10 season which represents 8% of total industry spend. Crew spend estimation is the least robust section of the model, a more accurate result would be obtained if a survey was undertaken.

It is also important to note that crew spend averages used in this study may result in an undercount when measuring the impact in Auckland. The ground handlers and shipping agents have indicated that much of the crew spend is focused on Auckland, as this port has retail and shopping facilities that are close to the port as well as a major casino.

Crew Pre and Post Cruise Activities

Crew also undertake pre and post tours around New Zealand. Cruise New Zealand has provided estimates of this spend which is still applied in this study. The model may be underestimating the size of the pre and post tours as the number of exchanging crew that undertake these tours may be significantly larger. Currently it is assumed that 3% of exchanging crew undertaking pre and post tours, it is conceivable that the rate could be significantly higher. In the 2009/10 season 60 crew are assumed to undertake pre or post cruise tours. These crew members spend on average $2,600, which includes spend on flights, land transport, accommodation, food and retail. The pre and post

cruise activity by crew represents a small fraction of the total spend by the industry (0.1%) so there is little point in attempting to measure this category of spend in a more robust way.

2.4 The Economic Model

Market Economics apply a set of Input Output models to the direct expenditure to assess the indirect and induced effects of spend to produce a total economic impact. Put simply "*an input-output model consists of a system of linear equations, each one of which describes the distribution of an industry's product throughout the economy*." (Miller 2009). This branch of modelling is concerned with flows of products between industrial sectors and consumers (which includes households, government, foreign trade and intermediate goods for production).

This technique is applied to expenditure estimates for the past season and the coming two seasons. The results are adjusted for inflation (real terms), with 2009 used as the base year or year of comparison (i.e. 2009 dollars).

It is important to note that in previous studies the assessment split total expenditure between cruise related (for which specific cruise industry multipliers have been calculated) and passenger and crew related (which are passed through standard economic multipliers). In this study the economic impact did not rely on separate multipliers for the industry spend. Details of the model used to calculate the flow on effects of the cruise industry are appended to the report.

2.5 The Auckland Region Exchange Model

This study has taken the daily seaport exchange data and applied a distribution that describes the exchange behaviour of passengers and crew (see 2.5.1) to establish the timing and flows of passengers (to the airport). This analysis is important because most passengers and some crew do not exchange directly from the cruise to the airport. Many cruise visitors choose to spend additional days in New Zealand and then exit days later. Understanding exchange behaviour is vital to assessing the full impact of cruise activity in Auckland, in particular. Given that cruise lines have options as to where they carry out passenger exchanges, it is important to understand the implications of these types of decisions on the Auckland economy.

2.5.1 Exchange Behaviour

The following section describes how the exchange behaviour was assessed. The method applied is different for international passengers, domestic passengers and crew. In the absence of survey data the model applies assumptions as to how exchange passengers behave. These assumptions rely on information drawn from interviews of cruise industry operators where possible. The study combines passenger behaviour data drawn from the ARC survey (2009) with anecdotal evidence from cruise industry operators to estimate the distribution of passenger and crew exchange behaviour by day to establish peaks in both seaport exchange and airport exchange activity.

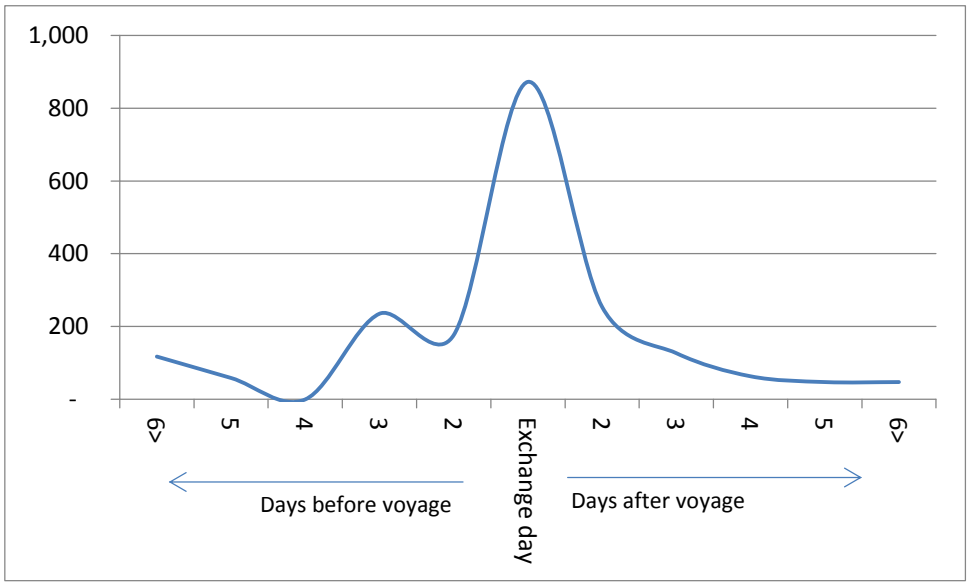
International Passenger Exchange Behaviour

The survey data (ARC 2009) shows that the majority of international cruise passengers choose to exit or enter one day either side of the cruise (45%). Around 41% of embarking passengers choose to arrive in Auckland at least three nights before the cruise. While 29% of disembarking passengers choose to stay in New Zealand for at least three nights before leaving New Zealand. Interviews with ground handlers, Auckland International Airport and airlines confirm that the result from the ARC survey corresponds to observed behaviour. Operators within the cruise industry, observe that around 30-50% of passengers exchange through the airport within one day of the cruise.

The survey data was applied directly to the seaport exchange data provided by CNZ. This allowed an estimate of the distribution of passenger airport exchange volume to be developed. The survey data shows that the majority of disembarking passengers leave the country on the same day the voyage terminates. The same is also true for embarking passengers, with the majority arriving in the country on the same day as the voyage begins. However there are a significant number of passengers that choose to stay in New Zealand several days before or after the voyage.

The model applies the distribution of behaviour present in the survey to establish the likely time frame for passengers to leave/enter New Zealand. In Figure 2.1 we use a hypothetical example to display modeled airport exchange behaviour. In this example a ship which undertakes a full seaport exchange in Auckland, with 1000 passengers disembarking and 1000 embarking. The model predicts that the peak passenger exchange will exceed 800 passengers on the day of the seaport exchange. The bulk of the passengers will have left or entered the country in the five days centered on the seaport exchange date (approximately 80%).

Figure 2.1 Example of Modelled Exchange Behaviour in Auckland.

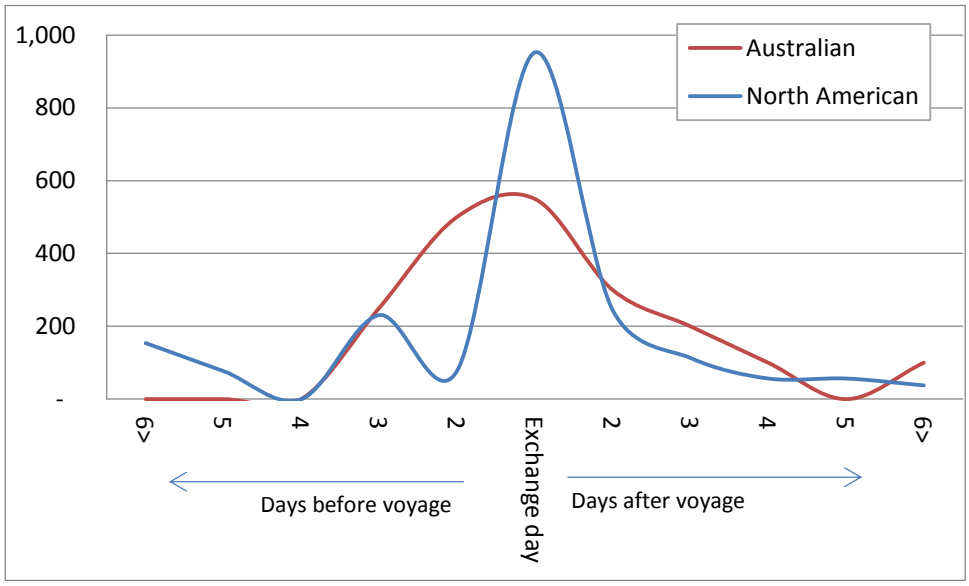


However it is worth noting that the exchange model does not attribute different exchange behaviour for passengers from different home origins or different classes of ship.

It is believed that the passenger exchange behaviour pattern will vary depending on country of origin. Analysis of the ARC data indicates that Australian passengers tend to stay two to three days in the

country before and after the voyage (90% exchange in the five days centered on the exchange day), while the North Americans tend to either exit or enter within one day of the voyage, with a reasonable proportion staying longer than two days (distribution for North Americans has a higher peak on the exchange day and fatter tails, see figure 2.2). This means that the exchange model may tend to understate the peaks when voyages dominated by North American passengers exchange in Auckland. The opposite may be true for the Australian dominated voyages.

Figure 2.2 Exchange Behaviour in Auckland (Australians and North American for example voyage)



There may also be a difference in exchange behaviour between passengers on different classes of voyage. It is believed that passengers on higher class voyages may stay longer than those from the lower class voyages. This means that it is likely that the exchange peak for higher class vessels is lower (on average) with broader shoulders than for lower class vessels. If this behavioural pattern exists we would expect that the exchange model would underestimate the peak for lower class ships and overestimate the peak for high class ships. Unfortunately the sample of passengers in the ARC survey did not cover a range of ships by class, which means that we are unable to draw any conclusions on this pattern of behaviour.

While the existing model is relying on the best available data we believe that improvements could be made with additional survey data. This survey would need to cover passengers by origin and class of ship.

Domestic Passenger Exchange Behaviour

For the purposes of this study the potential domestic passenger movements is also estimated. As there is no data to establish a pattern of behaviour for domestic cruise passengers, the study applies broad assumptions. The estimation for domestic passengers is sensitive to the assumptions applied and is only included to provide an indication of the possible quantum of the flows. It has been assumed that 20% of domestic travellers that exchange in Auckland use air travel to return home.

Crew Exchange Behaviour

There is evidence that suggests that crew exchange behaviour is significantly different from passenger behaviour. The operators surveyed indicate that the majority of crew cross the border within one to two days of the cruise. For this study we were unable to obtain actual data which confirms the views of the operators. Therefore in the model we have assumed that 80% of crew leave the country within one day of the cruise and 95% within two days. The remaining 5% of crew arrive or leave within three days of the cruise.

3 National Direct Expenditure - 2009/2010 Season

3.1 Introduction

When a cruise vessel arrives in New Zealand it begins a long chain of economic transactions that add employment and value to the New Zealand economy. Expenditure occurs well before a vessel docks, and continues after it leaves. In the interim, direct expenditure occurs across many sectors and regions of New Zealand.

To add structure to this information, direct expenditure has been divided into three major categories:

- Passenger related expenditure;
- Crew related expenditure;
- Cruise related expenditure.

These relate to specific elements of the industry and help to refine the analysis. The information is reported across the different size bands of vessel by category of spend and total spend is also disaggregated by port and region.

3.2 Cruise Activity 2009/2010

Over the 2009/10 season 25 different vessels offered 81 separate cruises in (or from) New Zealand waters. In the 2009/10 season, 21 cruises (26%) were the small Band 4 vessels, 8 cruises (10%) were Band 3 vessels, 10 cruises (12%) were Band 2 vessels, and 42 cruises (52%) were the large Band 1 vessels. In total cruise ships spent 483 days in port or at a non-port stop, on average the larger vessels spent less time in port or at a stop than the smaller vessels.

As the size of the vessel directly correlates to the number of passengers and crew it can carry, Band 1 vessels also carried 77% of all passengers and 76% of crew, while Band 3 and 4 vessels carried 6% of passengers and 9% of crew. This also highlights the high crew to passenger ratios on the smaller more boutique cruise vessels.

In total some 109,951 unique passengers embarked and/or disembarked or were in transit in New Zealand as a direct result of the 2009/10 cruise ship season.

Table 3.1 Cruise Activity Measures 2009/10 Season (Passengers, Cruises, Crew)

		Ship			Passenger			Crew		
Vessel Band	GRT Range	Vessels	Port Days	Cruises	Unqiue	Port Days	Exchange *	Carried	Port Days	Exchange *
1	50,000-100,000	13	265	42	84,805	516,245	26,295	35,275	213,147	1,015
2	35,000-50,000	2	18	10	19,034	23,307	33,195	6,910	10,166	636
3	20,000-35,000	6	54	8	4,270	26,568	2,701	2,823	18,651	117
4	5,000-20,000	4	147	21	1,842	13,611	2,276	1,545	11,279	171
TOTAL		25	483	81	109,951	579,730	64,467	46,553	253,242	1,939

**measures number of seaport exchanges, as some passengers embark and disembark they exchange twice*

It is also important to understand the nationality mix of cruise passengers, as nationality has been used to estimate average retail expenditure while in port and air travel departure/arrival distributions.

While no official statistics are recorded that cover the entire sector, Cruise New Zealand collate accurate statistics on passenger nationality from information provided directly by each ship.

Table 3.2 outlines the nationality mix for the 2009/10 season. It is important to note that there are a significant number of New Zealanders that cruise during any one year (15%). These are primarily to the Pacific Islands during the early winter months on the Pacific Sun. New Zealanders also visit New Zealand ports on both trans-Tasman and world voyages. Cruises to NZ are dominated by Australian passengers (40%), with Americans accounting for 21% of passengers and 11% from the United Kingdom.

Table 3.2 Nationality of Cruise Passengers, 2009/10 Season

Nationality	Passenger Estimates	Share of Total
Australia	43,977	40%
Canada	4,523	4%
Germany	2,507	2%
UK	12,029	11%
Japan	418	0%
New Zealand	16,436	15%
USA	23,509	21%
Others	6,552	6%
Total	109,951	100%

International Passengers and Crew

In total 555,124 passenger port days were spent in New Zealand by international visitors during the 2009/10 season – of total port days 91% were made by passengers in Band 1 vessels. The season also saw 36,951 international passengers exchange through New Zealand ports.

Each vessel also has a set number of crew required to cater for the passengers, in 2009/10 season 46,553 crew visited New Zealand. In most ports, crew will go ashore and spend on a variety of retail items and entertainment activities. It is estimated that some 253,242 crew days were spent in ports and stops. There was also a limited amount of crew exchanging occurring whilst in New Zealand (1,939) with the bulk of the crew remaining with the ships during their time in New Zealand waters.

Table 3.3 International Cruise Activity Measures 2009/10 Season (Passengers and Crew)

Vessel Band	GRT Range	Passenger			Crew		
		Unqiue	Port Days	Exchange *	Carried	Port Days	Exchange *
1	50,000-100,000	82,126	505,078	24,034	35,275	213,147	1,015
2	35,000-50,000	5,383	10,536	8,093	6,910	10,166	636
3	20,000-35,000	4,231	26,329	2,663	2,823	18,651	117
4	5,000-20,000	1,775	13,183	2,161	1,545	11,279	171
TOTAL		93,515	555,124	36,951	46,553	253,242	1,939

**measures number of seaport exchanges, as some passengers embark and disembark they exchange twice*

The passenger data provides an estimate of passenger movements into and out of the country for international cruise passengers. The data shows that 140,049 international cruise passenger

movements occurred in 2009-10, with 70,752 passengers entering New Zealand and 69,297 exiting. Given that most of the exchange activity occurs in Auckland it is important to understand the volume and distribution (transit as distinct to embark/disembark) of passengers moving in and out of the country.

Table 3.4 International Cruise Passenger Movements 2009/10 Season (Inbound and Outbound)

Vessel Band	GRT Range	Inbound			Outbound		
		Disembark	Transit	Total	Embark	Transit	Total
1	50,000-100,000	12,566	49,992	62,558	11,468	49,992	61,460
2	35,000-50,000	4,327	43	4,370	3,766	43	3,809
3	20,000-35,000	1,308	1,025	2,333	1,355	1,025	2,380
4	5,000-20,000	1,002	489	1,491	1,159	489	1,648
TOTAL		19,203	51,549	70,752	17,748	51,549	69,297

Domestic Passengers

The domestic passenger numbers are presented to provide information about the size of the domestic market as this will impact on the exchange capacities. It is important to note that as domestic spend is not net additional to New Zealand it has been excluded from the economic modelling.

There were around 16,436 New Zealand residents that undertook a cruise in 2009/10 season and 84% of these passengers embark and disembark in New Zealand. The New Zealand market is split into two; the larger winter Pacific Islands cruises which only turnaround in Auckland (65% of NZ passengers) and the smaller group that undertake “standard” cruises with the international passengers to other New Zealand ports (35% of NZ passengers).

Table 3.5 Domestic Cruise Activity Measures 2009/10 Season (Passengers)

Vessel Band	GRT Range	Passenger		
		Unqiue	Port Days	Exchange *
1	50,000-100,000	2,679	11,167	2,261
2	35,000-50,000	13,651	12,771	25,102
3	20,000-35,000	39	240	38
4	5,000-20,000	67	429	115
TOTAL		16,436	24,606	27,516

**measures number of seaport exchanges, as some passengers embark and disembark they exchange twice*

3.3 Direct Expenditure Estimates

Direct expenditure estimates have been based on the 2009 spend ratios which are applied to cruise and passenger details of the latest season. Each cruise is assessed using these spend ratios, meaning expenditure can be disaggregated between ports and regions according to their cruising schedule for more detailed localised assessments.

In this section we present results for three categories of; cruise industry spend, cruise passenger and cruise ship crew spend. There are over 75 sub-categories of spend that are calculated to estimate the total direct expenditure from the New Zealand Cruise Industry.

Cruise Industry Expenditure

The largest expenditure category is that related to the vessels presence in New Zealand waters. This includes not only the physical presence of the ship and the associated costs of running, berthing and maintaining the ships, but also cruise related passenger and crew activity – activities that are directly attributable to the cruises in New Zealand. This includes:

- spend by vessels on fuel, berthage, security, stevedoring, port fees etc;
- cruise passenger spend on flights, pre- or post- package accommodation;
- spend by the cruise lines on moving crew to and from New Zealand;
- spend on provedoring for all passengers and crew while on board;
- spend on onboard entertainment.

Cruise Passenger Expenditure

Passenger related expenditure covers all expenditure that is not directly tied to the activities of the cruise itself. This is primarily retail spend while on excursions or during free time spent ashore (during port stops or before or after the cruise).

Cruise Crew Expenditure

The final category of spend covers crew related spend. As with passenger spend, crew related expenditure covers only that money spent independently in New Zealand while in port or before and after cruises - primarily retail spend.

Total Direct Expenditure

Summing the components of expenditure detailed above gives total cruise season direct expenditure for the 2009/10 season of $271.2m (Table 3.6). The passenger related spend is the largest expenditure category, with 53% of spend from industry activity. The cruise vessel related spend in the New Zealand economy is $104.1m which is around 38% of the total industry expenditure. The cruise crew expenditure is the smallest expenditure category with $22.3m spent in 2009/10 season.

Table 3.6 Total Direct Expenditure 2009/10 Season ($m)

Vessel Band	GRT Range	Passenger Related*	Crew Related	Cruise Vessel Related*	Total Direct Expenditure
1	50,000-100,000	114.0	18.3	74.1	206.4
2	35,000-50,000	16.2	1.6	17.5	35.3
3	20,000-35,000	10.1	1.6	7.2	18.9
4	5,000-20,000	4.6	0.8	5.3	10.6
TOTAL		144.8	22.3	104.1	271.2

**Incorporates total amount spent on ship fuel and International airfares*

3.4 National Economic Impacts 2009/10

The direct expenditure by passengers, ship owners and crew generates second and subsequent rounds of spending as businesses, either supplying the sector directly (e.g. provedoring companies, bus tour operators, retail outlets etc) or indirectly (e.g. farmers, manufacturers etc) increase their demands for intermediate goods and services, labour and capital to meet the needs of cruise vessels and tourists. This in turn causes suppliers to produce more goods, pay more wages or employ more workers.

These transactions are called the **indirect effects**. Workers and owners are paid wages for the additional work they do or take additional profits which are in turn saved or spent (generating additional activity). These are termed the **induced effects**.

Having established the scale of direct economic impacts, indirect, induced and employment impacts can be estimated by applying national level economic multipliers (as described in Methodology, above). Multipliers are a simple way to measure the flow on effects throughout the economy arising from additional direct expenditure. They are expressed as a 'multiple' that is applied to the value of direct expenditure to generate total value added, total gross output or additional employment. In effect multipliers mimic the operation of the economy by summing sales of intermediate goods and services that make up final goods purchased by the cruise industry.

It is important to understand that multipliers assume the economy is operating at full capacity and that the additional spend generated by the cruise sector will create 'new' employment or new activity rather than utilise spare capacity. It is also important to focus on the beneficial effects of additional economic activity – that is those components that contribute to New Zealand's Gross Domestic Product (GDP). If all that was achieved by cruise ships visiting New Zealand was increased imports, then there are no benefits to the country. Contributions to GDP are measured by assessing the Value Added component of activity generated by the cruise industry. This is done by way of the Value Added ratio and multiplier.

Table 3.7 presents the total economic effects of the cruise industry throughout the New Zealand economy for the 2009/10 season.

Table 3.7 New Zealand Direct, Indirect, Induced and Employment (EC) Impacts 2009/10 Season

	Passenger Related*	Crew Related	Cruise Vessel Related*	Total Industry
Economic Impact				
Expenditure*	118.9	21.6	28.4	168.9
Total Output	288.4	52.1	69.6	410.1
Total Value Added	132.6	24.9	33.3	190.9
Employment Impacts				
Direct Employment	1,163	239	160	1,562
Total Employment	2,245	434	414	3,093

**For the purposes of an Economic Impact Assessment the majority of direct expenditure on airfares and ship fuel are excluded.*

In total, the $168.9m of direct expenditure that “sticks” to the New Zealand economy, generated almost $410.1m in total output during the 2009/10 season. Of this total $190.9m was contribution to GDP (Total Value Added). The equivalent of 3,093 jobs was sustained by the direct, indirect and induced activity associated with the cruise industry.

It is important to understand the difference between Total Economic Output and Total Value Added. Total economic output measures all transactions in the economy including; imports, raw materials, and the purchase of goods already manufactured, whereas total value added measures only **additional value generated** in the economy – essentially, it is the cruise industry’s contribution to GDP.

Total Value Added is the most important measure of economic impact as this is the component that makes the nation as a whole better off.

4 National Forecast 2010/11 and 2011/12 Seasons

It is possible to provide some estimates of the likely impacts from the 2010/11 and 2011/12 cruise season. Advance cruise bookings are known, however not all passenger numbers are known so are estimated using average occupancy rates for passengers and crews applied to vessel passenger and crew capacities. Seasonal averages (excluding the winter cruises) are applied to ships that did not travel to New Zealand in 2009/10 season in order to estimate their likely impacts. The 2011/12 seasonal data was adjusted to include winter cruises as these have not been booked but it is fairly certain that these cruises will go ahead.

Even though many costs will increase slightly over the next two year period, average expenditures used for the 2009/10 season are applied to the forecast schedule and passengers to produce estimates of the economic impacts and implications of the upcoming season.

4.1 Cruise Activity 2010/11 and 2011/12

It is anticipated that during the 2010/11 season there will be 96 cruises up from 81 in the 2009/10 season. Overall there will be around 736,634 passenger days spent in New Zealand ports (Table 4.1). This represents a 27% increase in passenger days from the 2009/10 season. Crew activity within New Zealand grows to 315,816 port days in the season.

Table 4.1 Cruise Activity Measures 2010/11 (Passengers, Cruises, Crew)

		Ship			Passenger			Crew		
Vessel Band	GRT Range	Vessels	Port Days	Cruises	Unqiue	Port Days	Exchange *	Carried	Port Days	Exchange *
1	50,000-100,000	17	362	66	126,236	677,123	49,521	49,335	277,400	1,625
2	35,000-50,000	4	27	5	5,534	25,568	62	2,636	13,129	73
3	20,000-35,000	9	62	10	4,954	25,418	2,926	3,178	18,985	232
4	5,000-20,000	4	109	15	1,517	8,525	1,384	1,201	6,302	97
TOTAL		34	559	96	138,242	736,634	53,893	56,350	315,816	2,026

**measures number of seaport exchanges, as some passengers embark and disembark they exchange twice*

The 2011/12 season is expected to be even stronger than 2010/11 where there will be 124 cruises. Overall there will be around 1,152,936 passenger days and 484,867 crew days spent in New Zealand ports. This represents a 57% increase in passenger days from the 2010/11 season and the first time more than one million passenger days have been spent in New Zealand ports.

Table 4.2 Cruise Activity Measures 2011/12 (Passengers, Cruises, Crew)

		Ship			Passenger			Crew		
Vessel Band	GRT Range	Vessels	Port Days	Cruises	Unqiue	Port Days	Exchange	Carried	Port Days	Exchange
1	50,000-100,000	16	557	96	187,132	1,055,743	63,591	72,420	428,663	2,374
2	35,000-50,000	2	25	3	2,023	29,129	57	1,192	9,970	29
3	20,000-35,000	7	108	17	8,307	52,969	7,230	6,067	38,027	470
4	5,000-20,000	4	60	8	2,480	15,094	1,907	1,107	8,207	103
TOTAL		29	750	124	199,943	1,152,936	72,786	80,786	484,867	2,975

**measures number of seaport exchanges, as some passengers embark and disembark they exchange twice*

4.2 Direct Expenditure

Based on these activity figures, and spend/passenger day estimates from the 2009/10 season, direct expenditure and total economic impacts can be assessed. During the 2010/11 season $305.4m of direct expenditure is expected to be generated by the cruise industry (Table 4.3). The industry direct spend is expected to increase to $470.7m in the 2011/12 season. Note this includes all external airfares and bunkering costs.

Table 4.3 Forecast Direct Cruise Industry Expenditure 2010/11 and 2011/12 Season ($m)

Vessel Band	GRT Range	Passenger Related*	Crew Related	Cruise Vessel Related*	Total Direct Expenditure
2010-11 Season					
1	50,000-100,000	136.7	24.4	106.1	267.3
2	35,000-50,000	7.1	1.1	3.3	11.5
3	20,000-35,000	10.4	1.6	8.4	20.5
4	5,000-20,000	2.6	0.5	3.1	6.1
TOTAL (2010-11)		156.8	27.7	120.9	305.4
2011-12 Season					
1	50,000-100,000	209.8	38.1	156.2	404.1
2	35,000-50,000	5.4	0.9	3.3	9.6
3	20,000-35,000	25.7	3.3	16.3	45.3
4	5,000-20,000	5.3	0.7	5.8	11.8
TOTAL (2011-12)		246.1	43.0	181.6	470.7

**Incorporates total amount spent on ship fuel and International airfares*

The bulk of the expenditure is associated with large vessels (Band 1 accounts for 88% and 86% of spend in the two seasons). Overall, total direct expenditure is up on the 2009/10 season ($271.2m) by 74% due mainly to the increase in ship passenger capacity and consequent passenger port days.

4.3 National Economic Impacts

By applying the cruise industry base multipliers it is possible to forecast economic impacts at a national level from this level of expenditure. The direct cruise expenditure that remains in New Zealand grows from $168.9m in 2009/10 to $304.6m in 2011/12. The industry is expected to generate total gross output of $477.8m in 2010/11, up from $410.1m in the 2009/10 season. Total value added is expected to grow to $223.0m in 2010/11 and then to $346.0m in 2011/12. This level of activity is expected to generate employment for about 5,606 by 2011/12 which is 81% greater than 2009/10 (Table 4.4).

Table 4.4 Direct, Indirect, Induced and Employment (EC) Impacts 2009/10, 2010/11 and 2011/12

	Total Industry			Growth
	2009-10	2010-11f	2011-12f	2009-2012
Economic Impact				
Expenditure*	168.9	196.4	304.6	80%
Total Output	410.1	477.8	741.4	81%
Total Value Added	190.9	223.0	346.0	81%
Employment Impacts				
Direct Employment	1,562	1,818	2,829	81%
Total Employment	3,093	3,606	5,606	81%

**For the purposes of an Economic Impact Assessment the majority of direct expenditure on airfares and ship fuel are excluded.*

5 Annual Summary of Economic Impacts

Direct expenditure, Total Output, Total Value Added and Employment for the preceding ten seasons and the coming seasons have been compared below in Table 5.1[10]. The historic results are sourced from the annual or biennial studies of the Industry (2001, 2003, 2005, 2006, 2007 and 2008). As there was no annual study for some years the forecast from the previous biennial study has been used as the best estimate (2002, 2004 and 2009 are estimates, denoted as (e)).

The trend indicates a significant jump in direct expenditure between the 2000/01 season and the 2001/02 season. This is followed by reductions between 2002/03 and 2004/05. The 2005/06 shows a significant jump in cruise industry expenditure which was followed by a small decline in the 2006/07 season. In the 2007/08 season the industry grew significantly (66%) with the forecast 2008/09 season showing the continued growth. However it is believed that the estimate for the 2008/09 season may have overstated the activity levels for the year. The global financial crisis began in 2008 and would have impacted negatively on the season. This means that the rapid decline between the 2008/09 and 2009/10 season is probably overstated. The forward bookings for the next two seasons show that the industry is expected to recover strongly (35% p.a.) and grow to record levels by 2011/12.

The employment supported by the industry has grown rapidly from 1,133 in 2000/2001 season to 3,093 in the current season. The industry is expected to grow even faster in the future with employment sustained expected to reach 5,600 by 2011/12.

Table 5.1 National Cruise Industry Economic Impacts 2000-2012

Season*	Direct Spend **	Value Added	Employment ***
2000-2001	90	78	1,133
2001-2002(e)	186	175	2,600
2002-2003	125	114	1,856
2003-2004(e)	93	86	1,389
2004-2005	91	82	1,256
2005-2006	160	151	2,367
2006-2007	136	121	1,856
2007-2008	223	199	3,100
2008-2009(e)	262	239	3,579
2009-2010	169	191	3,093
2010-2011(f)	196	223	3,606
2011-2012(f)	305	346	5,606

**2009 $, previous results converted from historic values using CPI.*

***Direct expenditure on airfares and ship fuel are excluded.*

****FTE 2000-2009 converted to EC.*

[10] This table is presented for comparison purposes only, note that spend figures from 2000/01 through to 2008/09 have been converted to 2009 dollars. Also the previous studies used FTE as a measure of employment, the employment results from previous studies have been converted to ECs. Also the results for 2009/10 and the forecasts 2010/11 and 2011/12 are in line with the updated Cruise Economic Impact Model. There have been a number of changes in the calculation and the spend ratios (discussed in sections above) that are likely to have had a significant bearing on these figures. The model has since been updated using data from surveys and industry operators. **This means the figures are not directly comparable as data has been used to replace assumptions**.

6 Auckland Region Cruise Industry

The cruise industry activity in New Zealand focuses on the Auckland region. Industry spend also focuses on Auckland because the region is New Zealand's passenger exchange port due to the international air links & hotel capacity for pre/post cruise stopovers. Additionally, Auckland has developed marine related facilities to exchange passengers and service the passenger ships. There are also more retail and excursion opportunities than are available at the other ports and stops around New Zealand. Additionally, the port acts as the main staging point from which Pacific Island winter cruises operate from New Zealand.

In this section we discuss the economic impact of cruise activity on the Auckland regional economy for the 2009/10 season and the two future seasons. The data on passenger and crew exchanges has been used to establish the potential movements through the airport.

6.1 Economic Impact in Auckland Region

The industry is estimated to have spent $163.3m in the Auckland region which is over 60% of total national spend. However, the majority of spend in Auckland region is related to passenger exchange activity and fuel bunkering. As much of the spend on these two elements flows overseas, the majority of industry spend does not stay within the region, specifically, 60% leaks out.

In the 2009/10 year around $65.6m of the Industry spend within the region will 'stick' and create positive economic impacts and results directly in employment equivalent to 472 employees. Industry spend flows through the economy creating additional sales with a total output value of $137.6m. The regional GDP (value added) is impacted positively by $63.0m and total employment supported by the industry is equivalent to 928 employees.

Table 6.1 Auckland Region Direct, Indirect, Induced ($m) and Employment (EC) Impacts

2009/10 Season

	Passenger Related	Crew Related	Cruise Vessel Related	Total Direct Expenditure
Direct Expenditure	105.3	5.9	52.1	163.3
Economic Impact				
Expenditure*	42.3	5.8	17.6	65.6
Total Output	88.7	11.9	37.0	137.6
Total Value Added	40.2	5.8	17.1	63.0
Employment Impacts				
Direct Employment	322	56	94	472
Total Employment	620	97	211	928

**For the purposes of an Economic Impact Assessment the majority of direct expenditure on airfares and ship fuel are excluded.*

The total direct spend from the industry is forecast to grow from $163.3m in 2009/10 season to $177.4m in 2010/11 and $268.5m in 2011/12. The industry's impact on GDP (value added) grows by

70% to reach $106.9m. The industry is expected to generate and sustain more employment in the coming seasons, equivalent to 1,575 jobs by 2011/12.

Table 6.2 Auckland Region Direct, Indirect, Induced ($m) and Employment (EC) Impacts 2009/10, 2010/11 and 2011/12

	Total Industry			Growth
	2009-10	2010-11f	2011-12f	2009-2012
Direct Expenditure	163.3	177.4	268.5	64%
Economic Impact				
Expenditure*	65.6	73.4	110.7	69%
Total Output	137.6	154.2	232.6	69%
Total Value Added	63.0	70.9	106.9	70%
Employment Impacts				
Direct Employment	472	533	805	70%
Total Employment	928	1,044	1,575	70%

**For the purposes of an Economic Impact Assessment the majority of direct expenditure on airfares and ship fuel are excluded.*

6.2 Exchange Numbers and Forecasts

A key issue for the cruise industry is exchange capacity within Auckland. Many of the operators surveyed during this study voiced concerns about exchange capacity within the region. In this sub-section the future and past season is analysed to establish exchange activity with a view to assist the industry and policy makers in determining an appropriate response to the surge in forecast passenger volumes in the years ahead.

Some industry analysts have attempted to estimate exchange activity for Auckland and New Zealand. For example, Tourism New Zealand has utilised CNZ data to establish passenger origin for each year. However, no study has attempted to combine daily exchange patterns with seaport exchange data to establish airport exchange activity. This study combines survey data on exchange patterns with CNZ seaport exchange records and future bookings to establish exchange activity in the past season and in the coming seasons. The model also extends to include crew and domestic passenger exchanges.

In the following sub-section the average daily seaport and airport exchange for each month is presented along with an analysis of the daily peaks within each season. This report focuses on peaks in international passenger seaport and airport exchanges given the impact the peaks have on the ability for infrastructure to operate effectively.

It is noted that there are also significant peaks in exchange activity in the winter which are not discussed as they are caused by domestic travellers on cruises to the Pacific Islands and do not add significant value to the New Zealand economy.

6.2.1 Monthly Cruise Exchange

The cruise activity data provides an estimate of the number of passengers and crew that exchange at the Auckland seaport. The data suggests that around 96% of the season's seaport exchanges occur directly in Auckland. It is also likely that many of the people that exchange in other seaports around

the country will eventually travel through Auckland to access the international airport. However for the purposes of this study any seaport exchanges outside of Auckland are ignored.

The seaport exchanges are dominated by international visitors in the summer months, with 340 international passengers exchanging on an average day in February. Surprisingly the highest activity month for seaport exchanges occurs during the winter season. On the average day in June 366 passengers exchange through the seaport, the majority of which are domestic passengers.

However, the air exchange of international visitors peaks in the summer months December to February, with 250 to 340 internationals exchanging on an average day with a peak of up to 2,500.

The New Zealand market is most active in the June month with 63 domestic passengers potentially air exchanges on an average day, assuming a 20% domestic usage rate.

Table 6.3 Auckland Region Monthly Average Cruise Exchange per Day 2009/10 Season (Seaport and Airport)

	Seaport Exchange			Airport Exchange		
	International	Domestic	Total	International	Domestic*	Total
August	6	15	22	5	3	8
September	0	0	0	1	0	2
October	3	1	5	4	0	4
November	8	1	9	14	0	15
December	290	18	308	286	4	290
January	250	19	270	249	4	253
February	339	16	354	339	3	342
March	107	74	181	101	15	116
April	53	199	251	63	40	103
May	76	149	225	72	30	102
June	49	317	366	51	63	114
July	30	93	122	27	19	46

**assumes 20% of domestic exchange uses the airport*

Future cruise bookings highlight the number of ships and date of visits to Auckland. The passengers and crew that exchange are estimated using the 2009/10 season exchange averages[11]. The 2010/11 season peaks in January with 353 international airport exchanges per day on average. The 2011/12 season peaks to 552 internationals airport exchanges per day on average in October primarily driven by the Rugby World Cup 2011.

[11] The average for each ship in the 2009-10 season was applied to the future bookings. The seasonal average for five types of ship (Round the World, Australia Swing, Coastal Cruise, Winter Cruise and Rugby World Cup) was applied to ships that had not visited New Zealand in the 2009-10 season.

Table 6.4 Auckland Region Monthly Average Cruise Exchange per Day 2010/11 and 2011/12 (Seaport and Airport)

	Seaport Exchange			Airport Exchange		
	International	Domestic	Total	International	Domestic*	Total
2010-11						
August	0	0	0	0	0	0
September	2	2	4	2	0	2
October	111	3	114	109	1	109
November	10	0	10	26	0	26
December	129	11	140	129	2	131
January	370	32	403	353	6	359
February	244	19	263	229	4	233
March	22	2	24	39	1	39
April	0	0	0	5	0	6
May	111	367	478	101	72	174
June	86	284	370	88	57	146
July	0	0	0	1	0	1
2011-12						
August	0	0	0	0	0	0
September	0	0	0	0	0	0
October	552	11	563	552	2	554
November	110	8	118	110	2	111
December	201	25	226	190	5	195
January	245	29	273	266	6	272
February	245	20	265	237	4	241
March	180	9	188	175	2	177
April	9	3	11	16	1	17
May	111	367	478	101	72	174
June	86	284	370	88	57	146
July	0	0	0	1	0	1

**assumes 20% of domestic exchange uses the airport*

Cruise industry exchange activity is erratic with low activity and very high volumes occurring in the same month. For example, in the 2009/10 season there were weeks where 8,400 people exchange through the seaport and 7,000 through the airport, while in the same month there were weeks when very few passengers exchanged. This pattern is forecast to continue in the next two seasons with the busiest week in 2011/12 season exceeding 8,900 seaport exchanges and 8,000 airport exchanges.

This irregularity of activity means that it is important to evaluate and understand the flows of passengers on a day by day basis rather than a monthly average. In this study we have evaluated the busiest 10% of weeks in more detail as these are the weeks where capacity constants are most likely to be felt.

6.2.2 Auckland Daily Exchange Analysis

In this section the busiest days for the past season and the two forecast seasons are discussed. Analysis has focused on the top 10% of days where international exchange volumes are highest. The model predicts that airport exchange activity peaks within the summer months with activity being closely aligned with seaport exchanges of larger vessels.

2009/10 Season Exchanges

There were three peaks of activity in the 2009/10 season. The first peak is the largest and is centred around December 21st, the peak is caused by two large ships entering port within a small time frame. During this week the forecast predicts that around 8,400 people exchanged via the seaport. The model predicts that exchanges through the airport will exceed 1000 per day during this week, with the heaviest day occurring on the 22nd of December 2009 with almost 2,500 passengers exchanging through the airport.

The second peak of activity occurs in the middle of January. This peak occurs in the week centred around the 17th January, with over 5,600 people exchanging through the seaport which results in 700 people exchanging through the airport per day. This peak in exchange is caused by one large ship and a few smaller ships which call on Auckland in the middle of the month. The heaviest day at the airport occurs on the 16th of January with 2,400 exchanges occurring.

The third peak of the season occurs in February, this month's peak occurs during the week centred on the 10th with more than 700 airport exchanges per day, and then a smaller peak around the 15th with 450 airport exchanges per day. The seaport is expected to handle around 5,900 exchanges in the first week and 3,400 in the second week.

2010/11 Season Exchanges

The three peaks of activity in the 2010/11 season are later in the season than in the 2009/10 season. Like the previous season the first peak is the largest with over 6,000 people exchanging through the seaport. The model predicts that exchanges through the airport will reach 800 per day during the week centred on January 4th. The heaviest day occurs on the 3rd of January with almost 2,400 passengers exchanging through the airport.

The second peak in exchange activity occurs at the end of January. The peak occurs in the week centred on the 28th January, again with over 6,000 people exchanging through the seaport in the week. The exchange model predicts that on average 700 people exchanging through the airport per day. This peak in exchange will be caused by several large ships and a few smaller ships which call on Auckland. The heaviest day for the airport occurs on the 27th of January with 2,400 airport exchanges occurring.

The third peak of the season occurs in February and is much flatter than the first two peaks. This month sees a steady level of activity of over 263 seaport exchanges per day which converts into 233 airport exchanges per day. Around 1,000 passengers are predicted to exchange through the airport on the 25th and 27th of the month.

2011/12 Season Exchanges

The 2011/12 season has four peaks in exchange activity. The season also sees a general increase in activity in the shoulder seasons. The 2011/12 season is expected to see significant overall growth in activity.

The majority of this growth is focused on the pre summer shoulder, as a result of the Rugby World Cup. Given the high volumes of non-cruise related tourists during the Rugby World Cup it is

interesting to note that cruise exchanges will also be higher than normal for the month of October, with over 17,000 seaport exchanges as cruise ships dock in Auckland and discharge normal cruise passengers before taking on board RWC specific passengers.

The industry is expecting over 9,000 seaport exchanges between 6th and 24th which will be directly related to the RWC. The post and pre RWC voyages will also create significant numbers of exchange activity, with over 5,300 passengers either boarding or leaving ships which came to New Zealand for the RWC. The remaining 2,700 seaport exchanges are unrelated to the RWC.

The 24th of October will be the largest day with over 7,000 seaport exchanges and over 3,300 airport exchanges. Auckland will also see high volumes of exchange activity on the 6th and 14th October, with seaport exchanges reaching 2,500 and seaport exchanges over 1,200. The model predicts three peaks with over 700 airport exchanges per day occurring on the 14th, 17th and 24th of the month. The biggest day is the 24th with up to 7,000 passengers exchanging through the seaport and 4,000 exchanges through the airport.

The model predicts a second peak in exchange activity in late December. It is expected that there will be over 700 airport exchanges per day during the week centred on December 30th. This peak in activity is caused by the full seaport exchange of one large ship and four partial exchanges by other ships (total weekly seaport exchange is likely to be almost 6,000 passengers). The heaviest day occurs on the 29th of December with over 2,400 passengers exchanging through the airport.

The third peak of activity occurs during the week centred on the 24th January, with seaport exchanges exceeding 5,800 and an average of over 700 people exchanging through the airport per day. The heaviest day occurs on the 23rd of January with 2,300 exchanges occurring.

And finally in February, there is a flatter peak. In the first week of February 4,700 seaport exchanges are expected. This means that over 500 people are likely to move through the airport per day during the week. The heaviest day occurs on the 4th of February with 1,100 airport exchanges occurring.

Findings

The model predicts strong growth in the summer peak and exceptionally strong growth in the shoulder seasons in 2011 due to the Rugby World Cup events. It is also interesting and important to note that there is likely to be exchange capacity constraints if no further facilities are built or if processes are not put in place to deal with the unprecedented spike in exchange volume. The existing facilities allow only one (large) ship to exchange in any given day as berthage and exchange capacity is limited.

6.3 Capacity Issues in Auckland

During this study several industry experts that were interviewed mentioned issues within Auckland which could impact negatively on the industry[12]. These issues mainly related to the port flow and passenger movement to and from the ships. These issues mainly arise for bigger ships where volumes are much higher. The data shows that these issues will occur more often in the future because ships are getting larger and more ships are cruising New Zealand waters.

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[12] See page 53 for the list of industry representatives and experts interviewed during the research.

The most significant issue raised is the lack of sufficient or suitable terminal facilities. The existing facilities have constraints which do not allow for a fully functioning embarking and disembarking process. The experts interviewed noted that it takes half a day to disembark and a further half day to embark. This creates issues where operators have to provide holding areas for embarking and disembarking passengers during the period between flights and embarking or disembarking times. It also means that passengers are unable to undertake other activities during this period. It is believed that a smooth/fast exchange will increase the chance of pre and post cruise spend.

There are issues with baggage processing capacity, the first being that the baggage processing facility is unable to handle a full exchange of baggage from the large ships. From a logistics point of view the small size of the existing terminal means sometimes less than half the baggage from the larger ships can be handled at once. This means that exchanging correct baggage and passengers at the same time is extremely difficult and time consuming. The wharf creates a bottleneck which reduces the free time available to passengers. There are also weather issues with undercover space not being sufficient for the passenger exchanges.

The port to airport link could be improved. Some operators suggest that a direct flight check in service should be made available at the port. This would allow disembarking travellers to spend more time in Auckland and allow smoother processing at the airport. Again this would require more space than is currently devoted to the cruise ship terminal.

The ground handlers also mentioned that there are issues with land transport access and capacity. There is a concern that coach and taxi access is limited at Princes Wharf which inhibits a smooth flow of passengers.

Finally, the study revealed that for some high volume days airport related activity will be greatly increased. To reduce bottlenecks at check in and customs processing, the airport and airlines should be given advanced warning of high volume days and communicate that effectively to its teams concerned. Examples at other successful cruise ports have also shown that providing a wharf-side airline and customs check-in can greatly dilute this volume of traffic and may encourage luggage-free passengers to do more downtown spending before making their way to the airport.

7 Gaps and Further Work

One of the goals of this study was to identify any gaps and weaknesses in the data and understanding of the cruise industry. This section outlines the gaps and suggests which gaps deserve future research. We also provide an indication as to the magnitude of the study required to fill each gap.

7.1 Cruise Vessel

The industry activity is the most well understood activity within the cruise industry. The research shows two areas of concern which relate to, providoring and irregular spend.

- Providoring: The providoring spend has been estimated using anecdotal evidence from interviews with a small number of providores. The data used in this model indicates that providores provide less than $3 of food per person cruise day. This data is not robust and it is our view that a detailed survey of providores may provide significantly different results.

- Irregular spend: The industry has been able to provide detailed financial information which is robust for the given 2009/10 season. However there is a concern that some spend by the industry is lumpy in nature and the reliance on a single year of data may create artificial results. For example this issue is apparent when comparing the previous bunkering data with the 2009/10 season. In the most recent season bunkering was historically low, we have been informed that this has occurred as a result of one of the main cruise line operator's reducing world and trans-Pacific voyages to New Zealand (these voyages tend to bunker in New Zealand). The future bookings indicate that this operator is going to resume these voyages in the coming seasons which may cause an undercount in the economic forecasts. It is our view that the study should use a time series of data (multiple years of financial accounts) to smooth out irregular spend patterns.

There are also several small spend categories (maintenance, container handling etc) which are based on assumptions and anecdotal data from the industry. However as these spend categories are small (less than 0.5%) relative to the total spend in the cruise industry the overall findings are not sensitive to these assumptions. It is our view that the existing estimation is sufficient and further analysis of these costs would provide little to no improvement in the modelling.

The study suggests that there are two future streams of research that could be undertaken to improve the modelling and understanding of the cruise vessel spend. First the survey of providores suggested would be relatively easy to undertake and could be completed in less than a week. The second research stream would be more difficult as the creation of a historic time series is likely to be time consuming with much of the burden falling on the shipping agents and port authorities.

7.2 Passenger Behaviour

The spend related to passenger activity is the largest industry spend and as such, requires the most research as the results from the model are sensitive to assumptions about passenger spend. There are three data gaps, non-excursion port spend, excursions spend and post/pre cruise activity.

- Non-excursion port spend: The model relies on previous surveys and international literature for the setting of port spend. It is noted that these data sets may be biased or not apply directly to the New Zealand situation. The model is sensitive to this spend category, further research would increase the robustness of the model. The best technique for understanding passenger spend is a survey which covers significant numbers of passengers from all different types of ship.

- Excursion spend: The excursions spend has been estimated using anecdotal information from ground handlers. This technique is unlikely to provide an exact fix on the spending patterns of passengers as there is significant numbers of FIT and the average data provided by the ground handlers may not reflect the weighted average. It is believed that ground handlers hold detailed information about the number of passengers undertaking each excursion and the cost of each excursion. This data is required by the ship operators to assess the profitability of each excursion. This data would be highly confidential which may make it hard to obtain. Given the dispersed nature of FIT activity it will be harder to ascertain excursion activity of these passengers. This data could be collected in a survey in combination with passenger spend survey.

- Post/pre cruise activity: The model relies on the previous TNZ survey to establish pre and post cruise activity. We are concerned that the small sample size in that survey may have biased the results. An extensive survey of passenger activity would provide more robust data on which to base the estimation of pre and post cruise activity. The exchange analysis relies on the ARC survey data which has limited coverage and the data may contain bias.

There are two suggested research streams that will improve the understanding of passenger behaviour.

- The first is a survey of passengers which would cover enough passengers by origin and cruise type to establish a robust set of spend averages. This study would cover FIT excursions, pre/post cruise activity and general in port expenditure. This survey would be relatively expensive and time consuming.

- The second piece of work that is suggested is the collection and analysis of ground handlers data on excursion activity. It is believed that the ground handlers could provide this data relatively easily as they are already required to collate this information for the ship operators. The analysis of ground handlers data could be undertaken in less than a week.

7.3 Crew Behaviour

The crew expenditure and exchange behaviour has not been studied with detail. Crew related expenditure figures are estimates and do not have the rigor that would come from a structured survey into their spending habits. It is suggested that this part of the industry deserves some investigation and a survey of crew would be the best way forward. The survey could be undertaken using an internet portal to reduce the cost and would not need to cover as many ships types as the crew activity in each ship will be similar.

8 Conclusion

The study shows that the cruise industry is expected to grow strongly over the next two seasons. The results show that the credit crisis and the global downturn in (2008/2009) have impacted negatively on the New Zealand cruise industry. However the future bookings show that the industry is likely to rebound strongly and grow to record levels in 2011/12.

The Auckland region is expected to see strong growth in activity with large volumes of passengers likely to exchange and average ship size increasing. The analysis of daily exchange patterns shows that the activity within the port is likely to increase dramatically from the 2009/10 to the 2011/12 season. The Ports of Auckland plays a significant role in facilitating growth in the Industry nationally and any constraints at the port may inhibit growth potential nationally as well as regionally. It is noted that industry experts are particularly concerned about the flow at the port, they point out constraints on baggage handling, passenger movements and disembarkation/embarkation issues. Auckland is the first and last point of call for many passengers, for this reason the smooth exchange from seaport to airport can greatly affect the quality of the travellers experience.

There are five areas in which future research can be conducted to provide a better understanding of the industry:

1. Collect and analyse records from providores.
2. Create a time series of ship related spend to smooth irregular spending patterns.
3. Conduct a survey of passenger behaviour, covering pre/post cruise activity, FIT excursions and onshore expenditure.
4. Collect and analyse records from ground handlers on excursion and exchange expenditure.
5. Conduct a survey of crew activity, covering pre/post cruise activity, FIT excursions and onshore expenditure.

Appendix 1: Economic Models & Multiplier Analysis

National Economic Model

The basis of this study is a multiplier analysis of the flow on effects arising from direct expenditure generated by cruise ships, passengers and crew. A national level 88 sector Input Output model of the New Zealand economy has been applied. The model is based on Statistics New Zealands Inter-Industry Study carried out in 1995/96. The inter industry study collected transaction information between different sectors of the economy so that it is possible to tell how much one sector purchases from another in order to produce final outputs. This study collected information across 88 sectors of the economy allowing multipliers to be calculated at the 88 sector level across regions.

Multipliers

Multipliers measure the flow on effects of direct expenditure in the economy. They measure two things specifically;

- The **Indirect effect** of direct spending. The indirect effect occurs when suppliers to the cruise industry increase their demands for goods and services from their suppliers in order to meet the increased demand from the cruise industry. For example, a providoring company receives an order for $20,000 worth of fresh fruit and vegetables from a cruise line. They immediately place orders with a range of suppliers for the goods. These suppliers in turn, purchase more seed, fertiliser and machinery in response to the increased sales they are making. The indirect or Type I multiplier attempts to capture all these transactions in a single “multiple”. In effect it measures how many time a single dollar of increased demand is multiplied through the economy.

- The ***Induced effect*** of direct and indirect spending. The induced effect captures increased spending due to increases in wages and salaries paid to workers and owners indirectly, and indirectly affected sectors. As people earn more money for the additional work they do, they spend more. The induced multiplier attempts to capture this round of increased economic activity. The induced multiplier is usually added to the indirect multiplier to produce a Type II multiplier that measures the total economic effect of additional spend.

Economic impacts can be measured a number of ways, therefore multipliers have been calculated for three different aspects of economic activity;

- Gross Output. Gross output measures the total activity within the economy. It is the broadest measure of economic activity and does not necessarily provide an accurate measure of economic benefits. For example, if an economy has a very high import component then a gross output measure might be high, however as most of the goods are not produced locally the economy is creating very little internal wealth.
- Value Added. Value added is the most appropriate measure of economic impact. It measures the level of value that is generated within an economy. It is closely related to GDP, the standard measure of economic performance of an economy.
- Employment. This is measured in employment count (EC).

The balance of this appendix describes the derivation of regional input-output models, and multipliers developed for impact analysis. It outlines the fundamentals of input-output modelling, including definitions and structures and the methodology that generates sub-national economic accounts through a series of mechanical steps. Finally, the key aspects of multiplier analysis are described.

Input-Output Modelling

The origins of input-output modelling may be traced back to the Physiocrats of the 18th Century. Francois Quesnay's Tableau Economique of 1758 traced successive rounds of wealth generated by agricultural expenditure. While the Tableau Economique investigated the concepts of circular flow and general equilibrium, it was not until another Frenchman, Leon Walrus in his Elements d'Economie Politique Pure of 1874, that a detailed theoretical framework for analysing economic interdependence was created. Contemporary input-output economics is attributed to Wassily Leontief, a Noble prize winning American economist, who in 1936 published an input-output table for the American economy. Leontief simplified the Walrus model to develop a theory of production based on the general equilibrium concept of economic inter-dependence.

The Input-Output Table

An input-output table describes inter-industry linkages in an economy for a given period. Information on such linkages is normally obtained from national economic accounts, which are, in turn, derived from a national census of production. Information on final demand consumption and expenditure on primary inputs is also included. Input-output tables share an intimate relationship with the national accounts and as such allow the derivation of standard economic indicators such as Balance of Trade, Gross Domestic Product (GDP), contribution to GNP by sector, and gross output by sector.

Conventionally, an input-output table is presented in a matrix format, with each industry assigned a row and column. The element xij in row i column j indicates the volume of goods flowing from industry i to be used as inputs in industry j. In other words, each row indicates the flow from each industry to all other industries and to final demand, while each column indicates the purchasing pattern of each industry.

An input-output table may be divided vertically into two parts: the part on the left represents the inputs into the production process of the productive industries, while the part on the right represents the sales to the final disposal sectors. Each part may further be subdivided horizontally into two sections so as to distinguish between intermediate inputs and primary inputs. The resulting input-output table consists of four quadrants (labelled I to IV) (Table A.1).

Table A.1 **An Input-Output Table**

	Industry 1	Industry ... *j* ...	Industry *n*	Sub Total	House -holds	Govt. Expen- diture	Other Final Demands	Exports	Sub Total	Total Gross Output
Industry 1 Industry ... *i* ... Industry *n*	Quadrant I x_{ij}				Quadrant III					X_i
Sub Total										
Labour Value Added Other Primary Inputs Imports	Quadrant II				Quadrant IV					
Sub Total										
Total Gross Input	X_j									

Quadrant I, known as the processing or intermediate demand quadrant, represents the flows of transactions between industries used in the intermediate stages of production. A key characteristic of the intermediate demand quadrant is that there must be the same number of rows as columns. Furthermore, the total value of output of each intermediate industry must always be equal to its total expenditure on inputs.

Quadrant III displays the sales by each sector to final demand, ie. the part of an industry's output not used by another industry as an input. This quadrant describes the consumer behaviour of a number of important markets including household consumption, government consumption, increases in stock, capital formation, and exports.

Quadrant II describes the primary inputs used in each industry. These inputs are described as 'primary' because they do not form part of the output of intermediate production as defined by the rows forming quadrants I and III. The following primary input categories are typically included: subsidies[13], indirect taxes, depreciation, wages and salaries, gross operating surplus and imports. The total of the primary inputs for each industry less imports represents the value added to commodities consumed in the production process ie. the contribution made by that sector to GDP.

Quadrant IV displays the primary inputs that are directly used by final demand sectors. This includes non-market transfers such as benefits and pensions as well as imports of commodities for consumption by households and investors.

Input-output tables are often converted into technical coefficient format that more clearly represents the purchasing patterns of industries. This is undertaken by dividing column elements by their respective column totals. Such coefficients represent the first round inputs from each row industry i following a unit increase in output of any row industry i per unit of output produced by column industry j.

[13] *Subsidies are entered with a negative sign as they represent receipts, not expenses.*

Assumptions of Input-Output Modelling

Four major assumptions make the derivation of input-output tables feasible:

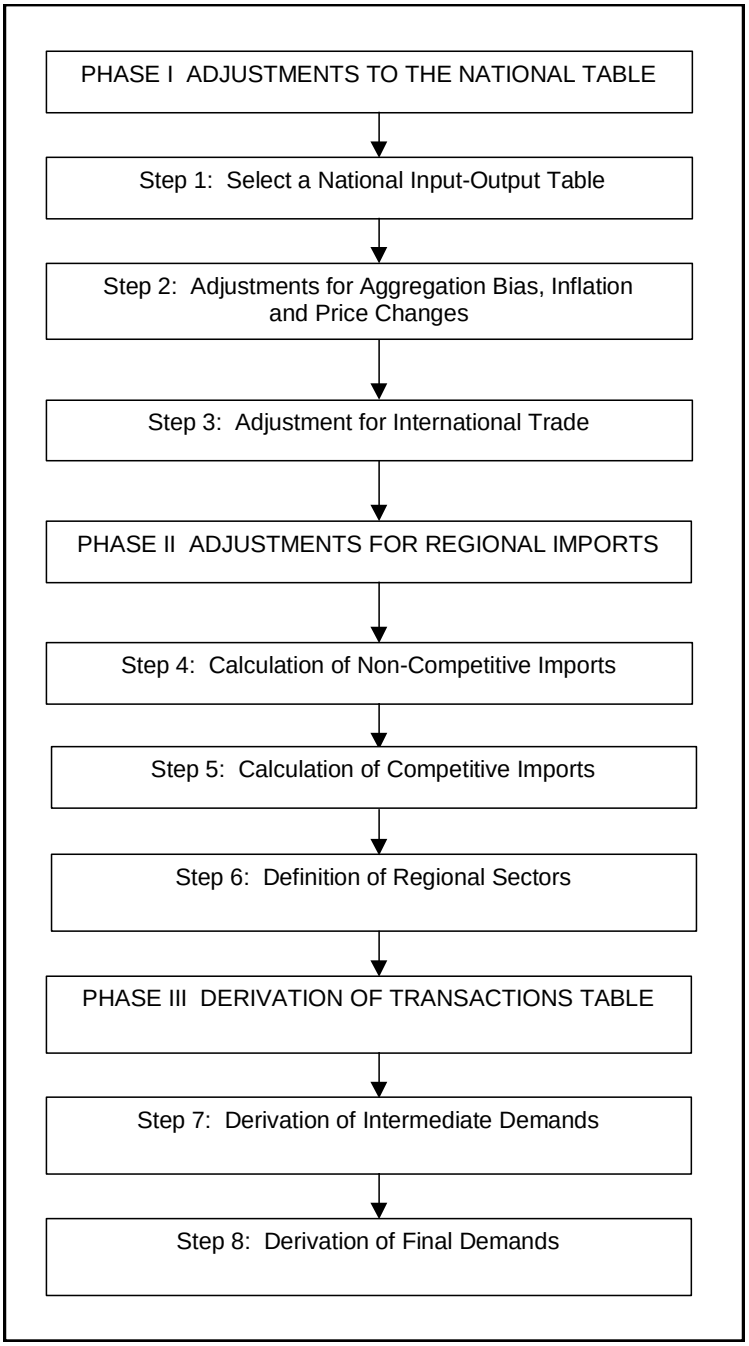
- Homogeneity. This states that each industry in an input-output table produces only one output. Implicit in this assumption is the notion that all businesses that constitute an industry use the same product mix in production of this one output.
- Additivity. This states that the total effect of carrying out several types of production is the sum of the separate effects. This implies the absence of any synergistic effects and external economies (or diseconomies) of scale.
- Linearity. This presumes that the ratio of inputs to outputs decreases and increases in a linear nature. This also infers that there are no external economies (or diseconomies) of scale.
- Fixed coefficients of production. This states that inputs are required in fixed proportions to outputs in each industry. Inherently this assumes that there are constant returns to scale in production and that the elasticity of substitution between inputs is zero.

Regionalisation Methodology

The various approaches available for generating regional input-output tables are usually categorised as ‘survey’ or ‘non-survey’. In survey methods, the elements which make up the transactions table are generated from primary data gathered through the use of various survey techniques and are often considered the most attractive in theoretical terms. In non-survey methods, transactions table elements are derived from other tables by various adjustment techniques. These methods are employed when data is unavailable and/or time and cost constraints exist.

The economic accounts used for this study have been derived using a non-survey approach. This approach employs a series of mechanical steps to reduce national coefficients to regional equivalents, but also provides opportunities for insertion of superior data. The economic account construction methodology is shown in Figure A.2.

Figure A.2 **The Economic Account Methodology**



Phase I: Adjustments to the National Table

In this phase an appropriate national input-output table is chosen and adjustments for aggregation bias, inflation, price changes and international trade are made.

Step 1: Select a National Input-Output Table

The economic accounts were generated from the 1995/96 Inter-Industry Study of the New Zealand Economy published by Statistics New Zealand (SNZ). This study has been updated by Market Economics using employment and output information collected by SNZ to 2003/04. This study covered 126 sectors, with 9 primary input and 7 final demand categories. All sector definitions are compatible with the New Zealand Standard Industrial Classification (NZSIC) system.

Step 2: Adjustment for Aggregation Bias, Inflation and Price Changes

Reduction of national coefficients to form regional equivalents almost always results in aggregation bias. This occurs because the constituent businesses that form a sector do not have homogenous output, even though they are classified in the same sector. Thus the more aggregated an industry, the greater the over-estimation of self-sufficiency. While aggregation bias cannot be eliminated, it may be partially overcome by sector disaggregation.

This adjustment was undertaken using SNZ's 1995/96 Inter-Industry Study of the New Zealand Economy, which allowed for a 126 sector breakdown. Specifically:

- The 126 sectors for 1995/96 were aggregated to form 123 sectors that, in turn, could be uniquely aggregated to form the 88 sectors for 2001/02.

To obtain a national input-output table by 123 industries for 2001/02 the following simple extrapolation method was used:

- Productivity estimates (output per employment count (EC)) were calculated for the years 1995/96, 1997/98, 2000/01 and 2001/02.
- For each of these years the Producers' Price Index (PPI) was used to convert sector output, at the 123 sector level, into constant dollars. This allowed for changes in inflation and prices.

These output estimates were then aggregated and compared with Statistics New Zealand's SNA figures, and adjustments were made where deemed appropriate.

Final demand and primary input totals for 2001/02 were obtained from Statistics New Zealand. Components of final demand for aggregated sectors were applied to the 123 sectors, assuming equal splits across like sectors, to determine estimates of primary inputs for each sector.

Step 3: Adjustment for International Trade

Adjustments are made for international trade using Statistics New Zealand's Harmonised System, which disaggregates physical imports and exports into 10,000 commodities. As exports are coded by sector it is possible to obtain an exact match with the 123 sectors used at the national level. Matrix manipulations allow categorisation of the imports as sector inputs.

Phase II: Adjustment for Regional Imports

In this phase approximations of regional coefficients were produced through the calculation of non-competitive and competitive imports.

Step 4: Calculation of Non-Competitive Imports

Where production in sector i does not occur within a region then any inputs from sector i into sector j are treated as regional imports. Therefore the regional technical coefficient is set to zero, and its value in the national table is added to imports.

Step 5: Calculation of Competitive Imports

Following the calculation of non-competitive imports, it is necessary to adjust the national coefficients for sectors known to exist in each region. This is accomplished by determining the component of the national coefficients allocated to competitive imports. The Simple Location Quotient (SLQ) may be used to achieve this.

The SLQ is a measure which compares the relative importance of output or employment of a sector in a region to its relative importance in the nation. Mathematically, this may be modelled as,

$$SLQj = (X^r j/X^r)/(X^n j/X^n)$$

Where X represents employment and the superscripts r and n respectively the region and nation, and j row sector. Operationally, the regional coefficients for row sector j are estimated by multiplying the national coefficient by SLQj, and apportioning the difference to imports, that is,

$$r_{ij} = a_{ij}SLQ_j \text{ where } SLQ_j <= 1$$

This means that the region produces less than its share of national output in industry j and imports are therefore required. If the SLQ for an industry exceeds 1 then the size of the regional industry is greater in relative terms than its national equivalent, and is assumed to be capable of satisfying local demand. The SLQ technique assumes that national and regional technologies are identical, and that there are no product or sector mix problems. The SLQ technique allow national coefficients only to be revised downwards but not upwards.

The SLQs for Auckland were calculated using 2001 ECs from Statistics New Zealand Business Directory.

Step 6: Definitions of Regional Sectors

A total of 88 sectors were used to represent economic transactions in the model. Inputs into production not covered by the 88 sectors were described by the following primary input categories: compensation of employees, operating surplus, indirect taxes, subsidies, consumption of fixed capital, imports and import duties and other primary inputs. Similarly, consumption of commodities not covered by the 88 sectors was described by the following final demand categories: household consumption, local and central government consumption, and other final demands (exports, net increases in stocks and capital formation).

Phase III: Derivation of Transactions Tables

In this phase transactions tables were derived for the region. Two functions were required: (1) the derivation of the intermediate demand transactions, and (2) the completion of the final demand quadrants.

Step 7 Derivation of Intermediate Demands

This involved the conversion of regional coefficients to transactions by multiplying the elements of each column sector by estimates of that sectors' share of total gross output. Shares were derived by calculating the regional (or TLA) share of national employment. This resulted in the intermediate demand and primary input quadrants of the regional transactions table.

Step 8 Derivation of Final Demands

This involved the generation of estimates for the final demand quadrants of the transactions table. Household consumption is particularly important as it is necessary for the calculation of multipliers. Local and central government consumption were also calculated. Other final demands were calculated as the residual achieving the necessary row and column consistencies.

Household consumption along with local and central government consumption were estimated by applying a population index (for example):

Population of region	404,200
Population of New Zealand	3,454,900

Population index : 404,200/3,454,900 = 0.1170 (4 d.p.)

In turn, estimates of household consumption for each regional sector were obtained by multiplying the population index by the national output for each sector. For example, if the national household consumption for the other farming sector was $241 million, then for the region this was estimated as:

Other farming: 241 * 0.1170 = $28.20 million

Multiplier Analysis

Introduction

A major extension of the input-output model is the derivation of multipliers. Multipliers are a summary measure of the economic interdependence produced as a result of secondary benefits. Specifically, an increase in final demand for any sector has repercussions throughout the whole economy, causing increases in output beyond the initial change in demand. This is known as the multiplier effect.

Multiplier Definitions

In general, multipliers are capable of measuring output, income, value added and employment generated from economy activity within a region. Three types of multiplier are conventionally used:

- Output Multipliers. These show the relationship between an additional unit of spending and changes in the level of output.

- Employment Multipliers. These show the relationship between an additional unit of spending and changes in the level of employment.
- Value Added Multipliers. These show the relationship between an additional unit of spending and changes in the level of value added.

There are two different types of output, employment and value added multipliers commonly used:

- Type I Multiplier. This multiplier attempts to explain indirect effects initiated from second and subsequent round effects as successive waves of necessary output increases occur in the economy. It is expressed as the ratio of the direct and indirect change to direct change.
- Type II Multiplier. This multiplier explains induced effects initiated through consumer expenditure ie. this includes the effect of household expenditure generated by wages and salaries resulting from variations in demand in a given sector. It is expressed as the ratio of direct, indirect and induced change to direct change.

Multiplier Derivation

The transactions table may be converted into a table of technical coefficients. These are calculated by dividing the elements of the columns of the transactions table by the respective column total. These coefficients are often termed 'direct', 'input-output', or 'technical' coefficients, they are usually noted as Aij. They represent the first round inputs from each sector i (row) following a unit increase in output of any sector j (column) i.e. aij = Xij/Xj. However, this only shows the direct purchases from a sector i per unit of output produced by sector j.

To account for indirect effects, and to calculate Type I multipliers, it is necessary to subtract the quadrant I matrix from an identity matrix ((I - A), or Leontief matrix) and to invert the result, resulting in the Leontief inverse matrix, or (I - A)-1. Mathematically, this may be expressed in matrix terms as:

$$X = AX + Y$$

By transposition,

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

By solving the above system we derive the general solution:

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

(I - A) is termed the Leontief matrix

$(I - A)^{-1}$ is termed the Leontief inverse matrix

where:- A = (n x n) matrix of quadrant I technical coefficients

X = (n x 1) matrix of gross inputs

Y = (n x 1) matrix of final demand

I = (n x n) identity matrix

To account for direct, indirect and induced effects, and to calculate Type II multipliers, it is necessary to expand the quadrant I matrix to include the households coefficients (A*) then to subtract this matrix from the identity matrix ((I - A*), Leontief* matrix) and to invert the result, resulting in the Leontief* inverse matrix, or (I – A*)-1. This treats household inputs and household consumption as sectors, producing income and requiring inputs from other sectors.

The indirect effect for any sector can be calculated simply as technical coefficient element minus corresponding Leontief inverse matrix element. The induced effect for any sector can be calculated simply as Leontief inverse matrix element minus the corresponding Leontief* inverse element.

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McKay Shipping Limited

Renaissance Tours

Sea Services New Zealand Limited

Statistics New Zealand

Titan Marine Engineering Limited

Tourism New Zealand

Whiting Power Systems Limited